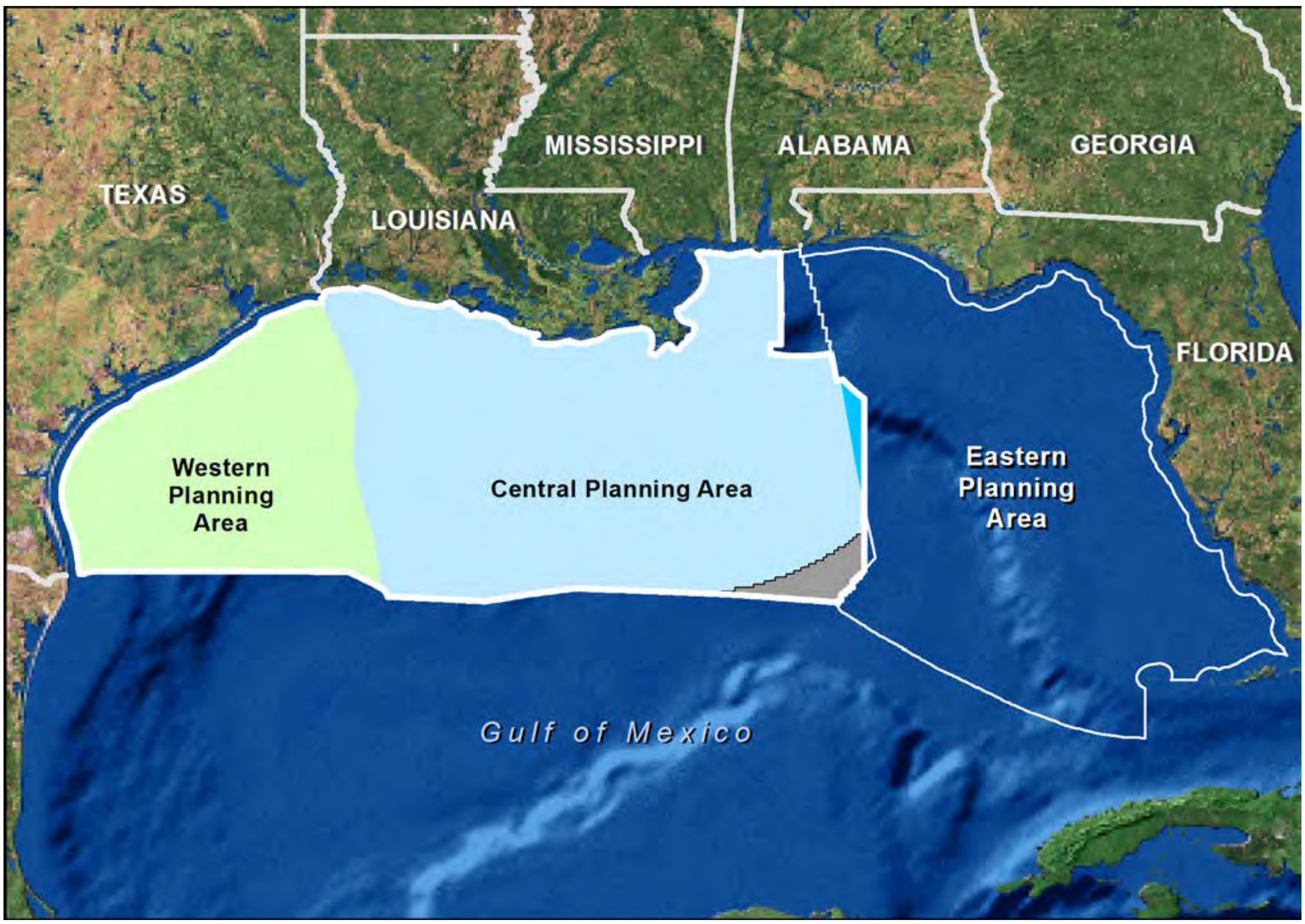
OCS EIS/EA
BOEM 2017-074

Gulf of Mexico OCS Lease Sale

Final Supplemental Environmental Impact Statement 2018

Volume I: Chapters 1-8 and Keyword Index



U.S. Department of the Interior
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region

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REGIONAL DIRECTOR'S NOTE

This Supplemental Environmental Impact Statement (EIS) addresses a proposed Federal action – a regionwide lease sale. This Supplemental EIS is expected to be used to inform decisions for proposed Outer Continental Shelf (OCS) oil and gas Lease Sales 250 and 251 in the Gulf of Mexico, as scheduled in the *2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program* (2017-2022 Five-Year Program). This Supplemental EIS is expected to be used to inform decisions for each of the two proposed lease sales scheduled in 2018 and to be used and supplemented as necessary for decisions on future Gulf of Mexico proposed regionwide lease sales. This Supplemental EIS contains analyses of the potential environmental impacts that could result from a proposed regionwide lease sale in the Gulf of Mexico as scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed regionwide lease sales scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS tiers from and updates the *Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement* (2017-2022 GOM Multisale EIS) and incorporates by reference all of the relevant material in the 2017-2022 GOM Multisale EIS.

Pursuant to the Outer Continental Shelf Lands Act's staged leasing process, the Bureau of Ocean Energy Management (BOEM) must make an individual decision on whether and how to proceed with each proposed lease sale. Therefore, in order to make an informed decision on a proposed regionwide lease sale, the analyses contained in this Supplemental EIS will be used to inform a decision for proposed Lease Sale 250, which is the first proposed lease sale for 2018. A separate decision will be made for the second proposed lease sale for 2018, which is proposed Lease Sale 251. A decision on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional National Environmental Policy Act (NEPA) reviews that may update this NEPA analysis, as necessary. Supplemental NEPA reviews, including opportunities for public involvement, are currently planned to be conducted annually for the remaining proposed lease sales.

This Final Supplemental EIS analyzes the potential impacts of a proposed action on the marine, coastal, and human environments. It is important to note that this Final Supplemental EIS was prepared using the best information that was publicly available at the time the document was prepared. This Supplemental EIS's analysis focuses on identifying the baseline conditions and potential environmental effects of oil and natural gas leasing, exploration, development, and production in the GOM. This Supplemental EIS will also assist decisionmakers in making informed, future decisions regarding the approval of operations, as well as leasing. At the completion of this EIS process, a decision will be made on whether and how to proceed with proposed Lease Sale 250.

BOEM's Gulf of Mexico OCS Region and its predecessors have been conducting environmental analyses of the effects of Outer Continental Shelf (OCS) oil and gas development since the inception of the National Environmental Policy Act of 1969. We have prepared and published more than 70 draft and 70 final EISs. Our goal has always been to provide factual, reliable, and clear analytical statements in order to inform decisionmakers and the public about the environmental effects of proposed OCS oil- and gas-related activities and their alternatives. We view the EIS process as providing a balanced forum for early identification, avoidance, and resolution of potential conflicts. It is in this spirit that we welcome comments on this document from all concerned parties.

Michael A. Celata
Regional Director
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region

COVER SHEET

Final Supplemental Environmental Impact Statement for the Proposed 2018 Gulf of Mexico OCS Lease Sales

Draft ( ) **Final (x)**

Type of Action: Administrative (x) Legislative ( )

Area of Potential Impact: Offshore Marine Environment and Coastal Counties/Parishes of Texas, Louisiana, Mississippi, Alabama, and northwestern Florida

Agency	Headquarters' Contact	Region Contacts
U.S. Department of the Interior Bureau of Ocean Energy Management Gulf of Mexico OCS Region (GM 623E) 1201 Elmwood Park Boulevard New Orleans, LA 70123-2394	Robert Martinson U.S. Department of the Interior Bureau of Ocean Energy Management 45600 Woodland Road (VAM-OEP) Sterling, VA 20166-9216 703-787-1574	Michelle K. Nannen 504-731-6682 Greg Kozlowski 504-736-2512

ABSTRACT

This Final Supplemental Environmental Impact Statement (EIS) addresses a proposed Gulf of Mexico OCS oil and gas lease sale as scheduled in the *2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program* (2017-2022 Five-Year Program). This Supplemental EIS is expected to be used to inform decisions for each of the two proposed regionwide lease sales scheduled for 2018 and to be used and supplemented as necessary for decisions on future Gulf of Mexico proposed regionwide lease sales. This Supplemental EIS contains analyses of the potential environmental impacts that could result from a proposed regionwide lease sale in the Gulf of Mexico as scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary to inform decisions for each remaining proposed lease sale scheduled in the 2017-2022 Five-Year Program.

The proposed action (lease sale) is a Federal action requiring an environmental review. This Final Supplemental EIS provides the following information in accordance with the National Environmental Policy Act and its implementing regulations, and it will be used in making a decision on the proposed action. This document includes the purpose and background of the proposed action, identification of the alternatives, description of the affected environment, and an analysis of

the potential environmental impacts of the proposed action, alternatives, and associated activities, including proposed mitigating measures and their potential effects. Potential contributions to cumulative impacts resulting from activities associated with the proposed action are also analyzed.

Hypothetical scenarios were developed on the levels of activities, accidental events that are foreseeable (such as oil spills), and potential impacts that might result if the proposed action is adopted. Activities and disturbances associated with the proposed action on biological, physical, and socioeconomic resources are considered in the analyses.

This Final Supplemental EIS analyzes the potential impacts of the proposed action on air and water quality, coastal habitats, deepwater benthic communities, *Sargassum*, live bottom habitats, fishes and invertebrates, birds, protected species, commercial and recreational fisheries, recreational resources, archaeological resources, human resources, and land use. It is important to note that this Final Supplemental EIS was prepared using the best information that was publicly available at the time the document was prepared. Where relevant information on reasonably foreseeable significant adverse impacts is incomplete or unavailable, the need for the information was evaluated to determine if it was essential to a reasoned choice among the alternatives and if so, was either acquired or in the event it was impossible or exorbitant to acquire the information, accepted scientific methodologies were applied in its place.

Additional copies of this Final Supplemental EIS and the other referenced publications may be obtained from the Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, Public Information Office (GM 335A), 1201 Elmwood Park Boulevard, New Orleans, Louisiana 70123-2394, by telephone at 504-736-2519 or 1-800-200-GULF, or on the Internet at http://www.boem.gov/nepaprocess/.

EXECUTIVE SUMMARY

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

2017-2022 Schedule of Proposed Gulf of Mexico OCS Region Lease Sales	
Lease Sale Number	Year
249	2017
250 and 251	2018
252 and 253	2019
254 and 256	2020
257 and 259	2021
261	2022

This Supplemental Environmental Impact Statement (EIS) addresses a proposed Federal action – a regionwide lease sale. This Supplemental EIS is expected to be used to inform decisions for each of the two lease sales scheduled in 2018, i.e., Lease Sales 250 and 251 in the Gulf of Mexico, as scheduled in the *2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program* (2017-2022 Five-Year Program; USDOI, BOEM, 2016a), and to be used and supplemented as necessary for decisions for each of the remaining proposed regionwide lease sales scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS contains analyses of the potential environmental impacts that could result from a proposed regionwide lease sale in the Gulf of Mexico (GOM) as scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS tiers from and updates the *Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement* (2017-2022 GOM Multisale EIS; USDOI, BOEM, 2017a) and provides analyses that can be used to inform decisions on the remaining proposed GOM lease sales in that document. This Supplemental EIS incorporates by reference all of the relevant material in the 2017-2022 GOM Multisale EIS. The decision on whether and how to proceed with proposed Lease Sale 250 will be made following the completion of this National Environmental Policy Act (NEPA) analysis. A separate decision will be made for the second proposed lease sale of 2018, i.e., Lease Sale 251. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA review that may update this Supplemental EIS as necessary.

The Bureau of Ocean Energy Management (BOEM) has issued the 2017-2022 Five-Year Program (USDOI, BOEM, 2016a), which proposes 10 regionwide GOM oil and gas lease sales on the OCS. Five regionwide lease sales are tentatively scheduled in August of each year from 2017 through 2021 and five regionwide lease sales are tentatively scheduled in March of each year from 2018 through 2022. The lease sales proposed in the GOM in the 2017-2022 Five-Year Program are regionwide lease sales comprised of the Western, Central, and a small portion of the Eastern Planning Areas (WPA, CPA, and EPA, respectively) not subject to Congressional moratorium (**Figure 1**).

The development of the 2017-2022 Five-Year Program initiates region-specific NEPA reviews for each of the proposed lease sales. Region-specific reviews are conducted by Program Area, and this Supplemental EIS contains analyses for the Gulf of Mexico OCS Region. Even though the 2017-2022 Five-Year Program includes regionwide lease sales in the GOM, any individual lease sale could still be scaled back during the prelease sale process, including for example to employ the separate planning area model used in the 2012-2017 Five-Year Program, should circumstances warrant.

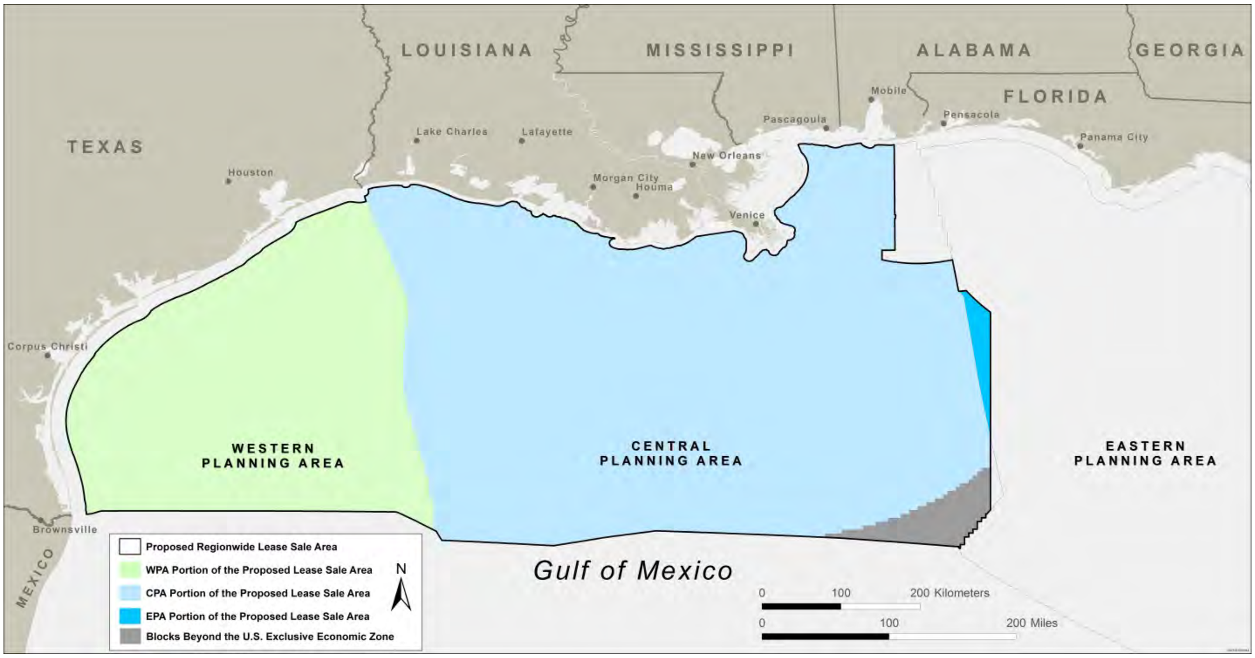

Figure 1. Proposed Regionwide Lease Sale Area Combining the Western, Central, and Eastern Planning Areas.

The Proposed Action

The proposed action evaluated in this Supplemental EIS is to hold a regionwide lease sale in the GOM according to the schedule of proposed lease sales set forth by the 2017-2022 Five-Year Program. This Supplemental EIS has been prepared to inform decisions for the proposed 2018 GOM lease sales and analyzes a single proposed action (i.e., a single proposed lease sale in the Gulf of Mexico) as scheduled in the 2017-2022 Five-Year Program. Since each of the 10 proposed lease sales in the GOM region are very similar and occur in close timeframes, BOEM prepared an EIS for a proposed action, looking at the 10 proposed lease sales in the 2017-2022 Five-Year Program cumulatively (i.e., the 2017-2022 GOM Multisale EIS). The analysis in the 2017-2022 GOM Multisale EIS will be used to inform each of the 10 proposed lease sale decisions. This Supplemental EIS tiers from and updates the 2017-2022 GOM Multisale EIS and contains analyses of the potential environmental impacts that could result from a single proposed lease sale (e.g., Lease Sale 250), but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program. However, pursuant to the OCSLA's staged leasing process, BOEM must make an individual decision on whether and how to proceed with each proposed lease sale. Therefore, in order to make an informed decision on a single proposed lease sale, the analyses contained in this Supplemental EIS examine impacts from a single proposed lease sale (e.g., Lease Sale 250). The decision on whether and how to proceed with proposed Lease Sale 250, which is the first GOM lease sale proposed for 2018, will be made following the completion of this NEPA analysis. A separate decision will be made for proposed Lease Sale 251, which is the second GOM lease sale proposed for 2018. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA reviews that may update this Supplemental EIS as necessary.

Purpose of the Proposed Action

The Outer Continental Shelf Lands Act of 1953, as amended (43 U.S.C. §§ 1331 *et seq*. [1988]), hereafter referred to as the OCSLA, establishes the Nation's policy for managing the vital energy and mineral resources of the OCS. Section 18 of the OCSLA requires the Secretary of the Interior to prepare and maintain a schedule of proposed OCS oil and gas lease sales determined to "best meet national energy needs for the 5-year period following its approval or reapproval" (43 U.S.C. § 1344). The Five-Year Program establishes a schedule that the U.S. Department of the Interior (USDOI or DOI) will use as a basis for considering where and when leasing might be appropriate over a 5-year period.

> *"It is hereby declared to be the policy of the United States that . . . the Outer Continental Shelf is a vital national resource held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs."*
>
> OCSLA, 43 U.S.C. §§ 1331 *et seq.*

The purpose of the proposed Federal action addressed in this Supplemental EIS (i.e., a proposed regionwide lease sale) is to offer for lease those areas that may contain economically recoverable oil and gas resources in order to further the orderly development of OCS oil and gas resources in accordance with the OCSLA, which specifically states that these areas "should be made available for expeditious and orderly development, subject to environmental safeguards" (OCSLA, 43 U.S.C. §§ 1331 *et seq*.). Each individual proposed lease sale would provide qualified bidders the opportunity to bid upon and lease available acreage in the Gulf of Mexico OCS in order to explore, develop, and produce oil and natural gas. This Supplemental EIS will determine the potential environmental impacts that could result from a single proposed lease sale (e.g., Lease Sale 250) scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary for each remaining Federal action (lease sale) scheduled in the 2017-2022 Five-Year Program.

Need for the Proposed Action

The need for the proposed action (i.e., a proposed regionwide lease sale) is to manage the development of OCS resources in an environmentally and economically responsible manner as required under Section 18 of the OCSLA. Oil serves as the feedstock for liquid hydrocarbon products, including gasoline, aviation and diesel fuel, and various petrochemicals. Oil from the Gulf of Mexico OCS contributes to meeting domestic demand and enhances national economic security. Since the U.S. is expected to continue to rely on oil and natural gas to meet its energy needs, each proposed action would contribute to meeting domestic demand and reducing the need for importing these resources.

The Decision to be Made

This Supplemental EIS has been prepared to inform decisions for each of the proposed 2018 GOM lease sales. After completion of the NEPA process for this Supplemental EIS, a decision will be made for proposed Lease Sale 250, which is scheduled for March 2018 (i.e., prepare a Record of Decision for proposed Lease Sale 250). A second NEPA review will be conducted for proposed Lease Sale 251, which is scheduled for August 2018, to consider any relevant new information; a second Record of Decision will be prepared for proposed Lease Sale 251. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA review that may update this Supplemental EIS as necessary.

Public Involvement

Pursuant to the OCSLA, the Bureau of Ocean Energy Management published a Call for Information (Call) to request and gather information to determine the Area Identification (Area ID) for each proposed lease sale in the 2017-2022 Five-Year Program, which is the nationwide schedule of proposed lease sales published for public input. The Call was published in the *Federal Register* (2015a) on September 4, 2015, and invited potential bidders to nominate areas of interest within the program area(s) included in the 2017-2022 Five-Year Program. Using information provided in response to the Call and from scoping comments, BOEM then developed an Area ID recommendation memorandum. The Area ID is an administrative prelease step that describes the geographic area for environmental analysis and consideration for leasing. On November 20, 2015, the Area ID decision was made. One Area ID was prepared for all proposed lease sales. The Area ID memorandum recommended keeping the entire GOM regionwide area included in the 2017-2022 Five-Year Program for consideration in the 2017-2022 GOM Multisale EIS and supplemental NEPA analyses such as this Supplemental EIS. The area identified for lease includes all of the available unleased blocks in the GOM not subject to Congressional moratorium pursuant to the Gulf of Mexico Energy Security Act of 2006.

BOEM conducted a public scoping process for this Supplemental EIS that extended from August 19 to September 19, 2016. Public scoping meetings were held in four cities (Gulfport, Mississippi; Mobile, Alabama; Houston, Texas; and New Orleans, Louisiana). In addition to accepting oral and written comments at each public meeting, BOEM accepted written comments by mail and through the regulations.gov web portal (http://www.regulations.gov). BOEM received a total of 433 comments in response to the Notice of Intent to Prepare an EIS and 8 additional comments at the scoping meetings, for a total of 441 comments.

Almost 380 individual comments were received in support of the proposed lease sales, 356 of which were form letters. Commenters stated that future leases are vital to the national economy and security, and are integral to the State of Louisiana and local economies and jobs. Several noted that oil and gas companies and employees must be good stewards of the environment and continue to provide more emphasis on safety. Several commenters stated that the recent downturn in oil and gas prices is hurting small towns and southern states in general.

Twenty-three individual comments were received that opposed future lease sales. Commenters stated that renewable energy should be pursued instead of oil and gas, fossil fuels should be left in the ground, and new lease sales are not compatible with the Paris Treaty. Issues of concern included the impacts of oil and gas on greenhouse gas emission and global climate change, the impacts of climate change on the GOM's environmental resources, warmer oceans, increased storms and flooding events, and land loss. Several commenters also expressed concern about continuing oil and chemical spill risks, continuing effects of past oil and chemical spills, leaking wells and pipelines, and a lack of reasonable alternatives. Environmental resources of concern included protected species (i.e., marine mammals, sea turtles, beach mice, protected birds, and corals), wetlands, fish nurseries, coral reefs, safety of seafood, and environmental justice. Comments were received expressing concerns for environmental justice related to those living nearby petrochemical processing facilities.

A Notice of Availablity (NOA) of the Draft Supplemental EIS was published in the *Federal Register* on March 31, 2017, initiating a solicitation of public comments on the Draft Supplemental EIS (*Federal Register*, 2017). The 45-day comment period ended on May 15, 2017; however, the Joint Trades and a private citizen requested an additional 30 days to comment on the air quality modeling and analysis. They were given a 30-day extension, which closed on June 14, 2017, to provide comments on air quality only; however, no additional air quality comments were received during the 30-day extension. In accordance with 30 CFR § 556.26, BOEM scheduled public meetings soliciting comments on the Draft Supplemental EIS. Fifty-seven individuals attended five public meetings, which were held in Houston, Texas; New Orleans, Louisiana; Pensocola, Florida; Mobile, Alabama; and Gulfport, Mississippi. BOEM received 291 substantive comments in response to the Draft Supplemental EIS via letter, email, written and verbal comments at the public meetings, and the regulations.gov website. BOEM also received 3,677 copies of a form letter and a petition signed by over 89,000 individuals requesting an end to offshore drilling. All comments (i.e., letters, court reporter transcripts, electronic submissions, etc.) were analyzed to identify all substantive issues raised by the public.

ALTERNATIVES

A proposed action is to hold a lease sale in the GOM according to the schedule of proposed lease sales set forth by the 2017-2022 Five-Year Program. BOEM has identified four action alternatives, and a No Action Alternative, to be analyzed in this Supplemental EIS. These alternatives are briefly described below. The mitigating measures (pre- and postlease), including the proposed stipulations, are summarized in **Chapter 2** of this Supplemental EIS and and are fully described in Chapter 2 and Appendices B and D of the 2017-2022 GOM Multisale EIS, as are the deferred alternatives not analyzed in detail.

Alternative A—Regionwide OCS Lease Sale (The Preferred Alternative)

Alternative A would allow for a proposed regionwide lease sale encompassing all three planning areas within the U.S. portion of the Gulf of Mexico OCS. This is BOEM's preferred alternative. This alternative would offer for lease all available unleased blocks within the WPA, CPA, and EPA portions of the proposed lease sale area for oil and gas operations (**Figure 2**), with the following exceptions:

(1) whole and portions of blocks deferred by the Gulf of Mexico Energy Security Act of 2006 (discussed in the *OCS Regulatory Framework* white paper [Cameron and Matthews, 2016]);

(2) blocks that are adjacent to or beyond the United States' Exclusive Economic Zone in the area known as the northern portion of the Eastern Gap; and

(3) whole and partial blocks within the current boundary of the Flower Garden Banks National Marine Sanctuary.

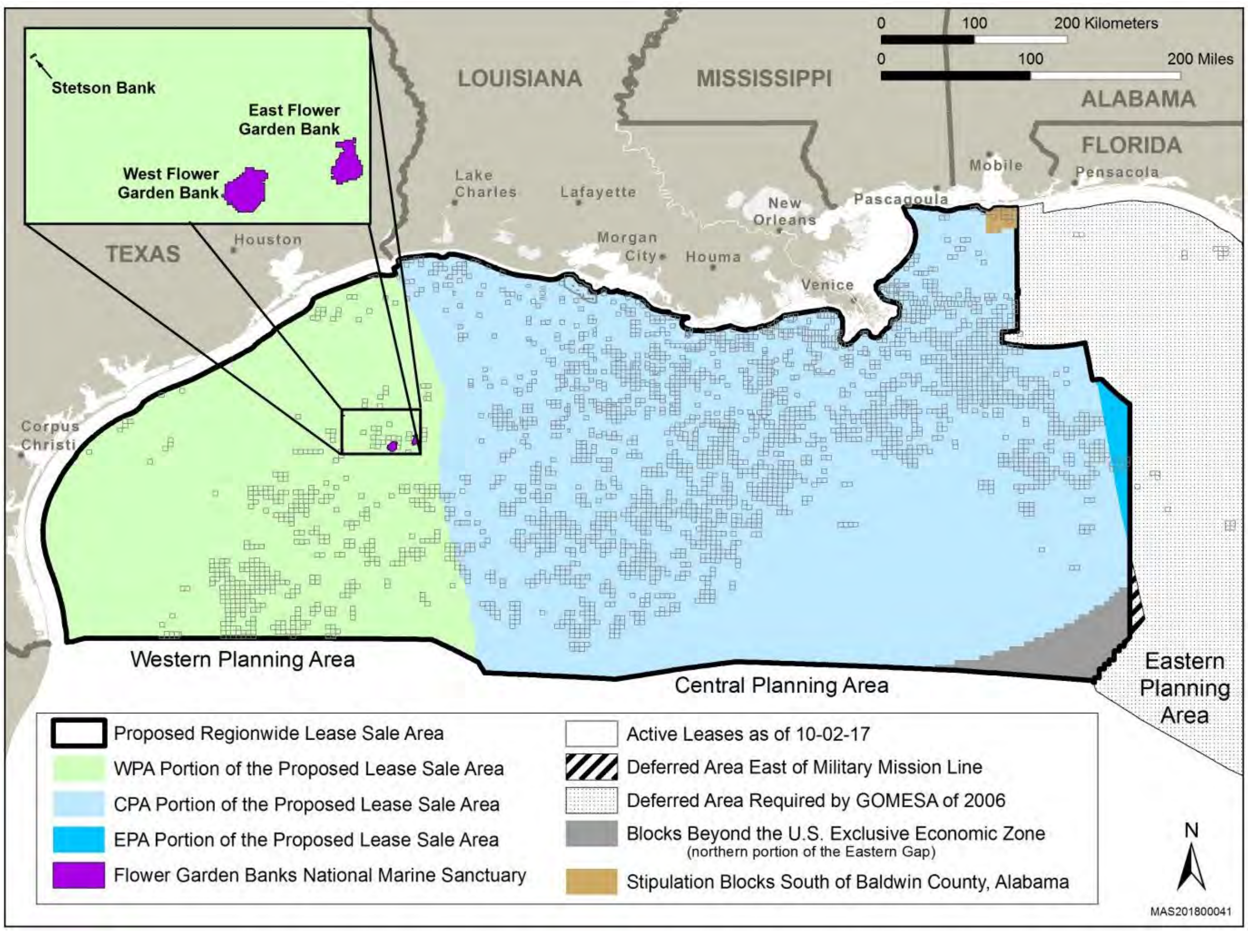

Figure 2. Proposed Regionwide Lease Sale Area, Encompassing the Available Unleased Blocks within All Three Planning Areas (approximately 91.93 million acres with approximately 76.9 million acres available for lease as of October 2017).

Alternative B—Regionwide OCS Lease Sale Excluding Available Unleased Blocks in the WPA Portion of the Proposed Lease Sale Area

Alternative B would allow for a proposed lease sale encompassing the CPA and EPA within the U.S. portion of the Gulf of Mexico OCS (**Figure 3**). Available blocks within the WPA would ***not*** be considered under this alternative. This alternative would offer for lease all available unleased blocks within the CPA and EPA portions of the proposed lease sale area for oil and gas operations, with the following exceptions:

(1) whole and portions of blocks deferred by the Gulf of Mexico Energy Security Act of 2006 (discussed in the *OCS Regulatory Framework* white paper [Cameron and Matthews, 2016]); and

(2) blocks that are adjacent to or beyond the United States' Exclusive Economic Zone in the area known as the northern portion of the Eastern Gap.

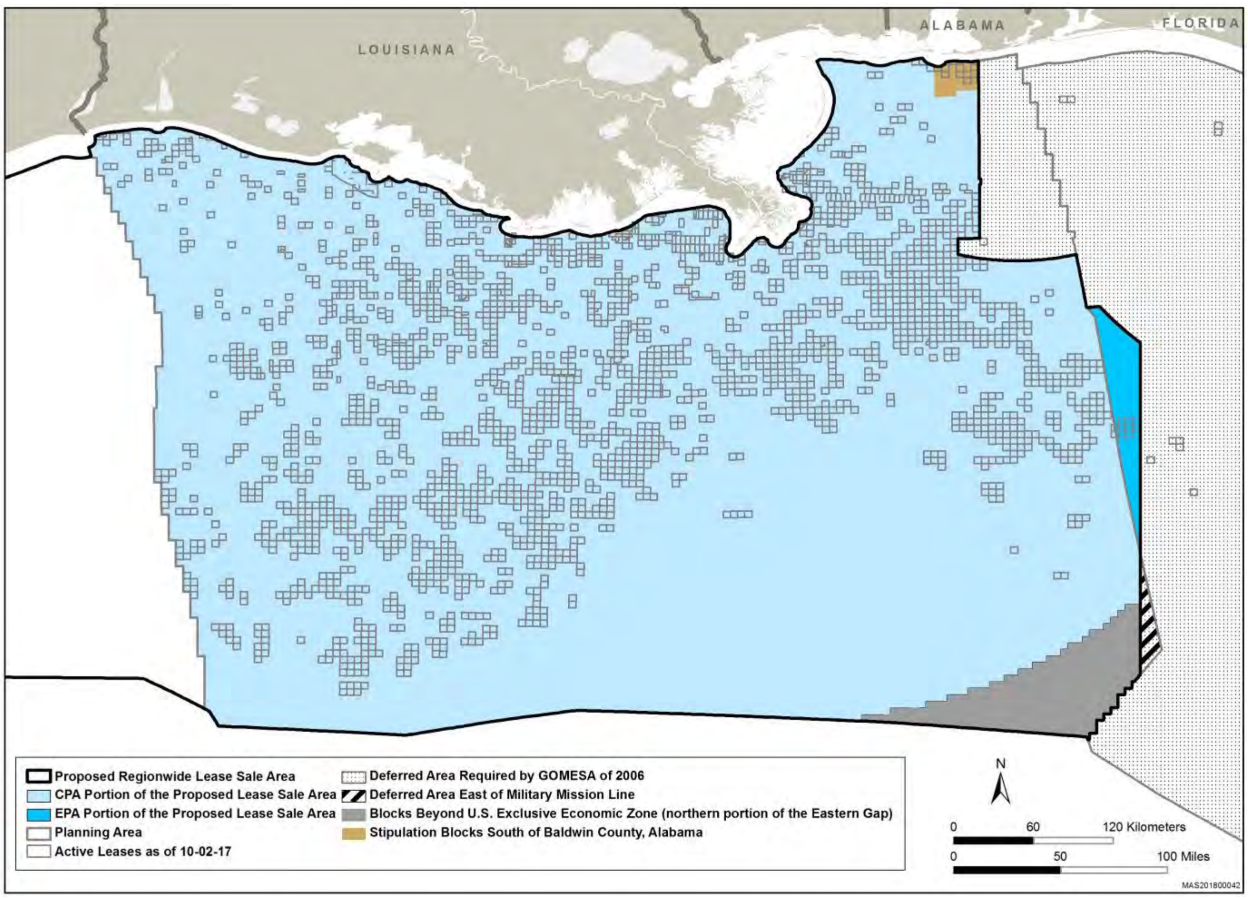

Figure 3. Proposed Lease Sale Area for Alternative B, Excluding the Available Unleased Blocks in the WPA (approximately 63.35 million acres with approximately 50.9 million acres available for lease as of October 2017).

Alternative C—Regionwide OCS Lease Sale Excluding Available Unleased Blocks in the CPA/EPA Portions of the Proposed Lease Sale Area

Alternative C would allow for a proposed lease sale encompassing the WPA within the U.S. portion of the Gulf of Mexico OCS (**Figure 4**). Available blocks within the CPA and EPA would ***not*** be considered under this alternative. This alternative would offer for lease all available unleased blocks within the WPA portion of the proposed lease sale area for oil and gas operations, with the following exception:

(1) whole and partial blocks within the current boundary of the Flower Garden Banks National Marine Sanctuary.

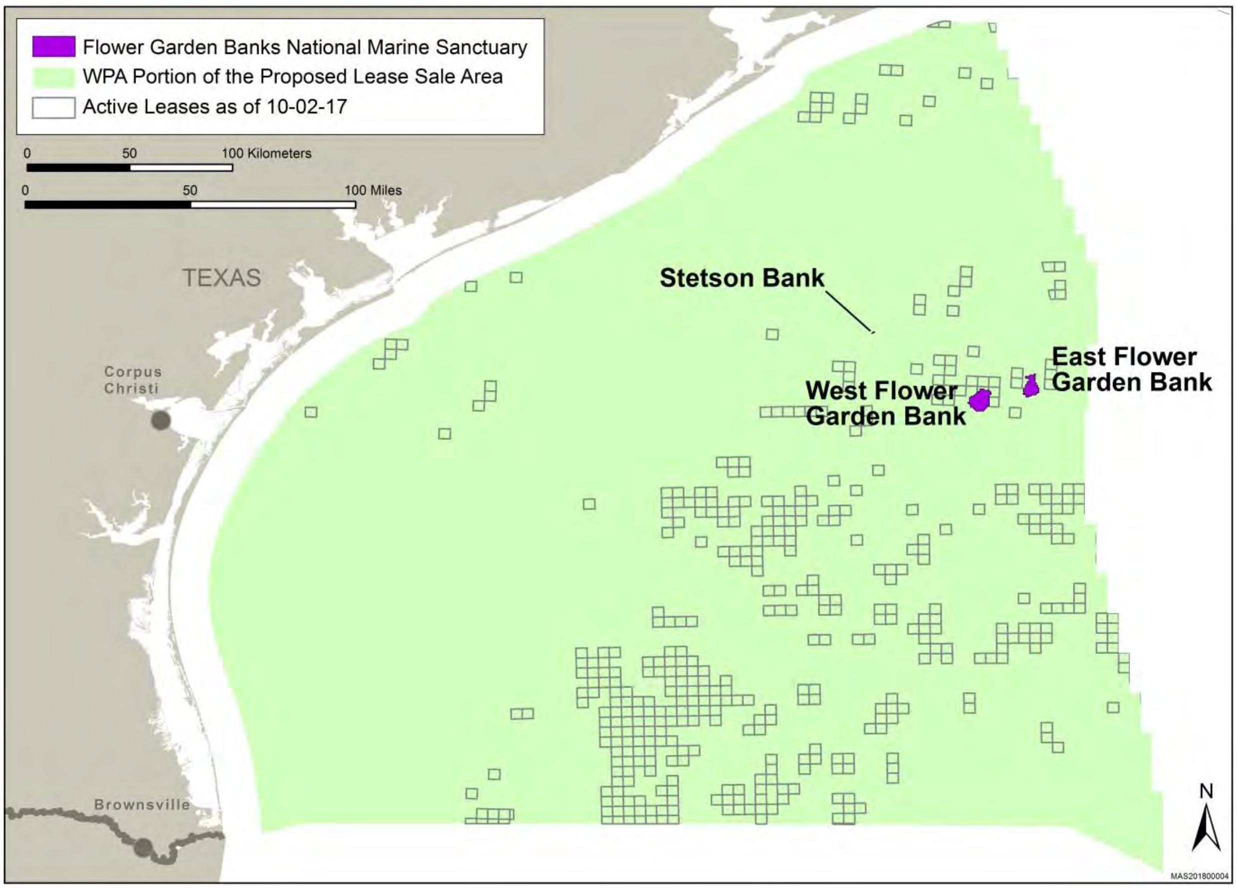

Figure 4. Proposed Lease Sale Area for Alternative C, Excluding the Available Unleased Blocks in the CPA and EPA (approximately 28.58 million acres with approximately 26.0 million acres available for lease as of October 2017).

Alternative D—Alternative A, B, or C, with the Option to Exclude Available Unleased Blocks Subject to the Topographic Features, Live Bottom (Pinnacle Trend), and/or Blocks South of Baldwin County, Alabama, Stipulations

Alternative D could be combined with any of the action alternatives above (i.e., Alternative A, B, or C) and would allow the flexibility to offer leases under any alternative with additional exclusions. Under Alternative D, the decisionmaker could exclude from leasing any available unleased blocks subject to any one and/or combination of the following stipulations:

- Topographic Features Stipulation;
- Live Bottom (Pinnacle Trend) Stipulation; and
- Blocks South of Baldwin County, Alabama, Stipulation (not applicable to Alternative C).

This alternative considered blocks subject to these stipulations because these areas have been emphasized in scoping, can be geographically defined, and adequate information exists regarding their ecological importance and sensitivity to OCS oil- and gas-related activities, as shown in **Figure 5**. All of the assumptions (including the other potential mitigating measures) and estimates would remain the same as described for any given alternative.

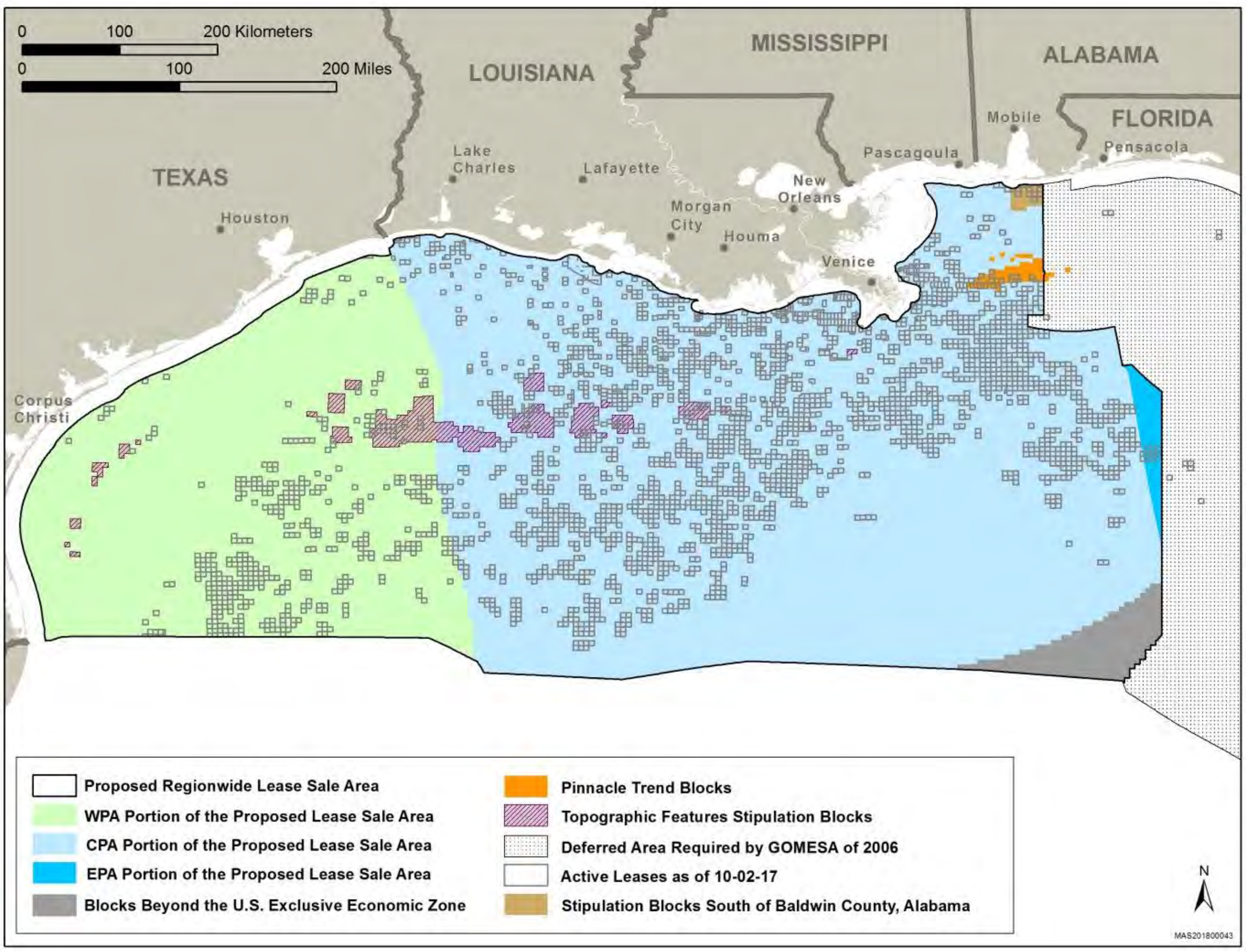

Figure 5. Identified Topographic Features, Pinnacle Trend, and Baldwin County Stipulation Blocks in the Gulf of Mexico.

Alternative E—No Action

Alternative E is the cancellation of a single proposed GOM lease sale within the 2017-2022 Five-Year Program. The opportunity for development of the estimated oil and gas that could have resulted from a proposed action (i.e., a single proposed lease sale) or alternative to a proposed action, as described above, would be precluded or postponed to a future lease sale. Any potential environmental impacts resulting from a proposed lease sale would not occur. Activities related to previously issued leases and permits (as well as those that may be issued in the future under a separate decision) related to the OCS Oil and Gas Program would continue. If a lease sale were to be cancelled, the resulting development of oil and gas would most likely be postponed to a future lease sale; therefore, the overall level of OCS oil- and gas-related activity would only be reduced by a small percentage, if any.

MITIGATING MEASURES

Proposed lease stipulations and other mitigating measures designed to reduce or eliminate environmental risks and/or potential multiple-use conflicts between OCS operations and U.S. Department of Defense activities may be applied to the chosen alternative. Mitigating measures in the form of lease stipulations are added to the lease terms and are therefore enforceable as part of the lease. The 10 lease stipulations being considered are the Topographic Features Stipulation; Live Bottom (Pinnacle Trend) Stipulation; Military Areas Stipulation; Evacuation Stipulation; Coordination Stipulation; Blocks South of Baldwin County, Alabama, Stipulation; Protected Species Stipulation; United Nations Convention on the Law of the Sea Royalty Payment Stipulation; Below Seabed Operations Stipulation; and the Stipulation on the Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (Transboundary Stipulation). The United Nations Convention on the Law of the Sea Royalty Payment Stipulation is applicable to a proposed lease sale even though it is not an environmental or military stipulation. The Topographic Features and Live Bottom (Pinnacle Trend) Stipulations have been applied as programmatic mitigation in the *Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022; Final Programmatic Environmental Impact Statement* (2017-2022 Five-Year Program EIS) (USDOI, BOEM, 2016b) and, therefore, these stipulations would apply to all leases issued under the 2017-2022 Five-Year Program in the designated lease blocks. Refer to **Chapter 2.2.3** for BOEM's mitigating measures. Chapter 2.2.4 and Appendix D of the 2017-2022 GOM Multisale EIS provide a more detailed analysis of the 10 lease stipulations and their effectiveness.

Application of lease stipulations will be considered by the decisionmaker. The inclusion of the stipulations as part of the analysis of the proposed actions does not ensure that the decisionmaker will make a decision to apply the stipulations to leases that may result from a proposed lease sale, nor does it preclude minor modifications in wording during subsequent steps in the prelease process if comments indicate changes are necessary or if conditions warrant. However, the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations have been applied as programmatic mitigation in the 2017-2022 Five-Year Program EIS and therefore, these stipulations would apply to all leases issued under the 2017-2022 Five-Year Program in the designated lease blocks. Any lease stipulations or mitigating measures to be included in a lease sale will be described in the Final Notice of Sale. In addition, mitigations may be added to plan and/or permits for OCS oil- and gas-related activities (**Chapter 2.2.3.3**). For more information on mitigating measures that are added at the postlease stage, refer to Appendix B ("Commonly Applied Mitigating Measures") of the 2017-2022 GOM Multisale EIS.

DIRECT AND INDIRECT ACTIONS ASSOCIATED WITH A PROPOSED LEASE SALE

BOEM describes the potentially occurring actions associated with a single proposed lease sale and the cumulative activities that provide a framework for a detailed analysis of the potential environmental impacts. Exploration and development scenarios describe the infrastructure and activities that could potentially affect the biological, physical, and socioeconomic resources in the GOM. They also include a set of ranges for resource estimates, projected exploration and development activities, and impact-producing factors.

Offshore activities are described in the context of scenarios for a proposed action (**Chapter 3.1**) and for the OCS Program (**Chapter 3.3**). BOEM's Gulf of Mexico Region developed these scenarios to provide a framework for detailed analyses of potential impacts of a proposed lease sale. The scenarios are presented as ranges (low to high) of the amounts of undiscovered, unleased hydrocarbon resources estimated to be leased and produced as a result of a proposed action. The scenarios encompass a range of activities (e.g., the installation of platforms, drilling wells, and installing pipelines, and the number of helicopter operations and service-vessel trips, etc.) that would be needed to develop and produce the amount of forecasted oil and gas resources.Environmental Impacts

Summaries of the affected environment and the potential impacts of a single proposed lease sale under each alternative are presented here. Detailed affected environment descriptions and impact analyses are analyzed by resource in the 2017-2022 GOM Multisale EIS and are hereby incorporated by reference. Analysis of the alternatives for each resource considers routine activities, accidental events, cumulative impact analysis, incomplete or unavailable information, and conclusions for each resource. This Supplemental EIS also incorporated by reference from the 2017-2022 GOM Multisale EIS the baseline data in the assessment of impacts from a proposed action on the resources and the environment (**Chapter 4**).

The major issues that frame the environmental analyses in this Supplemental EIS are the result of concerns raised during years of scoping for the Gulf of Mexico OCS Program. Issues related to OCS oil and gas exploration, development, production, and transportation activities include the potential for oil spills, wetlands loss, air emissions, wastewater discharges and water quality degradation, marine trash and debris, structure and pipeline emplacement activities, platform removal, vessel and helicopter traffic, multiple-use conflicts, support services, population fluctuations, land-use planning, impacts to recreation and beaches, aesthetic interference, environmental justice, and conflicts with State coastal zone management programs. Environmental resources and activities identified during the scoping process that warrant an environmental analysis include air quality, water quality, coastal habitats (including wetlands and seagrasses), barrier beaches and associated dunes, live bottom habitats (including topographic features and pinnacle trends), *Sargassum* and associated communities, deepwater benthic communities, marine mammals, sea turtles, birds, fishes and invertebrate resources, commercial fisheries, recreational fishing, recreational resources, archaeological resources, and socioeconomic factors (including environmental justice), and within the CPA only, beach mice.

Within each resource summary in **Chapter 4** and within the full analysis in the 2017-2022 GOM Multisale EIS, the cumulative analysis considers environmental and socioeconomic impacts that may result from the incremental impact of a proposed action when added to all past, present, and reasonably foreseeable future OCS oil- and gas-related activities (OCS Program), as well as non-OCS oil- and gas-related activities (e.g., import tankering and commercial fishing). This includes projected activity from lease sales that have been held but for which exploration or development has not yet begun or is continuing. In addition, impacts from natural occurrences, such as hurricanes, are analyzed.

Other relevant issues include impacts from the *Deepwater Horizon* explosion, oil spill, and response; impacts from past and future hurricanes on environmental and socioeconomic resources; and impacts on coastal and offshore infrastructure. During the past several years, the Gulf Coast States and Gulf of Mexico oil and gas activities have been impacted by major hurricanes. The description of the affected environment, which is incorporated by reference from the 2017-2022 GOM Multisale EIS, includes impacts from these relevant issues on the physical environment, biological environment, and socioeconomic activities, and on OCS oil- and gas-related infrastructure.

Impact Conclusions

The analyses of the potential impacts of routine activities and accidental events associated with a proposed action (lease sale) and a proposed action's incremental contribution to the cumulative impacts are described in the individual resource discussions in **Chapter 4**. A summary of the potential impacts from a proposed action on each environmental and socioeconomic resource and the conclusions of the analyses can be found in the following discussions. **Table 1** provides a comparison of expected impact levels by alternative and is derived from the analysis of each resource in **Chapter 4**. The findings for Alternatives A-E would be a proposed action's *incremental contribution* to the cumulative impacts from past, present, and future activities in the GOM. These activities would include both OCS oil- and gas-related and non-OCS oil- and gas-related activities that would be expected regardless of whether or not a lease sale was to occur. The impact-level ratings have been specifically tailored and defined for each resource within the **Chapter 4** impact analysis. Cumulative impacts of current, past, and reasonably foreseeable future activities, however, would continue to occur under Alternative E.

Table 1. Alternative Comparison Matrix.

Impact Level Key[1]					
Beneficial[2]	Negligible	Minor	Moderate	Major	
	Alternative				
Resource	A	B	C	D	E
Air Quality	Minor	Minor	Minor	Minor	None
Water Quality	Negligible	Negligible	Negligible	Negligible	None
Coastal Habitats					
Estuarine Systems	Moderate	Moderate	Minor	Moderate	Negligible
Coastal Barrier Beaches and Associated Dunes	Minor	Minor	Negligible to Minor	Negligible to Minor	Negligible
Deepwater Benthic Communities	Negligible	Negligible	Negligible	Negligible	None
Sargassum and Associated Communities	Negligible	Negligible	Negligible	Negligible	None
Live Bottoms					
Topographic Features	Negligible	Negligible	Negligible	Negligible	None
Pinnacles and Low-Relief Features	Negligible to Minor	Negligible to Minor	Negligible	Negligible	None
Fishes and Invertebrate Resources	Minor	Minor	Minor	Minor	None
Birds	Moderate	Moderate	Moderate	Moderate	None
Protected Species					
Marine Mammals	Negligible	Negligible	Negligible	Negligible	None
Sea Turtles	Negligible	Negligible	Negligible	Negligible	None
Beach Mice	Negligible	Negligible	Negligible	Negligible	None
Protected Birds	Negligible	Negligible	Negligible	Negligible	None
Protected Corals	Negligible	Negligible	Negligible	Negligible	None
Commercial Fisheries	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Recreational Fishing	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Recreational Resources	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Archaeological Resources	Negligible[3]	Negligible[3]	Negligible[3]	Negligible[3]	None
Human Resources and Land Use					
Land Use and Coastal Infrastructure	Minor	Minor	Minor	Minor	None
Economic Factors	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible to Minor
Social Factors (including Environmental Justice)	Minor	Minor	Minor	Minor	None

Impact Level Key[1]					
Beneficial[2]	Negligible	Minor	Moderate		Major
	Alternative				
Resource	A	B	C	D	E

Note: Some resources have a range for the impact levels to account for certain variables such as the uncertainty of non-OCS oil- or gas-related activities, the level and magnitude of potential accidental events, and the minimization of the OCS oil- or gas-related impacts through lease stipulations, mitigations, and/or regulations. The impact level ratings have been specifically tailored and defined for each resource within the **Chapter 4** impact analysis.

[1] The findings for Alternatives A-D are the incremental contribution of a proposed action added to what would be expected to occur under the No Action Alternative (i.e., no lease sale). Therefore, each impact determination under Alternatives A-D assumes that the conditions and impacts (i.e., past, present, and future activities as a result of past lease sales) under the No Action Alternative would still be present.

[2] The level of beneficial impacts is specified in the analysis, which could range from low, medium, or high.

[3] The level of impacts for archaeological resources ranges between negligible to major and is dependent upon whether a survey is performed, mitigation is imposed, mitigation is followed, or a site is identified prior to the activity.

Air Quality

Air quality is the degree at which the ambient air is free of pollution; it is assessed by measuring the pollutants in the air. To protect public health and welfare, the Clean Air Act established National Ambient Air Quality Standards (NAAQS) for certain common and widespread pollutants. The six common "criteria pollutants" are particle pollution (also known as particulate matter, $PM_{2.5}$ and PM_{10}), carbon monoxide (CO); nitrogen dioxide (NO_2); sulfur dioxide (SO_2); lead (Pb); and ozone (O_3). Air emissions from OCS oil and gas development in the Gulf of Mexico would arise from emission sources related to drilling and production with associated vessel support, flaring and venting, decommissioning, fugitive emissions, and oil spills. Associated activities that take place as a result of a proposed action support and maintain the OCS oil and gas platform sources. Air emissions from non-OCS oil- and gas-related emissions in the Gulf of Mexico would arise from emission sources related to State oil and gas programs, onshore industrial and transportation sources, and natural events. Since the primary NAAQS are designed to protect human health, BOEM focuses on the impact of these activities on the States, where there are permanent human populations.

In the “Air Quality Modeling in the Gulf of Mexico Region” study (**Appendices B-D**), photochemical grid modeling was conducted to assess the impacts to nearby states of existing and proposed future OCS oil and gas exploration, development, and production. This draft interim assessment is being used to disclose potential cumulative and incremental air quality impacts of the proposed lease sales. BOEM is in the process of updating the air quality modeling based on public comments, and the results of the final air quality modeling will be included in a future NEPA analysis that will be available for public review and comment. BOEM is considering correcting the initial air quality for sea-salt estimates, along with caisson emissions, decommissioned structures, and locations of platforms. In addition, BOEM is considering tagging the model for a single proposed lease sale, which was not done in the initial model run.

The revised air quality model run will not be completed before the publication of this Final Supplemental EIS. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as a reference for NEPA analysis. The air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated. In order to address data gaps and current impacts for this analysis, BOEM used the initial air quality modeling results, emissions inventory data, available studies of OCS oil- and gas-related activities, postlease exploration and development plan information, and current proposed lease sale scenario data, as well as previous proposed action scenario data, to reach the impact conclusions.

However, no activities beyond certain ancillary activities are actually authorized by the lease; therefore, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1** of this Supplemental EIS). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts. During its review of any plan submitted postlease, BOEM conducts an air quality review to determine if additional controls are necessary. At this postlease stage, BOEM has the authority to disapprove or require additional mitigation to reduce impacts from site-specific activities as additional information related to the revised air quality modeling becomes available. It is anticipated that new air quality modeling results will be available for consideration before any plan is submitted on a block leased as a result of proposed Lease Sale 250. Therefore, while additional air quality data would be useful in consideration of this proposed lease sale, it is not necessary for a decision on this proposed lease sale. Any concerns raised by the modeling study will be further refined by the time plans are submitted, and/or additional plan specific modeling may be required consistent with BOEM's regulations when the plan is submitted for approval.

The initial air quality modeling study examines the potential impacts of the proposed lease sales with respect to the NAAQS for the criteria pollutants O_3, NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}; the air quality-related values (AQRVs), including visibility and acid deposition (sulfur and nitrogen) in nearby Class I and sensitive Class II areas; and the incremental impacts of Prevention of Significant Deterioration (PSD) pollutants (NO_2, PM_{10}, $PM_{2.5}$) with respect to PSD Class I and Class II increments. (*Note: This analysis does not constitute a regulatory PSD increment consumption analysis as would be required for major sources subject to the New Source Review program requirements of the Clean Air Act*). An assessment of the final study results will be discussed in future NEPA documents.

Historic trend data are limited for a regionwide lease sale. In the scenario in **Chapter 3.1** of this Supplemental EIS and Chapter 3.1 of the 2017-2022 GOM Multisale EIS, the projected activities of a single regionwide lease sale is based on a range of historic observations and provides a reasonable expectation of oil and gas production anticipated from a single proposed lease sale. The projected activities of 10 proposed regionwide lease sales' mid-case scenario, which was used in the model, falls within the range of a single proposed lease sale. To understand how these results would apply to a single proposed lease sale, the level of projected activity was compared between the modeled highest year of the 10 proposed lease sales to a single proposed lease sale. This is conservative because the current price of oil equals the low range of the scenario. Using these assumptions, the potential impacts of a single proposed lease sale would be **minor**. More specifically, the potential impacts of a single proposed lease sale to the Breton Wilderness Area would be **moderate**, whereas the overall potential impacts of a single proposed lease sale would be **minor** for all other areas. However, since these potential impacts are estimated using the current prices of oil and gas, BOEM anticipates future modeling. A full analysis of air quality can be found in **Chapter 4.1**.

The *incremental contribution* of a proposed lease sale to the cumulative impacts would most likely have a ***minor*** effect on coastal nonattainment areas because most impacts on the affected resource could be avoided with proper mitigation. Portions of the Gulf Coast onshore areas have ozone levels that exceed the Federal air quality standard, but the incremental contribution from a proposed lease sale would be very small and would not on their own cause an exceedance.

As previously stated, BOEM contracted an air quality modeling study in the GOM region to assess the impacts of OCS oil- and gas-related development to nearby States, as required under the OCSLA. The data from forecasted emissions resulting from the 10 proposed lease sales was annualized using BOEM's Resource Evaluation's mid-case scenario. These results are presented in **Appendices B-D**. The cumulative impacts from all 10 proposed lease sales would be **minor** to **moderate**. More specifically, the cumulative impacts of 10 proposed lease sales to the Breton Wilderness Area and Gulf Islands National Seashore would be **moderate**, whereas the overall cumulative impacts of 10 proposed lease sales would be **minor** to **moderate**.

The cumulative impacts, in addition to the past, present, and future activities, of 10 proposed lease sales would most likely have a **moderate** effect on coastal nonattainment areas for certain pollutants. Portions of the Gulf Coast onshore areas have ozone levels that exceed the Federal air quality standard, but the cumulative impacts from 10 proposed lease sales do not on their own cause an exceedance. A full analysis of air quality can be found in **Chapter 4.1**.

Water Quality

Water quality is a term used to describe the condition or environmental health of a waterbody or resource, reflecting its particular biological, chemical, and physical characteristics and the ability of the waterbody to maintain the ecosystems it supports and influences. It is an important measure for both ecological and human health. The largest impact-producing factors affecting water quality are operational discharges and wastes, drilling fluid spills, chemical and waste spills, and oil spills. The impacts of OCS Program-related routine operational discharges (Chapter 3.1.5.1 of the 2017-2022 GOM Multisale EIS and summarized in **Table 3-8** of this Suppplemental EIS) on water quality are considered **negligible** (beyond 1,000 meters [m]; 3,281 feet [ft]) to **moderate** (within 1,000 m; 3,281 ft) of the source. The potential impacts from OCS Program-related oil spills on water quality are considered **moderate**, even with the implementation of mitigating measures. This is because activities to address oil spills may cause secondary impacts to water quality, such as the introduction of additional hydrocarbons into the dissolved phase through the use of dispersants and the sinking of hydrocarbon residuals from burning. The impacts from a proposed action are a small addition to the cumulative impacts on water quality when compared with inputs from hypoxia, potentially leaking shipwrecks, chemical weapon dumpsites, natural oil seeps, and natural turbidity. The *incremental contribution* of the routine activities and accidental events associated with a proposed action to the cumulative impacts on water quality is expected to be ***negligible*** for any of the action alternatives. For Alternative E, the cancellation of a proposed lease sale would result in no new activities associated with a proposed lease sale; therefore, the incremental impacts would be **none**. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of water quality can be found in **Chapter 4.2**.

Coastal Habitats

Estuarine Systems (Wetlands and Seagrasses/Submerged Vegetation)

The estuarine system is the transition zone between freshwater and marine environments. It can consist of many habitats, including wetlands and those containing submerged vegetation. The largest impact-producing factors affecting estuarine systems are navigation channel maintenance dredging, vessel operation, and oil spills. The impacts to these habitats from routine activities associated with a proposed action are expected to be **minor** to **moderate**. **Minor** impacts would be due to the projected low probability for any new pipeline landfalls (0-1 projected), the minimal contribution to the need for maintenance dredging, and the mitigating measures expected to be used to further reduce or avoid these impacts (e.g., the use of modern techniques such as directional drilling). However, impacts caused by vessel operations related to a proposed action over 50 years would be **moderate** considering the permanent loss of hundreds of acres of wetlands. Overall, impacts to estuarine habitats from oil spills associated with activities related to a proposed action would be expected to be **minor** because of the distance of most postlease activities from the coast, the expected weathering of spilled oil over that distance, the projected low probability of large spills near the coast, the resiliency of wetland vegetation, and the available cleanup techniques.

Cumulative impacts to estuarine habitats are caused by a variety of factors, including the OCS oil- and gas-related and non-OCS oil- and gas-related activities outlined in Chapter 4.3 of the 2017-2022 GOM Multisale EIS and human and natural impacts. Development pressures in the coastal regions of the GOM have been largely the result of tourism and residential beach-side development, and this trend is expected to continue. Storms will continue to impact the coastal habitats and have differing impacts. The *incremental contribution* of a proposed action to the cumulative impacts on estuarine habitats is expected to be ***minor to moderate*** depending on the selected alternative. Under Alternative E, the cancellation of a proposed lease sale would result in no new activities associated with a proposed lease sale. There could, however, be some incremental increase in impacts caused by a compensatory increase in imported oil and gas to offset reduced OCS production, but it would likely be **negligible**. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of estuarine habitats can be found in **Chapter 4.3.1**.

Coastal Barrier Beaches and Associated Dunes

The coastal barrier beaches and associated dunes are those beaches and dunes that line the coast of the northern GOM, including both barrier islands and beaches on the mainland. The largest impact-producing factors affecting estuarine systems are navigation channel maintenance dredging and oil spills. The impacts to coastal barrier beaches and dunes from routine activities associated with a proposed action are expected to be **minor** due to the minimal number of projected onshore pipelines, the minimal contribution to vessel traffic and to the need for maintenance dredging, and the mitigating measures that would be used to further reduce or avoid these impacts. The greater threat from an oil spill to coastal beaches is from a coastal spill as a result of a nearshore vessel accident or pipeline rupture, and cleanup activities. Overall, impacts to coastal barrier beaches and dunes from oil spills associated with OCS oil- and gas-related activities related to a proposed action would be expected to be **minor** because of the distance of most of the resulting activities from the coast, expected weathering of spilled oil, projected low probability of large spills near the coast, and available cleanup techniques.

Cumulative impacts to coastal barrier beaches and dunes are caused by a variety of factors, including the OCS oil- and gas-related and non-OCS oil- and gas-related activities outlined in Chapter 4.3.2 of the 2017-2022 GOM Multisale EIS and other human and natural impacts. Cumulative OCS oil- and gas-related spills resulting from all past and present leasing activities, including the millions of barrels that entered the Gulf of Mexico from the *Deepwater Horizon* oil spill, are estimated to have had a **major** impact on coastal barrier beaches and dunes. However, the incremental increase in impacts from reasonably foreseeable oil spills related to a proposed action is expected to be **minor**. Development pressures in the coastal regions of the GOM have been largely the result of tourism and residential beach-side development, and this trend is expected to continue. Efforts to stabilize the GOM shoreline through the construction of manmade structures can deprive natural restoration of the barrier beaches, i.e., sediment nourishment and sediment transport, which has adversely impacted coastal beach landscapes. Storms will continue to impact the coastal habitats and have differing impacts. The *incremental contribution* of a proposed action to the cumulative impacts on coastal barrier beaches and dunes is expected to be ***minor***. Under Alternative E, the cancellation of a proposed lease sale, the resulting additional impacts to coastal barrier beaches and dunes would be **negligible**; however, cumulative impacts from all sources, including OCS oil- and gas-related and non-OCS oil- and gas-related sources, would remain. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of coastal barrier beaches and associated dunes can be found in **Chapter 4.3.2**.

Deepwater Benthic Communities

BOEM defines “deepwater benthic communities” as including both chemosynthetic communities (chemosynthetic organisms plus seep-associated fauna) and deepwater coral communities (deepwater coral plus associated fauna). These communities are typically found in water depths of 984 ft (300 m) or deeper throughout the GOM, although deepwater benthic habitats are relatively rare compared with ubiquitous soft bottom habitats.

The OCS oil- and gas-related impact-producing factors for deepwater benthic communities can be grouped into three main categories: (1) bottom-disturbing activities; (2) drilling-related sediment and waste discharges; and (3) noncatastrophic oil spills. These impact-producing factors have the potential to damage individual deepwater habitats and disrupt associated benthic communities if insufficiently distanced or otherwise mitigated. However, impacts from individual routine activities and accidental events are usually temporary, highly localized, and expected to impact only small numbers of organisms and substrates at a time. Moreover, use of the expected site-specific plan reviews/mitigations will distance activities from deepwater benthic communities, greatly diminishing the potential effects. Therefore, at the regional, population-level scope of this analysis, and assuming adherence to all expected regulations and mitigations, the incremental contribution would be expected to be **negligible** for any of the action alternatives. Impacts from accidental events would be expected to be **negligible** to **minor** for any of the action alternatives. The expected OCS oil- and gas-related activities from a proposed action would also *contribute incrementally* to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative effects experienced by deepwater benthic communities, but only by a ***negligible*** amount. Under Alternative E, the potential for impacts would be **none** because new impacts to deepwater benthic communities related to a cancelled lease sale would be avoided entirely. The overall OCS oil- and gas-related cumulative impacts to deepwater benthic communities are estimated to be **negligible** to **minor**. Non-OCS oil- and gas-related activities such as commercial fishing (currently negligible) and shifting baseline environmental conditions related to climate change (currently negligible but likely to increase to major over time should current trends continue or worsen) could cause more noticeable impacts on deepwater benthic communities over the next 50 years. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of deepwater benthic communities can be found in **Chapter 4.4**.

Sargassum **and Associated Communities**

Sargassum in the GOM is comprised of *S. natans* and *S. fluitans*, and is characterized by a brushy, highly branched thallus with numerous leaf-like blades and berrylike pneumatocysts. The *Sargassum* cycle is truly expansive, encompassing most of the western Atlantic Ocean and the Gulf of Mexico with the growth, death, and decay of these plant and epiphytic communities, which may play a substantial role in the global carbon cycle. Several impacting factors can affect *Sargassum*, including vessel-related operations, oil and gas drilling discharges, operational discharges, accidental spills, non-OCS oil- and gas-related vessel activity, and coastal water quality. Routine vessel operations and accidental events that occur during drilling operations or vessel operations, and oiling due to an oil spill were the impact-producing factors that could be reasonably expected to impact *Sargassum* populations in the GOM. All of these impact-producing factors would result in the death or injury to the *Sargassum* plants or to the organisms that live within or around the plant matrix. However, the unique and transient characteristics of the life history of *Sargassum* and the globally widespread nature of the plants and animals that use the plant matrix buffer against impacts that could occur at any given location. Impacts to the overall population of the *Sargassum* community are therefore expected to be **negligible** from either routine activities or reasonably foreseeable accidental events for any of the action alternatives. The *incremental contribution* of a proposed action on the population of *Sargassum* would be ***negligible*** when considered in the context of cumulative impacts to the population. Under Alternative E, a proposed lease sale would be cancelled and the potential for impacts from routine activities and accidental events would be **none**. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. Impacts from changing water quality would be much more influential on *Sargassum* than OCS development and would still occur without the presence of OCS oil- and gas-related activities. An analysis of *Sargassum* and associated communities can be found in **Chapter 4.5**.

Live Bottoms

Topographic Features

Defined topographic features (**Chapter 4.6.1**) are a subset of GOM live bottom habitats that are large enough to have an especially important ecological role, with specific protections defined in the proposed Topographic Features Stipulation. Within the Gulf of Mexico, BOEM has identified 37 topographic features where some degree of protection from oil and gas development may be warranted based on geography and ecology. Of all the possible impact-producing factors, it was determined that bottom-disturbing activities associated with drilling, exploration, and vessel operations were the only impact-producing factors from routine activities that could be reasonably expected to substantially impact topographic features. The impact-producing factors resulting from accidental events include bottom-disturbing activities from drilling, exploration, and vessel operations, as well as the release of sediments and toxins during drilling operations. Oil-spill response activities were also considered to be a source of potential impacts to topographic features.

Adherence to the Topographic Features Stipulation (a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision) is analyzed in each action alternative and is detailed in Appendix D of the 2017-2022 GOM Multisale EIS. Application of the Topographic Features Stipulation would assist in preventing or at least minimizing potential impacts to topographic feature communities by increasing the distance of OCS oil- and gas-related activities from these features. The historical application of this stipulation has resulted in **negligible** impacts of a proposed action to topographic features from routine activities and accidental events. The *incremental contribution* of a proposed action to the overall cumulative impacts is also expected to be ***negligible*** with adherence to the required Topographic Features Stipulation. Under Alternative E, the potential for new incremental impacts to topographic features from a cancelled lease sale would be **none** because they would be avoided entirely. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. Impacts ranging from **negligible** to **moderate** may still be expected from non-OCS oil- and gas-related activities such as fishing, pollution, and climate change; however, the incremental impact of the proposed activities should not result in a meaningful augmentation of the overall expected impacts. An analysis of topographic features can be found in **Chapter 4.6.1**.

Pinnacles and Low-Relief Features

The Pinnacle Trend is an approximately 64 x 16 mile (103 x 26 kilometer) high-relief area in water depths ranging from approximately 200 to 650 ft (60 to 200 m). It is in the northeastern portion of the CPA at the outer edge of the Mississippi-Alabama shelf between the Mississippi River and De Soto Canyon (**Figures 2-4 and 4-2**). Outside of the Pinnacle Trend area, low-relief live bottom epibenthic communities occur in isolated locations in shallow waters (<984 ft; 300 m) throughout the GOM, wherever there exists suitable hard substrate and other physical conditions (e.g., depth, turbidity, etc.), allowing for community development. Hard bottom habitats occur throughout the GOM but are relatively rare compared with ubiquitous soft bottoms. The impact-producing factors for pinnacles and low-relief live bottom features and associated communities can be grouped into three main categories: (1) bottom-disturbing activities; (2) drilling-related sediment and waste discharges; and (3) oil spills. These impact-producing factors have the potential to damage individual pinnacle and low-relief feature habitats and disrupt associated benthic communities if insufficiently distanced or otherwise mitigated. The Live Bottom Stipulation (which is a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision), along with site-specific reviews of permit applications and associated distancing requirements, would mitigate potential impacts to the communities as a result of both routine activities and accidental events. At the broad geographic and temporal scope of this analysis, and assuming adherence to all expected lease stipulations and typically applied regulations and mitigations, routine activities are expected to have largely localized and temporary effects. Although accidental events have the potential to cause severe damage to specific pinnacle and low-relief feature communities, the number of such events is expected to be very small. Therefore, at the regional, population-level scope of this analysis, the *incremental contribution* of impacts from reasonably foreseeable routine activities and accidental activities to the overall cumulative impacts is expected to be ***negligible** to **minor***. Proposed OCS oil- and gas-related activities would also contribute incrementally to the overall OCS and non-OCS oil- and gas-related cumulative impacts experienced by pinnacle and low-relief feature habitats. Under Alternative E, the potential for impacts to pinnacle and low-relief feature communities related to a cancelled lease sale would be **none** because new impacts would be avoided entirely. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. The OCS oil- and gas-related cumulative impacts to live bottom communities are estimated to be **negligible** to **minor**. A full analysis of pinnacles and low-relief features can be found in **Chapter 4.6.2**.

Fish and Invertebrate Resources

The distribution of fishes and invertebrates varies widely, and species may be associated with different habitats at various life stages, which is discussed further in Chapter 4.7 of the 2017-2022 GOM Multisale EIS. The impact-producing factors affecting these resources are anthropogenic sound, bottom-disturbing activities, habitat modification, and accidental oil spills. The impacts from routine activities, excluding infrastructure emplacement, would be expected to be **negligible** or **minor** due to short-term localized effects. The installation of OCS oil- and gas-related infrastructure constitutes a long-term modification of the local habitat and is hypothesized to have resulted over the life of the program in **moderate** changes in the distribution of some species.

Although this effect is not necessarily adverse and infrastructure is expected to be decommissioned and sites restored to natural habitat, the cumulative impact over the life of the OCS Program extensively pertains to time and space. Accidental spills have been historically low-probability events and are typically small in size. The expected impact to fishes and invertebrate resources from accidental oil spills is **negligible**. Commercial and recreational fishing are expected to have the greatest direct effect on fishes and invertebrate resources, resulting in impact levels ranging from **negligible** for most species to potentially **moderate** for some targeted species (e.g., hogfish spp., gray triggerfish [*Balistes capriscus*], and greater amber jack [*Seriola dumerili*]). The analysis of routine activities and accidental events indicates the *incremental contribution* to the overall cumulative impacts on fishes and invertebrate resources as a result of a single proposed lease sale would be ***minor***. Under Alternative E, the cancellation of a proposed lease sale, the expected impacts on fish and invertebrate resources would be **none**. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of fish and invertebrate resources can be found in **Chapter 4.7**.

Birds

The affected species of birds include both terrestrial songbirds and many groups of waterbirds. Routine impacts to coastal, marine, and migratory birds that were considered include routine discharges and wastes, noise, platform severance with explosives (barotrauma), geophysical surveys with airguns (barotrauma), platform presence and lighting, and pipeline landfalls. The impacts to birds from routine OCS oil-and gas-related activities are similar wherever they may occur in the GOM, and all are considered **negligible** to **minor**. Negligible to minor impacts would not affect a substantial number of birds. Any impacts would be acute and reversible. As used here, acute means short-term, as it does in the context of short-term toxicity exposure and tests. Further, no injury to or mortality of a small number of individuals or a small flock would occur. Accidental impacts to birds are caused by oil spills, spill cleanup activities, and emergency air emissions. Seabirds may not always experience the greatest impacts from a spill, but it may take longer for populations to recover because of their unique population ecology (demography). Some species of seabirds, such as gulls, have larger clutches (laughing gulls usually have 3 eggs per clutch except in the tropics) and may recover quite quickly. However, many species of seabirds can have a clutch size of just one egg, and they have relatively long life spans and often have delayed age at first breeding. Because of the latter case, impacts on seabirds from overall accidental events would be expected to be **moderate**. Impacts from overall accidental events on other waterbirds farther inshore would also be expected to be **moderate** because of the extensive overlap of their distributions with oiled inshore areas and shorelines expected from a large oil spill (≥1,000 barrels [bbl]). Moderate impacts would affect a substantial abundance of birds.

The *incremental contribution* of a proposed action to the overall cumulative impacts is considered ***moderate***, but only because of the potential impacts that could result from a large oil spill (≥1,000 bbl). This conclusion is based on the increment of a proposed action compared with all cumulative OCS oil- and gas-related and non-OCS oil- and gas-related impacts. Alternative E would offer no new lease blocks for exploration and development; therefore, incremental impacts to birds would be **none**. However, there would be continuing impacts associated with the existing OCS oil- and gas-related activities from previously permitted activities and previous lease sales. An analysis of birds can be found in **Chapter 4.8**.

Protected Species

Marine Mammals

The Gulf of Mexico marine mammal community is diverse and distributed throughout the GOM, with the greatest abundances and diversity of species inhabiting oceanic and OCS waters. The major potential impact-producing factors affecting marine mammals in the GOM as a result of cumulative past, present, and reasonably foreseeable OCS oil- and gas-related activities are decommissioning activities, operational discharges, G&G activities, noise, transportation, marine debris, and accidental oil spills and spill-response activities. Accidental events involving large spills, particularly those continuing to flow fresh hydrocarbons into oceanic and/or outer shelf waters for extended periods (i.e., days, weeks, or months), pose an increased likelihood of impacting marine mammal populations inhabiting GOM waters. While accidental events cannot be predicted and have the potential to impact marine mammal species, the number of such events is expected to be very small based on Oil Spill Risk Analysis.

Proposed OCS oil- and gas-related activities would also contribute incrementally to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative effects experienced by marine mammal populations. At the regional, population-level scope of this analysis, impacts from reasonably foreseeable routine activities and accidental events could be **negligible** to **moderate** for any of the action alternatives. However, the *incremental contribution* of a proposed action to cumulative impacts to marine mammal populations, depending upon the affected species and their respective population estimate, even when taking into consideration the potential impacts of the *Deepwater Horizon* explosion, oil spill, and response; non-OCS oil- or gas-related activities; and the minimization of the OCS oil- or gas-related impacts through lease stipulations and regulations, would be expected to be ***negligible***. Under Alternative E, the cancellation of a proposed lease sale, the impacts on marine mammals within the Gulf of Mexico would be **none**. However, cumulative impacts from previous lease sales and non-OCS oil- and gas-related activities would remain. An analysis of marine mammals can be found in **Chapter 4.9.1**.

Sea Turtles

Five ESA-listed sea turtle species are present throughout the northern GOM year-round; however, only Kemp's ridley and loggerhead sea turtles commonly nest on beaches in the GOM during the nesting season. Due to the expected implementation of mitigations (e.g., BOEM and BSEE proposed compliance with Notices to Lessees and Operators under the proposed Protected Species Stipulation and conditions of approval on postlease activities), routine activities (e.g., noise or transportation) and accidental events (e.g., oil spills) related to a proposed action are not expected to have long-term adverse effects on the population size or productivity of any sea turtle species or populations in the northern GOM. Lethal effects could occur from chance collisions with OCS oil- and gas-related service vessels or ingestion of accidentally released plastic materials from OCS oil- and gas-related vessels and facilities. Most routine activities and accidental events as a result of a proposed action are therefore expected to have **negligible** to **moderate** impacts. For example, a minor impact might be a behavioral change in response to noise while a moderate impact might be a spill contacting an individual and causing injury or mortality.

Historically, intense harvesting of eggs, loss of suitable nesting beaches, and fisheries-related mortality led to the rapid decline of sea turtle populations. Anthropogenic actions continue to pose the greatest threat to sea turtles since their listing under the Endangered Species Act (ESA), as well as different natural threats including climate change, disease, and natural disasters. The *incremental contribution* of a proposed action to the cumulative impacts on sea turtles would be expected to be ***negligible***. Population-level impacts are not anticipated. Under Alternative E, the cancellation of a proposed lease sale, the impacts on sea turtles within the Gulf of Mexico would be **none**. However, cumulative impacts from previous lease sales and non-OCS oil- and gas-related activities would remain. An analysis of sea turtles can be found in **Chapter 4.9.2**.

Beach Mice

The four subspecies of beach mouse (*Peromyscus polionotus* ssp.) are small coastal rodents that are only found along beaches in parts of Alabama and northwest Florida, and are federally listed as endangered. Beach mice rely on dune systems as favorable habitat for foraging and maintaining burrows. Due to the distance between beach mouse habitat and OCS oil- and gas-related activities, impacts from routine activities are not likely to affect beach mouse habitat except under very limited situations. Pipeline emplacement or construction, for example, could cause temporary degradation of beach mouse habitat; however, these activities are not expected to occur in areas of designated critical habitat. Accidental oil spills and associated spill-response efforts are not likely to impact beach mice or their critical habitat because the species live above the intertidal zone where contact is less likely. Habitat loss from non-OCS oil- and gas-related activities (e.g., beachfront development) and predation have the greatest impacts to beach mice. Overall, the *incremental contribution* of impacts from reasonably foreseeable routine activities and accidental events to the overall cumulative impacts on beach mice is expected to be ***negligible***. Under Alternative E, the cancellation of a proposed lease sale, the impacts on beach mice would be **none**. However, cumulative impacts from previous lease sales and other non-OCS oil- and gas-related activities would remain. An analysis of beach mice can be found in **Chapter 4.9.3**.

Protected Birds

Protected birds are those species or subspecies listed under the ESA by the U.S. Fish and Wildlife Service (FWS) as threatened or endangered due to the decrease in their population sizes or loss of habitat; therefore, a proposed action could have a greater impact. BOEM is undergoing consultation with FWS to minimize the potential impacts to ESA-listed species. Impacts from routine activities, which include discharges and wastes affecting air and water quality, noise, and possibly artificial lighting, would be **negligible** to protected birds. The listed bird species considered are typically coastal birds and would not be exposed to much of the OCS oil- and gas-related activities. Waste discharges to air or water produced as a result of routine activities are regulated by the U.S. Environmental Protection Agency and BOEM, and these discharges are subject to limits to reduce potential impacts; therefore, due to precautionary requirements and monitoring, the impacts to protected birds would be **negligible**. The major impact-producing factors resulting from accidental events associated with a proposed action that may affect protected birds include accidental oil spills and response efforts. In the case of an accidental oil spill, impacts would be **negligible** to **moderate** depending on the magnitude and time and place of such an event. Major impacts could occur if a large oil spill occurred with direct contact to a protected bird species or if the habitat became contaminated, resulting in mortality of a listed species. Marine debris produced by OCS oil- and gas-related activities as a result of accidental disposal into the water may affect protected birds by entanglement or ingestion. Due to the regulations prohibiting the intentional disposal of items, impacts would be expected to be **negligible**; however, impacts may scale up to **moderate** if the accidental release of marine debris caused mortality of a listed bird.

Overall, BOEM would expect **negligible** to **moderate** impacts to protected birds considering routine activities, accidental events, and cumulative impacts. Due to the precautionary requirements and monitoring discussed in **Chapter 4.9.4**, the *incremental impacts* to protected birds would be ***negligible*** for any of the action alternatives (i.e., Alternatives A-D). Under Alternative E, the cancellation of a proposed lease sale, the additional incremental impacts to ESA-protected birds or their habitats would be **none**. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of protected birds can be found in **Chapter 4.9.4**.

Protected Corals

Elkhorn, staghorn, boulder star, lobed star, and mountainous star corals are listed by the National Marine Fisheries Service (NMFS) as threatened due to the decrease in their population sizes; therefore, the relative impacts from a proposed action on a particular group of coral colonies could have disproportionately higher population-level effects than what might be experienced by other non-listed coral species. BOEM understands this and therefore consults with NMFS to minimize any potential impacts to these species. Though the listed species are protected (i.e., given ESA status), they could experience the same types of potential impact-producing factors from a proposed action as other coral species. Without effective mitigations, routine activities and accidental events resulting from a proposed action could directly impact coral habitats within the GOM.

The site-specific survey information required for postlease reviews of permit applications would allow BOEM to identify and protect live bottom features (which protected corals may inhabit) from potential harm by proposed OCS oil- and gas-related activities by requiring that bottom-disturbing activity be distanced from live bottom features. Assuming adherence to the expected lease stipulations and other postlease, protective restrictions and mitigations, the routine activities related to a proposed action could have short-term localized and temporary effects on protected corals, if any. While accidental events have the potential to cause severe damage to specific coral communities, the number of such events is expected to be small, and any impacts would be reduced or prevented by the lease stipulations and postlease distancing requirements. Furthermore, the OCS lease blocks in the EPA that are closest to ESA-defined critical habitat areas for listed corals are not being offered in a proposed lease sale due to the current leasing moratorium and are therefore too distant to be reasonably affected by routine activities or accidental events. In addition, many of the protected corals occur within the Flower Garden Banks National Marine Sanctuary, which under the current boundaries is not proposed for future leasing under any of the alternatives in this Supplemental EIS or the 2017-2022 Gulf of Mexico Multisale EIS. Therefore, the *incremental contribution* of activities resulting from a proposed action to the overall cumulative impacts on protected corals is expected to be ***negligible***. Proposed OCS oil- and gas-related activities would contribute incrementally to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative impacts experienced by corals. The non-OCS oil- and gas-related cumulative impacts to protected corals are expected to be dramatically greater than any impacts related to OCS oil- and gas-related activities. Under Alternative E, the cancellation of a proposed lease sale, the impacts on protected corals would be **none**. However, cumulative impacts from previous lease sales and non-OCS oil- and gas-related activities would remain. An analysis of protected corals can be found in **Chapter 4.9.5**.

Commercial Fisheries

A proposed action could affect commercial fisheries by affecting fish populations or by affecting the socioeconomic aspects of commercial fishing. The impacts of a proposed action on fish populations are presented in **Chapter 4.7**. Routine activities such as seismic surveys, drilling activities, and service-vessel traffic can cause space-use conflicts with fishermen. Structure emplacement could have positive or negative impacts depending on the location and species. For example, structure emplacement prevents trawling in the associated area and, thus, could impact the shrimp fishery. On the other hand, production platforms can facilitate fishing for reef fish such as red snapper and groupers. The eventual removal of production platforms would reverse these positive and negative impacts. Accidental events, such as oil spills, could cause fishing closures and have other impacts on the supply and demand for seafood. However, accidental events that could arise from a proposed action would likely be small and localized. A proposed action would be relatively small when compared with the overall OCS Program, State oil and gas activities, overall vessel traffic, tropical storms/hurricanes, economic factors, Federal and State fisheries management strategies, and other non-OCS oil- and gas-related factors. Therefore, the *incremental contribution* of a proposed action to the cumulative impacts to commercial fisheries would range from ***beneficial (low)*** *to* ***minor*** adverse effects for any of the action alternatives. The exact impacts would depend on the locations of activities, the species affected, the intensity of commercial fishing activity in the affected area, and the substitutability of any lost fishing access. Alternative E would prevent these impacts from occurring, except for potential **negligible** impacts arising from adjustments to incomes in the economy. Under Alternative E, the cancellation of a proposed lease sale, fisheries would still be subject to the impacts from the OCS Program, as well as the impacts from non-OCS oil- and gas-related activities. An analysis of commercial fisheries can be found in **Chapter 4.10**.

Recreational Fishing

The Gulf of Mexico's extensive estuarine habitats (**Chapter 4.3.1**), live bottom habitats (**Chapter 4.6**), and artificial substrates (including artificial reefs, shipwrecks, and oil and gas platforms) support several valuable recreational fisheries. Alternatives A-D can affect recreational fishing by affecting fish populations or by affecting the socioeconomic aspects of recreational fishing. The impacts of Alternatives A-D on fish populations are presented in **Chapter 4.7**. Vessel traffic can cause space-use conflicts with anglers. Structure emplacement generally enhances recreational fishing, although this positive effect will be offset during decommissioning unless a structure were maintained as an artificial reef. Accidental events, such as oil spills, can cause fishing closures and can affect the aesthetics of fishing in an area. However, accidental events that could arise would likely be small and localized. Alternatives A-D should also be viewed in light of overall trends in OCS platform decommissioning, State oil and gas activities, overall vessel traffic, tropical storms/hurricanes, economic factors, and Federal and State fisheries management strategies. The *incremental impacts* of Alternatives A-D on recreational fisheries are expected to be ***beneficial (low)*** *to* ***minor***. Alternative E, the cancellation of a proposed lease sale, would cause some economic adjustments (refer to **Chapter 4.14.2**), which could cause **negligible** impacts to recreational fishing activities. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of recreational fishing can be found in **Chapter 4.11**.

Recreational Resources

Alternatives A-D would contribute to the negligible to minor space-use conflicts (from vessel traffic) and visual impacts (from the visibility of OCS structures) that arise due to the broader OCS Program. Structure emplacements can have **beneficial (low)** impacts on recreational fishing and diving because platforms often act as artificial reefs, but the eventual removal of these structures would lead to **negligible** to **minor** negative impacts. Oil spills can have a **negligible** to **minor** negative affect on beaches and other coastal recreational resources. Alternatives A-D should also be viewed in light of of the overall OCS Program, as well as various non-OCS oil- and gas-related factors, such as beach/wetlands erosion, beach disruptions, economic factors, and activities, that can cause space-use conflicts and aesthetic impacts such as commercial and military activities. Because of the relatively small contribution of any given lease sale under any of the proposed action alternatives (i.e., Alternatives A-D) to the overall OCS Program, in addition to other non-OCS oil- and gas-related activities, the *incremental impacts* are expected to be ***beneficial (low)*** *to* ***minor*** adverse effects. Under Alternative E, the cancellation of a proposed lease sale, there could be **negligible** impacts to recreational resources due to the small economic adjustments. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of recreational resources can be found in **Chapter 4.12**.

Archaeological Resources

Archaeological resources are any material remains of human life or activities that are at least 50 years of age and that are capable of providing scientific or humanistic understanding of past human behavior, cultural adaptation, and related topics through the application of scientific or scholarly techniques, such as controlled observation, contextual measurement, controlled collection, analysis, interpretation, and explanation (30 CFR § 250.105). Archaeological resources are primarily impacted by any activity that directly disturbs or has the potential to disturb the seafloor. For the OCS Program, this includes the placement of drilling rigs and production systems on the seafloor; pile driving associated with platform emplacement; pipeline placement and installation; the use of seismic receiver nodes and cables; the dredging of new channels, as well as maintenance dredging of existing channels; anchoring activities; post-decommissioning activities, including trawling clearance; and the masking of archaeological resources from industry-related infrastructure and debris.

Regardless of which planning area a proposed lease sale is held, the greatest potential impact to an archaeological resource as a result of a proposed action under any of the action alternatives is site-specific and would result from direct contact between an offshore activity or accidental event and a site. A proposed action's postlease activities, including the drilling of wells and installation of platforms, installation of pipelines, anchoring, the removal of platforms and other structures installed on the seafloor, and site clearance activities, as well as accidental events such as loss of debris, may result in **negligible** to **major** impacts to archaeological sites.

Major impacts could potentially occur if the mitigations described in **Chapter 4.13** were not applied to postlease activities. With the identification, evaluation, and avoidance or mitigation of archeological resources, the *incremental contribution* of a proposed action is expected to result in ***negligible***, long-term cumulative impacts to archaeological resources; however, if an archaeological site were to be impacted, impacts may range from **negligible** to **major**. Under Alternative E, the cancellation of a proposed lease sale, the impact-producing factors discussed in **Chapter 4.13** would not take place for that proposed lease sale; therefore, the impacts would be **none**. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of archaeological resources can be found in **Chapter 4.13**.

Human Resources and Land Use (Including Environmental Justice)

Land Use and Coastal Infrastructure

Oil and gas exploration, production, and development activities on the OCS are supported by an expansive onshore network of coastal infrastructure that includes hundreds of large and small companies. Because OCS oil- and gas-related activities are supported by this long-lived, expansive onshore network, routine operations associated with a proposed action are not expected to produce any major impacts to land use and coastal infrastructure. Potential impacts from routine operations could range from **negligible** to **moderate**, depending on the location, scale, and type of activity.

The impacts of reasonably foreseeable accidental events such as oil spills, chemical and drilling fluid spills, and vessel collisions are not likely to last long enough to adversely affect overall land use or coastal infrastructure in the analysis area and would therefore be **negligible** to **moderate**. The cumulative analysis includes impacts that could result from a proposed lease sale combined with baseline conditions, all past, present, and future OCS oil- and gas-related lease sales and activities, as well as all past, present, and reasonably foreseeable future actions that are external to OCS oil- and gas-related activities. Activities relating to all past, present, and future OCS oil- and gas-related activities are expected to minimally affect the current land use of the analysis area because most subareas have strong industrial bases and designated industrial parks. Non-OCS oil- and gas-related activities contribute substantially to the cumulative impacts on land use and coastal infrastructure, while only a ***minor*** *incremental contribution* is expected for a proposed action.

For any of the action alternatives, the cumulative impacts on land use and coastal infrastructure could range from **beneficial** to **moderate** for OCS oil- and gas-related activities and **beneficial** to **major** for non-OCS oil- and gas-related activities depending on the specifics of each situation, whether the impacts are measurable, how long the impacts would last, and the size of the affected geographic area as defined in **Chapter 4.14.1**. Alternative E would result in no lease sale and, thus, the direct impacts as a result of a proposed lease sale would be **none**, and there would be no incremental contribution of impacts to land use and coastal infrastructure beyond a temporary negative economic impact for the oil and gas industry and coastal states (such as Louisiana), which are more dependent on oil and gas revenues. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of land use and coastal infrastructure can be found in **Chapter 4.14.1**.

Economic Factors

A proposed lease sale would lead to **beneficial** impacts arising from industry expenditures, government revenues, corporate profits, and other market impacts. Some of these impacts would be concentrated along the Gulf Coast, while others would be widely distributed. A proposed lease sale could also lead to negative economic impacts (**negligible** to **minor**) arising from accidental events and disruptions to other industries. There would be some differences in economic impacts among the alternatives, corresponding to the differences in the scales and distributions of likely activities. Chapter 4.14.2 of the 2017-2022 GOM Multisale EIS presents detailed estimates of the economic impacts of the alternatives. The alternatives should be viewed in light of the OCS Program, as well the numerous forces that can affect energy markets and the overall economy. Most of the *incremental economic impacts* of a proposed action are forecast to be ***beneficial***, although there would be some ***minor*** adverse impacts. Alternative E, the cancellation of a proposed lease sale, would negatively impact firms and employees that depend on recurring leases; therefore, the impacts of Alternative E would be **negligible** to **minor**, with some partially offsetting **beneficial** impacts. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. An analysis of economic factors can be found in **Chapter 4.14.2**.

Social Factors (Including Environmental Justice)

Potential social impacts resulting from a proposed action would occur within the larger socioeconomic context of the GOM region. The affected environment of the analysis area is quite large geographically and in terms of population (133 counties and parishes with over 22.7 million residents). The impacts from routine activities related to a proposed action are expected to be **negligible** to **moderate**, widely distributed, and to have little impact because of the existing extensive and widespread support system for the petroleum industry and its associated labor force. Outside of a low-probability catastrophic oil spill, which is not reasonably foreseeable and not part of a proposed action, any potential accidental events are not likely to be of sufficient scale or duration to have adverse and disproportionate long-term impacts for people and communities in the analysis area and would therefore range from **negligible** to **moderate**. In the cumulative analysis, impacts from OCS oil- and gas-related activities would range from **beneficial** to **moderate**. Non-OCS oil- and gas-related factors, which include all human activities, natural events, and processes, actually contribute more to cumulative impacts than do factors related to OCS oil- and gas-related activities alone because of the analysis area's complex socioeconomic framework and result in **beneficial** to **major** impacts. The *incremental contribution* of a proposed action to cumulative impacts would be ***minor***. Alternative E would result in no lease sale and, thus, the overall incremental impacts as a result of Alternative E would be **none**. Cumulative impacts of current and past activities (OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative.

Coastal populations experience cumulative impacts that include all human activities and natural processes and events. The cumulative analysis includes impacts that could result from a proposed lease sale combined with baseline conditions, all past, present, and future OCS oil- and gas-related lease sales and activities, as well as all past, present, and reasonably foreseeable future actions that are external to OCS oil- and gas-related activities. Within this divided analytical framework of OCS oil-and gas-related and non-OCS oil- and gas-related impacts, the largest quantity of impact-producing factors for coastal populations occur as non-OCS oil- and gas-related impacts because OCS oil- and gas-related activities form a very small part of the greater, complex socioeconomic structure in the GOM. The *incremental contribution* of a proposed action to cumulative impacts of a single proposed lease sale would be ***minor*** for communities and people in the Gulf Coast region.

Environmental Justice Determination: The oil and gas industry in the GOM region is expansive and long-lived over several decades with substantial infrastructure in place to support both onshore and offshore activities. BOEM's scenario estimates call for 0-1 new gas processing plant and 0-1 new pipeline landfall over the 50-year life of a single proposed action. Impacts to GOM populations from a proposed action would be immeasurable for environmental justice since these low-income and minority communities are located onshore, distant from Federal OCS oil- and gas-related activities. Also, since these vulnerable populations are located within the larger context of onshore and State-regulated nearshore oil and gas activities that are connected to downstream infrastructure over which BOEM has no regulatory authority, BOEM has determined that a proposed action would not produce environmental justice impacts in the GOM region. An analysis of social factors and an environmental justice determination can be found in **Chapter 4.14.3**.

APPENDICES

To improve the readability of this Supplemental EIS, more detailed supporting information has been placed in the appendices, which include a Memorandum of Agreement between BOEM and the National Park Service, meteorological information used for the air quality modeling, description of emissions generation, and photochemical modeling.

Appendix A is the Memorandum of Agreement between BOEM and the National Park Service; it outlines the roles and responsibilities for both agencies during the preparation of this Supplemental EIS.

Appendix B details the meteorological information used for the air quality modeling described in **Chapter 4.1**. Parameters such as wind speed, wind direction, air temperature, and humidity are required by models to determine the rate that pollutants disperse and react in the atmosphere. This appendix details the modeling performance evaluation of a Weather and Research Forecast model for 2012 used in conducting the air quality modeling summarized in **Chapter 4.1**.

Appendix C describes how the emissions were generated for the Cumulative and Visibility Impact Analysis Emissions Inventory used in conducting the air quality modeling summarized in **Chapter 4.1**.

Appendix D provides the photochemical modeling, evaluation of the modeling, and results of the air quality modeling summarized in **Chapter 4.1**.

Appendix E provides detailed responses to comments received on the Draft Supplemental EIS. The comments and responses are presented in a matrix organized by the topics of the comments.

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ABBREVIATIONS AND ACRONYMS

µg	microgram
µm	micrometer
2017-2022 Five-Year Program	*2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program*
2017-2022 Five-Year Program EIS	*Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022, Final Programmatic Environmental Impact Statement*
2017-2022 GOM Multisale EIS	*Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement*
2D	two dimensional
3D	three dimensional
ac	acre
Agreement	Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico
Area ID	Area Identification
AQRV	air quality-related value
bbl	barrel
Bbbl	billion barrels
Bcf	billion cubic feet
BBO	billion barrels of oil
BOE	billion barrels of oil equivalent
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
B.P.	before present
BSEE	Bureau of Safety and Environmental Enforcement
BTEX	benzene, toluene, ethylbenzene, and xylene
Call	Call for Information
CAMx	Comprehensive Air-quality Model with extensions
CD	Consistency Determination
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CG	Coast Guard (also: USCG)
CH_4	methane
CMAQ	Community Multiscale Air Quality
CMP	Coastal Management Program
CO	carbon monoxide

COA	conditions of approval
CO_2	carbon dioxide
CO_2-e	CO_2-equivalent
COE	Corps of Engineers (U.S. Army)
CPA	Central Planning Area
CZMA	Coastal Zone Management Act
DOCD	development operations coordination document
DOI	Department of the Interior (U.S.) (also: USDOI)
DOT	Department of Transportation (U.S.) (also: USDOT)
DPP	development and production plan
EFH	essential fish habitat
e.g.	for example
EIA	Economic Impact Area
EIS	environmental impact statement
EP	exploration plan
EPA	Eastern Planning Area
ESA	Endangered Species Act of 1973
et al.	and others
et seq.	and the following
FPSO	floating production, storage, and offloading system
FR	*Federal Register*
ft	feet
FWS	Fish and Wildlife Service
G&G	geological and geophysical
GHG	greenhouse gas
GOADS	Gulfwide Offshore Activity Data System
GOM	Gulf of Mexico
GOMESA	Gulf of Mexico Energy Security Act
GWEI	Gulfwide Emission Inventory
H_2S	hydrogen sulfide
ha	hectare
HRG	high-resolution geophysical
Hz	Hertz
i.e.	that is
km	kilometer
LA	Louisiana
LCA	Louisiana Coastal Area
LNG	liquefied natural gas

LOOP	Louisiana Offshore Oil Port
m	meter
MAG-PLAN	MMS Alaska-GOM Model Using IMPLAN
MARAD	Maritime Administration (U.S. Department of Transportation)
MATS	Modeled Attainment Test Software
mg/L	milligrams/liter
mi	mile
mm	millimeter
MMbbl	million barrels
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MODU	mobile offshore drilling unit
N.	north
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
nmi	nautical-mile
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NTL	Notice to Lessees and Operators
O_3	ozone
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSHA	Occupational Safety and Health Administration
OSRA	Oil Spill Risk Analysis
OSRP	oil-spill response plan
OSV	offshore support vessel
Pb	lead
PBR	Potential Biological Removal
PDARP/PEIS	*Deepwater Horizon Oil Spill: Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*

PM	particulate matter
$PM_{2.5}$	particulate matter less than or equal to 2.5 μm
PM_{10}	particulate matter less than or equal to 10 μm
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
ROD	Record of Decision
SC	source category
Secretary	Secretary of the Interior
SO_2	sulphur dioxide
SO_x	sulphur oxides
Tcf	trillion cubic feet
TPY	tons per year
Trustees	Natural Resource Damage Assessment Trustees
U.S.	United States
U.S.C.	United States Code
UME	unusual mortality event
USCG	U.S. Coast Guard (also: CG)
USDHS	U.S. Department of Homeland Security
USDOC	U.S. Department of Commerce
USDOE	U.S. Department of Energy
USDOI	U.S. Department of the Interior (also: DOI)
USDOT	U.S. Department of Transportation (also: DOT)
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VGP	Vessel General Permit
VOC	volatile organic compound
VSP	vertical seismic profiling
W.	west
WPA	Western Planning Area
WRF	Weather and Research Forecasting
yr	year

CONVERSION CHART

To convert from	To	Multiply by
centimeter (cm)	inch (in)	0.3937
millimeter (mm)	inch (in)	0.03937
meter (m)	foot (ft)	3.281
meter^2 (m^2)	foot^2 (ft^2)	10.76
meter^2 (m^2)	yard^2 (yd^2)	1.196
meter^2 (m^2)	acre (ac)	0.0002471
meter^3 (m^3)	foot^3 (ft^3)	35.31
meter^3 (m^3)	yard^3 (yd^3)	1.308
kilometer (km)	mile (mi)	0.6214
kilometer^2 (km^2)	mile^2 (mi^2)	0.3861
hectare (ha)	acre (ac)	2.47
liter (L)	gallons (gal)	0.2642
degree Celsius (°C)	degree Fahrenheit (°F)	°F = (1.8 x °C) + 32
1 barrel (bbl) = 42 gal = 158.9 L = approximately 0.1428 metric tons 1 nautical mile (nmi) = 1.15 mi (1.85 km) or 6,076 ft (1,852 m) tonnes = 1 long ton or 2,240 pounds (lb)		

CHAPTER 1

THE PROPOSED ACTION

What's in This Chapter?

- The Bureau of Ocean Energy Management (BOEM) has issued the *2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program* (2017-2022 Five-Year Program). It sets forth a schedule for 10 proposed regionwide Gulf of Mexico lease sales spaced evenly throughout the 5-year period.
- The *Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement* (2017-2022 GOM Multisale EIS) is an EIS that provides the environmental review foundation for all 10 proposed GOM lease sales in the Five-Year Program schedule.
- This Supplemental EIS has been prepared to inform decisions for the proposed 2018 GOM lease sales in the 2017-2022 Five-Year Program. It tiers from and updates the 2017-2022 GOM Multisale EIS and contains analyses of the potential environmental impacts that could result from a proposed regionwide lease sale (e.g., Lease Sale 250), but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program.
- The proposed action in this Supplemental EIS is to hold a regionwide lease sale in the GOM according to the schedule of proposed lease sales set forth by the 2017-2022 Five-Year Program.
- The purpose of a proposed lease sale analyzed in this Supplemental EIS is to offer for lease those areas in the Gulf of Mexico (GOM) that may contain economically recoverable oil and gas resources in accordance with the Outer Continental Shelf Lands Act (OCSLA), subject to environmental safeguards in order to further the orderly development of OCS oil and gas resources.
- The need for a proposed lease sale analyzed in this Supplemental EIS is to manage the development of Outer Continental Shelf (OCS) energy resources in an environmentally and economically responsible manner. Oil and gas from the Gulf of Mexico OCS would contribute to meeting domestic demand and enhance national economic security.
- This Supplemental EIS explains the environmental considerations used to assess the potential environmental consequences of a proposed lease sale and its alternatives, as well as the potential mitigations that could minimize or avoid those consequences.
- The decision on whether and how to proceed with proposed Lease Sale 250 will be made following the completion of this National Environmental Policy Act (NEPA) analysis. A separate decision will be made for proposed Lease Sale 251 and the remaining proposed regionwide lease sales scheduled in the 2017-2022 Five-Year Program.

1 THE PROPOSED ACTION

1.0 INTRODUCTION

This Supplemental EIS contains analyses of the potential environmental impacts that could result from a single proposed lease sale (e.g., Lease Sale 250), but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program.

This Supplemental Environmental Impact Statement (EIS) addresses a proposed Federal action – a regionwide lease sale. This Supplemental EIS is expected to be used to inform decisions for each of the two lease sales scheduled in 2018, i.e., Lease Sales 250 and 251 in the Gulf of Mexico, as scheduled in the *2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program* (2017-2022 Five-Year Program; USDOI, BOEM, 2016a), and to be used and supplemented as necessary for decisions on future Gulf of Mexico proposed regionwide lease sales. This Supplemental EIS contains analyses of the potential environmental impacts that could result from a proposed regionwide lease sale in the Gulf of Mexico as scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS tiers from and updates the *Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement* (2017-2022 GOM Multisale EIS; USDOI, BOEM, 2017a) and incorporates by reference all of the relevant material in the 2017-2022 GOM Multisale EIS. The decision on whether and how to proceed with proposed Lease Sale 250 will be made following the completion of this National Enviornmental Policy Act (NEPA) analysis. A separate decision will be made for the second lease sale of 2018, i.e., proposed Lease Sale 251. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA review that may update this Supplemental EIS as necessary.

> *This Supplemental EIS tiers from and updates the* Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement *(2017-2022 GOM Multisale EIS).*

The Bureau of Ocean Energy Management (BOEM) issued the 2017-2022 Five-Year Program (USDOI, BOEM, 2016a) in 2016. The 2017-2022 Five-Year Program proposes 10 regionwide Gulf of Mexico (GOM) oil and gas lease sales. Five regionwide lease sales are tentatively scheduled in August of each year from 2017 through 2021 and five regionwide lease sales are tentatively scheduled in March of each year from 2018 through 2022. The lease sales proposed in the GOM in the 2017-2022 Five-Year Program are regionwide lease sales comprised of the Western, Central, and a small portion of the Eastern Planning Areas (WPA, CPA, and EPA, respectively) not subject to Congressional moratorium. These planning areas are located off the States of Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 1-1**).

2017-2022 Schedule of Proposed Gulf of Mexico OCS Region Lease Sales	
Lease Sale Number	Year
249	2017
250 and 251	2018
252 and 253	2019
254 and 256	2020
257 and 259	2021
261	2022

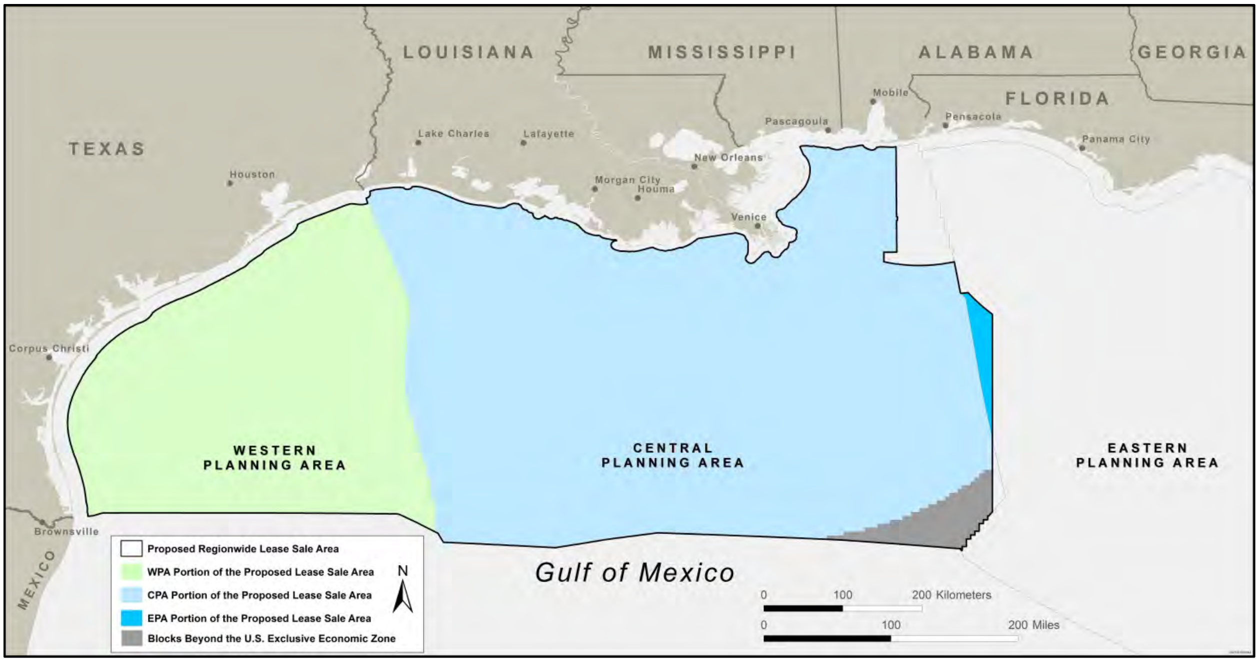


Figure 1-1. Proposed Regionwide Lease Sale Area Combining the Western, Central, and Eastern Planning Areas.

The development of the 2017-2022 Five-Year Program initiates region-specific NEPA reviews for each of the proposed lease sales. Region-specific reviews are conducted by Program Area, and this Supplemental EIS contains analyses for the Gulf of Mexico OCS Region. Even though the 2017-2022 Five-Year Program includes regionwide lease sales for the GOM, any individual lease sale could still be scaled back during the prelease sale process, including for example, to employ the separate planning area model used in the *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program*: *2012-2017* (2012-2017 Five-Year Program; USDOI, BOEM, 2012), should circumstances warrant. For more detail on the Five-Year Program and its relationship to the individual lease sale consultation and decision process, refer to Chapter 1.3.1 of the 2017-2022 GOM Multisale EIS.

The Proposed Action

> *The proposed action is to hold a lease sale in the GOM according to the schedule of proposed lease sales set forth by the 2017-2022 Five-Year Program.*

The proposed action evaluated in this Supplemental EIS is to hold a regionwide lease sale in the GOM according to the schedule of proposed lease sales set forth by the 2017-2022 Five-Year Program. This Supplemental EIS has been prepared to inform decisions for the proposed 2018 GOM lease sales and analyzes a single proposed action (i.e., a single proposed lease sale in the Gulf of Mexico) as scheduled in the 2017-2022 Five-Year Program. Since each of the 10 proposed lease sales in the GOM region are very similar and occur in close timeframes, BOEM prepared an EIS for a proposed action, looking at the 10 proposed lease sales in the 2017-2022 Five-Year Program cumulatively (i.e., the 2017-2022 GOM Multisale EIS). The analysis in the 2017-2022 GOM Multisale EIS will be used to inform each of the 10 proposed lease sale decisions. This Supplemental EIS tiers from and updates the 2017-2022 GOM Multisale EIS and contains analyses of the potential environmental impacts that could result from a single proposed lease sale (e.g., Lease Sale 250), but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program. However, pursuant to the OCSLA's staged leasing process, BOEM must make an individual decision on whether and how to proceed with each proposed lease sale. Therefore, in order to make an informed decision on a single proposed lease sale, the analyses contained in this Supplemental EIS examine impacts from a single proposed lease sale (e.g., Lease Sale 250). The decision on whether and how to proceed with proposed Lease Sale 250, which is the first GOM lease sale proposed for 2018, will be made following the completion of this NEPA analysis. A separate decision will be made for proposed Lease Sale 251, which is the second GOM lease sale proposed for 2018. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA review that may update this Supplemental EIS as necessary.

1.1 Purpose of the Proposed Action

The Outer Continental Shelf Lands Act of 1953, as amended (43 U.S.C. §§ 1331 *et seq*.), hereafter referred to as OCSLA, establishes the Nation's policy for managing the vital energy and mineral resources of the OCS. Section 18 of OCSLA requires the Secretary to prepare and maintain a schedule of proposed OCS oil and gas lease sales determined to "best meet national energy needs for the 5-year period following its approval or reapproval" (43 U.S.C. § 1344). The Five-Year Program establishes a schedule that the U.S. Department of the Interior (USDOI or DOI) will use as a basis for considering where and when leasing might be appropriate over a 5-year period.

> *"It is hereby declared to be the policy of the United States that ... the Outer Continental Shelf is a vital national resource held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs."*
>
> OCSLA, 43 U.S.C. §§ 1331 *et seq.*

The purpose of the proposed Federal action addressed in this Supplemental EIS (i.e., a proposed regionwide lease sale) is to offer for lease those areas that may contain economically recoverable oil and gas resources in order to further the orderly development of OCS oil and gas resources in accordance with the OCSLA, which specifically states that these areas "should be made available for expeditious and orderly development, subject to environmental safeguards" (OCSLA, 43 U.S.C. §§ 1331 *et seq*.). Each individual proposed lease sale would provide qualified bidders the opportunity to bid upon and lease available acreage in the Gulf of Mexico OCS in order to explore, develop, and produce oil and natural gas. This Supplemental EIS will determine the potential environmental impacts that could result from a single proposed lease sale (e.g., Lease Sale 250) scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary for each remaining Federal action (lease sale) scheduled in the 2017-2022 Five-Year Program.

1.2 NEED FOR THE PROPOSED ACTION

The need for the proposed action (i.e., a proposed regionwide lease sale) is to manage the development of the OCS energy resources in an environmentally and economically responsible manner, as required under Section 18 of the OCSLA. Oil serves as the feedstock for liquid hydrocarbon products, including gasoline, aviation and diesel fuel, and various petrochemicals. Oil from the Gulf of Mexico OCS contributes to meeting domestic demand and enhances national economic security. Since the U.S. is expected to continue to rely on oil and natural gas to meet its energy needs, each proposed action would contribute to meeting domestic demand and to reducing the need for imports of these resources. Refer to Chapter 1.2 of the 2017-2022 GOM Multisale EIS for details on petroleum consumption and energy needs in the United States, as well as the Gulf of Mexico OCS region's resource potential.

1.3 OCS OIL AND GAS PROGRAM PLANNING AND DECISION PROCESS

BOEM produces NEPA documents for each of the major stages of energy development planning. These documents include an overarching Five-Year Program EIS for the Five-Year Program, NEPA review for the individual decisions on oil and gas lease sales, and site-specific reviews for the approval of exploration, development and production, and decommissioning plans and permits (**Figure 1-2**). This Supplemental EIS is a NEPA review for the individual decision on an oil and gas lease sale.

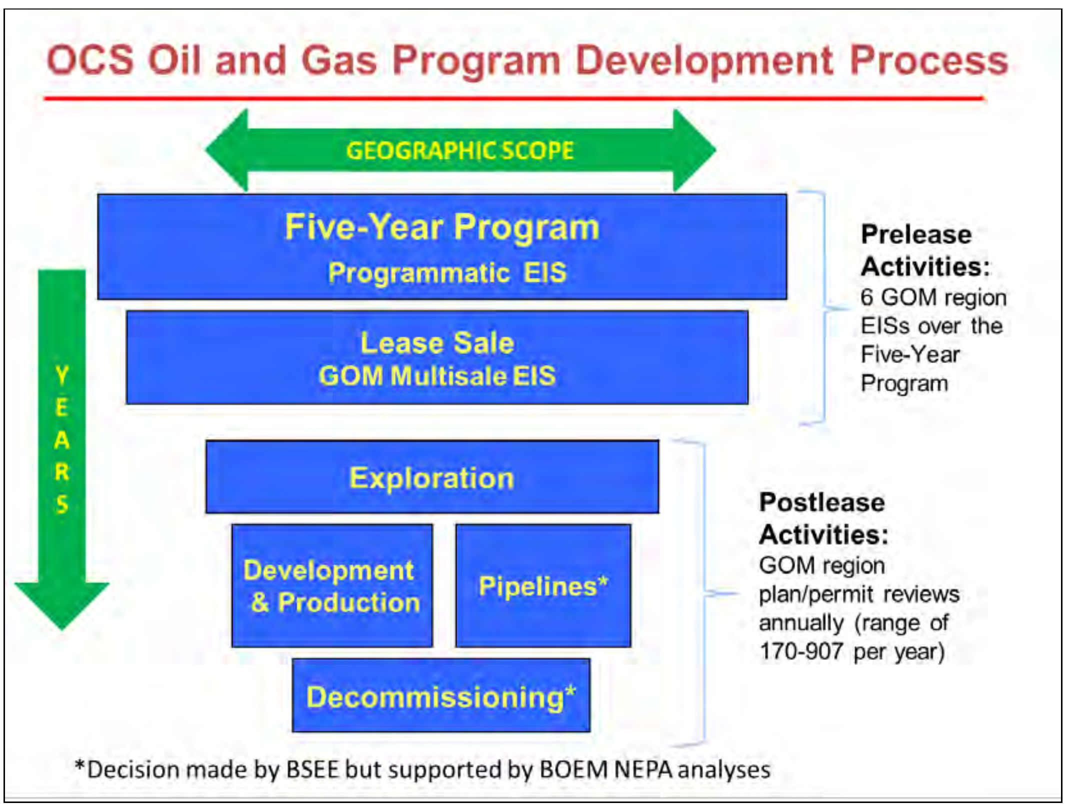


Figure 1-2. OCS Oil and Gas Program Development Process.

1.3.1 Prelease Process

BOEM has a two-stage Federal offshore prelease sale planning process:

(1) develop a Five-Year Program of proposed offshore lease sales for the OCS Program; and

(2) conduct an individual lease sale consultation and decision process for each lease sale scheduled in the approved Five-Year Program.

Due to the staged decisionmaking process in OCSLA, BOEM does a staged or tiered process in which NEPA documents are prepared that cover potential impacts associated with the various stages of the OCSLA process. This includes analyses at the Five-Year Program stage, proposed lease sale stage, exploration or development and production plan stage, and various permitting stages, including, but not limited to, drilling and decommissioning. At the lease sale stage, this is typically done through an EIS, which analyzes the potential impacts of postlease activities. However, at the lease issuance stage, no activities beyond certain ancillary activities (e.g., geological and geophysical operations, data collection, and geotechnical evaluations) are actually authorized by the lease; therefore, there are few environmental impacts reasonably expected from the lease sale itself. Nonetheless, BOEM has chosen in its discretion to prepare an EIS at this stage to analyze the potential environmental impacts that could result if exploration, development, production, and decommissioning activities eventually occur, in order to provide the context and setting of future proposed actions and to better understand the potential impacts associated with these types of activities as well as cumulative impacts on GOM resources.

As described in the 2017-2022 Five-Year Program, any individual lease sale could still be scaled back during the prelease sale process to offer a smaller area should circumstances warrant. For example, an individual lease sale could offer an area that conforms more closely to the separate planning area model used in the 2012-2017 Five-Year Program. Therefore, the analyses in this Supplemental EIS also includes alternatives similar to past WPA, CPA, and EPA lease sale environmental reviews.

This Supplemental EIS supplements, tiers from, updates, summarizes, and incorporates by reference all of the relevant analyses from the 2017-2022 Five-Year Program EIS and 2017-2022 GOM Multisale EIS, which are referenced below.

- November 2016 – *Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022—Final Programmatic Environmental Impact Statement* (2017-2022 Five-Year Program EIS; USDOI, BOEM, 2016b)
- March 2017 – *Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement* (2017-2022 GOM Multisale EIS; USDOI, BOEM, 2017a)

This Supplemental EIS will

- update the baseline conditions and potential environmental effects of oil and natural gas leasing, exploration, development, and production in the GOM since publication of the 2017-2022 GOM Multisale EIS;
- analyze the potential impacts of a proposed action on the marine, coastal, and human environments;
- assist decisionmakers in making informed, future decisions regarding the approval of operations, as well as leasing; and
- focus on the potential environmental effects of oil and natural gas leasing, exploration, development, and production in the areas that were identified through the Area Identification (Area ID) procedure for the 2017-2022 GOM Multisale EIS as the proposed lease sale area. In addition to the No Action Alternative (i.e., cancel a proposed lease sale), other alternatives may be considered for the proposed lease sale, such as deferring certain areas from a proposed lease sale.

1.3.2 Gulf of Mexico Postlease Activities

BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are responsible for managing, regulating, and monitoring oil and natural gas exploration, development, and production operations on the OCS to promote the orderly development of mineral resources in a safe and environmentally sound manner. BOEM's regulations for oil, gas, and sulphur lease operations are specified in 30 CFR parts 550, 551, 554, and 556. The BSEE's regulations for oil, gas, and sulphur operations are specified in 30 CFR parts 250 and 254. Refer to Appendix A of the 2017-2022 GOM Multisale EIS for descriptions of postlease activities, including the following: geological and geophysical (G&G) surveys; exploration and development plans; permits and applications; inspection and enforcement; pollution prevention, oil-spill response plans and financial responsibility; air emissions; flaring and venting; hydrogen sulfide (H_2S) contingency plans; archaeological resources regulation; coastal zone management consistency review and appeals for postlease activities; best available and safest technologies, including at production facilities; personnel training and education; structure removal and site clearance; marine protected species NTLs; and the Rigs-to-Reefs program.

All plans for OCS oil- and gas-related activities (e.g., exploration and development plans) go through rigorous BOEM review and approval to ensure compliance with established laws and regulations before any project-specific activities can begin on a lease. Mitigating measures are incorporated and documented in plans submitted to BOEM. These measures may be implemented through, among other things, lease stipulations and project-specific requirements or conditions of approval. Conditions of approval are based on BOEM's and BSEE's technical and environmental evaluations of the proposed operations. Conditions may be applied to any OCS plan, permit, right-of-use and easement, or pipeline right-of-way grant.

Mitigating measures address concerns such as endangered and threatened species, geologic and manmade hazards, military warning and ordnance disposal areas, archaeological sites, air quality, oil-spill response planning, deepwater benthic communities, artificial reefs, operations in H_2S-prone areas, and shunting of drill effluents in the vicinity of biologically sensitive features. Refer to Appendix B of the 2017-2022 GOM Multisale EIS ("Commonly Applied Mitigating Measures") for more information on the mitigations that BOEM and BSEE often apply to permits and approvals. Operational compliance of the mitigating measures is enforced through BSEE's onsite inspection program.

BOEM and BSEE issue Notices to Lessees and Operators (NTLs) to provide clarification, description, or interpretation of a regulation; guidelines on the implementation of a special lease stipulation or regional requirement; or convey administrative information. A detailed listing of the current Gulf of Mexico OCS Region's NTLs is available through BOEM's Gulf of Mexico OCS Region's website at http://boem.gov/Regulations/Notices-Letters-and-Information-to-Lessees-and-Operators.aspx or through the Region's Public Information Office at 504-736-2519 or 1-800-200-GULF. A detailed listing of BSEE's Gulf of Mexico OCS Region's current NTLs is available through BSEE's website at https://www.bsee.gov/guidance-and-regulations/guidance/notice-to-lessees.

1.4 The Decision To Be Made

This Supplemental EIS has been prepared to inform decisions for the proposed 2018 GOM lease sales. After completion of the NEPA process for this Supplemental EIS, a decision will be made for proposed Lease Sale 250, which is scheduled for March 2018 (i.e., prepare a Record of Decision (ROD) for proposed Lease Sale 250). A second NEPA review will be conducted for proposed Lease Sale 251, which is scheduled for August 2018, to consider any relevant new information; a second Record of Decision will be prepared for proposed Lease Sale 251. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA reviews that may update this Supplemental EIS as necessary.

The decision on whether and how to proceed with proposed Lease Sale 250 will be made following the completion of this NEPA analysis. A separate decision will be made for Lease Sale 251.

1.5 Regulatory Framework

Federal laws mandate the OCS leasing program (i.e., OCSLA) and the environmental review process (e.g., NEPA). These regulations are intended to encourage orderly, safe, and environmentally responsible development of oil, natural gas, alternative energy sources, and other mineral resources on the OCS. BOEM consults with numerous federally recognized Indian Tribes and Federal and State departments and agencies that have authority to govern and maintain ocean resources pursuant to other Federal laws. For more information on BOEM's consultation partners for specific Federal regulations, specific consultation and coordination processes with federally recognized Indian Tribes, and Federal, State, and local agencies, refer to Chapter 1.5 of the

2017-2022 GOM Multisale EIS. In addition, a detailed description of major Federal laws and Executive Orders that are relevant to the OCS leasing process is provided in the *OCS Regulatory Framework* white paper, which can be found on BOEM's website (Cameron and Matthews, 2016).

1.6 OTHER OCS OIL- AND GAS-RELATED ACTIVITIES

BOEM and BSEE have programs and activities that are OCS-related but not specific to the oil and gas leasing process or to the management of exploration, development, and production activities. These programs include environmental and technical studies, cooperative agreements with other Federal and State agencies for NEPA work, joint jurisdiction over cooperative efforts, inspection activities, and regulatory enforcement. BOEM also participates in industry research efforts and forums. The information collected through these efforts is used in support of the BOEM NEPA documents that inform Agency decisions. Chapter 1.6 of the 2017-2022 GOM Multisale EIS contains descriptions of the other OCS oil- and gas-related activities, including the Environmental Studies Program, Technology Assessment Program, oil-spill response research, and interagency agreements.

1.7 OTHER PERTINENT ENVIRONMENTAL REVIEWS OR DOCUMENTATION

BOEM is aware of other environmental reviews and studies relevant to the resources under consideration in this Supplemental EIS. Notices of Availibility were published in the *Federal Register* for the following reviews: BOEM's *Gulf of Mexico OCS Proposed Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas; Final Programmatic Environmental Impact Statement* (USDOI, BOEM, 2017d), NOAA's *Flower Garden Banks National Marine Sanctuary Expansion Draft Environmental Impact Statement* (USDOC, NOAA, ONMS, 2016), and the Natural Resource Damage Assessment Trustees' (Trustees) *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees, 2016). For more details on these documents, refer to Chapter 1.7 of the 2017-2022 GOM Multisale EIS.

In addition, supporting technical information in previous NEPA reviews have been developed as standalone technical reports and are summarized and incorporated by reference as appropriate. These include the OCS regulatory framework and improvements since the *Deepwater Horizon* explosion, oil spill, and response; the catastrophic spill event analysis (USDOI, BOEM, 2017b); and the essential fish habitat assessment (USDOI, BOEM, 2016c). Subsequent updates to this information have been minimal and, therefore, BOEM has prepared separate technical reports, which will be updated as needed. These reports can be found on BOEM's website at http://www.boem.gov/nepaprocess/. This approach is conducive to reducing the size of this Supplemental EIS and future NEPA documents.

1.8 FORMAT AND ORGANIZATION OF THIS SUPPLEMENTAL EIS

In an effort to thoroughly explain all the environmental consideration and mitigations that are involved in BOEM's assessment of the potential environmental consequences of OCS oil- and gas-related activities, BOEM recognizes that past NEPA reviews have become encyclopedic in nature. To more closely align with CEQ's guidance regarding EIS format, a major goal in preparing this Supplemental EIS includes increasing the readability of the document for decisionmakers and the public, and shortening the document by providing relevant and appropriate information needed to assess the effects of the proposed actions and alternatives. A major focus for preparing this Supplemental EIS has been on clear and concise writing, using graphics to emphasize major concepts where appropriate, and referencing more detailed and technical supporting information in appendices from the 2017-2022 GOM Multisale EIS and incorporating those appendices by reference. The remaining chapters in this Supplemental EIS are described below.

- **Chapter 2** describes the proposed action, including the potential lease sale options and the alternatives, being analyzed in this Supplemental EIS; discusses the potential mitigating measures (pre- and postlease), including the proposed stipulations, and the issues considered and not considered in the analysis; and discusses the deferred alternatives and provides a broad comparison of impacts by alternative.
- **Chapter 3** describes all the potentially occurring actions associated with a proposed regionwide lease sale in the Five-Year Program and the cumulative activities that provide a framework for detailed analyses of the potential impacts analyzed in **Chapter 4**. Exploration and development scenarios describe the infrastructure and activities that could potentially affect the biological, physical, and socioeconomic resources in the GOM. It is a hypothetical framework of assumptions based on estimated amounts, timing, and general locations of OCS exploration, development, and production activities and facilities, both offshore and onshore. It also includes a set of ranges for resource estimates, projected exploration and development activities, and impact-producing factors.
- **Chapter 4** describes the affected environment and the potential impacts of a proposed regionwide lease sale and each alternative by resource. Analysis of the alternatives includes routine activities, accidental events, cumulative impact analysis, incomplete or unavailable information, and conclusions for each resource.
- **Chapter 5** describes the consultation and coordination efforts used in preparing this Supplemental EIS. This includes a description of the scoping process and summary of scoping comments, activities, and results; cooperating agencies; distribution of the EIS; consultations with Federal and State agencies under the Coastal Zone Management Act, Endangered Species Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the National Historic Preservation Act; and government-to-government consultation and coordination.

Chapter 5 also includes comments received on the Draft Supplemental EIS and BOEM's responses.

- **Chapter 6** includes all the citations referred to throughout this Supplemental EIS.
- **Chapter 7** is a list of all the preparers of this Supplemental EIS.
- **Chapter 8** is a glossary of terms.
- Finally, to improve the readability of this Supplemental EIS, more detailed supporting information has been placed in the **Appendices**.

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

What's In This Chapter?

- Alternative A: A single proposed regionwide lease sale offering all available unleased blocks within the WPA, CPA, and EPA portions of the proposed lease sale area with exceptions as outlined in **Chapter 2.2.1**.
- Alternative B: A single proposed lease sale offering all available unleased blocks within the CPA and EPA, but not within the WPA portion of the proposed lease sale area with exceptions.
- Alternative C: A single proposed lease sale offering all available unleased blocks within the WPA, but not within the CPA/EPA portions of the proposed lease sale area with one exception.
- Alternative D: Alternative A, B, or C with the option to exclude any available unleased blocks subject to the Topographic Features Stipulation, Live Bottom (Pinnacle Trend) Stipulation, and/or Blocks South of Baldwin County, Alabama, Stipulations.
- Alternative E: Cancellation of a single proposed regionwide lease sale.
- The pre- and postlease mitigating measures being analyzed are presented.
- The issues analyzed and those not considered within this Supplemental EIS are presented.
- A comparison of the potential impacts to each resource by alternative is presented.

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.0 INTRODUCTION

This Supplemental EIS addresses a proposed Federal action – a regionwide lease sale. This Supplemental EIS is expected to be used to inform decisions for each of the two proposed lease sales scheduled in 2018, i.e., Lease Sales 250 and 251 in the Gulf of Mexico OCS (**Figure 1-1**), as scheduled in the 2017-2022 Five-Year Program (USDOI, BOEM, 2016a), and to be used and supplemented as necessary for decisions for each of the remaining proposed regionwide lease sales scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS contains analyses of the potential environmental impacts that could result from a proposed regionwide lease sale in the Gulf of Mexico as scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program. The decision on whether and how to proceed with proposed Lease Sale 250 will be made following the completion of this NEPA analysis. A separate decision will be made for the second proposed lease sale in 2018, i.e., Lease Sale 251. The proposed action (proposed lease sale) assumes compliance with applicable regulations and lease stipulations in place at the time a ROD is signed for a proposed action. Four action alternatives (Alternatives A-D) and a No Action Alternative (Alternative E) are described, including a comparison of impacts by alternative.

Agencies are encouraged to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues appropriate for decision at each level of environmental review.

2.1 SUPPLEMENTAL EIS NEPA ANALYSIS

The planned supplemental approach for regionwide lease sales is intended to focus the NEPA/EIS process on updating subsequent lease sale NEPA reviews as necessary to address any relevant significant new information and/or issues since publication of the previous lease sale NEPA documents from which it tiers. Since proposed GOM Lease Sales 250, 251, 252, 253, 254, 256, 257, 259, and 261 and their projected activities are very similar, the impacts from a single proposed regionwide lease sale (e.g., Lease Sale 250) examined in this Supplemental EIS may be applied to the remaining proposed GOM lease sales scheduled in the 2017-2022 Five-Year Program, as authorized under 40 CFR § 1502.4, which allows related or similar proposals to be analyzed in one EIS. Proposed Lease Sales 250, 251, 252, 253, 254, 256, 257, 259, and 261 were also considered in the cumulative analysis of the 2017-2022 GOM Multisale EIS. This Supplemental EIS tiers from, updates, summarizes, and incorporates by reference the 2017-2022 GOM Multisale EIS. Proposed GOM Lease Sales 250, 251, 252, 253, 254, 256, 257, 259, and 261 are expected to be within the scenario ranges summarized in **Chapter 3** of this Supplemental EIS and as discussed in Chapter 3 of the 2017-2022 GOM Multisale EIS.

This Supplemental EIS is expected to be used to inform decisions for the two proposed lease sales scheduled in 2018 and to be used and supplemented as necessary for decisions for each of the remaining proposed regionwide lease sales scheduled in the 2017-2022 Five-Year Program. At the completion of the NEPA process for this Supplemental EIS, a decision will be made on whether and how to proceed with proposed GOM Lease Sale 250, which is scheduled for March 2018. A second NEPA review will be conducted for proposed Lease Sale 251, which is scheduled for August 2018, to consider any relevant new information, and a second ROD will be published for proposed Lease Sale 251. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA reviews that may update this Supplemental EIS as necessary.

Informal and formal consultation with other Federal agencies, the affected States, federally recognized Indian Tribes, nongovernmental organizations, and the public is being conducted as appropriate to integrate to the fullest extent possible environmental impact analyses with other environmental review laws and Executive Orders.

2.2 ALTERNATIVES, MITIGATING MEASURES, AND ISSUES

Through the scoping efforts for this Supplemental EIS and the prior 2017-2022 GOM Multisale EIS, numerous issues and topics were identified for consideration. During the scoping period for the prior 2017-2022 Multisale EIS, a number of alternatives or deferral options were suggested and examined for inclusion in Chapter 2.2.2 of the 2017-2022 GOM Multisale EIS. Those alternative and deferral options were also reexamined during the preparation of this Supplemental EIS. These suggestions included additional deferrals, policy changes, and suggestions beyond the scope of this Supplemental EIS. BOEM has not identified any new significant information that changes its conclusions in the prior 2017-2022 GOM Multisale EIS or that indicates that the proposed alternatives or deferral options are appropriate for further in-depth analysis. The justifications for not carrying those suggestions through detailed analyses in this Supplemental EIS are the same as those used in the 2012-2017 GOM Multisale EIS.

The analyses of environmental impacts from the proposed alternatives summarized below and described in detail in **Chapter 4** are based on the development scenario, which is a set of assumptions and estimates on the amounts, locations, and timing for OCS oil and gas exploration, development, and production operations and facilities, both offshore and onshore. A detailed discussion of the development scenario and major related impact-producing factors is included in **Chapter 3**.

2.2.1 What are the Alternatives that BOEM is Considering for Each Proposed Lease Sale?

The discussions below outline the alternatives that are considered for this environmental analysis. All available unleased blocks within the WPA, CPA, and EPA portions of the proposed lease sale area, with the exceptions as outlined for each alternative below, are being offered for lease. The mitigating measures (pre- and postlease), including the proposed stipulations, are fully described in Chapter 2 and Appendix D of the 2017-2022 GOM Multisale EIS.

2.2.1.1 Alternative A—Regionwide OCS Lease Sale (The Preferred Alternative)

Alternative A would allow for a proposed regionwide lease sale encompassing all three planning areas within the U.S. portion of the Gulf of Mexico OCS. This is BOEM's preferred alternative. This alternative would offer for lease all available unleased blocks within the WPA, CPA, and EPA portions of the proposed lease sale area for oil and gas operations (**Figure 2-1**), with the following exceptions:

(1) whole and portions of blocks deferred by the Gulf of Mexico Energy Security Act of 2006 (discussed in the *OCS Regulatory Framework* white paper [Cameron and Matthews, 2016]);

(2) blocks that are adjacent to or beyond the United States' Exclusive Economic Zone in the area known as the northern portion of the Eastern Gap; and

(3) whole and partial blocks within the current boundary of the Flower Garden Banks National Marine Sanctuary.

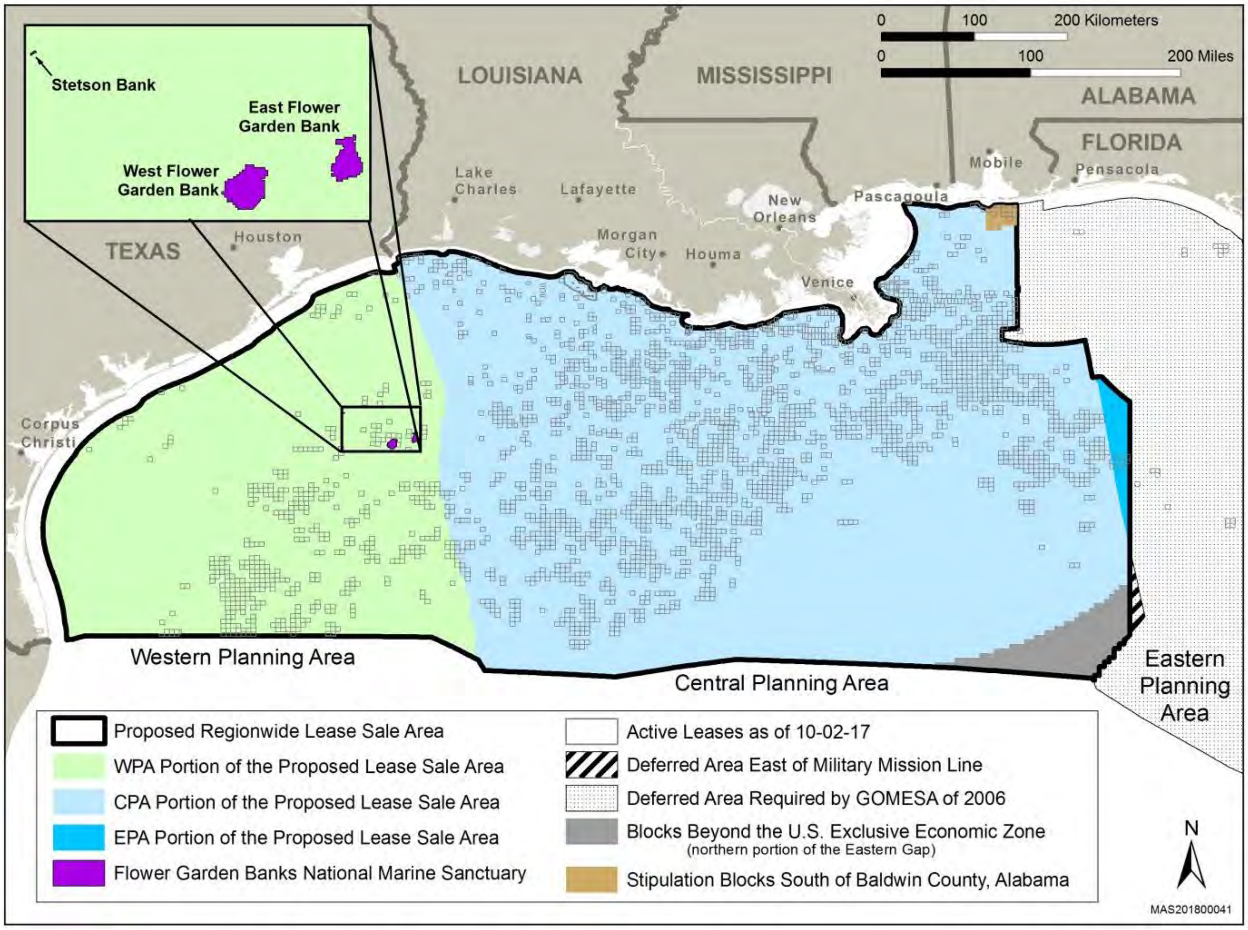


Figure 2-1. Proposed Regionwide Lease Sale Area, Encompassing the Available Unleased Blocks within All Three Planning Areas (a total of approximately 91.93 million acres with approximately 76.9 million acres available for lease as of October 2017).

A proposed regionwide lease sale would include all three BOEM planning areas encompassing a total of approximately 91.93 million acres with approximately 76.9 million acres available for lease as of October 2017. Leasing information related to all three planning areas is updated monthly and can be found on BOEM's website at http://www.boem.gov/Gulf-of-Mexico-Region-Lease-Map/.

In general, a regionwide lease sale would represent 1.2-4.2 percent of the total OCS Program production in the GOM based on barrels of oil equivalent resource estimates (refer to **Chapter 3.1.2**). The estimated amounts of resources projected to be leased, discovered, developed, and produced as a result of a typical proposed regionwide lease sale are 0.211-1.118 billion barrels of oil (BBO) and 0.547-4.424 trillion cubic feet (Tcf) of gas (refer to **Table 3-5**).

2.2.1.2 Alternative B—Regionwide OCS Lease Sale Excluding Available Unleased Blocks in the WPA Portion of the Proposed Lease Sale Area

Alternative B would allow for a proposed lease sale encompassing the CPA and EPA within the U.S. portion of the Gulf of Mexico OCS (**Figure 2-2**). Available blocks within the WPA would ***not*** be considered under this alternative. This alternative would offer for lease all available unleased blocks within the CPA and EPA portions of the proposed lease sale area for oil and gas operations, with the following exceptions:

(1) whole and portions of blocks deferred by the Gulf of Mexico Energy Security Act of 2006; and

(2) blocks that are adjacent to or beyond the United States' Exclusive Economic Zone in the area known as the northern portion of the Eastern Gap.

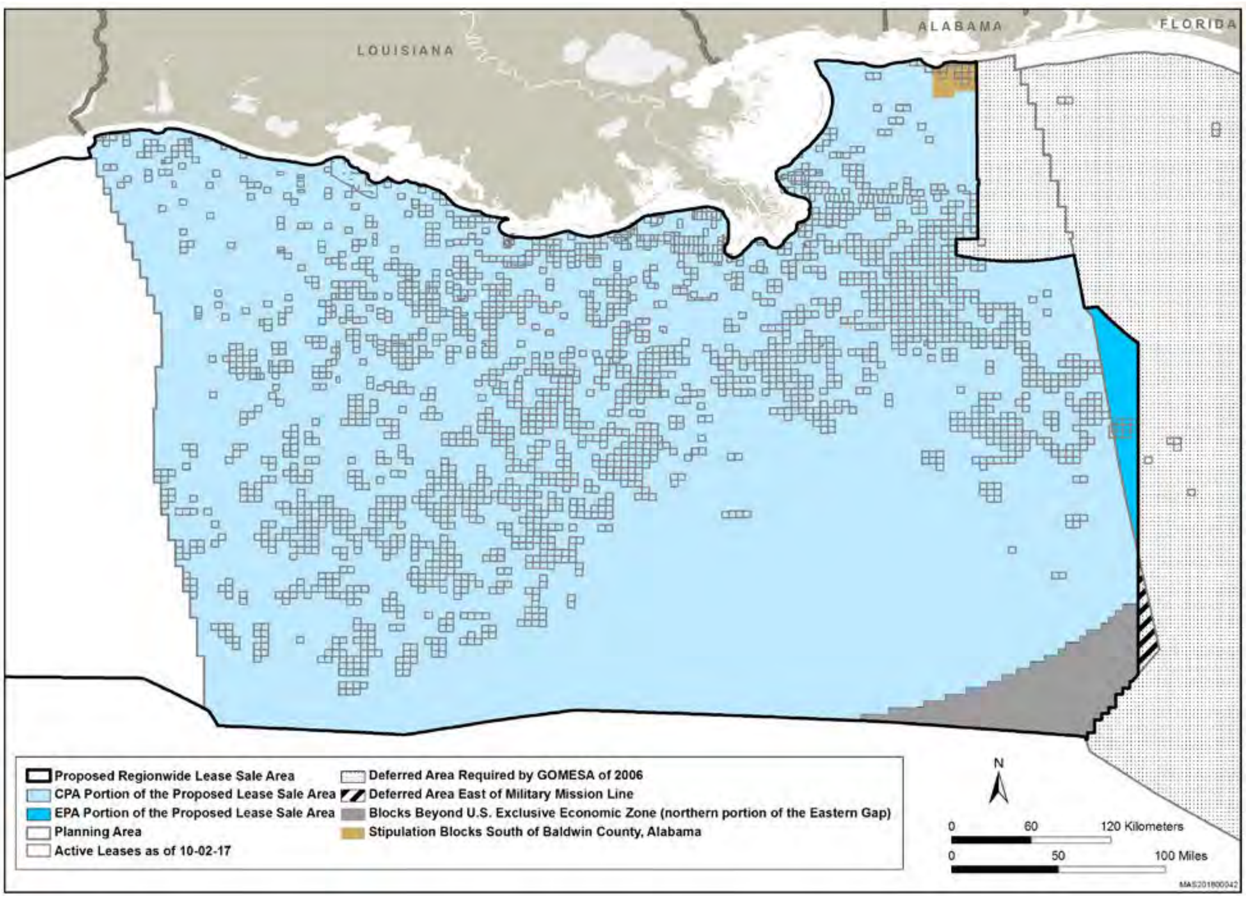


Figure 2-2. Proposed Lease Sale Area for Alternative B, Excluding the Available Unleased Blocks in the WPA. (The CPA and EPA encompass a total of approximately 63.35 million acres with approximately 50.9 million acres available for lease as of October 2017.)

In general, a lease sale that would include all available unleased blocks in the CPA and EPA would represent approximately 1.0-3.6 percent of the total OCS Program production in the GOM based on barrels of oil equivalent resource estimates (refer to **Table 3-2**). The proposed Alternative B lease sale area encompasses approximately 63.35 million acres as that planning area is described as a subset of Alternative A. The estimated amounts of resources projected to be leased, discovered, developed, and produced as a result of a proposed lease sale under Alternative B are 0.185-0.970 BBO and 0.441-3.672 Tcf of gas (refer to **Table 3-5**).

2.2.1.3 Alternative C—Regionwide OCS Lease Sale Excluding Available Unleased Blocks in the CPA/EPA Portions of the Proposed Lease Sale Area

Alternative C would allow for a proposed lease sale encompassing the WPA within the U.S. portion of the Gulf of Mexico OCS (**Figure 2-3**). Available blocks within the CPA and EPA would ***not*** be considered under this alternative. This alternative would offer for lease all available unleased blocks within the WPA portion of the proposed lease sale area for oil and gas operations, with the following exception:

(1) whole and partial blocks within the current boundary of the Flower Garden Banks National Marine Sanctuary.

The proposed Alternative C lease sale area encompasses virtually all of the WPA's approximately 28.58 million acres as that planning area is described as a subset of Alternative A. In general, a lease sale that would include all available unleased blocks in the WPA would represent approximately 0.2-0.6 percent of the total OCS Program production in the GOM based on barrels of oil equivalent resource estimates (refer to **Table 3-2**). The estimated amounts of resources projected to be leased, discovered, developed, and produced as a result of a proposed lease sale offering only WPA available blocks are 0.026-0.148 BBO and 0.106-0.752 Tcf of gas (refer to **Table 3-5**).

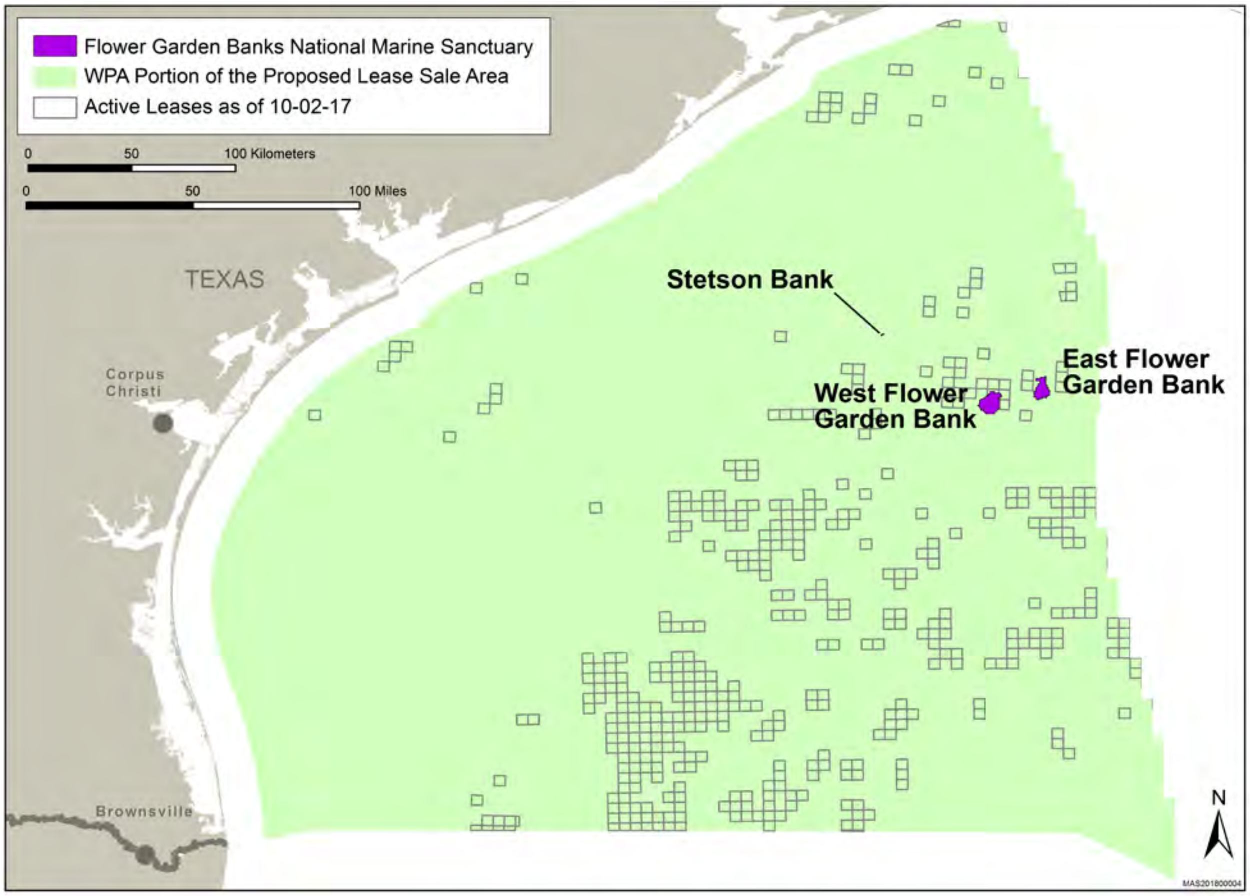


Figure 2-3. Proposed Lease Sale Area for Alternative C, Excluding the Available Unleased Blocks in the CPA and EPA. (The WPA encompasses a total of approximately 28.58 million acres with approximately 26.0 million acres available for lease as of October 2017.)

2.2.1.4 Alternative D—Alternative A, B, or C, with the Option to Exclude Available Unleased Blocks Subject to the Topographic Features, Live Bottom (Pinnacle Trend), and/or Blocks South of Baldwin County, Alabama, Stipulations

Alternative D could be combined with any of the action alternatives above (i.e., Alternatives A, B, or C) and would allow the flexibility to offer leases under any alternative with additional exclusions. Under Alternative D, the decisionmaker could exclude from leasing any available unleased blocks subject to any one and/or a combination of the following stipulations:

- Topographic Features Stipulation;
- Live Bottom (Pinnacle Trend) Stipulation; and
- Blocks South of Baldwin County, Alabama, Stipulation (not applicable to Alternative C).

This alternative considered blocks subject to these stipulations because these areas have been emphasized in scoping, can be geographically defined, and adequate information exists regarding their ecological importance and sensitivity to OCS oil- and gas-related activities. Figure 2-5 of the 2017-2022 GOM Multisale EIS illustrates one example of the blocks that could be excluded under this alternative (shaded in blue).

A total of 207 blocks within the CPA and 160 blocks in the WPA are affected by the Topographic Features Stipulation (**Figure 2-4**). There are currently no identified topographic features protected under this stipulation in the EPA. The Live Bottom Stipulation covers the pinnacle trend area of the CPA, affecting a total of 74 blocks (**Figure 2-4**). More details on the blocks affected by the Topographic Features Stipulation and the Pinnacle Trend blocks subject to the Live Bottom Stipulation can be found at http://www.boem.gov/Biologically-Sensitive-Areas-List/. Maps indicating the areas affected by the Topographic Features Stipulation can be found at http://www.boem.gov/Topographic-Features-Stipulation-Map-Package/.

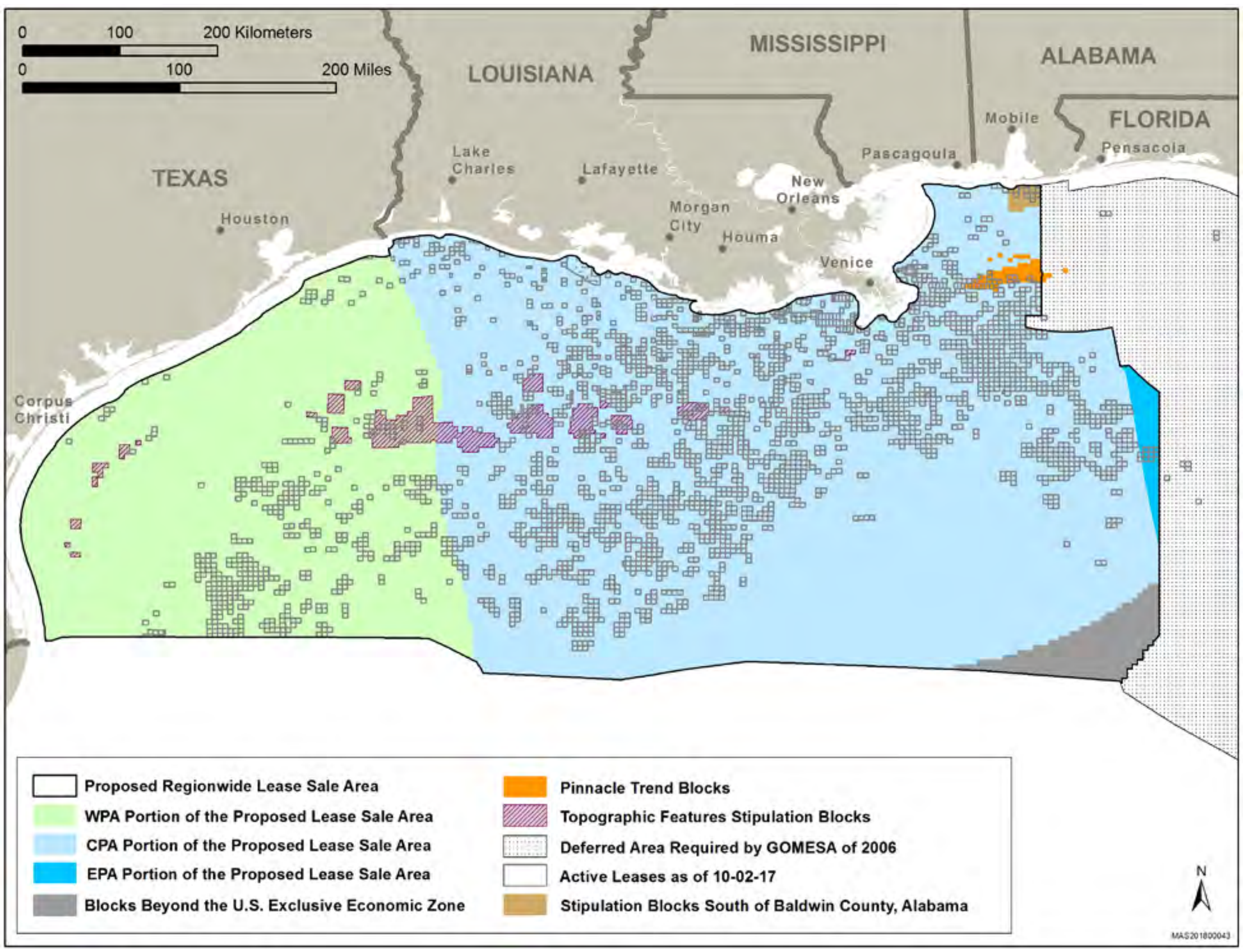


Figure 2-4. Identified Topographic Features, Pinnacle Trend, and Blocks South of Baldwin County, Alabama, Stipulation Blocks in the Gulf of Mexico.

As of the publication of this Supplemental EIS, the Blocks South of Baldwin County, Alabama, Stipulation (herein referred to as the Baldwin County Stipulation Blocks) applies to a total of 32 blocks (Mobile Blocks 826-830, 869-874, 913-918, 957-962, 1001-1006, and Viosca Knoll Blocks 33-35) within 15 mi (24 km) of Baldwin County, Alabama (representing less than 1% of the total number of blocks to be offered under Alternative A or B). The intent of a proposal excluding these blocks would be to mitigate the visual impacts of concern raised by the Governor of Alabama on previous EISs, as well as in the 2017-2022 Five-Year Program from which the 2017-2022 GOM Multisale EIS and this Supplemental EIS tier. The stipulation, however, has been continually adopted in annual CPA lease sales since 1999 and has effectively mitigated visual impact. The stipulation specifies requirements for consultation that lessees must follow when developing plans for fixed structures (refer to Appendix D of the 2017-2022 GOM Multisale EIS) while still allowing leasing and OCS oil- and gas-related operations in the area, which could not occur with the no-leasing buffer. If any of the action alternatives are selected, BOEM expects this stipulation to be analyzed and decided on at the lease sale stage; therefore, visual impacts would be reduced to the greatest extent practicable should the stipulation be applied.

Alternative D, if adopted, would prevent any OCS oil- and gas-related activity whatsoever in the affected blocks; thus, it would eliminate any potential direct impacts to the biota of those blocks from OCS oil- and gas-related activities, which otherwise could be conducted within the blocks. Under Alternative D, the number of blocks that would become unavailable for lease represents only a small percentage of the total number of blocks to be offered under Alternative A, B, or C (<4%, even if blocks subject to all three stipulations were excluded). Therefore, Alternative D could reduce offshore infrastructure and activities, but Alternative D may (and BOEM believes more reasonable to expect) only delay activity or shift the location of offshore infrastructure and activities farther from these sensitive zones and not lead to a reduction in overall offshore infrastructure and activities. The regional impact levels for all resources, except for the topographic features and live bottoms, would be similar to those described under Alternative A, B, or C. All of the assumptions (including the proposed stipulations and other potential mitigating measures designed to reduce environmental risk) and estimates would remain the same as described for Alternatives A, B, or C. The exclusion of this small subset of available unleased blocks could reduce exploration, development, and production flexibility and, therefore, could result in adverse economic effects (e.g., reduced royalties). A detailed discussion of the development scenario and related impact-producing factors is included in **Chapter 3**.

2.2.1.5 Alternative E—No Action

Alternative E is the cancellation of a single proposed GOM lease sale within the 2017-2022 Five-Year Program. The opportunity for development of the estimated oil and gas that could have resulted from a proposed action (i.e., a single proposed lease sale) or alternative to the proposed action, as described above, would be precluded or postponed to a future lease sale. Any potential environmental impacts resulting from a proposed lease sale would not occur. Activities related to previously issued leases and permits (as well as those that may be issued in the future under a separate decision) related to the OCS Oil and Gas Program would continue. If a lease sale were to be cancelled, the resulting development of oil and gas would most likely be postponed to a future lease sale; therefore, the cumulative level of OCS oil- and gas-related activity would only be reduced by a small percentage, if any. Therefore, the cancellation of a proposed lease sale would not significantly change the environmental impacts of overall OCS oil- and gas-related activity. However, the cancellation of a proposed lease sale may result in direct economic impacts to the individual companies and revenues collected by the Federal Government (and thus revenue disbursements to the States) could also be adversely affected. If future lease sales were to occur, the impacts from the cancellation of a single lease sale to individual companies and Federal revenues would likely be minor. The 2017-2022 Five-Year Program EIS discusses the impacts of cancelling all proposed GOM lease sales included in the 2017-2022 Five-Year Program.

2.2.2 What Other Alternatives and Deferrals Has BOEM Considered But Not Analyzed in Detail?

Chapter 2.2.3 of the 2017-2022 GOM Multisale EIS includes a detailed description of alternatives previously considered but not analyzed in detail in this Supplemental EIS, including the following:

- previous multisale approach, which consisted of a total of 12 proposed lease sales, including 5 annual proposed lease sales in the WPA, 5 annual proposed lease sales in the CPA, and 2 proposed lease sales in the EPA.
- exclude blocks subject to the proposed Flower Garden Banks National Marine Sanctuary expansion;
- additional buffer zones around potential areas of concern (e.g., the blocks subject to Congressional moratorium pursuant to the Gulf of Mexico Energy Security Act of 2006 and the Gulf Islands National Seashore);
- proposed lease sale offering only available unleased blocks in the EPA;
- proposed lease sale with additional mitigating measures for sperm whale high-use areas;
- regionwide OCS proposed lease sale excluding blocks within the De Soto Canyon area;
- regionwide OCS proposed lease sale excluding blocks within loggerhead sea turtle critical habitat; and
- delay leasing until the state of the Gulf of Mexico's environmental baseline since the *Deepwater Horizon* explosion, oil spill, and response is better understood.

The justifications for not engaging in detailed analysis of these alternatives and deferrals is provided in the 2017-2022 GOM Multisale EIS, and BOEM has identified no new information that changes these conclusions.

Two additional alternatives were identified during scoping for this Supplemental EIS. They are listed below:

- stop issuing leases for oil and gas in the Gulf of Mexico; and
- use renewable energy in place of oil and gas.

Both of those issues were addressed in the 2017-2022 Five-Year Program EIS, and because this Supplemental EIS tiers from the Five-Year Program EIS, the analyses are incorporated by reference into this Supplemental EIS. As a result, the full analyses of these alternatives will not be addressed in this Supplemental EIS. A brief summary of the alternative analyses is presented below.

BOEM has addressed the alternative to stop issuing leases in the Gulf of Mexico in Chapters 2.4, "Reduced Proposed Action (Alternative C)," and 2.5, "No Action (Alternative D)" of the 2017-2022 Five-Year Program EIS. These alternatives evaluated the environmental effects of having reduced areas of leasing or no new lease sales during the 2017-2022 Five-Year Program. The impacts of these alternatives are discussed in Chapters 4.4.3.4 "C(4): Exclusion of the Gulf of Mexico Program Area" and 4.4.4 "Alternative D – The No Action Alternative" of the 2017-2022 Five-Year Program EIS. However, it should be noted that oil -and gas-related activities stemming from previous programs would continue, and only activity resulting from proposed lease sales in the new 2017-2022 Five-Year Program would be halted.

BOEM has addressed the potential for alternative energy on the OCS in Chapters 1.4.6.1 ("Renewable Energy") and 2.7.4 ("Develop Alternative or Renewable Energy Sources as a Complete or Partial Substitute for Oil and Gas Leasing on the OCS") of the 2017-2022 Five-Year Program EIS. However, BOEM determined that an analysis of the potential for alternative energy is outside the scope of this Supplemental EIS for a proposed action. BOEM also determined that alternative energy is not a reasonable alternative to achieve the purpose of and need for the proposed action because the development of renewable energy resources in the foreseeable future does not fully or partially satisfy the purpose of and need for the proposed action at this time. The objective of this Supplemental EIS is to provide an analysis of the environmental impacts of oil and gas leasing. BOEM's Office of Renewable Energy is responsible for developing an offshore renewable energy program in the Gulf of Mexico. Information on BOEM's Renewable Energy Program, OCS leases, and renewable energy projects is available on BOEM's website at http://www.boem.gov/Renewable-Energy/.

2.2.3 What Types of Mitigating Measures Does BOEM Apply?

Mitigating measures considered in this NEPA document rely primarily on avoiding an impact altogether by not allowing certain actions or parts of an action.

Agencies are required to identify and include in an EIS those appropriate mitigating measures not already included in the proposed action or alternatives. The CEQ regulations (40 CFR § 1508.20) define mitigation as follows:

- Avoidance—Avoiding an impact altogether by not taking a certain action or part of an action.
- Minimization—Minimizing impacts by limiting the intensity or magnitude of the action and its implementation.
- Restoration—Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Maintenance—Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensation—Compensating for the impact by replacing or providing substitute resources or environments.

BOEM considers the use of mitigation at all phases of energy development and planning, from the overarching 2017-2022 Five-Year Program EIS, through each of the NEPA documents for the lease sales, and followed by more site-specific reviews for exploration, development and production, and decommissioning plans (**Figure 1-3**). Mitigations can be applied at the prelease stage, typically through applying lease stipulations or at the postlease stage by applying site-specific mitigating measures to plans, permits, and/or authorizations (refer to Appendix A of the 2017-2022 GOM Multisale EIS). Through this approach, BOEM is able to analyze impacts and mitigations that are appropriate for consideration at the appropriate time.

2.2.3.1 Proposed Lease Mitigating Measures (Stipulations)

The potential lease stipulations and mitigating measures included for analysis in this Supplemental EIS were developed as a result of numerous scoping efforts for the continuing OCS Program in the Gulf of Mexico. The 10 lease stipulations being considered are as follows:

- Topographic Features Stipulation;
- Live Bottom (Pinnacle Trend) Stipulation;
- Military Areas Stipulation;
- Evacuation Stipulation;
- Coordination Stipulation;
- Blocks South of Baldwin County, Alabama, Stipulation;
- Protected Species Stipulation;
- United Nations Convention on the Law of the Sea Royalty Payment Stipulation;

- Below Seabed Operations Stipulation; and
- Stipulation on the Agreement Between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (Transboundary Stipulation).

These mitigating measures would be considered for adoption by the decisionmaker, as applicable, under authority delegated by the Secretary of the Interior. The Topographic Features and Live Bottom (Pinnacle Trend) Stipulations have been applied as programmatic mitigation in the 2017-2022 Five-Year Program EIS (USDOI, BOEM, 2016b) and, therefore, would apply to all leases issued under the 2017-2022 Five-Year Program in the designated lease blocks. The analysis of the other eight stipulations for any particular alternative does not ensure application of the stipulations to leases that may result from any proposed lease sale nor does it preclude minor modifications in wording during subsequent steps in the prelease process if comments indicate changes are necessary or if conditions change.

Any stipulations or mitigation requirements to be included in a lease sale will be described in the ROD for that lease sale. Mitigating measures in the form of lease stipulations are added to the lease terms and are therefore enforceable as part of the lease. In addition, each exploration and development plan, as well as any pipeline applications related to leases issued as a result of a lease sale, will undergo a NEPA review, and additional project-specific mitigations applied as conditions of plan approval at the postlease stage. The BSEE has the authority to monitor and enforce these conditions under 30 CFR part 250 subpart N and may seek remedies and penalties from any operator that fails to comply with those conditions, stipulations, and mitigating measures.

2.2.3.2 Prelease Mitigating Measures (Stipulations) by Alternative

Table 2-1 indicates what stipulations could be applied for each alternative. Alternative D would consider the same stipulations as Alternative A, B, or C, as applicable, with the exception of removing the Topographic Features and Live Bottoms (Pinnacle Trend) Stipulations since all blocks subject to these stipulations would not be made available. Since Alternative E is the cancellation of a proposed lease sale, no stipulations would apply.

Table 2-1. Applicable Stipulations by Alternative.

Stipulation	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E[1]
Topographic Features	X[2]	X	X	–[3]	–
Live Bottoms	X	X	–	–	–
Military Areas	X	X	X	X	–
Evacuation	X	X	–	See A, B, or C	–
Coordination	X	X	–	See A, B, or C	–
Blocks South of Baldwin County, Alabama	X	X	–	See A, B, or C	–

Stipulation	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E[1]
Protected Species	X	X	X	X	–
United Nations Convention on the Law of the Sea Royalty Payment	X	X	X	X	–
Below Seabed Operations	X	X	–	See A, B, or C	–
Transboundary	X	X	X	X	–

[1] Alternative E would cancel a proposed lease sale and no leasing activities would occur; therefore, no stipulations would apply.
[2] Stipulations that would apply to specific lease blocks under any given alternative are marked with an X.
[3] Stipulations that would not apply are marked "–".

2.2.3.3 Postlease Mitigating Measures

Mitigating measures are a standard part of BOEM's program to ensure that operations are always conducted in an environmentally sound manner.

Postlease mitigating measures have been implemented for over 40 years in the Gulf of Mexico region, as they relate to OCS plans and pipeline applications. Following a lease sale, an applicant seeks approvals to develop their lease by preparing and submitting OCS plans. The OCS plans are reviewed by BOEM and, depending on what is proposed to take place in a specific place, plans may be denied, approved, or approved with conditions of approval (COA). The COAs become part of the approved postlease authorization and include environmental protections, requirements that maintain conformance with law, the requirements of other agencies having jurisdiction, or safety precautions. Mitigating measures are an integral part of BOEM's program to ensure that operations are conducted in an environmentally sound manner (with an emphasis on avoiding or minimizing any adverse impact of routine operations on the environment). For example, certain measures ensure site clearance, and survey procedures are carried out to determine potential snags to commercial fishing and avoidance of archaeological sites and biologically sensitive areas such as pinnacles, topographic features, and chemosynthetic communities.

BOEM analyzes impacts on a finer geographic scale than that analyzed in the 2017-2022 GOM Multisale EIS and this Supplemental EIS through site-specific environmental reviews, and applies mitigations as conditions of approval to permits, as appropriate. Appendix A of the 2017-2022 GOM Multisale EIS discusses BOEM's rigorous postlease processes and Appendix B of the 2017-2022 GOM Multisale EIS describes over 120 standard mitigations that may be required by BOEM or BSEE as a result of plan and permit review processes for the Gulf of Mexico OCS Region.

Mitigating measures have been proposed, identified, evaluated, or developed through previous BOEM lease sale and site-specific NEPA reviews and analyses. For example, certain measures ensure site clearance, and survey procedures are carried out to determine potential snags to commercial fishing and avoidance of archaeological sites and biologically sensitive areas such as pinnacles, topographic features, and deepwater benthic communities. Many of these mitigating measures have been adopted and incorporated into regulations and/or as guidelines governing OCS exploration, development, and production activities. All plans for OCS oil- and gas-related activities (e.g., exploration and development plans, pipeline applications, and structure-removal applications) go through rigorous BOEM review and approval to ensure compliance with established laws and regulations. Existing mitigating measures must be incorporated and documented in plans submitted to BOEM. Operational compliance of the mitigating measures is enforced through BSEE's onsite inspection program.

Some BOEM-identified mitigating measures are incorporated into OCS oil- and gas-related operations through cooperative agreements or efforts with industry and State and Federal agencies. These mitigating measures include the National Marine Fisheries Service's (NMFS) Observer Program to protect marine mammals and sea turtles during explosive removals, labeling operational supplies to track possible sources of debris or equipment loss, development of methods of pipeline landfall to eliminate impacts to beaches or wetlands, and beach cleanup events.

Site-specific mitigating measures are also applied by BOEM during plan and permit reviews. BOEM realized that many of these site-specific mitigations were recurring and developed a list of commonly applied "standard" mitigations. There are currently over 120 standard mitigations that could be applied by BOEM during plan and permit reviews. The wording of a standard mitigation is developed by BOEM in advance and may be applied whenever conditions warrant. Standard mitigation text is revised as often as is necessary (e.g., to reflect changes in regulatory citations, agency/personnel contact numbers, and internal policy). Categories of site-specific mitigations include the following: air quality; archaeological resources; artificial reef material; deepwater benthic communities; Flower Garden Banks; topographic features; hard bottoms/pinnacles/potentially sensitive biological features; military warning areas and Eglin Water Test Areas; hydrogen sulfide; drilling hazards; remotely operated vehicle surveys; geophysical survey reviews; and general safety concerns. Site-specific mitigation "types" may include the following: advisories; conditions of approval; hazard survey reviews; inspection requirements; notifications; post-approval submittals; and safety precautions. In addition to standard mitigations, BOEM may also apply nonrecurring mitigating measures that are developed on a case-by-case basis. Refer to Appendix B of the 2017-2022 GOM Multisale EIS ("Commonly Applied Mitigating Measures") for more information on the mitigations that BOEM and BSEE typically apply to plans and/or permits.

BOEM is continually revising applicable mitigations to allow the Gulf of Mexico OCS Region to more easily and routinely track mitigation compliance and effectiveness. A primary focus of this effort is requiring post-approval submittal of information within a specified timeframe or after a triggering event (e.g., end of operations reports for plans, construction reports for pipelines, and removal reports for structure removals).

2.2.4 What are the Primary Topics and Resources Being Evaluated?

Issues are defined by CEQ to represent those principal "effects" that an EIS should evaluate in-depth. Scoping identifies specific environmental resources and/or activities rather than "causes" as significant issues (Council on Environmental Quality, 1981). The analysis in the EIS can then show the degree of change from the present conditions for each issue to the actions arising from the proposed action.

Selection of environmental and socioeconomic issues to be analyzed was based on the following criteria:

- issue is identified in CEQ regulations as subject to evaluation;
- the relevant resource/activity was identified through agency expertise, through the scoping and comment process, or from comments on past EISs;
- the resource/activity may be vulnerable to one or more of the impact-producing factors associated with the OCS Program;
- a reasonable probability of an interaction between the resource/activity and impact-producing factor should exist; or
- information that indicates a need to evaluate the potential impacts to a resource/activity has become available.

2.2.4.1 Issues to be Analyzed

Chapter 2.2.5.1 of the 2017-2022 GOM Multisale EIS addresses the issues related to potential impact-producing factors and the environmental and socioeconomic resources and activities that could be affected by OCS oil- and gas-related activities, including accidental events, drilling fluids and cuttings, visual and aesthetic interference, air emissions, water quality degradation, other wastes, structure and pipeline emplacement, platform removals, OCS oil- and gas-related support services, activities, and infrastructure, sociocultural and socioeconomic, geological and geophysical activities, and other issues. **Chapter 4** of this Supplemental EIS and Chapter 4 of the 2017-2022 GOM Multisale EIS describe the resources and activities that could be affected by the impact-producing factors listed above and include the following resource topics:

- Air Quality
- Water Quality (Coastal and Offshore)
- Coastal Habitats (Estuarine Systems and Coastal Barrier Beaches and Associated Dunes)
- Deepwater Benthic Communities (Chemosynthetic and Deepwater Coral)
- *Sargassum* and Associated Communities
- Live Bottom Habitats (Topographic Features, Pinnacles, and Low-Relief Features)
- Fishes and Invertebrate Resources
- Birds
- Protected Species (ESA-Listed Marine Mammals, Sea Turtles, Beach Mice, Protected Birds, and Protected Corals)
- Commercial Fisheries
- Recreational Fishing
- Recreational Resources
- Archaeological Resources (Historic and Prehistoric)
- Human Resources and Land Use (Land Use and Coastal Infrastructure, Economic Factors, and Social Factors, Including Environmental Justice)

2.2.4.2 Issues Considered but Not Analyzed

As previously noted, the CEQ regulations for implementing NEPA instruct agencies to adopt an early process (termed “scoping”) for determining the scope of issues to be addressed and for identifying significant issues related to a proposed action. As part of this scoping process, agencies shall identify and eliminate from detailed study the issues that are not significant to the proposed action or have been covered by prior environmental review. No new issues were introduced to this Supplemental EIS during the comment period for the Draft Supplemental EIS.

Comments received during scoping are summarized in **Chapter 5.6.2.2**. Many of those issues were analyzed in detail in the 2017-2022 GOM Multisale EIS and summarized and/or updated as needed in this Supplemental EIS. These issues include the following:

- cumulative impacts to coastal resources, including wetlands;
- compensatory mitigation;
- updates and safety improvements implemented by regulators and industry;
- downstream and lifecycle greenhouse gas emissions from lease sales;
- well-stimulation activities and associated environmental impacts;
- climate change on GOM environmental resources, including warmer oceans, increased storms and flood events, and land loss;
- economic impacts as a result of canceling or holding a proposed lease sale;
- substitution effects of renewable energy sources in place;
- oil and chemical spills, including continued effects from past spills and leaking wells and pipelines; and
- environmental justice concerns related to those living near petrochemical facilities.

2.3 COMPARISON OF IMPACTS BY ALTERNATIVE

The full analyses of the potential impacts of routine activities and accidental events associated with a proposed action and a proposed action’s incremental contribution to the cumulative impacts are described in the individual resource discussions in Chapter 4 of the 2017-2022 GOM Multisale EIS and summarized in **Chapter 4** of this Supplemental EIS. **Table 2-2** provides a comparison of expected impact levels by alternative and is derived from the analysis of each resource in **Chapter 4**. The expected impact levels for Alternatives A-E represent the *incremental contribution* of impacts from a proposed lease sale in comparison to the cumulative impacts from past, present, and future activities in the GOM. These activities include both OCS oil- and gas-related and non-OCS oil- and gas-related activities that would be expected regardless of whether or not a lease sale was to occur. The impact-level ratings have been specifically tailored and defined for each resource within the **Chapter 4** impact analysis. Cumulative impacts of current, past, and reasonably foreseeable future activities would continue to occur under Alternative E.

Table 2-2. Alternative Comparison Matrix.

Impact Level Key[1]					
Beneficial[2]	Negligible	Minor	Moderate	Major	
	Alternative				
Resource	A	B	C	D	E
Air Quality	Minor	Minor	Minor	Minor	None
Water Quality	Negligible	Negligible	Negligible	Negligible	None
Coastal Habitats					
Estuarine Systems	Moderate	Moderate	Minor	Moderate	Negligible
Coastal Barrier Beaches and Associated Dunes	Minor	Minor	Negligible to Minor	Negligible to Minor	Negligible
Deepwater Benthic Communities	Negligible	Negligible	Negligible	Negligible	None
Sargassum and Associated Communities	Negligible	Negligible	Negligible	Negligible	None
Live Bottoms					
Topographic Features	Negligible	Negligible	Negligible	Negligible	None
Pinnacles and Low-Relief Features	Negligible to Minor	Negligible to Minor	Negligible	Negligible	None
Fishes and Invertebrate Resources	Minor	Minor	Minor	Minor	None
Birds	Moderate	Moderate	Moderate	Moderate	None
Protected Species					
Marine Mammals	Negligible	Negligible	Negligible	Negligible	None
Sea Turtles	Negligible	Negligible	Negligible	Negligible	None
Beach Mice	Negligible	Negligible	Negligible	Negligible	None
Protected Birds	Negligible	Negligible	Negligible	Negligible	None
Protected Corals	Negligible	Negligible	Negligible	Negligible	None
Commercial Fisheries	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Recreational Fishing	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Recreational Resources	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Archaeological Resources	Negligible[3]	Negligible[3]	Negligible[3]	Negligible[3]	None

Impact Level Key[1]					
Beneficial[2]	Negligible	Minor		Moderate	Major
	Alternative				
Resource	A	B	C	D	E
Human Resources and Land Use					
Land Use and Coastal Infrastructure	Minor	Minor	Minor	Minor	None
Economic Factors	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible to Minor
Social Factors (including Environmental Justice)	Minor	Minor	Minor	Minor	None

Note: Some resources have a range for the impact levels to account for certain variables such as the uncertainty of non-OCS oil- or gas-related activities, the level and magnitude of potential accidental events, and the minimization of the OCS oil- or gas-related impacts through lease stipulations, mitigations, and/or regulations. The impact level ratings have been specifically tailored and defined for each resource within the **Chapter 4** impact analysis.

[1] The findings for Alternatives A-D are the incremental contribution of a proposed action added to what would be expected to occur under the No Action Alternative (i.e., no lease sale). Therefore, each impact determination under Alternatives A-D assumes that the conditions and impacts (i.e., past, present, and future activities as a result of past lease sales) under the No Action Alternative would still be present.

[2] The level of beneficial impacts is specified in the analysis, which could range from low, medium, or high.

[3] The level of impacts for archaeological resources could range between negligible and major, and is dependent upon whether a survey is performed, mitigation is imposed, mitigation is followed, or a site is identified prior to the activity. Refer to **Chapter 4.13** for details.

2.4 Summary of Impacts

A search by BOEM's subject-matter experts was conducted for each resource to consider new information made available since publication of the 2017-2022 GOM Multisale EIS and to consider new information on the *Deepwater Horizon* explosion, oil spill, and response. It must also be emphasized that, in arriving at the overall conclusions for certain environmental resources (e.g., coastal and marine birds, fisheries, and wetlands), the conclusions are not based on impacts to individuals, small groups of animals, or small areas of habitat, but on impacts to the resources/populations as a whole.

BOEM's subject-matter experts determined through literature searches and communications with other agencies and academia that there was no new information made available since publication of the 2017-2022 GOM Multisale EIS that is relevant to potential impacts from the incremental contribution of a proposed lease sale. Therefore, the analyses and potential impacts for the resources remain the same as those that were presented in the 2017-2022 GOM Multisale EIS. These impact conclusions are presented in **Chapter 4** of this Supplemental EIS. The analyses and potential impacts detailed in that NEPA document remains valid and, as such, apply for the remaining proposed regionwide GOM lease sales scheduled in the 2017-2022 Five-Year Program.

In accordance with CEQ guidelines to provide decisionmakers with a robust environmental analysis, the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b) provides an analysis of the potential impacts of a low-probability catastrophic oil spill, which is not part of a proposed action and not likely expected to occur, to the environmental and cultural resources and the socioeconomic conditions analyzed in **Chapter 4**. In addition, a low-probability catastrophic oil spill is analyzed in the 2017-2022 Five-Year Program EIS, from which this Supplemental EIS tiers.

CHAPTER 3

IMPACT-PRODUCING FACTORS AND SCENARIO

What's in This Chapter?

BOEM develops scenarios that describe projected OCS oil- and gas-related routine activities and accidental events from a single proposed lease sale, the projected OCS oil and gas cumulative activities of multiple lease sales, and the non-OCS oil- and gas-related activities and/or events.

- Routine activities for a single proposed lease sale include the following:
  - exploration and delineation (geological and geophysical surveys, and drilling exploration and delineation wells);
  - offshore development and production (drilling production wells, infrastructure emplacement, and work-overs and abandonment of wells); and
  - decommissioning and removal operations (the removal and/or abandonment of platforms and pipelines).
- Accidental events for a single proposed lease sale could include the following:
  - releases into the environment (e.g., oil spills, loss of well control, accidental air emissions, pipeline failures, and chemical and drilling fluid spills);
  - collisions (e.g., helicopter, service vessels, and platforms); and
  - spill-response activities.
- Cumulative activities include the following:
  - Cumulative OCS Oil and Gas Program (all activities, i.e., the routine activities and the accidental events that could occur, from past, proposed, and future lease sales); and
  - non-OCS oil- and gas-related activities (impact-producing factors from the broad range of other activities taking place within the proposed lease sale area).

3 IMPACT-PRODUCING FACTORS AND SCENARIO

3.0 INTRODUCTION

Chapters 3.1 and 3.2 of the 2017-2022 GOM Multisale EIS describe in detail the routine and accidental impact-producing factors and activity scenarios associated with Alternatives A, B, C, and D that could potentially affect the biological, physical, and socioeconomic resources of the Gulf of Mexico. Chapter 3.3 of the 2017-2022 GOM Multisale EIS describes in detail the cumulative impact-producing factors and activity scenarios resulting from past and future lease sales that are relevant to Alternatives A, B, C, and D. The following information is a summary of the impact-producing factors and scenario incorporated from the 2017-2022 GOM Multisale EIS.

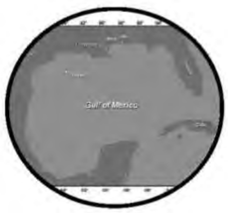
What is an Impact-Producing Factor?

An impact producing factor is an activity or process, as a result of a proposed lease sale, that could cause impacts on the environmental or socioeconomic setting. The impact analyses determine the context and intensity of effects caused by any source on environmental resources (**Chapter 4**) including OCS oil- and gas-related activity and other ecological, economic, or social effects. Each phase of oil- and gas-related operation has a set of impact-producing factors that may affect physical or environmental conditions and/or may affect one or more natural, cultural, or socioeconomic resources.

How are the Impact-Producing Factors Categorized?

Routine Activities. These activities generally occur on a regular basis during the lifetime of a lease. The operations are broken down by phase and include exploration, development, oil or gas production and transport, and decommissioning. Routine operations are evaluated over the 50-year analysis period. Routine operations are discussed in **Chapter 3.1**.

Accidental Events. As a consequence of routine activities, the potential for accidental releases exists. Types of accidental events include releases into the environment (e.g., oil spills, loss of well control, accidental air emissions, pipeline failures, and chemical and drilling fluid spills), collisions (e.g., helicopter, service vessels, and platforms) and spill-response activities. Reasonably foreseeable accidental events are discussed in **Chapter 3.2**.



Cumulative Impacts. The impact-producing factors considered in this chapter are defined as other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as the aforementioned projected routine activities and potential accidental events, including the Cumulative OCS Oil and Gas Program (2017-2086). Cumulative activities are discussed in **Chapter 3.3**.

3.1 Routine Activities

3.1.1 What Activities Routinely Occur as a Result of a Single Lease Sale?

The OCS oil and gas operations on a lease generally occur in four phases: (1) exploration to locate viable oil or natural gas deposits; (2) development well drilling, platform construction, and pipeline infrastructure; (3) operation (oil or gas production and transport); and (4) decommissioning of facilities once a reservoir is no longer productive or profitable. These phases are illustrated in **Figure 3-1**, which also illustrates that geological and geophysical (G&G) activities can occur during all four phases. Under a proposed action, activities would occur on OCS leases only after a lease sale is held. Although unusual cases exist where activity on a lease may continue beyond 50 years, forecasts indicate that the significant activities associated with exploration, development, production, and abandonment of leases in the GOM occur well within the 50-year analysis period of a single lease sale. For each lease sale analyzed within the 50-year analysis period, all activities would be concluded by the 44^{th} year.

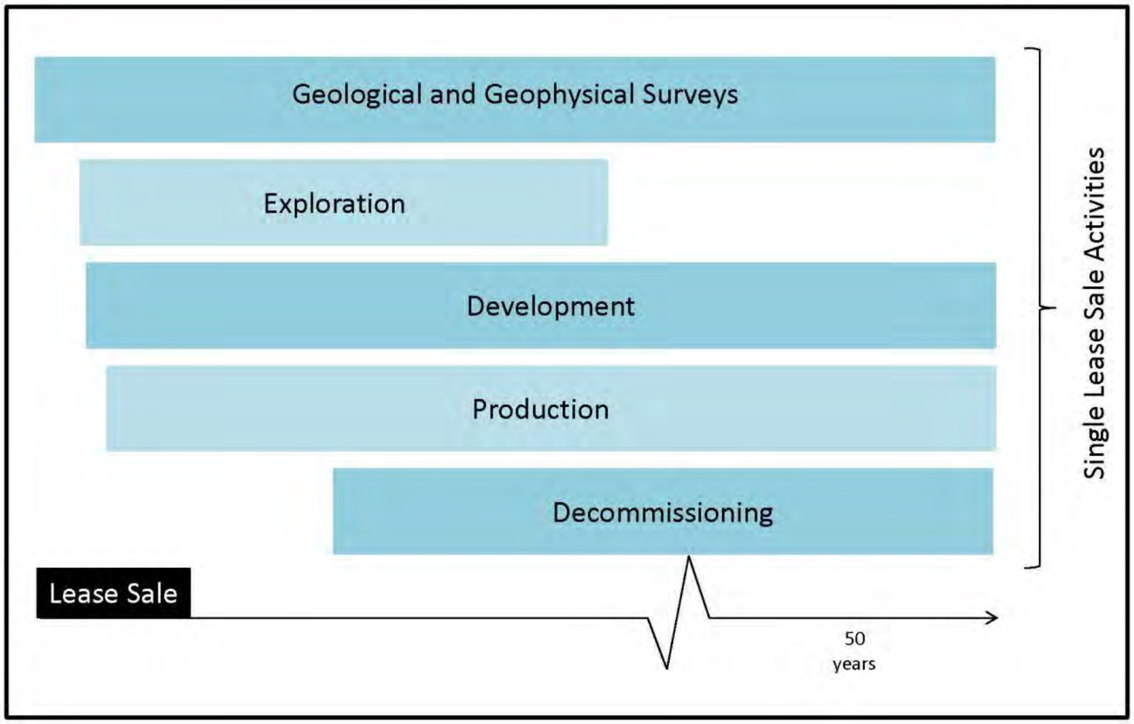


Figure 3-1. Phases of OCS Activity Resulting from a Single Proposed Lease Sale over 50 Years.

3.1.1.1 Exploration and Delineation

Geological and Geophysical

> ***What is a shallow hazard?*** *Buried channels up to 4,000 ft (1,219 m) below the seafloor filled with permeable sediment present hazards to drilling operations. Drilling through these channels may result in water flowing up and around the well casing and may deposit sand or silt on the seafloor within a few hundred feet of the wellhead and could result in hydrate formation if gas is present. Unanticipated shallow hazards can lead to downhole pressure kicks that range from minor and controllable to significant and uncontrollable, and up to and including a serious blowout condition.*

The G&G surveys conducted as a result of a lease sale typically collect data on surficial or near-surface geology used to identify on-lease potential shallow hazards for engineering and site planning for bottom-founded structures. Geological and geophysical processes and regulations are discussed in greater detail in Appendix A.1 and Chapter 3.1.2.1 of the 2017-2022 GOM Multisale EIS. The G&G activities for oil and gas exploration are authorized on the basis of whether or not the proposed activities are (1) before leasing takes place (prelease) and authorized by permits or (2) on an existing lease (postlease or ancillary) and authorized by OCS plan approvals, plan revisions, or by a requirement for notification of BOEM before certain on-lease activities are undertaken. BOEM's resource evaluation program oversees G&G data acquisition and permitting activities pursuant to regulations at 30 CFR parts 550 and 551. There are a variety of G&G activities that are conducted for oil and gas exploration and development as on-lease activities:

- various types of deep-penetration seismic airguns used almost exclusively for oil and gas exploration;
- electromagnetic surveys, deep stratigraphic and shallow test drilling, and various remote-sensing methods in support of oil and gas exploration;
- high-resolution geophysical (HRG) surveys (airgun and non-airgun) used to detect and monitor geohazards, archaeological resources, and certain types of benthic communities; and
- geological and geotechnical bottom sampling used to assess the suitability of seafloor sediments for supporting structures (e.g., platforms, pipelines, and cables), as well as to identify environmental resources such as chemosynthetic communities, gas hydrates, buried channels and faults, and archaeological resources.

Exploration and Delineation Plans and Drilling

The term exploration well generally refers to the first well drilled on a prospective geologic structure to confirm that a resource exists and to validate how much resource can be expected to be extracted.

Oil and gas operators use drilling terms that represent stages in the discovery and development of hydrocarbon resources. If a resource is discovered during the drilling of an exploration well in quantities appearing to be economically viable, one or more follow-up delineation wells are drilled. Refer to **Figure 3-1** above for a relative exploration timeline on an oil or gas lease. Delineation wells are drilled to specific subsurface targets in order to obtain information about the reservoir that can be used by the operator to identify the lateral and vertical extent of a hydrocarbon accumulation. Following a discovery, an operator often temporarily plugs and abandons the well to allow time for a development plan to be generated and for equipment to be built or procured. In the GOM, exploration and delineation wells are typically drilled with mobile offshore drilling units (MODUs) (i.e., jack-up rigs, semisubmersible rigs, submersible rigs, platform rigs, or drill ships). Non-MODUs, such as inland barges, are also used. Refer to Chapter 3.1.2.2 of the 2017-2022 GOM Multisale EIS for more information on exploration and delineation plans and drilling.

3.1.1.2 Development

Offshore Development

A development well is drilled to extract resources from a known hydrocarbon reservoir.

Delineation and production wells are sometimes collectively termed development wells. After a development well is drilled, the operator must decide whether or not to complete the well without delay, to delay completion with the rig on station so that additional tests may be conducted, or to temporarily abandon the well site and move the rig off station to a new location and drill another well. Sometimes an operator may decide to drill a series of development wells, move off location, and

The completion process includes the suite of activities that are carried out to prepare a development well for production.

then return with a rig to complete all the wells at one time. If an exploration well is clearly a dry hole and contains no oil or gas, the operator would typically permanently abandon the well without delay but could also convert the well into an injection well to store carbon dioxide (CO_2), dispose of waste water, enhance oil production and mining, or prevent saltwater intrusion. Development well drilling is discussed in greater detail in Chapter 3.1.3.1 of the 2017-2022 GOM Multisale EIS.

Offshore production systems may be placed over development wells to facilitate production from a prospective hydrocarbon reservoir. These structures provide the means to access and control wells. They serve as a staging area to process and treat produced hydrocarbons from wells, initiate export of produced hydrocarbons, conduct additional drilling or reservoir stimulation, conduct workover activities, and carry out eventual abandonment procedures. There is a range of offshore infrastructure installed for hydrocarbon production. Among these are pipelines, fixed and floating platforms, caissons, well protectors, casing, wellheads, and conductors. Offshore production systems are discussed in greater detail in Chapter 3.1.3.2 of the 2017-2022 GOM Multisale EIS.

Pipelines are the primary method used to transport a variety of liquid and gaseous products between OCS production sites and onshore facilities around the GOM and are installed during the development phase. A mature pipeline network exists in the GOM to transport oil and gas production from the OCS to shore. BOEM projects that the majority of new pipelines constructed as a result of a proposed action would connect to the existing pipeline infrastructure.

Coastal Infrastructure

Oil and gas exploration, production, and development activities on the OCS are supported by an expansive onshore infrastructure industry that includes large and small companies providing an array of services from construction facilities, service bases, and waste disposal facilities to crew, supply, and product transportation, as well as processing facilities. It is an extensive and mature system that provides support for both offshore and onshore oil and gas activities in the GOM region. Coastal Infrastructure is discussed in greater detail in Chapter 3.1.7 of the 2017-2022 GOM Multisale EIS and **Chapter 4.14.1** of this Supplemental EIS.

3.1.1.3 Production

The production well is completed for the purpose of extracting hydrocarbons from the subsurface.

Depending on the information obtained from delineation or exploration well drilling, these wells can be completed and prepared to serve as production wells. Production wells are wells that are drilled following the delineation stage of the development program and are positioned within the reservoir to maximize the volume of production. Wells initially drilled as delineation wells that are later converted to production wells and wells drilled as production wells are sometimes collectively referred to as development wells.

Following the drilling of development wells, the operator of a field may decide to remain on location and immediately begin the next stage of the field development program, i.e., preparing the development wells for production. However, there are a number of reasons that the operator may decide to move off location and delay the work required to prepare the wells for production; for example, additional well tests may be required or the drilling rig may be committed to another location. When a decision to delay the work is chosen, each development well would be temporarily abandoned before the drilling rig can be moved to another location. It is also common for an operator to drill the required number of development wells in stages, leaving sometime between the stages to evaluate the information obtained from the wells and, if necessary, use this information to modify the development program.

A deepwater operations plan is required for all deepwater development projects in water depths ≥1,000 ft (305 m) and for all projects proposing subsea production technology. A deepwater operations plan is required initially and is usually followed by a development operations coordination document (DOCD). The DOCD is the chief planning document that lays out an operator's specific intentions for development. Production is discussed in greater detail in Chapters 3.1.1 and 3.1.3.2 of the 2017-2022 GOM Multisale EIS. Refer to Appendix A.2 of the 2017-2022 GOM Multisale EIS for a detailed discussion on regulations, processes, and environmental information requirements for lessees and operators related to exploration plans (EPs), deepwater operations plans, and DOCDs.

3.1.1.4 Decommissioning and Removal Operations

During exploration, development, and production operations, the seafloor around activity sites within a proposed lease sale area becomes the repository of temporary and permanent equipment and structures. Regulations and processes related to structure and site clearance are discussed in Appendix A.13 of the 2017-2022 GOM Multisale EIS. The structures are generally grouped into two main categories depending upon their relationship to the platform/facilities (i.e., piles, jackets, caissons, templates, mooring devises, etc.) or the well (i.e., wellheads, casings, casing stubs, etc.).

A varied assortment of severing devices and methodologies has been designed to cut structural targets during the course of decommissioning activities. These devices are generally grouped and classified as either nonexplosive or explosive, and they can be deployed and operated by divers using remotely operated vehicles, or from the surface. Which severing tool the operators and contractors use takes into consideration the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions.

Nonexplosive severing tools are used on the OCS for a wide array of structure and well decommissioning targets in all water depths. Based on 10 years of historical data (1994-2003), nonexplosive severing is employed exclusively on about 58 (~37%) removals per year (USDOI, MMS, 2005). Since many decommissionings use both explosive and nonexplosive technologies (prearranged or as a backup method), the number of instances may be much greater. Common nonexplosive severing tools consist of abrasive cutters (e.g., sand cutters and abrasive water jets), mechanical (carbide) cutters, diver cutting (e.g., underwater arc cutters and the oxyacetylene/oxy-hydrogen torches), and diamond wire cutters. Explosive severance tools can be deployed on almost all structural and well targets in all water depths. Historically, explosive charges are used in about 98 (~63%) decommissioning operations annually (USDOI, MMS, 2005), often as a back-up cutter when other methodologies prove unsuccessful. Explosives work to sever their targets by using (1) mechanical distortion (ripping), (2) high-velocity jet cutting, and (3) fracturing or "spalling."

While production structures are removed, it is anticipated that multiple appurtenances or types of equipment (e.g., subsea systems, pipelines, umbilical lines, etc.) would not be removed from the seafloor if placed in waters exceeding 800 m (2,625 ft), as allowed under certain conditions in 30 CFR part 250. For more information on decommissioning, refer to Chapter 3.1.6 of the 2017-2022 GOM Multisale EIS.

Workovers and Abandonments

> *Completed and producing wells may require periodic reentry that is designed to maintain or restore a desired flow rate. These procedures are referred to as a well "workover."*

Workover operations are also carried out to evaluate or reevaluate a geologic formation or reservoir (including recompletion to another stratum) or to permanently abandon a part or all of a well. Workovers on subsea completions require that a rig be moved on location to provide surface support. Workovers can take from 1 day to several months to complete depending on the complexity of the operations, with a median of 7 days. Current oil-field practices include preemptive procedures or treatments that reduce the number of workovers required for each well. On the basis of historical data, BOEM projects a producing well may have seven workovers or other well activities during its lifetime.

There are two types of well abandonment operations—temporary and permanent. An operator may temporarily abandon a well to (1) allow detailed analyses or additional delineation wells while deciding if a discovery is economically viable, (2) save the wellbore for a future sidetrack to a new geologic bottom-hole location, or (3) wait on design or construction of special production equipment or facilities. The operator must meet specific requirements to temporarily abandon a well. Permanent abandonment operations are undertaken when a wellbore is of no further use to the operator (i.e., the well is a dry hole or the well's producible hydrocarbon resources have been depleted). During permanent abandonment operations, equipment is removed from the well, and specific intervals in the well that contain hydrocarbons are plugged with cement. A cement surface plug is also required for the abandoned wells. This serves as the final isolation component between the wellbore and the environment.

3.1.2 How Much and Where is Activity Expected to Occur as a Result of a Proposed Action?

What is a scenario? *Scenario development is the process of analyzing and projecting future activities that could occur as a result of each action alternative (i.e., Alternative A, B, C, or D).*

A scenario describes the offshore activities that could occur for a single proposed lease sale under each alternative. BOEM's Gulf of Mexico OCS Region developed these scenarios to support the detailed analyses of a proposed lease sale's potential impacts whether regionwide or for individual planning areas, as defined in the alternatives in **Chapter 2.2.2**. Each scenario is a hypothetical framework of assumptions based on estimated amounts, timing, and general locations of OCS exploration, development, and production for offshore and onshore activities and facilities. The scenario for each alternative is defined as a set of ranges for resource estimates, projected exploration and development activities, and impact-producing factors.

The scenarios do not predict future oil and gas activities with absolute certainty even though they were formulated using historical information and current trends in the oil and gas industry. These scenarios are only approximate since future factors such as the economic climate, the future availability of support facilities, and future pipeline capacities are all unknown. The scenarios used in the 2017-2022 GOM Multisale EIS represent the best assumptions and estimates of a set of future conditions that are considered reasonably foreseeable and suitable for presale impact analyses (refer to Chapter 3 of the 2017-2022 GOM Multisale EIS). The development scenarios do not represent a BOEM recommendation, preference, or endorsement of any level of leasing or offshore operations or of the types, numbers, and/or locations of any onshore operations or facilities.

How are the Scenarios Developed?

How are ranges determined? *The low and high production scenarios, and the factors that influence them, are used to create the range in scenario oil and gas activity.*

BOEM uses a series of spreadsheet-based data analyses tools to develop the forecasts of oil and gas exploration, discovery, development, and production activity scenario for each action alternative presented in the 2017-2022 GOM Multisale EIS and this Supplemental EIS. The activity level associated with a proposed lease sale could vary based on a number of factors, including the price of oil, hydrocarbon resource potential, cost of development, and resource availability (e.g., drill rig availability), among other things. The scenario information presented takes into account historical oil and gas prices, price trends, oil and gas supply and demand, and related factors that influence oil and gas product-price and price volatility. The analyses are compared with actual historical activity and infrastructure data to ensure that historical precedent, as well as recent trends, is reflected in each activity forecast. Due to the inherent uncertainties associated with an assessment of undiscovered resources, probabilistic techniques were employed to develop the scenario, and the results are reported as a range of values corresponding to probabilities of occurrence.

> ***What does a range of activity mean?*** *A meaningful range provides a reasonable expectation of the lowest to highest oil and gas production and associated activity anticipated from a single proposed lease sale.*

BOEM used these analyses to develop a reasonable low activity scenario and a reasonable high activity scenario for each alternative. BOEM does not expect every lease sale to reach the highest high or lowest low of the forecasted scenario ranges, but every lease sale would fall within the ranges. The range of volumes described by these scenarios represents BOEM's best estimate of the range of possible production volumes and associated activity that can reasonably be expected from the acreage leased during a single proposed lease sale for Alternatives A, B, C, and D. Under Alternative D, the number of blocks that would become unavailable for lease represents a small percentage (<4%) of the total number of blocks to be offered under Alternative A, B, or C. Therefore, Alternative D could reduce offshore infrastructure and activities or may shift the location of offshore infrastructure and activities farther from sensitive topographic zones, but though this may affect the outcome of activity, the ranges provided for Alternatives A, B, and C are broad enough to encompass this change. The location and geologic formation of the oil and gas reserves, and the ability to access them, would determine if a reduction in offshore infrastructure and activities would occur or not. Since the ranges given for Alternatives A, B, and C are broad and represent the low and high levels of forecasted activity, any reduction of activity from choosing Alternative D would still fall within those ranges; therefore, the scenarios do not change when considering Alternative D. The potential impacts associated with selecting Alternative D are discussed in **Chapter 4** under each resource. Refer to **Chapter 2.2.1.4** for more information on Alternative D.

These scenarios are developed to provide the environmental impact analyses in **Chapter 4** the flexibility to develop impact metrics for the full range of potential impacts that could be possible from a single proposed lease sale. BOEM is confident that the analysis methodology, with adjustments and refinements based on recent activity levels and industry information, adequately project Gulf of Mexico OCS oil- and gas-related activities in both the short term and the long term in the analyses for the 2017-2022 GOM Multisale EIS and this Supplemental EIS.

To analyze impact-producing factors for a proposed action and each alternative, the geographic ranges of each alternative were divided into offshore subareas based upon ranges in water depth. **Figure 3-2** depicts the location of the offshore subareas. The water-depth ranges reflect the technological requirements and related physical and economic impacts as a consequence of the oil and gas potential, exploration and development activities, and lease terms unique to each water-depth range.

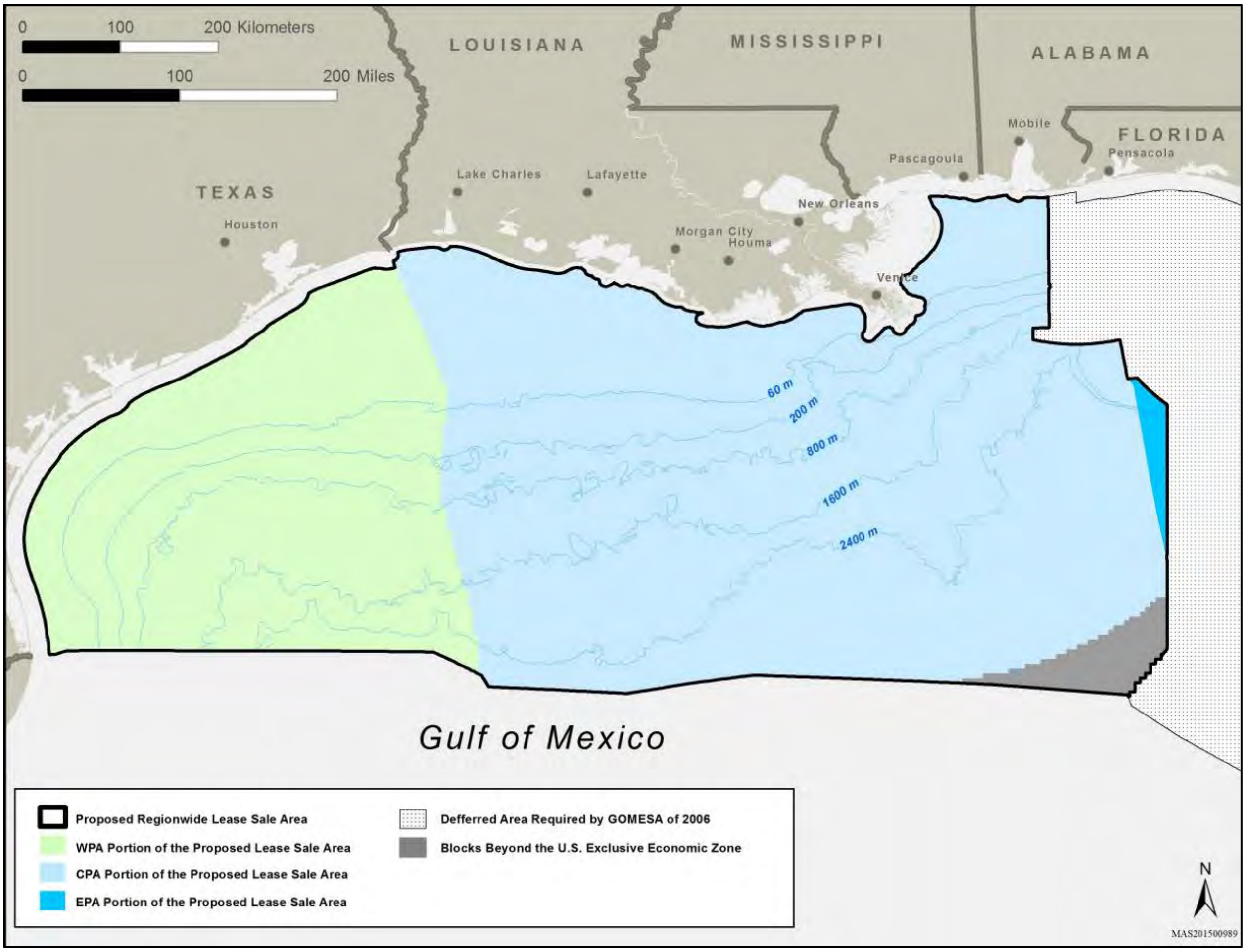


Figure 3-2. Offshore Subareas in the Gulf of Mexico.

The major impact-producing factors of a single proposed lease sale (including the number of exploration and delineation wells, production platforms, and development wells) projected to develop and produce the estimated oil and gas resources for Alternatives A, B, and C are given in **Table 3-1**. This table shows the distribution of these factors by offshore subareas for each alternative. **Table 3-1** also includes estimates of the major impact-producing factors related to the projected levels of exploration, development, and production activity. Estimates of resources and facilities are distributed into each of the subareas. The activities found in **Table 3-1** would occur within the 50-year analysis period of 2017-2066. When analyzing hydrocarbon resources by planning area across the GOM, the majority of oil and gas resources are located within the boundaries of the CPA; therefore, the majority of activity is expected to occur in the CPA.

Table 3-1. Offshore Scenario Activities Related to a Single Proposed Lease Sale for Alternative A, B, or C from 2017 through 2066.

Activity	Alternative[1]	Offshore Subareas (m)[2]						Totals[3]
		0-60	60-200	200-800	800-1,600	1,600-2,400	>2,400	
Exploration and Delineation Wells	A	24-634	8-300	5-11	6-15	5-8	5-16	53-984
	B	20-570	5-293	2-8	2-10	2-2	2-10	33-893
	C	4-64	2-7	2-3	3-5	3-6	3-6	17-91
Development and Production Wells[4]	A Total	14-326	7-220	7-95	13-51	10-37	10-38	61-767
	B Total	10-282	4-211	4-78	10-35	9-31	9-34	46-671
	C Total	4-44	4-9	4-17	4-16	3-6	3-4	22-96
	A Oil	1-35	0-23	3-46	6-22	5-19	4-19	19-164
	B Oil	1-32	0-23	2-38	5-18	4-16	4-17	16-144
	C Oil	0-5	0-1	2-9	1-5	1-4	1-3	5-27
	A Gas	1-35	0-23	3-46	6-22	5-19	4-19	19-164
	B Gas	5-169	2-120	0-17	1-7	1-6	1-7	10-326
	C Gas	2-27	2-6	0-4	1-7	0-1	0-1	5-46
Installed Production Structures	A	8-183	4-85	1-4	1-3	1-2	1-3	16-280
	B	7-158	3-81	1-3	1-2	1	1-2	14-247
	C	3-25	2-4	1	1	1	1	9-33
Production Structures Removed Using Explosives	A	6-130	3-63	0	0	0	0	9-193
	B	5-112	2-60	0	0	0	0	7-172
	C	2-18	2-3	0	0	0	0	4-21
Total Production Structures Removed	A	8-183	4-85	1-4	1-3	1-2	1-3	16-280
	B	7-158	3-81	1-3	1-2	1	1-2	14-247
	C	3-25	2-4	1	1	1	1	9-33
Length of Installed Pipelines (km)[5]	A	59-527	53-417	53-327	78-358	59-275	53-240	355-2,144
	B	40-395	34-336	33-240	55-233	50-227	42-210	254-1,641
	C	20-132	20-81	20-88	24-125	10-48	11-31	105-505
Service-Vessel Trips (1,000's round trips)	A	9-265	4-126	6-51	7-38	7-26	7-36	43-541
	B	8-229	3-120	6-39	6-26	6-15	6-25	38-452
	C	3-36	2-6	6-13	6-13	6-12	6-11	30-89
Helicopter Operations (1,000's trips)[6]	A	52-2,131	34-1,409	8-71	8-53	8-36	8-53	122-3,750
	B	43-1,848	26-1,426	8-53	8-36	8-18	8-36	105-3,415
	C	17-299	17-71	8-18	8-18	8-18	8-18	70-440

1 Alternative D could reduce activity values of the combined Alternative A, B, or C. Refer to **Chapter 2.2.1.4** for more information. Alternative A would be a regionwide lease sale, Alternative B would be the CPA/EPA portions of the proposed lease sale area, and Alternative C would be the WPA portion of the proposed lease sale area.

2 Refer to **Figure 3-2**.

3 Subareas totals may not add up to the planning area total because of rounding.

4 Development and Production Wells includes some exploration wells that were re-entered and completed. These wells were removed from the Exploration and Delineation well count.

5 Projected length of pipelines does not include length in State waters.

6 Helicopter trips include circuits. This means that each take-off and landing is counted as a trip and is not necessarily one trip offshore or one trip onshore. Trips may occur between platforms within a water depth.

While the activities associated with exploration, development, production, and abandonment of leases in the GOM are expected to occur during the 50-year analysis period of 2017-2066, the Cumulative OCS Oil and Gas Program scenario has an analysis period of 70 years or 2017-2086. The Cumulative OCS Oil and Gas Program scenario includes the 50-year analysis period for a single proposed lease sale (e.g., Lease Sale 250). It is important to note that a single proposed lease sale, no matter which alternative is selected, would represent only a small proportion of activity and a small contribution to the overall Cumulative OCS Oil and Gas Program activity forecasted to occur between 2017 and 2086 (refer to **Table 3-2**). The information in **Table 3-2** represents the incremental contribution of each alternative of a single proposed lease sale (e.g., Lease Sale 250) to the Cumulative OCS Oil and Gas Program scenario (2017-2086). Further information about the Cumulative OCS Oil and Gas Program scenario can be found in **Chapter 3.3.2.1** below. Specific projections for activities associated with a single proposed lease sale under each alternative are discussed in the following scenario sections.

Table 3-2. Percent of Production of Each Alternative of a Single Proposed Lease Sale (2017-2066) in Relation to Each Cumulative Production Scenario.

Single Proposed Lease Sale (2017-2066)	Percent of Production of a Single Proposed Lease Sale in Relation to		
	Cumulative Production Regionwide (2017-2086)	Cumulative Production in the CPA/EPA (2017-2086)	Cumulative Production in the WPA (2017-2086)
Alternative A	1.2-4.2%	–	–
Alternative B	1.0-3.6%	1.2-4.4%	–
Alternative C	0.2-0.6%	–	1.2-3.5%

Note: Alternative D could reduce production values of the combined Alternative A, B, or C. Refer to **Chapter 2.2.1.4** for more information.

3.1.2.1 Exploration Scenario

Geophysical surveys generally would be the first activities to occur within the Gulf of Mexico. For each alternative, G&G surveys are projected to follow the same trend as exploration drilling activities, which would peak in the first 20-25 years and then begin declining, with regards to a particular lease sale. The HRG surveys generally occur before exploratory drilling, but they can also occur before development drilling, platform and pipeline installation, and decommissioning activities. It is important to note that the cycling of G&G data acquisition is not driven by the 50-year life cycle of a single productive lease but instead would tend to respond to new production or potential new production driven by new technology. Consequently, some areas would be resurveyed in 2-year cycles, while other areas, considered nonproductive, may not be surveyed for 20 years or more. **Table 3-3** reflects a reasonable level of G&G surveying activities during 2017-2066 that could be expected to occur leading up to and following a scheduled lease sale in the Gulf of Mexico. The estimates below far exceed the number of blocks available for leasing in the entire Gulf of Mexico OCS. Data collection may be repeated on any one block as technology advances, or multiple surveys may be conducted over the same OCS blocks for different purposes (e.g., prelease exploratory surveys and shallow hazard surveys). Ancillary permits are postlease operational permits obtained by lease owners in furtherance of developing oil and gas resources. Ancillary activities are defined in 30 CFR § 550.105 and regulated in 30 CFR §§ 550.207-550.210.

Table 3-3. Exploration and Seismic Survey Activity Leading Up To and Following a Proposed Lease Sale in the Gulf of Mexico

Survey Area	2D Surveys (km)	2D Permits	3D Lease Blocks	3D Permits	Ancillary Permits	HRG Surveys	VSP Surveys
Regionwide	77,248-1,046,073	31-310	13,400-185,000	25-128	19-214	87-709	17-263
CPA/EPA	75,639-970,434	27-283	18,900-171,300	20-108	16-198	64-576	11-234
WPA	1,448-6,598	4-9	5,500-25,100	6-21	3-26	30-134	5-29

2D = two-dimensional; 3D = three-dimensional; HRG = high-resolution geophysical; VSP = vertical seismic profiling.

Following a lease sale, exploratory drilling activity could begin within the 1st year and would likely continue to occur over the course of each lease. The majority of the exploratory drilling for all blocks leased would likely occur early and would generally be complete by the 25th year for Alternative A, B, C, or D. **Figure 3-3(A)** shows the timeline of drilling exploration and delineation wells for a proposed action under Alternative A. **Figure 3-3(B, C)** depicts the high and low production scenario by planning area and water depth. When analyzing both the low and high production scenarios for all of the alternatives, most exploration drilling activity is expected to occur on the continental shelf (0- to 200-m [0- to 656-ft] water depth). Note that exploratory drilling activity spans less than 40 years and exploration wells are not all drilled during the same time period. The most exploration wells drilled in a given year from a proposed action is 64. The most exploration wells drilled in any given 5-year span is 298 (averaging about 32 wells drilled per year during the exploration phase), demonstrating that all forecasted exploration wells are drilled over time and not consolidated into a narrow timeframe, i.e., a single year. **Figure 3-3(B, C)** gives the reader an idea of which water-depth category the majority of activity within the GOM would occur; however, in reality, the activity would not be equally distributed across water-depth categories as depicted and would have geographic specificity based on geology.

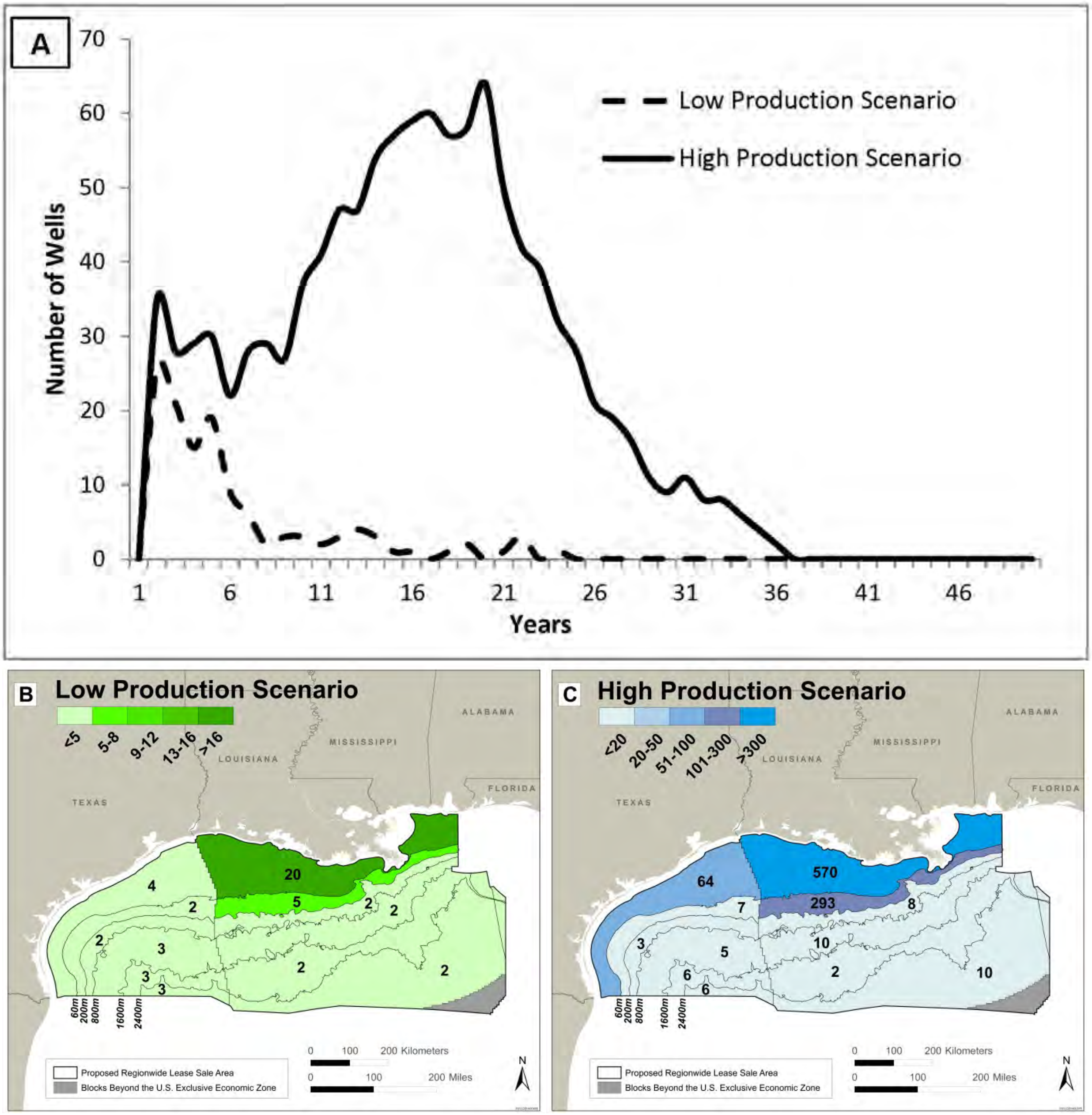


Figure 3-3. (A) Number of Exploration and Delineation Wells Drilled over the Course of a Proposed Action under Alternative A for 50 Years. (B, C) Location of Exploration Wells Drilled during the Entire 50-Year Period.

3.1.2.2 Development Scenario

Offshore Development Scenario

The peak in platform installation would lag behind the peak in exploration drilling. Following a lease sale, support infrastructure installation would likely occur over the course of each lease but could begin within 1 year. The majority of platforms installed in early years would be caissons and small fixed platforms in shallow water. Floating structures installed in deeper water would take many years to construct and install. The highest number of platforms operating as a result of a lease sale would peak before year 10 in the low production scenario and around year 25 for the high production scenario. **Figure 3-4(A)** depicts the estimated number of operating production structures in the GOM, with the exception of subsea systems for a single proposed lease sale. Various single well to multi-well structures would be installed and commissioned depending on the water depth. There would be a slight temporal lag between peak development drilling and platform installation. Platforms that are operated after peak development maximize production from the remaining production wells. **Table 3-1 and Figure 3-4(B, C)** show the estimated range installed production structures by water-depth range. Note that the production activity spans 40 years and that production structures are not all operational concurrently. **Figure 3-4(B, C)** gives the reader an idea of which water-depth category the majority of activity within the GOM would occur; however, in reality, the activity would not be equally distributed across water-depth categories as depicted and would have geographic specificity based on geology. Of the possible 280 total high forecasted production structures (refer to **Table 3-1**), the most structures operating in a given year from a proposed action would be 108 structures. Laying pipeline is part of the development process and must begin before the production phase can begin for most leases. The total estimated length of pipeline laid for each alternative can be found in **Table 3-1**. Regardless of the production scenario or alternative, most support structure installation is expected to be on the continental shelf (0- to 200-m [0- to 656-ft] water depth).

Coastal Infrastructure Scenario

The extensive presence of coastal infrastructure is not subject to rapid fluctuations and results from long-term industry trends. Existing oil and gas infrastructure is expected to be sufficient to handle development associated with a proposed action. Should there be some expansion at current facilities, the land in the analysis area is sufficient to handle such development. The number and location of existing coastal infrastructure can be seen in **Table 3-4**. There are currently 144 pipeline landfalls (i.e., pipelines that have at one time or another carried hydrocarbon product) in the Louisiana Coastal Area (LCA) (Smith, official communication, 2015). The BSEE and DOT share responsibility for pipeline regulation on the OCS in the transition between Federal and State waters. For more information on the regulation and permitting of pipelines, refer to Appendix A.3 of the 2017-2022 GOM Multisale EIS.

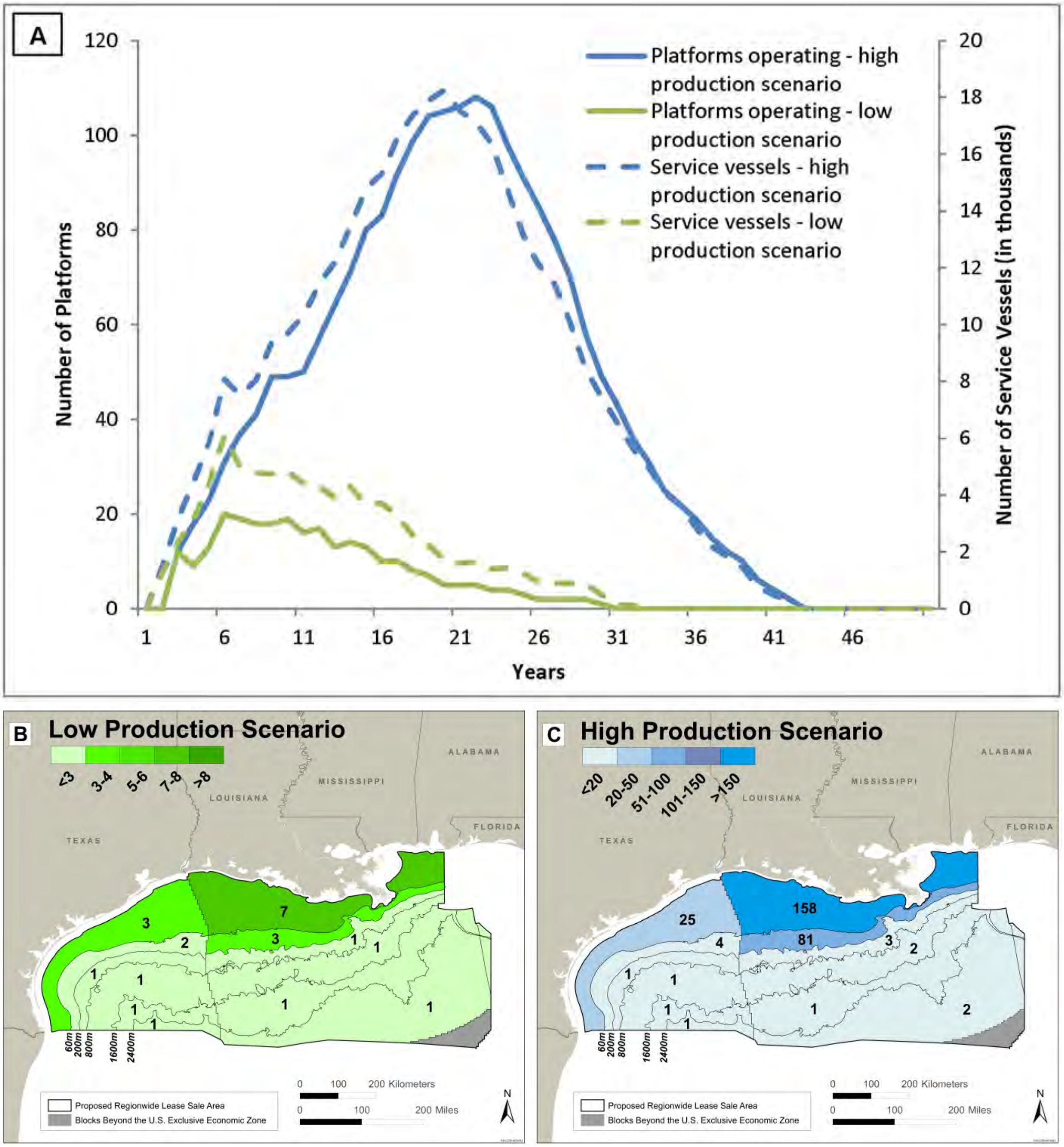


Figure 3-4. (A) Number of Production Structures and Service Vessels Operating over the Course of a Proposed Action under Alternative A for 50 Years. (B, C) Total Number of Platforms Installed in the Low and High Production Scenario by Water Depth.

Table 3-4. Existing Coastal Infrastructure Related to OCS Oil- and Gas-Related Activities in the Gulf of Mexico.

Infrastructure	Texas	Louisiana	Mississippi	Alabama	Florida	Total
Pipeline Landfalls[1]	14	122	3	5	0	144
Platform Fabrication Yards[2]	12	37	4	1	0	54
Shipyards[2]	32	64	9	18	14	137
Pipe Coating Facilities[2]	9	6	0	2	2	19
Supply Bases[2]	32	55	2	7	0	96
Ports[2]	11	14	3	1	5	34
Waste Disposal Facilities[2]	16	29	3	3	2	53
Natural Gas Storage Facilities[2]	13	8	0	1	0	22
Helicopter Hubs[2]	118	115	4	4	0	241
Pipeline Shore Facilities[2]	13	40	0	0	0	53
Barge Terminals[2]	110	122	6	6	8	252
Tanker Ports[2]	4	6	0	0	0	10
Gas Processing Plants[2]	39	44	1	13	1	98
Refineries[3]	20	16	3	3	0	42
Petrochemical Plants[2]	126	66	2	9	13	216

[1] Source: Smith, 2015.
[2] Source: Dismukes, 2011a.
[3] Source: USDOE, Energy Information Administration, 2015.

3.1.2.3 Production Scenario

Development and Production Drilling

Figure 3-5 below depicts the number of development and production wells that may result from a low and high scenario case by planning area and water depth. BOEM estimates that approximately 63-70 percent of wells drilled as development wells would become producing wells. Because there is some overlap, the two types of wells are grouped to prevent double counting. The distribution of development and production wells by water depth that could possibly occur as result of Alternative A, B, or C can be found in **Table 3-1**.

Development and production activity during a proposed action usually takes place over a 49-year period, beginning with the installation of a production platform on the first lease and ending with the drilling of the last development wells. The majority of development well drilling would likely occur in the first 25 years of each lease. Production of oil and gas could begin by the 3rd year after the lease sale and generally would conclude by the 50th year; refer to **Figure 3-5(A)** below. In the low production scenario, development and production activity is expected to occur fairly evenly spread between the continental shelf (0- to 200-m [0- to 656-ft] water depth) and deeper water depths (200-1,600 m; 656-5,249 ft) with a majority of activity in the CPA; however, for the high production scenario, most development and production drilling activity is expected to occur on the continental shelf (0- to 200-m [0- to 656-ft] water depth). **Figure 3-5(B, C)** gives the reader an idea of which water-depth category the majority of activity within the GOM would occur; however, in reality, the activity would not be equally distributed across water-depth categories as depicted and would have geographic specificity based on geology. Note that production drilling activity spans 40 years and that production wells would not all be drilled during the same time period. The most wells drilled in a given year would be 34, and the most wells drilled in any given 5-year span would be 150 (averaging 30 wells drilled per year), demonstrating that all the forecasted wells are drilled over time and not consolidated into a narrow timeframe, i.e., a single year.

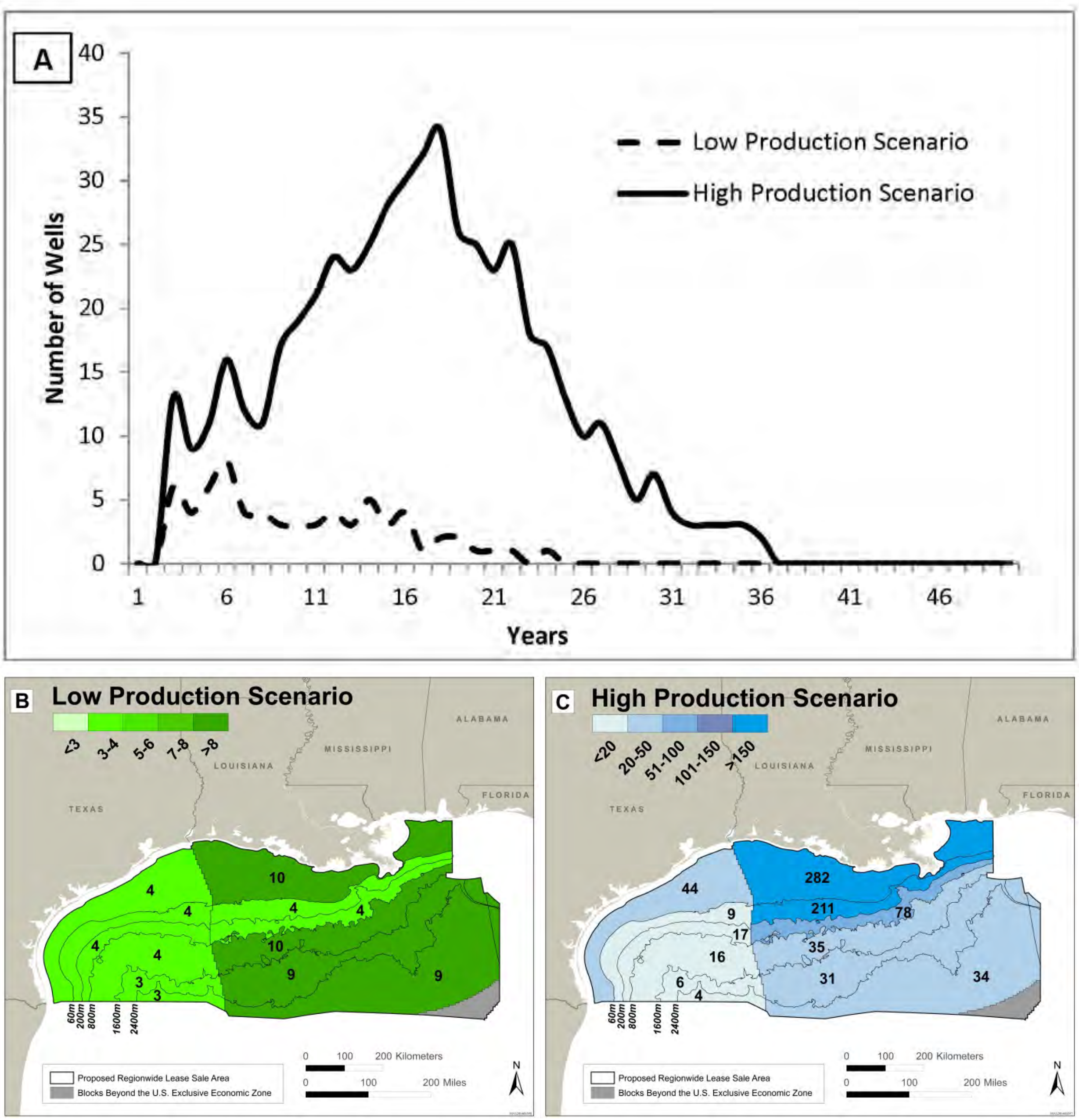


Figure 3-5. (A) Number of Production Wells Drilled over the Course of a Proposed Action under Alternative A for 50 Years. (B, C) Total Number of Development and Production Wells Drilled in the Low and High Production Scenario by Water Depth for Alternative A.

Oil and Gas Production

Table 3-5 presents the projected oil and gas production for a single proposed lease sale under each alternative (2017-2066) and for the Cumulative OCS Oil and Gas Program (2017-2086). Alternative D could reduce offshore production when chosen in conjunction with Alternative A, B, or C. However, it is also possible that Alternative D would only shift the location of offshore infrastructure and activities farther from sensitive topographic zones and not lead to a reduction in production. Refer to **Chapter 2.2.1.4** for more information on Alternative D. Refer to **Table 3-1** above for the offshore scenario activities related to a single proposed lease sale for Alternative A, B, or C from 2017 through 2066, which are associated with these projected oil and gas volumes in the Gulf of Mexico OCS.

Table 3-5. Projected Oil and Gas in the Gulf of Mexico OCS.

Reserve/Resource Production	Lease Sale (2017-2066)	OCS Cumulative (2017-2086)
Alternative A: Regionwide OCS Lease Sale		
Oil (BBO)	0.211-1.118	15.482-25.806
Gas (Tcf)	0.547-4.424	57.875-108.513
Alternative B: Regionwide OCS Proposed Lease Sale Excluding Available Unleased Blocks in the WPA Portion of the Proposed Lease Sale Area (or the CPA/EPA Portion of the Proposed Lease Sale Area)		
Oil (BBO)	0.185-0.970	13.707-22.152
Gas (Tcf)	0.441-3.672	46.328-84.009
Alternative C: Regionwide OCS Proposed Lease Sale Excluding Available Unleased Blocks in the CPA/EPA Portions of the Proposed Lease Sale Area (or the WPA Portion of the Proposed Lease Sale Area)		
Oil (BBO)	0.026-0.148	1.775-3.654
Gas (Tcf)	0.106-0.752	11.547-24.504

BBO = billion barrels of oil.
Tcf = trillion cubic feet.

Regardless of the alternative, the majority of oil and gas resources are located within the boundaries of the CPA. Therefore, for a proposed action under Alternative A, which would encompass all acreage available for lease within the WPA, CPA, and EPA, the majority of the activity would still be located in the CPA. An analysis of the scenario forecast for Alternative A suggests that a maximum of 88 percent of the oil production and associated activity and 83 percent of the gas production and associated activity is forecasted to occur within the CPA/EPA. A maximum of 13 percent of the oil production and associated activity and 19 percent of the gas production and associated activity from Alternative A is forecasted to occur within the WPA. For Alternatives A, B, C, and D, the majority of production is expected to occur along the slope in both the low and high production scenarios (**Figure 3-6**). Note that production activity spans to just over

40 years. **Figure 3-6(B, C)** gives the reader an idea of which water-depth category the majority of activity within the GOM would occur; however, in reality, the activity would not be equally distributed across water-depth categories as depicted and would have geographic specificity based on geology. The highest production in a given year would be 0.112 billion barrels of oil equivalent (BOE), and the highest production in any given 5-year span would be 0.553 BOE (averaging 0.047 BOE per year when producing), demonstrating that the forecasted production occurs throughout the 40 years and is not consolidated into a narrow timeframe, i.e., a single year.

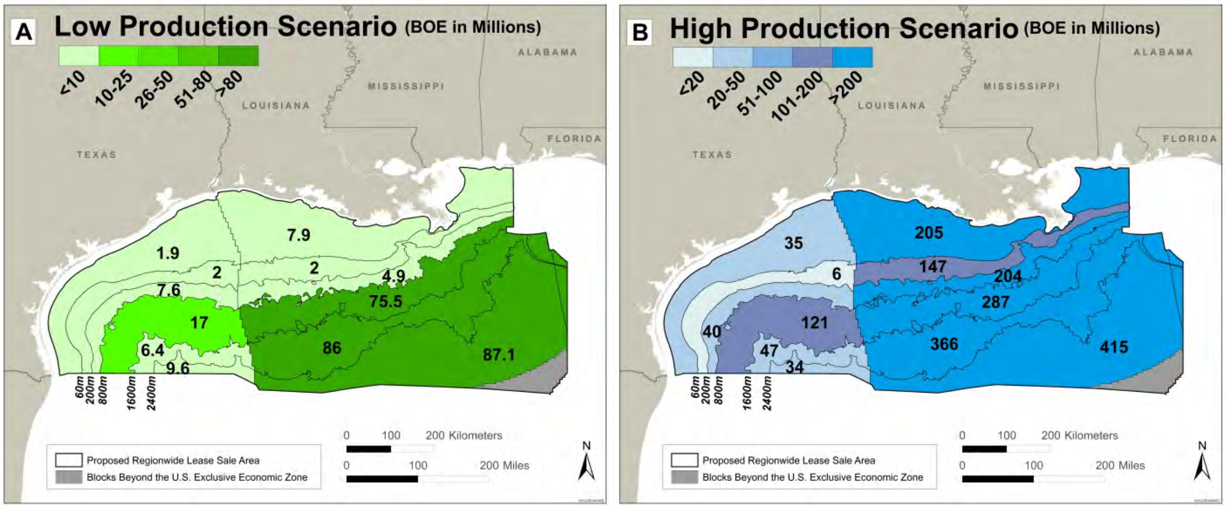


Figure 3-6. Total Oil and Gas Production (BOE) in the Gulf of Mexico in the Low and High Production Scenario by Water Depth.

Relatively more exploration and development drilling and structure installation would occur on the shelf (in depths <200 m [660 ft]) than in deep water, regardless of the production case scenario (**Table 3-6**).

Table 3-6. Depth Distributions within the Proposed Regionwide Lease Sale Area.

Geographic Province	Percent Wells		Percent Platforms		Percent Gas		Percent Oil Production	
	Low	High	Low	High	Low	High	Low	High
Shelf	46.5	85	75	95	13	73	1	6
Slope	53.5	15	25	5	87	27	99	94

3.1.2.4 Decommissioning Scenario

Table 3-1 shows platform removals by water-depth subarea as a result of Alternatives A, B, and C. Approximately 70 percent of production structures installed landward of the 800-m (2,625-ft) isobath could be removed using explosives. About 30 percent of production structures landward of the 800-m (2,625-ft) isobath and all structures in water deeper than the 800-m (2,625-ft) isobath would be removed using nonexplosive methods. While the production structure is removed, it is anticipated that multiple types of support equipment (e.g., subsea systems, pipelines, umbilical lines, etc.) would not be removed from the seafloor if placed in waters exceeding 800 m (2,625 ft) as allowed under certain conditions in 30 CFR part 250. An estimate of the well stubs and other various subsea structures that may be removed using explosives is not possible at this time.

3.1.2.5 Transportation Scenario

Pipelines are the primary method used to transport a variety of liquid and gaseous products between OCS production sites and onshore facilities around the GOM (**Table 3-7**). A mature pipeline network exists in the GOM to transport oil and gas production from the OCS to shore. Historically, barging in the GOM has remained less than 1 percent. In 2005, barging activity temporarily rose to 1.29 percent while pipelines damaged from hurricanes were repaired. The average amount of oil barged between 2010 and 2014 was 0.12 percent annually. The number of active barging systems has been reduced over time from approximately eight systems in 2005 to four systems in 2010 and has remained constant since then. It is assumed that barging would continue to account for <1 percent of the oil transported for the entire OCS Program and for any single alternative. **Table 3-7** provides the percentages of oil barged to shore by subarea for each alternative. The floating, production, storage, and offloading (FPSO) systems are suitable for the light and intermediate oils of the GOM. The use of FPSOs is only projected in water depths >1,600 m (5,250 ft). Shuttle tankers are used to transport crude oil from FPSO production systems to Gulf Coast refinery ports or to offshore deepwater ports such as the Louisiana Offshore Oil Port (LOOP); the percentage of oil tankered is provided in **Table 3-7**.

Table 3-7. Oil Transportation Scenario under Alternative A, B, or C.

Activity	Alternative[1]	Offshore Subareas (m)[2]						Totals[3]
		0-60	60-200	200-800	800-1,600	1,600-2,400	>2,400	
Percent Oil Piped[4]	A	72-94%	100%	100%	100%	100%	100-66%	99.8-90.0%
	B	70-94%	100%	100%	100%	100%	100-50%	98.8-84.6%
	C	100%	100%	100%	100%	100%	100%	100%
Percent Oil Barged	A	28-6%	0%	0%	0%	0%	0%	0.2%
	B	30-6%	0%	0%	0%	0%	0%	0.2%
	C	0%	0%	0%	0%	0%	0%	0%
Percent Tankered[5]	A	0%	0%	0%	0%	0%	0-34%	0-9.8%
	B	0%	0%	0%	0%	0%	0-50%	0-15.2%
	C	0%	0%	0%	0%	0%	0%	0%

[1] Alternative D could reduce activity values of the combined Alternative A, B, or C. Refer to **Chapter 2.2.1.4** for more information. Percentage values indicated here would not change.
[2] Refer to **Figure 3-1**. Ranges are reported from the low production case scenario to the high production case scenario.
[3] Subareas totals may not add up to the planning area total because of rounding.
[4] 100% of gas is assumed to be piped.
[5] Tankering is forecasted to occur only in water depths >1,600 m (5,250 ft).

According to the Helicopter Safety Advisory Conference (2015), from 1996 to 2014, helicopter operations (take offs and landings) in support of regionwide OCS operations have averaged, annually, about 1.2 million operations, 2.7 million passengers, and 386,000 flight hours. There has been a decline in helicopter operations from 1,668,401 in 1996 to 741,201 in 2014

(Helicopter Safety Advisory Conference, 2015). Future projections are based on a high equal to the average number of flights over the last 15 years and a low equal to a continuing forecast of the current decline. **Table 3-1** shows helicopter trips by water-depth subareas as a result of Alternatives A, B, and C.

Service vessels are one of the primary modes of transporting personnel between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. In addition to offshore personnel, service vessels carry cargo (i.e., freshwater, fuel, cement, barite, liquid drilling fluids, tubulars, equipment, and food) offshore. Service-vessel operations are most closely tied to actual production activities. Visual representation of this can be seen in **Figure 3-4(A)**. **Table 3-1** shows service-vessel trips by water-depth subareas as a result of Alternatives A, B, and C.

3.1.3 Summary of Routine Impact Producing Factors

Table 3-8 below outlines the impact-producing factors and operations assumed to routinely occur throughout the lifetime of lease. The impact-producing factors and operations are grouped by operational phases that consist of exploration, development, oil or gas production, and decommissioning. Refer to **Table 3-9**, which provides descriptions of the routine impact-producing factors and operations that occur during the lifetime of a lease.

Table 3-8. Summary of the Timing of Impact-Producing Factors Associated with Routine Oil and Gas Activities.

Impact-Producing Factors and Activities	Exploration		Development	Production	Decommissioning
	Geological and Geophysical Survey	Exploration and Delineation Drilling			
Operations					
Geological and Geophysical	X	X	X	X	X
Drilling	X	X	X	X	-
Bottom Disturbance	X	X	X	X	X
Infrastructure Emplacement	-	X	X	X	-
Workovers and Abandonment	-	X	X	X	-
Decommissioning and Removal	-	-	-	-	X
Artificial Reefs	-	-	-	-	X
Transport					
Pipelines	-	X	X	X	X
Barges	-	X	X	X	X
Oil Tankers	-	-	X	X	-
Service Vessels	X	X	X	X	X
Helicopters	X	X	X	X	X
Navigation Channels	X	X	X	X	X
Discharges and Wastes					
Operational Wastes and Discharges Generated by OCS Oil- and Gas-Related Facilities	-	X	X	X	X
Operational Wastes and Discharges Generated by Service Vessels	X	X	X	X	X
Onshore Disposal of Waste and Discharge Generated Offshore or Onshore	X	X	X	X	X
Coastal Infrastructure					
Construction Facilities	X	X	X	X	-
Support Facilities and Transportation	X	X	X	X	X
Processing Facilities	-	-	X	X	-
Other Types of Impact-Producing Factors					
Air Emissions	X	X	X	X	X
Noise	X	X	X	X	X

Table 3-9. General Description of Routine Impact-Producing Factors.

Impact-Producing Factors and Specific Sources	Multisale EIS Chapter Reference	General Description
Exploration and Delineation		
Geological and Geophysical	3.1.2.1	The Exploration & Development (E&D) scenario considers two types of geophysical surveys: (1) marine seismic surveys, which generally cover a large area of leased and/or unleased acreage; and (2) geohazard surveys, which will include side-scan sonar and shallow-penetrating, reflection-seismic profiling conducted to detect archaeological resources or seafloor features that might be problematic for operations, such as drilling a well or installing a platform or pipeline on a more specific site. Geohazard surveys are often accompanied by geotechnical surveys, which involve sampling or measuring mechanical properties or stability of near-seafloor sediments. Sound source levels are dependent on equipment type and size. Airgun arrays may have source levels of 216 to 259 dB re 1 µPa-m, with frequencies <120 Hz. Other techniques (e.g., sparkers and boomers) are in the range of 212 to 221 dB re 1 µPa-m, with frequencies in the 800- to 1,200-Hz range (Richardson et al., 1995; USDOC, NOAA and Marine Conservation Biology Institution, 2000). Further detailed information for G&G surveys can be found in BOEM's *Atlantic OCS Proposed Geological and Geophysical Activities: Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement* (Atlantic G&G Activities Programmatic EIS; USDOI, BOEM, 2014).
Exploration and Delineation Plans and Drilling	3.1.2.2	Following a lease sale, exploratory drilling activity would likely occur over the course of each lease but could begin within 1 year. The majority of the exploratory drilling for all blocks leased would likely occur early and would generally be complete by the 25th year. If a resource is discovered during the drilling of an exploration well in quantities appearing to be economically viable, one or more follow-up delineation wells are drilled. Delineation wells are drilled to specific subsurface targets in order to obtain information about the reservoir that can be used by the operator to identify the lateral and vertical extent of a hydrocarbon accumulation.
Offshore Development and Production		
Development and Production Drilling	3.1.3.1	Delineation and production wells are sometimes collectively termed development wells. BOEM estimates that approximately 63-70% of wells drilled as development wells become producing wells. There is a wide variety of well completion techniques performed in the Gulf of Mexico, and the type of well completion used to prepare a drill well for production is based on the rock properties of the reservoir, as well as the properties of the reservoir fluid. However, for the vast majority of well completions, the typical process includes installing or "running" the production casing; cementing the casing; perforating the casing and surrounding cement; injecting water, brine, or gelled brine as carrier fluid for a "frac pack"/sand proppant pack and gravel pack; treating/acidizing the reservoir formation near the wellbore; installing production screens; running production tubing; and installing a production tree.
Infrastructure Emplacement/ Structure Installation	3.1.3.3	**Structures** may be placed over development wells to facilitate production from a prospect. These structures provide the means to access and control wells. They serve as a staging area to process and treat produced hydrocarbons from wells, initiate export of produced hydrocarbons, conduct additional drilling or reservoir stimulation, conduct workover activities, and carry out eventual abandonment procedures. There is a range of offshore infrastructure installed for hydrocarbon production. Among these are pipelines, fixed and floating platforms, caissons, well protectors, casing, wellheads, and conductors. **Subsea wells** may also be completed to produce hydrocarbons from on the shelf and in the deepwater portions of the GOM. The subsea completions would require a host structure to control their flow and to process their well

Table 3-9. General Description of Routine Impact-Producing Factors. (continued).

Impact-Producing Factors and Specific Sources	Multisale EIS Chapter Reference	General Description
		stream. Control of the subsea well is accomplished via an umbilical from the host. **Pipelines** are the primary means of transporting produced hydrocarbons from offshore oil and gas fields to distribution centers or onshore processing points. Pipelines range from small-diameter (generally 4-12 in; 10-30 cm) gathering lines, sometimes called flowlines, that link individual wells and production facilities to large-diameter (as large as 36 in; 91 cm) lines, sometimes called trunk lines, for transport to shore. Pipelines would typically be installed by lay barges that are either anchored or dynamically positioned while the pipeline is laid. **Production activities** can disturb small areas of the sea bottom beneath or adjacent to an emplaced structure. If mooring lines of steel, chain, or synthetic polymer are anchored to the sea bottom, or if wells are drilled, areas around the activity could also be directly affected by their emplacement. This disturbance includes physical compaction or crushing beneath the structure or mooring lines and the resuspension and settlement of sediment caused by the activities.
Offshore Infrastructure Presence	3.1.3.4	**Anchoring:** Most exploration drilling, platform, and pipeline emplacement operations on the OCS require anchors to hold the rig, topside structures, or support vessels in place. Anchors disturb the seafloor and sediments in the area where dropped or emplaced. Leasing on the OCS results in operations that temporarily occupy sea bottom and water surface area for dedicated uses. The OCS oil- and gas-related operations include the deployment of seismic vessels, bottom surveys, and installation of surface or subsurface bottom-founded production structures with anchor cables and safety zones. While in use, these areas would become unavailable to commercial fishermen, sand borrowing, or any other competing use. **Light pollution** in the GOM comes from OCS oil- and gas-related structures and service vessels and may increase visibility during night hours. The OCS oil- and gas-related structures in the GOM are illuminated from incandescent lights and from the glow of burning or flaring natural gas that cannot be stored or transported to shore.
Workovers and Abandonment	3.1.3.5	**Workovers:** Completed and producing wells may require periodic reentry that is designed to maintain or restore a desired flow rate. These procedures are referred to as a well “workover.” Workover operations are also carried out to evaluate or reevaluate a geologic formation or reservoir (including recompletion to another strata) or to permanently abandon a part or all of a well. Workovers can take from 1 day to several months to complete depending on the complexity of the operations, with a median of 7 days. Current oil-field practices include preemptive procedures or treatments that reduce the number of workovers required for each well. On the basis of historical data, BOEM projects a producing well may expect to have seven workovers or other well activities during its lifetime. **Abandonment Operations:** There are two types of well abandonment operations—temporary and permanent. Temporary abandonment is described in **Chapter 3.1.1.3** above. Permanent abandonment operations are undertaken when a wellbore is of no further use to the operator (i.e., the well is a dry hole or the well’s producible hydrocarbon resources have been depleted). During permanent abandonment operations, equipment is removed from the well, and specific intervals in the well that contain hydrocarbons are plugged with cement. A cement surface plug is also required for the abandoned wells. This serves as the final isolation component between the wellbore and the environment.

Table 3-9. General Description of Routine Impact-Producing Factors. (continued).

Impact-Producing Factors and Specific Sources	Multisale EIS Chapter Reference	General Description
Transport		
Barges	3.1.4.1	The capacity of oil barges used offshore can range from 5,000 to 80,000 bbl. Barges transporting oil may remain offshore for as long as 1 week while collecting oil, although the average round trip is assumed to be only 5 days. Historically, barging in the GOM has remained less than 1%. In 2005, barging activity temporarily rose to 1.29% while pipelines damaged from hurricanes were repaired. In 2014, 0.08% of the total volume was transported by barge as compared with 0.13% in 2010. The average amount of oil barged between 2010 and 2014 was 0.12% annually.
Oil Tankers	3.1.4.2	The use of FPSOs and shuttle tankering are only projected in water depths >800 m (2,625 ft). Shuttle tankers are used to transport crude oil from FPSO production systems to Gulf Coast refinery ports or to offshore deepwater ports such as the LOOP. Shuttle tanker design and systems are in compliance with USCG regulations, the Jones Act, and OPA requirements. As such, shuttle tankers are required to be double hulled. In the Gulf of Mexico, the maximum size of shuttle tankers is limited primarily by the 34- to 47-ft (10- to 14-m) water depths. Because of these depth limitations, shuttle tankers are likely to be 500,000-550,000 bbl in cargo capacity.
Service Vessels	3.1.4.3	Service vessels are one of the primary modes of transporting personnel between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. In addition to offshore personnel, service vessels carry cargo (i.e., freshwater, fuel, cement, barite, liquid drilling fluids, tubulars, equipment, and food) offshore.
Helicopters	3.1.4.4	Helicopters are one of the primary modes of transporting personnel between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. Helicopters are routinely used for normal crew changes and at other times to transport management and special service personnel to offshore exploration and production sites. In addition, equipment and supplies are sometimes transported. An operation is considered a takeoff and landing and may include platform to platform operations.
Discharges and Wastes		
Operational Wastes and Discharges Generated by OCS Oil- and Gas-Related Facilities	3.1.5.1	The primary operational wastes and discharges generated during offshore oil and gas exploration and development are drilling fluids, drill cuttings, various waters (e.g., bilge, ballast, fire, and cooling), deck drainage, sanitary wastes, and domestic wastes. During production activities, additional waste streams include produced water, produced sand, and well-treatment, workover, and completion fluids. Minor additional discharges occur from numerous sources. These discharges may include desalination unit discharges, blowout preventer fluids, boiler blowdown discharges, excess cement slurry, several fluids used in subsea production, and uncontaminated freshwater and saltwater. The USEPA, through general permits issued by the USEPA Region that has jurisdictional oversight, regulates all waste streams generated from offshore oil and gas activities. The USEPA Region 4 has jurisdiction over the eastern portion of the Gulf of Mexico OCS, including all of the EPA and a portion of the CPA off the coasts of Alabama and Mississippi. The USEPA Region 6 has jurisdiction over the rest of the CPA and all of the WPA. Each USEPA Region has promulgated general permits for discharges that incorporate the 1993 effluent guidelines and 2001 effluent guidelines for synthetic-based, fluids-wetted cuttings as a minimum. Permits issued under Section 402 of the Clean Water Act for offshore activities must comply with any applicable water quality standards and/or Federal water quality criteria, as well as Section 403 of the Clean Water Act. Water quality standards consist of the waterbody's designated uses, water quality criteria to protect those uses and to

Table 3-9. General Description of Routine Impact-Producing Factors. (continued).

Impact-Producing Factors and Specific Sources	Multisale EIS Chapter Reference	General Description
		determine if they are being attained, and antidegradation policies to help protect high-quality waterbodies. Discharges from offshore activities near State water boundaries must comply with all applicable State water quality standards.
Operational Wastes and Discharges Generated by Service Vessels	3.1.5.2	Discharges from supply/service vessels equal to or greater than 79 ft (24 m) in length are regulated by the U.S. Environmental Protection Agency's NPDES under the Vessel General Permit (VGP). The Final 2013 VGP was issued on March 28, 2013, became effective on December 19, 2013, and expires on December 19, 2018 (USEPA, 2013). The Final 2013 VGP regulates 26 specific discharge categories, including numeric ballast-water discharge limits for most vessels, and ensures that ballast-water treatment systems are functioning correctly.
Onshore Disposal of Waste and Discharge Generated Offshore or Onshore	3.1.5.3	Wastes that are typically transported to shore include produced sand, aqueous fluids such as wash water from drilling and production operations, naturally occurring radioactive materials such as tank bottoms and pipe scale, industrial wastes, municipal wastes, and other exploration and production wastes (Dismukes, 2010). Operators are prohibited in the GOM from discharging any produced sands offshore. Cutting boxes (15- to 25-bbl capacities), 55-gallon steel drums, and cone-bottom portable tanks are used to transport the solids to shore via offshore service vessels. Total produced sand from a typical platform is estimated to be 0-35 bbl/day (USEPA, 1993). The primary onshore facilities that support offshore oil- and gas-related activities include service bases, helicopter hubs at local ports/service bases, construction facilities (i.e., platform fabrication yards, pipeyards, and shipyards), processing facilities (i.e., refineries, gas processing plants, and petrochemical plants), and terminals (i.e., pipeline shore facilities, barge terminals, and tanker port areas). Water discharges from these facilities are from either point sources, such as a pipe outfall, or nonpoint sources, such as rainfall run-off from paved surfaces.
Decommissioning and Removal Operations		
Decommissioning and Removal	3.1.6	During exploration, development, and production operations, the seafloor around activity sites within a proposed lease sale area becomes the repository of temporary and permanent equipment and structures. Regulations and processes related to structure and site clearance are discussed in Appendix A.13 of the 2017-2022 GOM Multisale EIS. The structures are generally grouped into two main categories depending upon their relationship to the platform/facilities (i.e., piles, jackets, caissons, templates, mooring devises, etc.) or the well (i.e., wellheads, casings, casing stubs, etc.). A varied assortment of severing devices and methodologies has been designed to cut structural targets during the course of decommissioning activities. These devices are generally grouped and classified as either nonexplosive or explosive, and they can be deployed and operated by divers, remotely operated vehicles, or from the surface. Which severing tool the operators and contractors use takes into consideration the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions.
Artificial Reefs	3.1.6.2	Although BSEE supports and encourages the reuse of obsolete oil and gas structures as artificial reefs and is a cooperating agency in implementing the National Artificial Reef Plan, specific requirements must be met for a departure to be granted. More information on these regulations and processes can be found in Appendix A.15 of the 2017-2022 GOM Multisale EIS. Structure-removal permit applications requesting a departure under the Rigs-to-Reefs Policy undergo technical and environmental reviews. The policy document details the minimum engineering and environmental standards that operators/lessees must meet to be granted approval to deploy a structure as an artificial reef. Conditions of approval are applied as necessary to minimize the potential for adverse

Table 3-9. General Description of Routine Impact-Producing Factors. (continued).

Impact-Producing Factors and Specific Sources	Multisale EIS Chapter Reference	General Description
		effects to sensitive habitat and communities in the vicinity of the structure and proposed artificial reef site. Additionally, structures deployed as artificial reefs must not threaten nearby structures or prevent access to oil and gas, marine mineral, or renewable energy resources.
Coastal Infrastructure		
Onshore Facilities	3.1.7	Typical infrastructure (new or currently existing that may be expanded or retrofitted) that would support OCS activity and potentially may affect biological, physical, and socioeconomic resources include the following: • ports and support facilities (repair and maintenance yards, crew service, and; support sectors); • construction facilities (platform fabrication yards, shipyards and shipbuilding yards, and pipecoating facilities and yards); • transportation (offshore support vessels, tankers, pipelines, railroads, tank trucks, and navigation channels); and • processing facilities (natural gas processing, natural gas storage, liquefied natural gas, refineries, petrochemical plants, and waste management).
Other Routine Activities		
Air Emissions	3.1.8	Activities affecting air quality include vessel operations during geophysical surveys, drilling activities, platform construction and emplacement, pipeline laying and burial operations, platform operations, flaring, fugitive emissions, support vessel and helicopter operations, and evaporation of volatile organic compounds (VOCs) during transfers and spills. Activities affecting air quality onshore include emissions from new infrastructure constructed onshore and offshore activities that occur within 40 km (25 mi) of the State's boundary.
Noise	3.1.9	Acoustic sources can be described by their sound characteristics. For the regulatory process, they are generally divided into two categories: pulsed and continuous noise. Pulsed noises (e.g., explosives, airguns, and impact pile drivers) are generally considered powerful sounds with relatively short durations, broadband frequency content, and rapid rise times to peak levels. Continuous noises generally include all other noise (e.g., rotary machinery, propeller cavitation, and vibratory pile drivers), including vessel noise.
New and Unusual Technology	3.1.10	Technologies continue to evolve to meet the technical, environmental, and economic challenges of deepwater development. The operator must identify new or unusual technology, as defined in 30 CFR § 550.200, in exploration and development plans. Some of the technologies proposed for use by the operators are actually extended applications of existing technologies and interface with the environment in essentially the same way as well-known or conventional technologies. These technologies are reviewed by BOEM for alternative compliance or departures that may trigger additional environmental review.

3.2 ACCIDENTAL EVENTS

3.2.1 What Events Might Accidentally Occur as a Result of Operations Following a Lease Sale?

As a consequence of routine activities or operations assumed to routinely occur throughout the lifetime of lease, the potential for accidents exist. Types of reasonably foreseeable accidental events include releases into the environment (e.g., oil spills, loss of well control, accidental air emissions, pipeline failures, and chemical and drilling fluid spills), collisions (e.g., helicopter, service vessels, and platforms) and spill-response activities. Substantial preventative measures and Federal regulatory requirements from prevention to spill response, which are summarized below and described in greater detail in Chapter 3.2 of the 2017-2022 GOM Multisale EIS, are in place to mitigate these events.

3.2.1.1 Releases into the Environment

Oil Spills: Accidental releases into the environment can be caused by many factors. Oil-spill occurrence cannot be predicted, but an estimate of its likelihood can be quantified. BOEM has estimated the source and number of accidental oil spills that may occur based on the estimated volume of oil production for each program area and the assumed mode of transportation (Anderson et al., 2012). Oil-spill data indicate that the vast majority of spills reported in the Gulf of Mexico are ≤1 barrel (bbl). The most common cause of oil spills from both platforms and pipelines are hurricane related, since multiple accidental releases into the environment can occur during one hurricane event (ABS Consulting, Inc., 2016). Platform and pipeline spills include both crude oil and condensate, but platform spills may also include refined products such as diesel fuel. Crude oils are a natural mixture of hundreds of different compounds, and the chemical composition can vary significantly from different producing areas. Once spilled, oil is subject to a number of physical, chemical, and biological processes that alter its composition and that can influence spill-response activities and determine environmental impacts. Spills from pipelines are assumed to occur within their respective routes from production platform to destination. A loss of well control can occur when improperly balanced well pressure results in sudden, uncontrolled releases of fluids from a wellhead or wellbore (PCCI Marine and Environmental Engineering, 1999; Neal Adams Firefighters, Inc., 1991).

Pipeline Breaks: Substantial sources of damages to OCS pipeline infrastructure can be caused by corrosion, physical pipeline stress due to location, mass sediment movements, and mudslides that can exhume or push the pipelines into another location and by accidents due to weather or impacts from anchor drops or boat collisions.

Other Spills: Chemicals and synthetic-based drilling fluids are used in offshore oil and gas drilling and production activities, and may be spilled to the environment due to equipment failure, weather (i.e., wind, waves, and lightning), accidental collision, and human error.

Air Emissions: Accidental events associated with offshore oil- and gas-related activities can result in the emission of air pollutants. These OCS oil- and gas-related accidental events could include the release of oil, condensate, or natural gas; chemicals used offshore; pollutants from the burning of these products; fire; or H_2S release.

Trash and Debris: The policy regarding marine debris prevention is outlined in NTL 2015-BSEE-G03; however, equipment may be accidentally dropped to the seafloor or debris may be released accidentally from a platform or service vessel.

3.2.1.2 Collisions

Most collision mishaps are the result of service vessels colliding with platforms or vessel collisions with pipeline risers. The leading causes, not all inclusive, of recent helicopter accidents were engine related, loss of control or improper procedures, helideck obstacle strikes, controlled flight into terrain, and other technical failures (Helicopter Safety Advisory Conference, 2015).

3.2.1.3 Spill Response

In some cases, response efforts can also be an impact-producing factor. Offshore removal and spill-containment efforts to respond to an ongoing spill would likely require multiple technologies, including source containment, mechanical spill containment and cleanup, *in-situ* burning of the slick, and the use of chemical dispersants. Treatment methods for spills that extend onshore to sand beaches and marshes can include manual and mechanical removal, an on-site treatment plant, and sediment relocation. In the event of a spill, there is no single method of containment and removal that would be 100-percent effective. Refer to **Chapter 3.2.3** below for more information.

3.2.2 How Many Oil Spills Could Occur as a Result of a Proposed Lease Sale?

Analysis of Offshore Spills ≥1,000 bbl

BOEM conducts an oil-spill risk analysis prior to conducting lease sales in OCS areas (refer to **Figure 3-7**). The analysis is conducted in three parts:

(1) the trajectories of oil spills from hypothetical spill locations, which are simulated using the Oil Spill Risk Analysis (OSRA) model (Smith et al., 1982);

(2) the probability of oil-spill occurrence, which is based on spill rates derived from historical data (Anderson et al., 2012) and on estimated volumes of oil produced and transported; and

(3) the combination of results of the first two to estimate the overall oil-spill risk if there is oil development.

The OSRA model simulates the trajectory of thousands of spills throughout the Gulf of Mexico OCS and calculates the probability of these spills being transported and contacting specified geographic areas and features. Using the OSRA model, BOEM estimates the likely trajectories of hypothetical offshore spills ≥1,000 bbl. Only spills ≥1,000 bbl are addressed because smaller spills may not persist long enough to be simulated by trajectory modeling. For this analysis, the OSRA model was run for Alternatives A, B, and C, and the Cumulative OCS Oil and Gas Program (2017-2086). In the GOM, the Cumulative OCS Oil and Gas Program scenario comprises all future operations that would occur over a 70-year time period (2017-2086) from existing leases from previous lease sales, currently proposed lease sales within the 2017-2022 Five-Year Program, and future proposed regionwide lease sales.

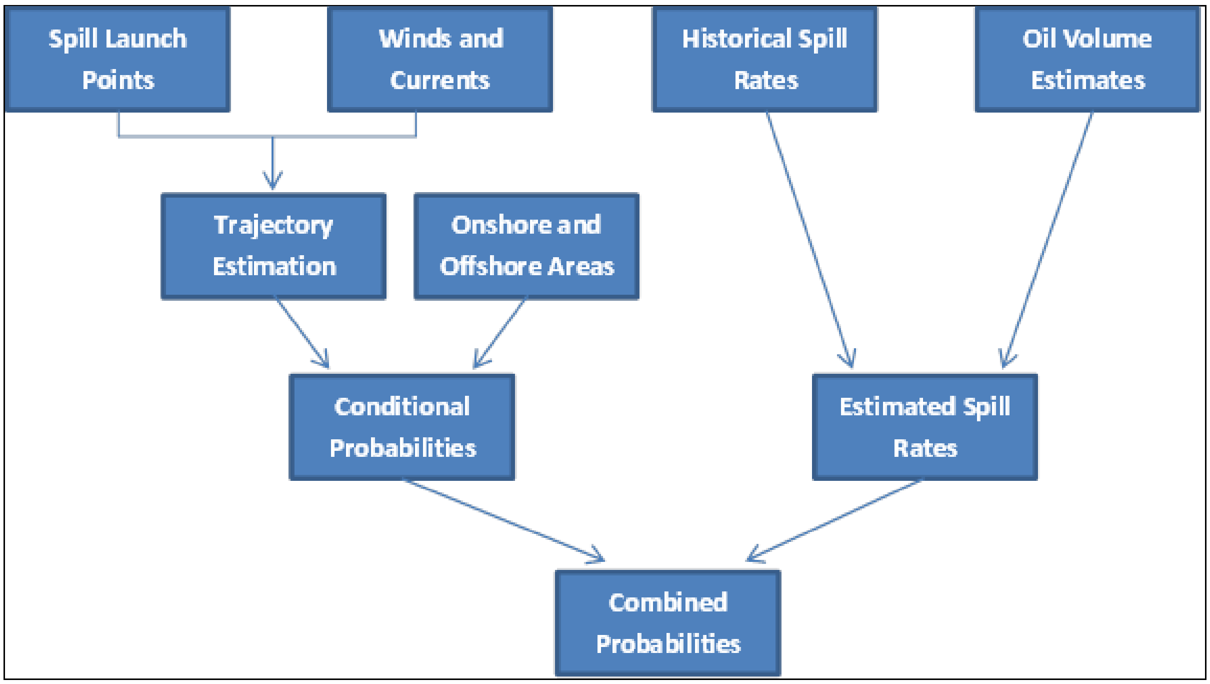


Figure 3-7. The Oil Spill Risk Analysis Model Process.

The mean number of spills estimated to occur as a result of each alternative is provided in **Table 3-10**. The range of the mean number of spills reflects the range of oil production volume estimated as a result of each alternative. The mean number of future spills ≥1,000 bbl is calculated by multiplying the spill rate by the volume of oil estimated to be produced as a result of each alternative. Spill rates were calculated based on the assumption that spills occur in direct proportion to the volume of oil handled and are expressed as number of spills per billion barrels of oil handled (spills/BBO).

Table 3-10. Mean Number and Sizes of Spills Estimated to Occur in OCS Offshore Waters from an Accident Related to Rig/Platform and Pipeline Activities Supporting Each Alternative Over a 50-Year Time Period.

Spill Size Group	Spill Rate (spills/BBO)[1]	Number of Spills Estimated			Estimated Median Spill Size (bbl)[1]
		Alternative A	Alternative B	Alternative C	
0-1.0 bbl	2,020	424-2,258	374-1,959	51-290	<1
1.1-9.9 bbl	57.4	12-64	11-56	2-9	3
10.0-49.9 bbl	17.4	4-20	3-17	1-3	
50.0-499.9 bbl	11.3	2-13	2-11	<1-2	126
500.0-999.9 bbl	1.63	<1-2	<1-2	<1	
Platforms					
≥1,000-9,999 bbl	0.25	<1	<1	<1	5,066
≥10,000 bbl	0.13	<1	<1	<1	–[2]
Pipelines					
≥1,000-9,999 bbl	0.88	<1-1	<1	<1	1,720
≥10,000 bbl	0.18	<1	<1	<1	–[2]

Notes: The number of spills estimated is derived by application of the historical rate of spills (1996-2010) per volume of crude oil handled based on the projected production for each alternative (**Table 3-5**). The actual number of spills that may occur in the future could vary from the estimated number.

[1]The spill rates presented are a sum of rates for United States OCS platforms/rigs and pipelines. The average (vs. the median) spill sizes for a larger number of spill size categories can also be found in the original source (Anderson et al., 2012).

[2]During the last 15 years, the only platform- or pipeline-related spill ≥10,000-bbl was the *Deepwater Horizon*. However, this spill is considered to be a low-probability catastrophic event, which is not reasonably foreseeable and is therefore not included.

The probabilities for oil-spill occurrence resulting from each alternative (2017-2066) and the Cumulative OCS Oil and Gas Program (2017-2086) for offshore spills ≥1,000 bbl can be found in **Table 3-11** and for spills ≥10,000 bbl in **Table 3-12**. The OSRA model estimates the chance of oil spills occurring during the production and transportation of a specific volume of oil over the lifetime of the scenario being analyzed. The estimation process uses a spill rate constant, based on historical accidental spills ≥1,000 bbl and ≥10,000 bbl, expressed as a mean number of spills per billion barrels of oil handled. For this analysis, the low estimate and high estimate of projected oil production for a single proposed lease sale for each alternative and for the Cumulative OCS Oil and Gas Program (2017-2086) are used. For more information on OCS spill-rate methodologies and trends, refer to Anderson et al. (2012). A discussion of how the range of resource estimates was developed is provided in **Chapter 3.1.2 and Table 3-6**.

Table 3-11. Oil-Spill Occurrence Probability Estimates for Offshore Spills ≥1,000 Barrels Resulting from Each Alternative (2017-2066) and the Cumulative OCS Oil and Gas Program (2017-2086).

	Forecasted Oil Production (Bbbl)[1]	Mean Number of Spills Estimated to Occur				Estimates of Probability (% chance) of One or More Spills			
		Platforms	Pipelines	Tankers	Total	Platforms	Pipelines	Tankers	Total
Single Proposed Lease Sale Alternatives									
Alternative A[2]	0.210	0.05	0.19	0	0.24	5	17	<0.5	21
	1.118	0.28	0.98	0.01	1.27	24	63	<0.5	72
Alternative B[3]	0.185	0.05	0.16	0	0.21	5	15	<0.5	19
	0.970	0.24	0.85	0	1.10	22	57	<0.5	67
Alternative C[4]	0.026	0.01	0.02	0	0.03	1	2	<0.5	3
	0.148	0.04	0.13	0	0.17	4	12	<0.5	15
Cumulative OCS Oil and Gas Program									
Regionwide	15.482	3.87	13.62	0.08	17.57	98	>99.5	7	>99.5
	25.806	6.45	22.71	0.13	29.29	>99.5	>99.5	12	>99.5
CPA/EPA	13.590	3.40	11.96	0.07	15.42	97	>99.5	7	>99.5
	22.381	5.60	19.70	0.11	25.40	>99.5	>99.5	11	>99.5
WPA	1.892	0.47	1.66	0	2.14	38	81	<0.5	88
	3.425	0.86	3.01	0	3.87	58	95	<0.5	98

Notes: Bbbl = billion barrels.
"Platforms" refers to facilities used in exploration, development, or production.
[1]Values represent the low and high resource estimates. Refer to **Table 3-1** for more information on resource estimates.
[2]Regionwide proposed lease sale.
[3]Regionwide proposed lease sale excluding blocks in the WPA.
[4]Regionwide proposed lease sale excluding blocks in the CPA/EPA.

Source: Ji, official communication, 2015.

Table 3-12. Oil-Spill Occurrence Probability Estimates for Offshore Spills ≥10,000 Barrels Resulting from Each Alternative (2017-2066) and the Cumulative OCS Oil and Gas Program (2017-2086).

	Forecasted Oil Production (Bbbl)[1]	Mean Number of Spills Estimated to Occur				Estimates of Probability (% chance) of One or More Spills			
		Platforms	Pipelines	Tankers	Total	Platforms	Pipelines	Tankers	Total
Single Sale Alternatives									
Alternative A[2]	0.210	0.03	0.04	0	0.07	3	4	<0.5	6
	1.118	0.15	0.20	0	0.35	14	18	<0.5	29
Alternative B[3]	0.185	0.02	0.03	0	0.06	2	3	<0.5	6
	0.970	0.13	0.17	0	0.30	12	13	<0.5	26
Alternative C[4]	0.026	0	0	0	0.01	<0.5	<0.5	<0.5	1
	0.148	0.02	0.03	0	0.05	2	3	<0.5	4
Cumulative OCS Oil and Gas Program									
Regionwide	15.482	2.01	2.79	0.02	4.82	87	94	2	99
	25.806	3.35	4.65	0.04	8.04	97	99	4	>99.5
CPA/EPA	13.590	1.77	2.45	0.02	4.23	83	91	2	99
	22.381	2.91	4.03	0.04	6.97	95	98	4	>99.5
WPA	1.892	0.25	0.34	0	0.59	22	29	<0.5	44
	3.425	0.45	0.62	0	1.06	36	46	<0.5	65

	Forecasted Oil Production (Bbbl)[1]	Mean Number of Spills Estimated to Occur				Estimates of Probability (% chance) of One or More Spills			
		Platforms	Pipelines	Tankers	Total	Platforms	Pipelines	Tankers	Total

Notes: Bbbl = billion barrels.
"Platforms" refers to facilities used in exploration, development, or production.
[1]Values represent the low and high resource estimates. Refer to **Table 3-1** for more information on resource estimates.
[2]Regionwide proposed lease sale.
[3]Regionwide proposed lease sale excluding blocks in the WPA.
[4]Regionwide proposed lease sale excluding blocks in the CPA/EPA.

Source: Ji, official communication, 2015.

Analysis of Offshore Spills <1,000 bbl

The number of spills <1,000 bbl estimated to occur over the next 50 years as a result of each alternative is provided in **Table 3-10**. The number of spills is estimated by multiplying the oil-spill rate for each of the different spill size groups by the projected oil production as a result of each alternative (**Tables 3-1 and 3-7**). As spill size increases, the occurrence rate decreases and so the number of spills estimated to occur decreases.

Analysis of Coastal Spills

Spills that occur in State offshore waters and/or navigation channels, rivers, and bays (coastal waters) from barges and pipelines carrying OCS-produced oil are referred to as coastal spills. These spills occur at shoreline storage, processing, and transport facilities supporting the OCS oil and gas industry. BOEM projects that most (>90%) oil produced as a result of a proposed action under Alternative A would be brought ashore via pipelines to oil pipeline shore bases, stored at these facilities, and eventually transferred via pipeline or barge to GOM coastal refineries. Because oil is commingled at shore bases and cannot be directly attributed to a particular lease sale, this analysis of coastal spills addresses spills that could occur prior to the oil arriving at the initial shoreline facility. It is also possible that non-OCS oil may be commingled with OCS oil at these facilities or during subsequent secondary transport.

According to USCG's database for the period from January 2002 through July 2015 (USDHS, CG, 2015) (**Table 3-13**) in the waters 0-9 nmi (0-10.36 mi; 16.67 km) off the Texas coast, there were a total of 91 spills reported from 2002 to 2015 or about 7 spills <1,000 bbl/yr. In the waters 0-3 nmi (0-3.45 mi; 5.56 km) off the Louisiana coast, there were a total of more than 2,143 spills reported from 2002 to 2015, or about 165 spills <1,000 bbl/yr. In the waters 0-3 nmi (0-3.45 mi; 5.56 km) off the Mississippi coast, there were a total of 42 spills reported from all sources, or about 3.2 spills <1,000 bbl/yr. In the waters 0-3 nmi (0-3.45 mi; 5.56 km) off the Alabama coast, there were a total 2 spills reported from all sources from 2002 to 2015, or about 0.2 spills <1,000 bbl/yr. In the waters 0-9 nmi (0-10.36 mi; 16.67 km) off the Florida coast, there were a total 0 spills reported from all sources from 2002 to 2015. When limited to just oil- and gas-related spill sources such as platforms, pipelines, MODUs, and support vessels, the number and most likely spill sizes to occur in coastal waters in the future are expected to resemble the patterns that have occurred in the past as long as the level of energy-related commercial and recreational activities remain the same. The coastal waters of Louisiana, Texas, Mississippi, Alabama, and

Florida have had a total of 165, 7, 3.2, 0.2, and 0, spills <1,000 bbl/yr, respectively. Assuming future trends would reflect past historical records, it is also predicted that Louisiana will be the state most likely to have a spill ≥1,000 bbl occur in water 0-3 mi (0-5 km) offshore. Between 2002 and 2015, only two spills ≥1,000 bbl occurred in coastal waters (refer to **Table 3-13** below), and those occurred in the coastal waters of Louisiana.

Table 3-13. Historic Spill Source, Location, and Characteristics of a Maximum Spill for Coastal Waters[1] (data extracted from USDHS CG records, 2002-July 2015).

Source	Number of Spills			Maximum Volume of a Single Incident	
	Total Number of Spill Events	Number of Spills (<1,000 bbl)	Number of Spills (≥1,000 bbl)	Volume (bbl) of Maximum Spill from the Source	Maximum Spill Amount Product/Year
Western Planning Area (WPA)[2]					
Fixed Platform	147	147	0	7.62	Crude/2005
Pipeline	0	0	0	N/A	N/A
MODU	2	2	0	4	Crude/2002
OSV	1	1	0	0.05	Crude/2014
Tank Ship or Barge	5	5	0	23.8	Crude/2009
Total	155	155	0	–	–
Central Planning Area (CPA)[2]					
Fixed Platform	2,398	2,398	0	300	Crude/2004
Pipeline	4	4	0	5	Crude/2002
MODU	28	27	1	4,928,100	Crude/2010
OSV	7	7	0	0.07	Crude 2014
Tank Ship or Barge	6	6	0	2	Crude/2013
Total	2,443	2,442	1	–	–
Eastern Planning Area (EPA)[2]					
Fixed Platform	0	0	0	N/A	N/A
Pipeline	0	0	0	N/A	N/A
MODU	0	0	0	N/A	N/A
OSV	0	0	0	N/A	N/A
Tank Ship or Barge	0	0	0	N/A	N/A
Total	0	0	0	–	–

Source	Number of Spills			Maximum Volume of a Single Incident	
	Total Number of Spill Events	Number of Spills (<1,000 bbl)	Number of Spills (≥1,000 bbl)	Volume (bbl) of Maximum Spill from the Source	Maximum Spill Amount Product/Year
Coastal Waters: Texas					
Fixed Platform	67	67	0	20	Crude/2002
Pipeline	14	14	0	10	Crude/2005
MODU	5	5	0	0.48	Crude/2002
OSV	2	2	0	0.05	Crude/2003
Tank Ship or Barge	3	3	0	0.36	Crude/2009
Total	91	91	0	–	–
Coastal Waters: Louisiana					
Fixed Platform	2,022	2,021	1	1,200	Crude/2008
Pipeline	98	97	1	7,000	Crude/2008
MODU	4	4	0	0.24	Crude/ 2013
OSV	17	17	0	3	Crude/2013
Tank Ship or Barge	2	2	0	50	Crude/2002
Total	2,143	2,141	2	–	–
Coastal Waters: Mississippi					
Fixed Platform	1	1	0	0.001	Crude/2008
Pipeline	0	0	0	N/A	NA
MODU	0	0	0	N/A	N/A
OSV	0	0	0	N/A	N/A
Tank Ship or Barge	1	1	0	0.05	Crude/2002
Total	2	2	0	–	–
Coastal Waters: Alabama					
Fixed Platform	2	2	0	0.024	Crude/2007
Pipeline	0	0	0	N/A	N/A
MODU	0	0	0	N/A	N/A
OSV	0	0	0	N/A	N/A
Tank Ship or Barge	0	0	0	N/A	N/A
Total	2	2	0	–	–

Source	Number of Spills			Maximum Volume of a Single Incident	
	Total Number of Spill Events	Number of Spills (<1,000 bbl)	Number of Spills (≥1,000 bbl)	Volume (bbl) of Maximum Spill from the Source	Maximum Spill Amount Product/Year
Coastal Waters: Florida					
Fixed Platform	0	0	0	N/A	N/A
Pipeline	0	0	0	N/A	N/A
MODU	0	0	0	N/A	N/A
OSV	0	0	0	N/A	N/A
Tank Ship or Barge	0	0	0	N/A	N/A
Total	0	0	0	–	–

bbl = barrel; MODU = mobile offshore drilling unit; N/A = not applicable; OSV = offshore support vessel.

Note: The reader should note that the spills are reported to USCG by responsible parties, other private parties, and government personnel. The USCG does not verify the source or volume of every report.

[1]Coastal Waters – the portion of the Gulf of Mexico under State jurisdiction that begins at the coastline and ends at the Federal/State boundary 9 nmi (10.36 mi; 16.67 km) offshore Texas; 3 nmi (3.5 mi; 5.6 km) offshore Louisiana, Mississippi, and Alabama; and 9 nmi (10.36 mi; 16.67 km) offshore West Florida.

[2]The database included represents spill events from January 2002 until July 2015.

3.2.3 What is the Response to Accidental Events?

In the event of a spill, particularly a loss of well control, there is no single method of containment and removal that would be 100-percent effective. It is likely that larger spills under the right conditions would require the simultaneous use of all available cleanup methods (i.e., source containment, mechanical spill containment and cleanup, dispersant application, and *in-situ* burning). There are many situations and environmental conditions that necessitate different approaches. Spill cleanup is a complex and evolving technology. Each new tool then becomes part of the spill-response tool kit. Each spill-response technique/tool has its specific uses and benefits (Fingas, 1995). Offshore removal and spill-containment efforts to respond to an ongoing spill offshore would likely require multiple technologies, including source containment, mechanical spill containment and cleanup, *in-situ* burning of the slick, and the use of chemical dispersants. Even with the deployment of all of these spill-response technologies, it is likely that, with the operating limitations of today's spill-response technology, not all of the oil can be contained and removed offshore.

The sensitivity of the contaminated shoreline is the most important factor in the development of cleanup recommendations. Shorelines of low productivity and biomass can withstand more intrusive cleanup methods such as pressure washing. Shorelines of high productivity and biomass are very sensitive to intrusive cleanup methods and, in many cases, the cleanup is more damaging than allowing natural recovery. Refer to Chapter 3.2.8 of the 2017-2022 GOM Multisale EIS for more information on specific spill-response techniques. For information on the effects of spill-response activity, refer to Chapter 4 of the 2017-2022 GOM Multisale EIS.

Within BSEE, the Oil Spill Preparedness Division addresses all aspects of oil-spill planning and preparedness. Additional information about the Oil Spill Preparedness Division can be found on BSEE's website at https://www.bsee.gov/what-we-do/oil-spill-preparedness. BOEM receives and reviews the worst-case discharge information submitted for EPs, development and production plans (DPPs), and DOCDs on the OCS. BOEM also has regulatory requirements addressing site-specific, oil-spill response plans (OSRPs). As required by BOEM at 30 CFR §§ 550.219 and 550.250, operators are required to provide BOEM with an OSRP that is prepared in accordance with 30 CFR part 254 subpart B with their proposed exploration, development, or production plan for the facilities that they will use to conduct their activities or to alternatively reference their approved regional OSRP. Refer to Chapter 3.2.8 of the 2017-2022 GOM Multisale EIS for more information.

3.2.4 Summary of Accidental Impact-Producing Factors

Table 3-14 below outlines the impact-producing factors from initial exploration to decommissioning for accidental oil and gas events. **Table 3-15** provides a general description of all accidental events that could occur during the lifetime of a lease.

Table 3-14. Summary of the Timing of Impact-Producing Factors Associated with Accidental Oil and Gas Events.

Impact-Producing Factors and Activities	Exploration		Development	Production	Decommissioning
	Geological and Geophysical Survey	Exploration and Delineation Drilling			
Oil Spills	–	X	X	X	X
Offshore Spills ≥1,000 bbl	–	X	X	X	X
Offshore Spills <1,000 bbl	–	X	X	X	X
Coastal Spills	X	X	X	X	X
Loss of Well Control	-	X	X	X	X
Accidental Air Emissions	X	X	X	X	X
Pipeline Failures	-	X	X	X	X
Vessel or Helicopter Collisions	X	X	X	X	X
Chemical and Drilling Fluid Spills	X	X	X	X	X
Wastes and Debris	X	X	X	X	X
Spill Response*	X	X	X	X	X

*Spill response can occur as a result of chemical or fuel spills as well as oil spills.

Table 3-15. General Description of Accidental Event Impact-Producing Factors.

	Multisale EIS Chapter Reference	General Description
Oil Spills	3.2.1	As a consequence of activities related to the exploration, development, production, and transportation of oil and gas, the potential for accidental releases exists. Petroleum spills include crude oil, condensate, and refined products such as diesel, hydraulic oil, lube oil and mineral oil. Spills from facilities include drilling rigs, drillships, and storage, processing, or production operations, while spills from pipelines are those that occur on the OCS and are directly attributable to the transportation of OCS oil. BOEM uses the Oil Spill Risk Analysis (OSRA) model to simulate the trajectory of thousands of hypothetical spills ≥1,000 bbl throughout the Gulf of Mexico OCS and calculates the probability of these spills being transported and contacting specified geographic areas and features. Additionally, the OSRA model calculates combined probabilities by multiplying the probability of contact by the probability of a spill occurring as a result of a proposed action. A more thorough discussion of oil spills and the OSRA model can be found in the chapters above and in Chapter 3.2.1 of the 2017-2022 GOM Multisale EIS.
Loss of Well Control	3.2.2	Operators are required to document any loss of well control event, even if temporary, and the cause of the event by mail or email to the addressee indicated in NTL 2010-N05. The operator does not have to include kicks that were controlled but should include the release of fluids through a flow diverter (a conduit used to direct fluid flowing from a well away from the drilling rig). The current definition for loss of well control is as follows: • uncontrolled flow of formation or other fluids (the flow may be to an exposed formation [an underground blowout] or at the surface [a surface blowout]); • uncontrolled flow through a diverter; and/or • uncontrolled flow resulting from a failure of surface equipment or procedures. Not all loss of well control events would result in a blowout as defined above. A loss of well control is most commonly thought of as a release to the human environment. A loss of well control can occur during any phase of development, i.e., exploratory drilling, development drilling, well completion, production, or workover operations. A loss of well control can occur when improperly balanced well pressure results in sudden, uncontrolled releases of fluids from a wellhead or wellbore (PCCI Marine and Environmental Engineering, 1999; Neal Adams Firefighters, Inc., 1991). Of the 40 loss of well control events reported in the GOM from 2007 to August 2015, 21 (52%) resulted in loss of fluids at the surface or underground (USDOI, BSEE, 2017a).
Accidental Air Emissions	3.2.3	Accidental events associated with offshore oil- and gas-related activities can result in the emission of air pollutants. These OCS oil- and gas-related accidental events could include the release of oil, condensate, or natural gas; chemicals used offshore; pollutants from the burning of these products; fire; or H_2S release. The air pollutants could include National Air Ambient Quality Standards criteria pollutants, volatile and semi-volatile organic compounds, hydrogen sulfide, and methane. Emissions sources related to accidents from OCS operations can include well blowouts, oil spills, pipeline breaks, tanker accidents, and tanker explosions.
Pipeline Failures	3.2.4	Significant sources of damages to OCS pipeline infrastructure can be caused by corrosion (Chapters 3.1.3.3.1 and 3.1.6.1 of the 2017-2022 GOM Multisale EIS), physical pipeline stress due to location, mass sediment movements and mudslides that can exhume or push the pipelines into another location, and accidents due to weather or impacts from anchor drops or boat collisions.
Vessel or Helicopter Collisions	3.2.5	From 2008 to August 2015, there were 122 OCS oil- and gas-related vessel collisions (USDOI, BSEE, 2017b). Most collision mishaps are the result of service vessels colliding with platforms or vessel collisions with pipeline risers. Approximately 10% of vessel collisions with platforms in the OCS caused diesel spills. Fires resulted from hydrocarbon releases in several of the collision incidents.

Table 3-15. General Description of Accidental Event Impact-Producing Factors. (continued).

	Multisale EIS Chapter Reference	General Description
		The average number of helicopter accidents per year in the GOM since 1984 has been 7.9 per year, with the last 10 years averaging 4.7 per year and with only 2 in 2014. The 2014 GOM oil industry helicopter accident rate per 100,000 flight hours was 0.68, with a total of 2 accidents compared with a 31-year annual average accident rate of 1.74. The fatal accident rate per 100,000 flight hours during 2014 was 0.34 compared with a 31-year average of 0.44 (Helicopter Safety Advisory Conference, 2015).
Chemical and Drilling Fluid Spills	3.2.6	Chemicals and synthetic-based drilling fluids are used in offshore oil and gas drilling and production activities, and may be spilled to the environment due to equipment failure, weather (i.e., wind, waves, and lightning), accidental collision, and human error.
Wastes and Debris	3.2.7	The BSEE policy regarding marine debris prevention is outlined in NTL 2015-BSEE-G03, "Marine Trash and Debris Awareness and Elimination." This NTL instructs OCS operators to post informational placards that outline the legal consequences and potential ecological harms of discharging marine debris
Spill Response		
BSEE-Spill Response Requirements	3.2.8.1	As a result of the Oil Pollution Act of 1990 and the reorganization of the Bureau of Ocean Energy Management, Regulation and Enforcement into BOEM and BSEE, BSEE was tasked with a number of oil-spill response duties and planning requirements. Within BSEE, the Oil Spill Preparedness Division addresses all aspects of offshore oil-spill planning, preparedness, and response. Additional information about the Oil Spill Preparedness Division can be found on BSEE's website at https://www.bsee.gov/what-we-do/oil-spill-preparedness. The BSEE implements the following regulations according to 30 CFR parts 250 and 254: • requires immediate notification for spills >1 bbl—all spills require notification to USCG, and BSEE receives notification from USCG of all spills ≥1 bbl; • conducts investigations to determine the cause of a spill; • assesses civil and criminal penalties, if needed; • oversees spill source control and abatement operations by industry; • sets requirements and reviews and approves OSRPs for offshore facilities (More information on OSRP regulations and processes can be found in Appendix A.5 of the 2017-2022 GOM Multisale EIS.); • conducts unannounced drills to ensure compliance with OSRPs; • requires operators to ensure that their spill-response operating and management teams receive appropriate spill-response training; • conducts inspections of oil-spill response equipment; • requires industry to show financial responsibility to respond to possible spills; and • provides research leadership to improve the capabilities for detecting and responding to an oil spill in the marine environment.
Offshore Response	3.2.8.2	It is likely that larger spills under the right conditions would require the simultaneous use of all available cleanup methods (i.e., source containment, mechanical spill containment and cleanup, dispersant application, and *in-situ* burning).
Onshore Response	3.2.8.3	Offshore response and cleanup is preferable to shoreline cleanup; however, if an oil slick reaches the coastline, it is expected that the specific shoreline cleanup countermeasures identified and prioritized in the appropriate Area Contingency Plans for various habitat types would be used. The sensitivity of the contaminated shoreline is the most important factor in the development of cleanup recommendations. Shorelines of low productivity and biomass can withstand more intrusive cleanup methods such as pressure washing. Shorelines of high productivity and biomass are very sensitive to intrusive cleanup methods and, in many cases, the cleanup is more damaging than allowing natural recovery.

3.3 CUMULATIVE IMPACTS

3.3.1 What Additional Activities, Not Considered a Part of a Proposed Action, has BOEM Considered?

A cumulative impact "results from the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR § 1508.7). The scope of a proposed action is important to consider in a broader context that accounts for the full range of actions and associated impacts taking place within the Gulf of Mexico, currently and into the foreseeable future. Repeated actions, even minor ones, may produce significant impacts over time.

The cumulative impacts assessment focuses on the resources, ecosystems, and human communities that may be affected by the incremental impacts associated with a proposed action (under any of the action alternatives), in combination with other past, present, and reasonably foreseeable future actions. Cumulative impacts on a given resource, ecosystem, or human community may result from single actions or a combination of multiple actions over time. These may be additive, less than additive (countervailing), or more than additive (synergistic).

Many of the past, present, and reasonably foreseeable future actions and trends that would contribute to cumulative impacts under a proposed action's alternatives also contribute to cumulative impacts under the No Action Alternative (Alternative E). Under Alternative E, a proposed action (i.e., a single proposed OCS oil and gas lease sale) would not occur and, as a result, energy could be obtained from other sources to replace the lost oil and gas production. The opportunity for development of the estimated oil and gas that could have resulted from a proposed action (i.e., a single proposed lease sale) or alternative to a proposed action, as described above, would be precluded or postponed to a future lease sale. As a result, a separate treatment of the cumulative effects under Alternative E is not considered here.

3.3.2 Summary of Cumulative Activities

3.3.2.1 Cumulative OCS Oil and Gas Program Scenario

The Cumulative OCS Oil and Gas Program scenario includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales. This includes projected activity from (1) past lease sales for which exploration or development has either not yet begun or is continuing; (2) lease sales that would be held in the 2017-2022 Five-Year Program; and (3) future lease sales that would be held as a result of future Five-Year Programs (4 additional programs are included in this cumulative analysis). This equates to a 70-year timeframe or 2017-2086 and includes a 50-year analysis period (2017-2066) for a single proposed lease sale (e.g., Lease Sale 250). Activities that take place as a result of Five-Year Programs beyond the next four programs are not included in this analysis.

It is reasonably foreseeable to assume that lease sales would continue to be proposed for many years to come in the Gulf of Mexico region based on resource availability, existing infrastructure, and projected time lapses required for any other major energy sources to come online. For the purposes of conducting cumulative impact analyses here, even though additional NEPA reviews would be required, four additional Five-Year Programs are assumed to occur (an additional 20 years of proposed lease sales), resulting in activities that could occur over the next 70 years. However, the level of activities (i.e., exploration wells, production wells, and pipelines) becomes more speculative as time is projected into the future. The causes for this are a number of things, including uncertainty in oil prices, resource potential, and cost of development and resource availability (e.g., drilling rig availability) versus the amount of acreage leased from a lease sale.

Therefore, these scenarios do not predict future OCS oil- and gas-related activities with absolute certainty, even though they were formulated using historical information and current trends in the oil and gas industry. These scenarios are only approximate since future factors such as the contemporary economic marketplace, the availability of support facilities, and pipeline capacities are all unknowns. Notwithstanding these unpredictable factors, the scenarios used in this Supplemental EIS represent the best assumptions and estimates of a set of future conditions that are considered reasonably foreseeable and suitable for presale impact analyses. The development scenarios do not represent BOEM's recommendation, preference, or endorsement of any level of leasing or offshore operations, or of the types, numbers, and/or locations of any onshore operations or facilities for future programs. Methodologies for the Cumulative OCS Oil and Gas Program scenario are similar to those for a regionwide or individual planning area typical lease sale scenario analysis and are described in detail in **Chapter 3.0** above. **Tables 3-16 and 3-17** present projections of the major activities and impact-producing factors related to future Cumulative OCS Oil and Gas Program activities.

Table 3-16 Future Activity Projections Associated with the Cumulative OCS Oil and Gas Program (2017-2086), Including All Future Activities that are Projected to Occur from Past, Proposed, and Future Lease Sales.

Activity	Planning Area		Offshore Subareas (m)[1]						Totals[2]
			0-60	60-200	200-800	800-1,600	1,600-2,400	>2,400	
Exploration and Delineation Wells	GOM		939-2,562	253-1,166	110-170	153-240	97-278	119-301	1,671-4,717
	CPA/EPA		775-1,999	202-1,007	83-142	88-184	70-142	99-211	1,317-3,685
	WPA		164-563	51-159	27-28	65-56	27-136	20-90	354-1,032
Development and Production Wells[3]	GOM	Total	4,050-9,225	1,570-4,324	912-2,034	617-1,127	446-723	633-985	8,238-18,418
		Oil	438-987	164-453	446-993	280-487	230-372	310-482	1,868-3,774
		Gas	2,440-5,566	894-2,457	186-415	149-288	79-126	126-194	3,874-9,046
	CPA/EPA	Total	3,170-6,634	1,139-3,558	676-1,557	490-779	405-623	595-899	6,475-14,050
		Oil	354-740	122-379	326-750	240-385	207-319	289-437	1,538-3,010
		Gas	1,898-3,972	645-2,015	142-327	95-152	72-110	119-179	2,971-6,755

Activity	Planning Area		Offshore Subareas (m)[1]						Totals[2]
			0-60	60-200	200-800	800-1,600	1,600-2,400	>2,400	
	WPA	Total	880-2,591	431-766	236-477	137-348	41-100	38-86	1,763-4,368
		Oil	84-247	42-74	120-243	40-102	23-53	21-45	330-764
		Gas	542-1,594	249-442	44-88	54-136	7-16	7-15	903-2,291
Installed Production Structures	GOM		2,168-5,121	558-1,638	36-71	26-38	16-38	23-42	2,827-6,948
	CPA/EPA		1,760-3,682	432-1,347	23-54	17-26	14-21	20-30	2,266-5,160
	WPA		408-1,439	126-291	13-17	9-12	2-17	3-12	561-1,788
Production Structures Removed Using Explosives	GOM		2,435-4,388	568-1,310	0	0	0	0	3,003-5,698
	CPA/EPA		2,051-3,315	440-1,065	0-0	0-0	0-0	0-0	2,491-4,380
	WPA		384-1,073	128-245	0-0	0-0	0-0	0-0	512-1,318
Total Production Structures Removed	GOM		3,381-6,148	784-1,796	39-69	36-44	20-33	21-31	4,281-8,121
	CPA/EPA		2,847-4,639	608-1,459	26-54	25-31	17-22	18-24	3,541-6,229
	WPA		534-1,509	176-337	13-15	11-13	3-11	3-7	740-1,892
Length of Installed Pipelines (km)[4]	GOM		2,181-15,822	1,432-10,511	1,078-8,037	1,268-8,265	700-7,001	704-7,359	7,363-56,995
	CPA/EPA		586-11,799	388-8,355	328-6,390	385-6,381	364-6,168	405-6,750	2,456-45,843
	WPA		1,595-4,023	1,044-2,156	750-1,647	883-1,884	336-833	299-609	4,907-11,152
Service-Vessel Trips (1,000's round trips)	GOM		2,443-6,998	645-2,300	284-942	213-556	134-498	187-577	3,909-11,873
	CPA/EPA		1,978-5,037	496-1,892	186-722	140-389	115-306	163-440	3,079-8,788
	WPA		465-1,960	150-408	98-221	72-167	19-192	23-137	830-3,085
Helicopter Operations (1,000's round trips)	GOM		11,714-55,063	4,511-25,155	270-1,162	183-651	139-422	183-546	17,000-83,000
	CPA/EPA		9,614-40,734	3,544-21,159	191-898	148-440	121-352	165-475	13,786-64,059
	WPA		2,098-14,329	966-3,996	78-264	34-211	17-70	17-70	3,214-18,941

[1]Refer to **Figure 3-1**.

[2]Subareas totals may not add up to the planning area total because of rounding.

[3]Development and Production Wells include some exploration wells that were re-entered and completed. These wells were removed from the Exploration and Delineation well count.

[4]Projected length of pipelines does not include length in State waters.

Table 3-17. Future Oil Transportation Projections Associated with the Cumulative OCS Oil and Gas Program (2017-2086), Including All Future Transportation that is Projected to Occur from Past, Proposed, and Future Lease Sales.

Activity	Region	Offshore Subareas (m)[1]						Totals[2]
		0-60	60-200	200-800	800-1,600	1,600-2,400	>2,400	
Percent Oil Piped[3]	GOM	94-95%	100%	100%	100%	89.6-87.4%	87.4-85.7%	91.6-90.6%
	CPA/EPA	94-95%	100%	100%	100%	97.8-96.3%	94.9-95.3%	90.8-91.0%
	WPA	100%	100%	100%	100%	100-89%	100-86.4%	100-95.1%
Percent Oil Barged	GOM	6-5%	0%	0%	0%	0%	0%	0.2%
	CPA/EPA	6-5%	0%	0%	0%	0%	0%	0.2%
	WPA	0%	0%	0%	0%	0%	0%	0%
Percent Tankered[4]	GOM	0%	0%	0%	0%	10.4-12.6%	12.6-14.3%	8-9%
	CPA/EPA	0%	0%	0%	0%	12.2-13.7%	5.1-4.7%	9-8.75%
	WPA	0%	0%	0%	0%	0-11%	0-13.6%	0-4.85%

[1]Refer to **Figure 3-1**. Ranges are reported from the low production case scenario to the high production case scenario.
[2]Subareas totals may not add up to the planning area total because of rounding.
[3]100% of gas is assumed to be piped.
[4]Tankering is forecasted to occur only in water depths >1,600 m (5,249 ft).

3.3.2.2 Non-OCS Oil- and Gas-Related Impact-Producing Factors

The impact-producing factors considered in this chapter are defined as other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as the aforementioned projected routine activities and potential accidental events, but they are not related to the Cumulative OCS Oil and Gas Program. **Table 3-18** below summarizes other impact-producing factors that could potentially affect an environmental or socioeconomic resource in addition to OCS oil- and gas-related activity.

While the scenario developed for the Cumulative OCS Oil and Gas Program scenario forecasts 70 years of activities, the scenarios developed as part of this chapter vary in the length of time projected depending on what would be considered reasonably foreseeable by impact-producing factors based on the data available and the ability to predict future actions without being speculative.

Table 3-18. General Description of Cumulative Non-OCS Oil- and Gas-Related Impact-Producing Factors.

Impact-Producing Factor and Specific Sources	Multisale EIS Chapter Reference	General Description
State Oil and Gas Activity		
State Oil and Gas Activity	3.3.2.1	All of the five Gulf Coast States have had some historical oil and gas exploration activity and, with the exception of Florida and Mississippi, all currently produce oil and gas in State waters. The coastal infrastructure that supports the OCS Program also supports State oil and gas activities. State oil and gas infrastructure consists of the wells that extract hydrocarbon resources, facilities that produce and treat the raw product, pipelines that transport the product to refineries and gas plants for further processing, and additional pipelines that transport finished product to points of storage and final consumption. The type and size of infrastructure that supports production depends upon the size, type, and location of the producing field, the time of development, and the life cycle stage of operations.
Pipeline Infrastructure	3.3.2.1.1	The existing pipeline network in the Gulf Coast States is the most extensive in the world and has unused capacity (Cranswick, 2001). The network carries oil and gas onshore and inland to refineries and terminals, and a network of pipelines distributes finished products such as diesel fuel or gasoline to and between refineries and processing facilities onshore (Peele et al., 2002, Figure 4.1). Expansion of this network is projected to be primarily small-diameter pipelines to increase the interconnectivity of the existing network and a few major interstate pipeline expansions. However, there is spare capacity in the existing pipeline infrastructure to move oil and gas to market, and deepwater ports can serve onshore facilities, including intrastate as well as interstate pipelines.
Artificial Reefs	3.3.2.1.2	The OCSLA and implementing regulations establish decommissioning obligations for lessees, including the removal of platforms. The Rigs-to-Reefs Policy provides a means by which lessees may request a waiver to the removal requirement. For additional information, refer to Chapter 3.1.6.2 of the 2017-2022 Gulf of Mexico Multisale EIS. Since the first Rigs-to-Reefs conversion, approximately 11% of the platforms decommissioned from the Gulf of Mexico OCS have been redeployed within designated State artificial reefs. Scientific and public interest in the ecology of offshore structures and the potential benefits of contributing hard substrate to a predominantly soft bottom environment have led to increased emphasis on the development of artificial reefs. The current paradigm posits oil and gas structures act as both fish-attracting and production-enhancing devices, depending upon the species (Carr and Hixon, 1997; Gallaway et al., 2009; Shipp and Bortone, 2009; Dance et al., 2011). However, determination of specific and cumulative impacts resulting from the construction of artificial reefs within permitted areas is very difficult. As recommended by the National Artificial Reef Plan (USDOC, NOAA, 2007), well-defined objectives, clear management strategies, and long-term monitoring are critical elements of an artificial reef program and are necessary if managers intend to use artificial reefs as a fisheries management tool.
Marine Vessel Activity		
Marine Transportation	3.3.2.2	Non-OCS oil- and gas-related vessels, other than above, utilize the GOM. These ships include research, recreational, and commercial vessels. Commercial and recreational fishing in the Gulf of Mexico are regulated by NMFS. For more information on recreational fishing vessels, refer to Chapter 4.11 of the 2017-2022 GOM Multisale EIS. For more information on commercial fishing vessels, refer to Chapter 4.10 of the 2017-2022 GOM Multisale EIS. Research activities, including surveys, genetic research, capture, relocation, or telemetric monitoring, may affect organisms or ecosystems in the GOM. The OCS oil- and gas-related vessels are required to survey for undiscovered archaeological and biological resources; however, these resources may be damaged by anchors of non-OCS oil- and gas-related vessels that do not perform surveys. Non-OCS oil- and gas-related tankering includes ships carrying crude or ships

Table 3-18. General Description of Cumulative Non-OCS Oil- and Gas-Related Impact-Producing Factors. (continued).

Impact-Producing Factor and Specific Sources	Multisale EIS Chapter Reference	General Description
		carrying product. Overall, tankering (including U.S. ships and foreign ships) in the U.S. increased by 28% between 2003 and 2011 (USDOT, MARAD, 2013). While U.S. tankering port of calls declined between 2003 and 2011, foreign ship tankering port of calls increased. Due to the double-hulled ships' ability to reduce or prevent oil spills and as part of the OPA requirements, double-hulled ships have replaced almost all single-hulled ships. In 2003, 60-70% of all tankers were double hulled, but by 2011, 97-100% of all tankers were double hulled.
Non-OCS Oil- and Gas-Related Wastes		
Shipwrecks	3.3.2.3.1	There are thousands of shipwrecks in U.S. waters. Some of the vessels involved in those wrecks are likely to contain oil, as fuel and possibly cargo, and may eventually result in pollution to the marine environment. Warships and cargo vessels sunk in wartime may also contain munitions, including explosives and chemical warfare agents, which may pose a continued threat because of their chemical composition.
Discharges Associated with Military Activities	3.3.2.3.2	Between the years of 1995 through 1999, Eglin Air Force Base in Florida conducted nearly 39,000 training sorties per year in the eastern Gulf. Potential impacts from these activities are discussed in the *Eglin Gulf Test and Training Range: Final Programmatic Environmental Assessment* (Air Force Air Armament Center, 2002). These military activities may result in marine impacts from chaff, fuel releases, flares, chemical materials, and debris.
Chemical Weapon Disposal	3.3.2.3.3	After World War I, chemical weapons were routinely disposed of in the world's oceans, including the GOM. In some instances, conventional explosives and radiological wastes were dumped along with chemical weapons. Army records document several instances of mustard and phosgene bombs being disposed of in the Gulf of Mexico, originating from New Orleans, Louisiana, and Mobile, Alabama. Chemical weapons disposed of in other locations, and potentially in the Gulf of Mexico, contained hydrogen cyanide, arsenic trichloride, cyanogen chloride, lewisite, tabun, sarin, and VX (Bearden, 2007).
Industrial Waste Dumping	3.3.2.3.4	Between 1940 and 1970, certain offshore locations of the United States were used for the disposal of various industrial wastes and low-level radioactive wastes, these activities being large, unrecorded, and unregulated (USDOC, NOAA, 2004).
Dredged Material Disposal	3.3.2.3.5	Dredged material is described in 33 CFR part 324 as any material excavated or dredged from navigable waters of the United States. Materials from maintenance dredging are primarily disposed of offshore on existing dredged-material disposal areas and in ocean dredged-material disposal sites (ODMDSs). Additional dredged-material disposal areas for maintenance or new project dredging are developed as needed and must be evaluated and permitted by the U.S. Army Corps of Engineers (COE) and relevant State agencies prior to construction. The ODMDSs are regulated by the USEPA under the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act. BOEM anticipates that, over the next 70 years, the amount of dredged material disposed of at ODMDSs would fluctuate, generally within the trends established by COE's district offices.
Land-Based Discharges	3.3.2.3.6	As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources on land that discharge pollutants into waters of the United States. Point sources are discrete conveyances (outfalls) such as pipes or manmade ditches that may contain process water flows and/or precipitation from impervious surfaces. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. In most cases, the NPDES permit program is administered by authorized states (USEPA, 2014).
Trash and Debris	3.3.2.3.7	Marine debris originates from both land-based and ocean-based sources. Forty-nine percent of marine debris originates from land-based sources, 18% originates from ocean-based sources, and 33% originates from general sources (sources that are a combination of land-based and sea-based activities) (USEPA, 2009a).

Table 3-18. General Description of Cumulative Non-OCS Oil- and Gas-Related Impact-Producing Factors. (continued).

Impact-Producing Factor and Specific Sources	Multisale EIS Chapter Reference	General Description
Other Non-OCS Oil- and Gas-Related Activities		
Non-OCS Oil- and Gas-Related Spills	3.3.2.4	The National Research Council (2003) computed petroleum hydrocarbon inputs into North American marine waters for several major categories. The results show that three activities – extraction, transportation, and consumption – are the main sources of anthropogenic petroleum hydrocarbon pollution in the sea.
Air Emissions	3.3.2.5	Air emissions are caused by non-OCS onshore oil and gas activities and offshore State oil and gas activities, including combustion sources from power and heat generation, and the use of compressors, pumps, and reciprocating engines (i.e., boilers, turbines, and other engines); emissions resulting from flaring and venting of gas; and fugitive emissions. Non-OCS oil- and gas-related activities can also include emissions from commercial and home heating, naturally occurring forest fires, motor vehicles, industrial activities in territorial seas and coastal waters, and industrial and transportation activities onshore.
Noise	3.3.2.7	Other noise sources in the GOM are from non-OCS oil- and gas-related activities: vessel propeller cavitation from commercial shipping vessels, research vessels, tourism vessels, and commercial and recreational fishing vessels; sources from other equipment used on vessels (e.g., pingers used in fisheries to prevent animals getting caught in nets); State drilling operations; aircraft; military operations; coastal infrastructure construction (e.g., pile driving); underwater explosions; and natural phenomena such as wind, large storms, or lightning strikes. It is not under BOEM's authority to regulate any of these non-OCS oil- and gas-related noise sources, although some do occur on the OCS.
Military Warning and Water Test Areas	3.3.2.6.1	The Gulf of Mexico (GOMEX) Range Complex contains four separate operating areas: Panama City and Pensacola, Florida; New Orleans, Louisiana, and Corpus Christi, Texas. The operating areas within the GOMEX Range Complex are not contiguous but are scattered throughout the GOM. The GOMEX Range Complex includes special-use airspace with associated warning areas and restricted airspace, and surface and subsurface sea space of the four operating areas. The air space over the GOM is used by the Department of Defense for conducting various military operations. Twelve military warning areas and six Eglin Water Test Areas are located within the GOM (**Figure 2-7**). These military warning areas and Eglin Water Test Areas are multiple-use areas where military operations and oil and gas development have coexisted without conflict for many years. Several military stipulations are planned for leases issued within identified military areas.
Offshore Deepwater Ports and Liquefied Natural Gas (LNG) Terminals	3.3.2.6.2	Deepwater ports are designed to provide access for tankers and LNG carriers to offshore offloading facilities for hydrocarbon products, i.e., crude oil and natural gas. Crude oil passing through an offshore port may be temporarily stored and then transported to shore via pipeline. The term "deepwater port" includes all associated components and equipment, including pipelines, pumping stations, service platforms, mooring buoys, and similar features or equipment to the extent that they are located seaward of the high water mark (USDOT, MARAD, 2015). The LNG terminal means all natural gas facilities located onshore or nearshore (in State waters) that are used to receive, unload, load, store, transport, gasify, liquefy, or process natural gas that is imported to the U.S. from a foreign country, exported to a foreign country from the U.S., or transported in interstate commerce by a waterborne vessel.

Table 3-18. General Description of Cumulative Non-OCS Oil- and Gas-Related Impact-Producing Factors. (continued).

Impact-Producing Factor and Specific Sources	Multisale EIS Chapter Reference	General Description
Gas Hydrates	3.3.2.6.3	Methane hydrates (or gas hydrates) are cage-like lattices of water molecules containing methane, the chief constituent of natural gas found under arctic permafrost, as well as beneath the ocean floor. These may represent one of the world's largest reservoirs of carbon-based fuel. BOEM anticipates that, over the next 40 years, the Joint Industry Project would complete the third leg of its characterization project for GOM gas hydrates in the cumulative impacts area. Within 40 years, it is likely that the first U.S. domestic production from hydrates may occur in Alaska, where gas obtained from onshore hydrates would either support local oil and gas field operations or be available for commercial sale if and when a gas pipeline is constructed to the lower 48 states. However, it is not possible to discount the possibility that first U.S. domestic production of gas hydrates could occur in the GOM.
Renewable Energy	3.3.2.6.4	The two primary categories of renewable energy that have the potential for development in the coastal and OCS waters of the U.S. are wind turbines and marine hydrokinetic systems. The first and most technologically mature renewable energy is wind energy, a popular source of clean and renewable energy that has been in use for centuries.
Aquaculture	3.3.2.6.5	Offshore aquaculture is the rearing of aquatic animals in controlled environments (e.g., cages or net pens) in Federal waters. The NOAA has published the rule to implement a Fishery Management Plan for regulating offshore aquaculture in the Gulf of Mexico (*Federal Register*, 2016a). The rule establishes a comprehensive regulatory program for managing the development of an aquaculture industry in Federal waters of the Gulf of Mexico.
OCS Sand Barrowing	3.3.2.6.6	If OCS sand is desired for coastal restoration or beach nourishment, BOEM uses the following two types of lease conveyances: a noncompetitive negotiated agreement that can only be used for obtaining sand and gravel for public works projects funded in part or whole by a Federal, State, or local government agency; and a competitive lease sale in which any qualified person may submit a bid. BOEM has issued 51 noncompetitive negotiated agreements but has never had a competitive lease sale for OCS sand and gravel resources. BOEM's Marine Minerals Program continues to focus on identifying sand resources for coastal restoration, investigating the environmental implications of using those resources, and processing noncompetitive use requests.
Coastal Environments		
Sea-Level Rise	3.3.2.8.1	As part of the Mississippi River's delta system, both the Delta Plain and the Chenier Plain of the Louisiana Coastal Area (LCA) are experiencing relatively high rates of subsidence. An absolute sea-level rise would be caused by the following two main contributors to the volume of ocean water on the Earth's surface: (1) change in the volume of ocean water based on temperature; and (2) change in the amount of ice locked in glaciers, mountain ice caps, and the polar ice sheets. For the period 1961-2003, thermal expansion of the oceans accounts for only 23 ± 9% of the observed rate of sea-level rise (Bindoff et al., 2007); the remainder is water added to the oceans by melting glaciers, ice caps, and the polar ice sheets. The lowest rate of rise is found in Panama City, Florida, with a rate of 1.6 mm/yr or 0.53 ft/century. Given this range, BOEM anticipates that, over the next 50 years, the northern GOM would likely experience a minimum relative sea-level rise of 80.7 mm (3.18 in) and a maximum relative sea-level rise of 482.6 mm (19.0 in). Sea-level rise and subsidence together have the potential to affect many important areas, including the OCS oil and gas industry, waterborne commerce, commercial fishery landings, and important habitat for biological resources (State of Louisiana, Coastal Protection and Restoration Authority, 2012a).
Erosion	3.3.2.8.2	BOEM conservatively estimates that there are approximately 4,850 km (3,013 mi) of Federal navigation channels, bayous, and rivers potentially exposed to OCS traffic regionwide (Table 3-7 of the 2017-2022 GOM Multisale EIS) and that the average canal is widening at a rate of 0.99 m/year (3.25 ft/year) (Thatcher et al., 2011). Regionwide, this results in a total annual land loss of approximately 480 ac/yr (1,186 ha/yr).
Coastal Restoration	3.3.2.8.3	Coastal Louisiana wetlands make up the seventh largest delta on Earth and undergo about 90% of the total coastal wetland loss in the continental United States. In fact, from 1932 to 2010, coastal Louisiana has undergone a net change

Table 3-18. General Description of Cumulative Non-OCS Oil- and Gas-Related Impact-Producing Factors. (continued).

Impact-Producing Factor and Specific Sources	Multisale EIS Chapter Reference	General Description
Programs		in land area of about 1.2 million ac (0.48 million ha). The first systematic program authorized for coastal restoration in the LCA was the 1990 Coastal Wetlands Planning, Protection and Restoration Act, otherwise known as the "Breaux Act." The projects included in the Louisiana Coastal Master Plan have the potential to build between 580 and 800 mi^2 (1,502 and 2,072 km^2) of land over the next 50 years, depending on future coastal conditions. The Coastal Impact Assistance Program provides Federal grant funds derived from Federal offshore lease revenues to oil-producing states for conservation, protection, or restoration of coastal areas. The Natural Resource Damage Assessment Trustee Council has a statutory responsibility to assess natural resource damages from the *Deepwater Horizon* oil spill, restore trust resources, and seek compensation for lost use of those trust resources.
Saltwater Intrusion	3.3.2.8.4	Saltwater intrusion is one of many factors that impact coastal environments, contributing to coastal land loss. Such impacts can be natural, as when storm surge brings GOM water inland, or anthropogenic, as when navigation or pipeline canals allow tides to introduce high salinity water to interior marshes.
Maintenance Dredging	3.3.2.8.5	Along the Texas Coast there are eight federally maintained navigation channels in addition to the Gulf Intracoastal Waterway. Most of the dredged materials from the Texas channels have high concentrations of silt and clay. Beneficial uses of dredged material include beach nourishment for the more sandy materials and storm reduction projects or ocean disposal for much of the finer-gained material. Current figures estimate that approximately 38% of that average is available for the beneficial use of the dredge materials program (U.S. Dept. of the Army, COE, 2013). The COE reported that, over the last 20 years, approximately 12,545 ha (31,000 ac) of wetlands have been created with dredged materials, most of which are located on the LCA delta plain (U.S. Dept. of the Army, COE, 2013). The remaining material is disposed of in areas described in the dredged material disposal chapter of the 2017-2022 GOM Multisale EIS (i.e., Chapter 3.3.2.3.5).
Natural Events and Processes		
Physical Oceanography	3.3.2.9.1	Physical oceanographic processes in the GOM include the Loop Current, Loop Current eddies, and whirlpool-like features that appear underneath the Loop Current and Loop Current eddies that interact with the bottom. Infrequently observed processes include a limited number of high-speed current events, at times approaching 100 cm/s (39 in/s). These events were observed at depths exceeding 1,500 m (4,921 ft) in the northern GOM (Hamilton and Lugo-Fernandez, 2001; Hamilton et al., 2003) and as very high-speed currents in the upper portions of the water column observed in deep water by several oil and gas operators.
Natural Seeps	3.3.2.9.2	"Natural seeps" is used here to mean the naturally occurring seepage of crude oil and tar into the GOM. These seeps are geographically common and have likely been active throughout history. Natural seeps account for approximately 47% of the crude oil entering the marine environment (Kvenvolden and Cooper, 2003).
Hurricanes	3.3.2.9.3	Twenty-one hurricanes made landfall in the WPA, CPA and EPA during the 1995-2016 hurricane seasons, disrupting OCS oil- and gas-related activity in the GOM (Table 3-31 of the 2017-2022 GOM Multisale EIS). Half of these hurricanes reached a maximum strength of Category 1 or 2 while in the CPA or WPA, while the other half were powerful hurricanes reaching maximum strengths of Category 4 or 5. The current era of heightened Atlantic hurricane activity began in 1995; therefore, the Gulf of Mexico could expect below average hurricanes in the GOM in the near term due to a strong El Nino. Increased hurricanes may occur if El Nino wanes during the first half of the 50-year analysis period and levels return to below-normal activity during the remaining half to three-quarters of the 50-year analysis period.
Climate Change	3.3.2.9.4	Issues related to climate change, including global warming, sea-level rise, and programmatic aspects of climate change relative to the environmental baseline for the GOM are discussed in Chapter 4.2.1 of the 2017-2022 Five-Year Program EIS.

Table 3-18. General Description of Cumulative Non-OCS Oil- and Gas-Related Impact-Producing Factors. (continued).

Impact-Producing Factor and Specific Sources	Multisale EIS Chapter Reference	General Description
Mississippi River-Related Issues		
Mississippi River Hydromodification	3.3.2.10	The Mississippi River has been anchored in place by engineered structures built in the 20th century and has been hydrologically isolated from the delta it built. The natural processes that allowed the river to flood and distribute alluvial sediments across the delta platform and channels to meander have been shut down. Hydromodifying interventions include construction of (1) levees along the river and distributary channel systems, (2) upstream dams and flood control structures that impound sediment and meter the river flow rate, and (3) channelized channels with earthen or armored banks. Once the natural processes that act to add sediment to the delta platform to keep it emergent are shut down, subsidence begins to outpace deposition of sediment.
Mississippi River Eutrophication	3.3.2.11	The Mississippi River Basin drains 41 percent of the contiguous United States. The basin covers more than 1,245,000 mi^2 (3,224,535 km^2) and includes all or parts of 31 states and 2 Canadian provinces (U.S. Dept. of the Army, COE, 2015). Dissolved pollutants, including nutrients, enter surface water within the Mississippi River Basin via uncontained runoff and groundwater discharge (nonpoint sources).
Hypoxia	3.3.2.12	The Gulf of Mexico hypoxic zone is a band of oxygen-stratified water that stretches along the Texas-Louisiana shelf each summer where the dissolved oxygen concentrations are less than 2 milligrams/liter (USEPA, 2015). Other small hypoxic areas infrequently form at the discharge of smaller rivers along the Gulf Coast; however, in the Gulf of Mexico, the hypoxic zone resulting from the Mississippi and Atchafalaya Rivers is by far the predominant feature. The hypoxic zone is the result of excess nutrients, primarily nitrogen, carried downstream by rivers to discharge to coastal waters.
Sedimentation	3.3.2.13	The lower Mississippi River, from Cairo, Illinois, to the Gulf of Mexico, transported an average of 150 million tons (with a range of 70-230 million tons) of sediment annually between 1963 and 2005. Historically, the quantity of sediment derived from catchment erosion has been affected by changes in land use and river management, increasing in the 19th and early 20th centuries before decreasing due to soil conservation and improved land management. Seasonal analysis shows that, in the spring, the median load is approximately four times the median total load in the fall. The median sediment size is mostly silt, but it coarsens during the winter and spring when 10% of the sediment load is coarser than fine sand (U.S. Dept. of the Army, European Research Office, 2008).

CHAPTER 4

DESCRIPTION OF THE ENVIRONMENT AND IMPACT ANALYSIS

What's in This Chapter?

- **Chapter 4** describes the affected environment and potential environmental consequences of a proposed regionwide lease sale.
- Resources analyzed are as follows:
  - Air Quality
  - Water Quality
  - Coastal Habitats (Estuarine Systems, and Coastal Barrier Beaches and Associated Dunes)
  - Deepwater Benthic Communities
  - *Sargassum* and Associated Communities
  - Live Bottom Habitats (Topographic Features, and Pinnacles and Low-Relief Features)
  - Fishes and Invertebrate Resources
  - Birds
  - Protected Species (Marine Mammals, Sea Turtles, Beach Mice, Protected Birds, and Protected Corals)
  - Commercial Fisheries
  - Recreational Fishing
  - Recreational Resources
  - Archaeological Resources
  - Socioeconomic Issues (Land Use and Coastal Infrastructure, Economic Factors, and Social Factors, Including Environmental Justice)
- Impact-producing factors and impact-level definitions are identified for each resource.
- The analyses of environmental consequences consider the potential impacts from routine activities, accidental events, and cumulative impacts; and incomplete or unavailable information.
- Other analyses in this chapter include the following:
  - Unavoidable Adverse Impacts of a Proposed Action
  - Irreversible and Irretrievable Commitment of Resources
  - Relationship Between the Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

4 DESCRIPTION OF THE AFFECTED ENVIRONMENT AND IMPACT ANALYSIS

4.0 OVERVIEW

The impacts of the 10 regionwide lease sales proposed in the 2017-2022 Five-Year Program were analyzed in the 2017-2022 GOM Multisale EIS. This Supplemental EIS has been prepared to inform decisions for the proposed 2018 GOM lease sales and analyzes a single proposed action (i.e., a proposed regionwide lease sale in the Gulf of Mexico) as scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS contains analyses of the potential environmental impacts that could result from a proposed regionwide lease sale in the Gulf of Mexico as scheduled in the 2017-2022 Five-Year Program, but the analyses may be applied and supplemented as necessary to inform decisions for each of the remaining proposed lease sales scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS supplements, tiers from, updates, summarizes, and incorporates by reference all of the relevant analyses from the 2017-2022 Five-Year Program EIS and 2017-2022 GOM Multisale EIS, which are referenced below:

- November 2016 – *Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022—Final Programmatic Environmental Impact Statement* (2017-2022 Five-Year Program EIS; USDOI, BOEM, 2016b); and

- March 2017 – *Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement* (2017-2022 GOM Multisale EIS; (USDOI, BOEM, 2017a).

An analysis of the routine activities, accidental events, and cumulative impacts of a proposed action on the environmental, socioeconomic, and cultural resources of the Gulf of Mexico can be found in Chapter 4 of the 2017-2022 GOM Multisale EIS, which is hereby incorporated by reference.

The purpose of this Supplemental EIS is to determine if there are significant new circumstances or information bearing on a proposed action or its impacts, as previously discussed in the 2017-2022 GOM Multisale EIS, and if so, to disclose those changes and conclusions. This includes all relevant new information available since publication of the 2017-2022 GOM Multisale EIS. As will be demonstrated within each environmental, socioeconomic, and cultural resources chapter in this Supplemental EIS, no new circumstances or new information was identified since the publication of the 2017-2022 GOM Multisale EIS and the conclusions reached in the 2017-2022 GOM Multisale EIS remain the same for this Supplemental EIS.

> ***Chapter 4** describes the affected environment and potential environmental consequences of a single proposed lease sale.*

As discussed in **Chapter 1.2**, BOEM makes individual decisions on whether and how to proceed with each proposed lease sale pursuant to the OCSLA's staged leasing process. The decision on whether and how to proceed with proposed Lease Sale 250, which is the first lease sale proposed for 2018, will be made following the completion of this NEPA analysis. A separate decision will be made on whether and how to proceed with the second lease sale proposed for 2018, which is Lease Sale 251. Decisions on the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program will be made based on additional NEPA review that may update this Supplemental EIS as necessary. This chapter describes the affected environment and the potential impacts of routine activities, reasonably foreseeable accidental events, and cumulative impacts caused by a proposed lease sale and the alternatives on these resources.

This chapter is organized by groups of resources. The chapter is divided into the physical factors (i.e., air and water quality), biological factors (i.e., habitat resources followed by the fauna that are found in or utilize these habitats), and finally the social environment, including commercial fisheries, recreational resources, land use, and environmental justice.

- Air Quality (**Chapter 4.1**)
- Water Quality (**Chapter 4.2**)
- Habitat Resources
  - Coastal Habitats (**Chapter 4.3**)
  - Deepwater Benthic Communities (**Chapter 4.4**)

  - *Sargassum* and Associated Communities (**Chapter 4.5**)
  - Live Bottom Habitats (**Chapter 4.6**)
- Faunal Resources
  - Fish and Invertebrate Resources (**Chapter 4.7**)
  - Birds (**Chapter 4.8**)
  - Protected Species (**Chapter 4.9**)
- Social Environment
  - Commercial Fisheries (**Chapter 4.10**)
  - Recreational Fishing (**Chapter 4.11**)
  - Recreational Resources (**Chapter 4.12**)
  - Archaeological Resources (**Chapter 4.13**)
  - Human Resources and Land Use (**Chapter 4.14**)

The habitat resource chapters focus on the impact-producing factors that would affect their environment while the other chapters concentrate on the biological effects of impact-producing factors on fauna and human resources. To decrease repetition, the habitat information is generally not restated in the fauna chapters and vice versa.

As discussed above, this Supplemental EIS tiers from and uses information contained in both the 2017-2022 Five-Year Program EIS (USDOI, BOEM, 2016b) and 2017-2022 GOM Multisale EIS (USDOI, BOEM, 2017a). BOEM concentrated on providing a focused analysis by incorporating information by reference from these documents. Programmatic aspects of the potential impacts of climate change relative to the environmental baseline for the Gulf of Mexico OCS Program are discussed within each resource and in Chapter 1 of the 2017-2022 Five-Year Program EIS. In addition, the potential for alternative energy on the Federal OCS is addressed in the 2017-2022 Five-Year Program EIS (Chapters 1.4.6.1 and 2.7.4), from which this Supplemental EIS tiers. Furthermore, supporting technical information in previous NEPA reviews have been developed as white papers and are summarized and incorporated by reference as appropriate. These white papers include the *OCS Regulatory Framework* (Cameron and Matthews, 2016), *Catastrophic Spill Event Analysis* (USDOI, BOEM, 2017b) and *Essential Fish Habitat Assessment* (USDOI, BOEM, 2016c). BOEM has also prepared a technical report on climate change as part of the 2017-2022 Five-Year Program EIS, which is incorporated by reference into this Supplemental EIS (Wolvovsky and Anderson, 2016).

This Supplemental EIS was prepared with consideration of potential changes to or new information about the baseline conditions of the physical, biological, and socioeconomic resources. Current baselines (including past and present events) are described for all resources in full detail under their respective "Affected Environment" sections in the 2017-2022 GOM Multisale EIS, which is hereby incorporated reference, and are summarized in this Supplemental EIS. Past events such as Hurricanes Katrina and Rita and the *Deepwater Horizon* explosion, oil spill, and response have potentially affected multiple resources over a large area. Specific to the *Deepwater Horizon*, the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees, 2016), which its intention was assessing and creating restoration plans to relieve injuries from the *Deepwater Horizon* explosion, oil spill, and response to natural resources and services, has been completed. The injuries assessed within the PDARP/PEIS do not necessarily equate the baseline as defined in NEPA, but they were considered when determining the baseline for our impact determinations.

The level of adverse effect depends on many factors, including the sensitivity of the resource as well as the sensitivity of the environment in which the resource is located. All effects may not currently be known and some could take years to fully develop (refer to the "Incomplete or Unavailable Information" for each resource). The analyses of impacts from the *Deepwater Horizon* explosion, oil spill, and response on the physical, biological, and socioeconomic resources in this Supplemental EIS, are based on credible scientific information that was publicly available at the time this document was prepared. This credible scientific information was applied using accepted methodologies, including numerical modeling of data and scientific writing methods to convey the information of BOEM's subject-matter experts' technical knowledge and experience. However, BOEM and the Deepwater Horizon Natural Resource Damage Assessment Trustee Council continue to study, measure, and interpret impacts arising out of that spill. BOEM continues to analyze the *Deepwater Horizon* explosion, oil spill, and response as information becomes available, and it was evaluated as part of the baseline for resources in this Supplemental EIS. Thus, there are instances in which BOEM is faced with incomplete or unavailable information (refer to **Chapter 4.0.2.4**) that may be relevant to evaluating reasonably foreseeable significant adverse impacts on the human environment. Further, a low-probability catastrophic event and the resulting analysis of potential effects are presented in *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b).

4.0.1 What Encompasses the Affected Environment for a Gulf of Mexico Lease Sale?

Each resource chapter includes a summarized description of the affected environment and a summarized analysis of the potential environmental consequences of the alternatives for that particular resource. The Federal and State waters of the Gulf of Mexico and the adjacent coastal states are generally the affected environment described in each resource chapter. Current baselines are described for all resources under their respective "Affected Environment" sections in Chapter 4 of the 2017-2022 GOM Multisale EIS and are hereby incorporated reference. Specific to the PDARP/PEIS (Deepwater Horizon Natural Resource Damage Assessment Trustees, 2016), the altered baseline includes individual protected species directly affected by the *Deepwater Horizon* explosion, oil spill, and response, an unexpected unique catastrophic event. BOEM understands that each oil-spill event is unique and that its outcome depends on several factors, including time of year and location of the release relative to winds, currents, land, and sensitive resources, as well as specifics of the well and response effort. BOEM also understands that the severity of impacts from an oil spill cannot be predicated on volume alone. BOEM has analyzed a low-probability catastrophic event (USDOI, BOEM, 2017b) in conjunction with its analysis of potential effects, as requested by CEQ pursuant to its regulation at 40 CFR § 1502.22. A low-probability catastrophic spill is, by definition, not reasonably certain to occur. Other methods of analysis are neither significantly limited in their applicability and availability nor would they provide any meaningful or useful information to be used to assess the risk of catastrophic spill occurrence at this programmatic level of oil and gas activities in the GOM. The return period of a catastrophic oil spill in OCS areas is estimated to be 165 years, with a 95 percent confidence interval between 41 years and more than 500 years (Ji et al., 2014).

4.0.2 How are the Potential Environmental Consequences Determined?

The analyses of potential impacts to the wide variety of physical, environmental, and socioeconomic resources in the vast area of the GOM and adjacent coastal areas is very complex. For this Supplemental EIS, a set of assumptions and a scenario were developed, along with descriptions of impact-producing factors that could occur from routine OCS oil- and gas-related activities, including accidental events. Analysis of the various alternatives considers these impact-producing factors (described in detail in **Chapter 3**) within a distinct framework that includes frequency, duration, and geographic extent. Frequency (whether rare, intermittent, or continuous) refers to how often the factor occurs over the entire analysis period of 50 years for routine activities and accidental events. Duration refers to how long the factor lasts from less than a year to many years. Geographic extent covers what areas are affected, and depending on the factor, how large of an area is affected.

> *An impact-producing factor is an activity or process, as a result of a proposed lease sale, that could cause impacts on the environmental or socioeconomic setting. **Chapter 3** provides a description of all possible impact-producing factors considered in this analysis.*

Using this information, the interdisciplinary team of subject-matter experts applied knowledge and experience to conduct analyses of the potential effects of a proposed lease sale on resources. Specialized education, experience, and technical knowledge are required of these subject-matter experts, as well as familiarity with the numerous impact-producing factors associated with OCS oil- and gas-related activities and other activities that can cause cumulative impacts in the area to conduct this analysis. Knowledge and practical working experience of major environmental laws and regulations such as NEPA, the Clean Water Act, Clean Air Act, Coastal Zone Management Act (CZMA), ESA, Marine Mammal Protection Act, Magnuson-Stevens Fishery Conservation and Management Act, and others are also required to conduct this analysis. In order to accomplish this task, BOEM has assembled an interdisciplinary team with many years of collective experience. The vast majority of this team has advanced degrees with a high level of knowledge related to the particular resources discussed in this chapter. This team prepares the input to BOEM's lease sale EISs and a variety of subsequent postlease NEPA reviews, and is also involved with ESA, Essential

Fish Habitat Assessment, and CZMA consultations. In addition, this same staff is also directly involved with the development of studies conducted by BOEM's Environmental Studies Program. The results of these studies feed directly into the Bureau of Ocean Energy Management's NEPA analyses.

How Were Impact Levels Defined?

The environmental consequences in each resource chapter include an analysis of applicable impact-producing factors from the categories of routine activities, accidental events, and cumulative impacts that would occur under any of the action alternatives (i.e., Alternatives A, B, C, and D).

It must be emphasized that, in arriving at the overall conclusions for certain environmental resources (e.g., birds, fisheries, and wetlands) for each alternative, the conclusions are based on potential impacts to the resources or species population as a whole, not to individuals, small groups of animals, or small areas of habitat. BOEM analyzes impacts on a finer geographic scale and mitigations that are appropriate for consideration through site-specific environmental reviews (refer to Appendix A of the 2017-2022 GOM Multisale EIS). Each resource topic discussion includes a threshold effects determination and includes a resource-specific definition of impact level. Additionally, potential beneficial effects of a proposed action have also been considered and identified in individual resource chapters. For example, implementation of a proposed lease sale is anticipated to have beneficial impacts in the Area of Interest for economics due to the direct and indirect spending associated with the oil and gas industry. For this Supplemental EIS, effects thresholds are defined using four categories of significance.

- **Negligible** – Impacts may or may not cause observable changes to natural conditions; regardless, they do not reduce the integrity of a resource.
- **Minor** – Impacts cause observable and short-term changes to natural conditions but they do not reduce the integrity of a resource.
- **Moderate** – Impacts cause observable and short-term changes to natural conditions and/or they reduce the integrity of a resource.
- **Major** – Impacts cause observable and long-term changes to natural conditions and they reduce the integrity of a resource.

The potential magnitude of impact using these resource-specific definitions are provided in most resource chapters as a summary table to help the reader quickly identify the level of potential impacts for each impact-producing factor.

The conclusions developed by BOEM's subject-matter experts regarding the potential effects of a proposed lease sale for most resources are necessarily qualitative in nature; however, they are based on the science-based judgment of the highly trained subject-matter experts. Staff approach this effort utilizing credible scientific information and apply it to the subject resources using accepted methodologies. It is important to note that, barring another catastrophic oil spill, which is a low-probability accidental event not expected to occur and therefore not part of a proposed action, the adverse impacts associated with a proposed lease sale are expected to be small, and beneficial impacts are projected as well for certain activities and species. This is because of BOEM's potential use of lease sale stipulations and mitigations, site-specific mitigations that may become conditions of plan or permit approval at the postlease stage, and mitigations required by other State and Federal agencies that help to avoid or minimize many of the impacts. Over the years, a suite of lease stipulations and mitigating measures has been developed to eliminate or ameliorate potential environmental effects, where implemented (refer to Appendix B, "Commonly Applied Mitigation Measures," of the 2017-2022 GOM Multisale EIS). BOEM's primary mitigative method is the avoidance of impacts, which is primarily implemented during approval of postlease activities. In many instances, these were developed in coordination with other natural resource agencies such as NMFS and FWS. Informal and formal consultation with other Federal agencies and affected States, and commenting opportunities for the public are implemented to assist in the development of the information and analyses in this Supplemental EIS. Specifically, information requests soliciting input on the proposed lease sales were issued during scoping for this Supplemental EIS (refer to **Chapter 5**). The impact-level conclusions reached in each resource area consider the applicable impact-producing factors, the level of activity, and the geographic area of each alternative.

Lease sale stipulations considered for a proposed lease sale may include the Topographic Features Stipulation; Live Bottom (Pinnacle Trend) Stipulation; Military Areas Stipulation; Evacuation Stipulation; Coordination Stipulation; Blocks South of Baldwin County, Alabama, Stipulation; Protected Species Stipulation; United Nations Convention on the Law of the Sea Royalty Payment Stipulation; Below Seabed Operations Stipulation; and the Stipulation on the Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (Transboundary Stipulation). The Topographic Features and Live Bottom (Pinnacle Trend) Stipulations have been applied as programmatic mitigation in the 2017-2022 Five-Year Program EIS (USDOI, BOEM, 2016b) and, therefore, would apply to all leases issued under the 2017-2022 Five-Year Program in the designated lease blocks. Site-specific postlease mitigations may include buffer zones and avoidance criteria to protect sensitive resources such as areas of deepwater benthic communities, topographic features, and historic shipwrecks. Mitigations may also be required by other agencies (i.e., the U.S. Army Corps of Engineers and State Coastal Zone Management agencies) to avoid or reduce impacts from OCS oil- and gas-related activities, e.g., boring under beach shorelines and the rerouting of pipelines to reduce or eliminate impacts from OCS pipelines that make landfall. These mitigations and their potential effect on reducing or eliminating impacts from a proposed lease sale are analyzed in this chapter.

Under all four action alternatives, postlease activities would be reviewed on a case-by-case basis and the applicable commonly applied mitigating measures (refer to Appendix B of the 2017-2022 GOM Multisale EIS) would be identified during site-specific reviews of plans and permits. This avoids excessive replication of discussion of similar if not identical impacts throughout the entire document, allowing the reader to focus on the differences between the alternatives.

4.0.2.1 Routine Activities

The types of routine activities that could occur from all operations as a result of a single proposed lease sale are described in **Chapter 3.1**. The major types of routine activities include geological and geophysical surveys; exploration, development, and production drilling; infrastructure emplacement and presence, including pipelines; transportation, including barges, vessels, and helicopters; discharges and wastes; decommissioning and removal; coastal infrastructure; air emissions; noise; and safety issues. The time period for postlease activities related to a single proposed lease sale is 50 years.

4.0.2.2 Accidental Events

A summary of the information on accidental events that are reasonably foreseeable from all operations conducted under the OCS Program, as well as information on the number and sizes of spills from non-OCS oil- and gas-related sources is provided in **Chapter 3.2**. The types of accidental events that could reasonably be expected as a result of postlease activities include oil spills, losses of well control, accidental air emissions, pipeline failures, vessel and helicopter collisions, chemical and drilling-fluid spills, and spill response as a result of a proposed lease sale.

4.0.2.3 Cumulative Impacts

The cumulative analysis considers impacts to physical, biological, and socioeconomic resources that may result from the incremental impact of a proposed lease sale when added to all past, present, and reasonably foreseeable future human activities and natural processes. However, most resources consider the past and present cumulative impacts as part of the baseline environmental conditions, and they are covered where relevant in the affected resource description. It is reasonably foreseeable to assume that lease sales would continue to occur, as they have historically, for many years to come in the Gulf of Mexico region, based on resource availability, existing infrastructure, and projected time lapses required for any other major energy sources to come online. However, the level of activities (exploration wells, production wells, and pipelines) becomes more speculative as time is projected further into the future. The causes for this are uncertainty in long-term oil price forecasts, hydrocarbon resource potential, cost of exploration, development and production, and various resource constraints (e.g., drilling rig availability versus the amount of acreage leased from a lease sale). Furthermore, OCSLA provides for phased decisionmaking, each of which is a decision subject to NEPA. The OCSLA stages include the Five-Year Program stage to identify a schedule of leases over the period; the lease sale stage; the exploration stage; the development and production stage; and ultimately decisions on how a lessee may proceed with decommissioning. These reviews require consideration of cumulative impacts that would factor in changing environmental baselines, oil and gas price forecasts, and technology advancements, among others. Additionally, even though continued consumer demand is likely, new advances in technology (both on upstream development and production ends and downstream user ends) can potentially change the level of projected activities and how they are conducted. These could further minimize environmental risks. Technology advancements and organizational effectiveness could also further reduce projected air emissions, wastewater quantities, and other impact producing factors such as helicopter and vessel trips and accidental events.

Therefore, cumulative impact assessment for this Supplemental EIS considers existing environmental baseline conditions, past OCS oil- and gas-related and non-OCS oil- and gas-related activities in the GOM, projected future activities as a result of past lease sales, 50 years of incremental projected activities as a result of the proposed lease sales during the 2017-2022 Five-Year Program, and reasonably assumes projected activities for future lease sales based on current trends. Non-OCS oil- and gas-related activities include, but are not limited to, import tankering; marine transportation; State oil and gas activity; recreational, commercial, and military vessel traffic; offshore liquefied natural gas activity; recreational and commercial fishing; onshore development; and natural processes. The time period for reasonably foreseeable future actions are dependent upon the nature of each resource and are therefore defined in each resource chapter. The types of cumulative activities that could reasonably occur are described in **Chapter 3.3**.

4.0.2.4 Incomplete or Unavailable Information

Throughout this chapter, where information was incomplete or unavailable, BOEM complied with its obligations under NEPA to determine if the information was relevant to reasonably foreseeable significant adverse impacts; if so, whether it was essential to a reasoned choice among alternatives; and, if it was essential, whether it can be obtained and whether the cost of obtaining the information is exorbitant, as well as whether scientifically credible information using generally accepted scientific methodologies can be applied in its place (40 CFR § 1502.22).

The most notable incomplete or unavailable information relates to some aspects of the effects from the *Deepwater Horizon* explosion, oil spill, and response. Credible scientific data regarding the potential short-term and long-term impacts from the *Deepwater Horizon* explosion, oil spill, and response on some GOM resources have become available. However, information relating to long-term effects continue to be studied and remain incomplete at this time, and it could be many years before this information becomes available. The Trustees have released the PDARP/PEIS (Deepwater Horizon Natural Resource Damaage Assessment Trustees, 2016). However, there remains information being developed through the Natural Resource Damage Assessment (NRDA) process, as well as studies being conducted as part of an adaptive restoration plan for various resources, that are not yet available to the public. BOEM will continue to use the best scientific research as it becomes available for their analysis. Nonetheless, BOEM's subject-matter experts acquired and used newly available, scientifically credible information; determined that other additional information was not available absent exorbitant expenditures or could not be obtained regardless of cost in a timely manner; and where gaps remained, exercised their best professional judgment to extrapolate baseline conditions and impact analyses using accepted methodologies based on credible information. While incomplete or unavailable information could conceivably result in potential future shifts in baseline conditions of habitats that could affect BOEM's decisionmaking, BOEM has determined that it can make an informed decision at this time without this incomplete or unavailable information. BOEM's subject-matter experts have applied other scientifically credible information using accepted theoretical approaches and research methods, such as information on related or surrogate species. Moreover, BOEM will continue to monitor these resources for effects caused by the *Deepwater Horizon* explosion, oil spill, and response, and will ensure that future BOEM environmental reviews take into account any new information that may emerge.

Furthermore, BOEM has considered the reasonably foreseeable impacts of a low-probability catastrophic oil spill in a white paper. These types of events, such as the one that resulted from the *Deepwater Horizon* explosion, are not reasonably expected to occur and therefore are not part of a proposed action. BOEM has prepared the *Catastrophic Spill Event Analysis* white paper, which provides a summary of existing credible scientific evidence related to this issue and BOEM's evaluation of the potential impacts to the physical, biological, and socioeconomic resources and conditions based upon theoretical approaches or research methods generally accepted in the scientific community (USDOI, BOEM, 2017b). The white paper was included in previous lease sale EISs as an appendix and subject to public review and comment. To avoid repetition and redundancies, the white paper is incorporated by reference and is publicly available on BOEM's website at http://www.boem.gov/nepaprocess/. BOEM updated the analysis in the white paper and will update it again should new information become available relevant to the reasonably foreseeable impacts of a catastrophic spill event.

In addition, BOEM used the initial results of the "Air Quality Modeling in the Gulf of Mexico Region" study, which was the best available science at this time, to draw impact conclusions on air quality. BOEM is in the process of updating the air quality modeling based on public comments, and the results of the final air quality modeling will be included in a future NEPA analysis that will be available for public review and comment. BOEM is considering correcting the initial air quality model for sea-salt estimates, along with caisson emissions, decommissioned structures, and locations of platforms. In addition, BOEM is considering tagging the model for a single proposed lease sale, which was not done in the initial model run.

The revised air quality model run will not be completed before the publication of this Final Supplemental EIS. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as a reference for NEPA analysis. The air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated. In order to address data gaps and current impacts for this analysis, BOEM used the initial air quality modeling results, emissions inventory data, available studies of OCS oil- and gas-related activities, postlease exploration and development plan information, and current proposed lease sale scenario data, as well as previous proposed action scenario data, to reach the impact conclusions. This approach was adequate because it assessed a combination of pollutants from OCS oil- and gas-related activities, non-OCS oil- and gas-related activities, and non-oil and gas activities.

It should be noted that no activities beyond certain ancillary activities are actually authorized by the lease; therefore, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1**). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts. During its review of any plan submitted postlease, BOEM conducts an air quality review to determine if additional controls are necessary. At this postlease stage, BOEM has the authority to disapprove or require additional mitigation to reduce impacts from site-specific activities as additional information related to the revised air quality modeling becomes available. It is anticipated that new air quality modeling results will be available for consideration before any plan is submitted on a block leased as a result of proposed Lease Sale 250. Therefore, while additional air quality data would be useful in consideration of this proposed lease sale, it is not necessary for a decision on this proposed lease sale. Any concerns raised by the modeling study will be further refined by the time plans are submitted, and/or additional plan-specific modeling may be required consistent with BOEM's regulations when the plan is submitted for approval.

4.0.2.5 Alternatives

Each resource chapter includes a summary of the relevant impact-producing factors to that specific resource from the routine activities, accidental events, and cumulative impacts that are described in **Chapter 3**. After this general analysis, the scale and location of these activities, events, and impacts are considered for each alternative.

Alternative A

In general, Alternative A could potentially result in 1.2-4.2 percent of the forecasted cumulative OCS oil and gas activity in the Gulf of Mexico and would occur in the WPA, CPA, and EPA portions of the proposed lease sale area (refer to **Chapter 3.1.2**). Most of the activity (up to 83%) of a proposed lease sale under Alternative A is expected to occur in the CPA and EPA portions of the proposed lease sale area, while up to 19 percent of the activity could occur in the WPA portion of the proposed lease sale area. Approximately 75.7 million acres (82%) of the regionwide lease sale area would be available for lease under this alternative.

Alternative B

Alternative B could potentially result in 1.0-3.6 percent of the forecasted cumulative OCS oil and gas activity in the Gulf of Mexico, or a slightly smaller amount of activity than proposed for Alternative A, and would be located geographically in the CPA and EPA portions of the proposed lease sale area (refer to **Chapter 3.1.2**). Approximately 49.8 million acres (54%) of the regionwide lease sale area would be available for lease. While all of the leases issued under this alternative would occur in the CPA and EPA portions of the proposed lease sale area, activities such as vessel support and pipeline or coastal infrastructure could occur in the WPA portion of the proposed lease sale area.

Alternative C

Alternative C could potentially result in 0.2-0.6 percent of the forecasted cumulative OCS oil and gas activity in the Gulf of Mexico, which is much smaller than either Alternative A or B (refer to

Chapter 3.1.2). Approximately 25.9 million acres (28%) of the regionwide lease sale area would be available for lease. While all of the leases issued under this alternative would occur in the WPA portion of the proposed lease sale area, activities such as vessel support and pipeline or coastal infrastructure could occur in the CPA/EPA portion of the proposed lease sale area.

Alternative D

Under Alternative D, the number of blocks that would become unavailable for lease represents only a small percentage of the total number of blocks to be offered under Alternative A, B, or C (<4%), even if blocks subject to all three stipulations were excluded. However, it is also possible (and BOEM believes more reasonable to expect) that Alternative D would only shift the location of offshore infrastructure and activities farther from these sensitive zones and not lead to a reduction in offshore infrastructure and activities.

Alternative E

Alternative E is the cancellation of a single proposed lease sale. Under Alternative E, there would be no routine activities or accidental events as a result of a proposed lease sale. Therefore, there would be no associated impacts resulting from a proposed lease sale. Cancellation of a proposed lease sale, however, would not stop all OCS oil- and gas-related activities. Activities related to previously issued leases and permits (as well as those that may be issued in the future under separate decision) related to the OCS Oil and Gas Program would continue and could have impacts similar to those described in each resource chapter. However, no new activities related to a proposed lease sale would proceed and, therefore, those additional impacts would be avoided.

4.0.2.6 Summary

The summaries in this chapter have thoroughly examined the existing credible scientific evidence that is relevant to evaluating the reasonably foreseeable significant impacts of a proposed lease sale and the alternatives on the environment. Detailed analyses from the 2017-2022 GOM Multisale EIS have been reanalyzed and incorporated by reference. All reasonably foreseeable impacts, including beneficial ones, were considered. Impacts that could have catastrophic consequences, even if their probability of occurrence is low, not reasonably expected, and not part of a proposed action are considered in the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b). Throughout this chapter, where information was incomplete or unavailable, BOEM complied with its obligations under NEPA to determine if the information was relevant to reasonably foreseeable significant adverse impacts; if so, whether it was essential to a reasoned choice among alternatives; and, if it was essential, whether it can be obtained and whether the cost of obtaining the information is exorbitant, as well as whether credible scientific information applied using generally accepted scientific methodologies can be used in its place (40 CFR § 1502.22). BOEM has made conscientious efforts to comply with the spirit and intent of NEPA and to be comprehensive in its analyses of potential environmental impacts.

4.1 AIR QUALITY

Typical Supplemental EIS analyses summarize the analyses from which they tier and re-analyze the conclusions based on new information. However, since this initial air quality analysis was completed for the Final 2017-2022 GOM Multisale EIS and did not have the benefit of public review, the complete initial analysis was included in the Draft Supplemental EIS for public review and comment. Comments from Federal agencies, industry, and the general public obtained during the public comment period and from meetings concerning the initial air quality model are being taken into consideration as BOEM revises the initial air quality model, which will be included in a future NEPA analysis that will be available for public review and comment. BOEM is considering correcting the initial air quality model for sea-salt estimates, along with caisson emissions, decommissioned structures, and locations of platforms. In addition, BOEM is considering tagging the model for a single proposed lease sale, which was not done in the initial model run.

The revised air quality model run will not be completed before the publication of this Final Supplemental EIS. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as a reference for NEPA analysis. The air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated. In order to address data gaps and current impacts for this analysis, BOEM used the initial air quality modeling results, emissions inventory data, available studies of OCS oil- and gas-related activities, postlease exploration and development plan information, and current proposed lease sale scenario data, as well as previous proposed action scenario data, to reach the impact conclusions.

However, no activities beyond certain ancillary activities are actually authorized by the lease; therefore, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1**). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts. During its review of any plan submitted postlease, BOEM conducts an air quality review to determine if additional controls are necessary. At this postlease stage, BOEM has the authority to disapprove or require additional mitigation to reduce impacts from site-specific activities as additional information related to the revised air quality modeling becomes available. It is anticipated that new air quality modeling results will be available for consideration before any plan is submitted on a block leased as a result of proposed Lease Sale 250. Therefore, while additional air quality data would be useful in consideration of this proposed lease sale, it is not necessary for a decision on this proposed lease sale. Any concerns raised by the modeling study will be further refined by the time plans are submitted, and/or additional plan-specific modeling may be required consistent with BOEM's regulations when the plan is submitted for approval.

The analyses of the potential impacts of routine activities and accidental events associated with a GOM proposed lease sale and its incremental contribution to the cumulative impacts to air quality are presented in this chapter. The approach of the analysis is to focus on the greatest reasonably foreseeable impact-producing factors from OCS oil- and gas-related routine activities (from exploration, development, and production), as well as accidental events and cumulative impacts, and to define the impact levels for each. The impact-producing factors considered and analyzed include (1) OCS oil- and gas-related emissions sources related to drilling and associated vessel support, production and the connected action of vessel support, flaring and venting, decommissioning, and oil spills; (2) other emissions not caused by OCS oil and gas development (i.e., non-OCS oil- and gas-related emissions such as State oil and gas programs, onshore industrial and transportation sources, and natural events); and (3) the incremental contribution of all postlease activities as a result of a single proposed lease sale. The impact-level definitions and the analyses supporting these conclusions are discussed in this chapter.

In order to assess the impacts from these oil- and gas-related activities, BOEM used an emissions inventory along with air dispersion and photochemical modeling. While an emissions inventory is an accounting of air emissions of criteria pollutants, precursors of criteria pollutants, and hazardous air pollutants from a variety of air emission sources, the comprehensive data from the inventory can be used to support air quality modeling. Typically, impacts are determined through modeling, and concentrations are reported. These impacts are then compared with reference measures, such as National Ambient Air Quality Standards (NAAQS), Significant Impact Levels (SILs), etc., to support impact conclusions. For the 2017-2022 GOM Multisale EIS and this Supplemental EIS analyses, BOEM used the following: (1) the results of the *Year 2011 Gulfwide Emissions Inventory* (GWEI) study, herein incorporated by reference (Wilson et al., 2014); (2) the changes in regulations as a result of the 2010 *Deepwater Horizon* explosion, oil spill, and response to determine the impact-producing factors (**Table 4-1**) that have the greatest impact potential in the GOM region; and (3) the results of the initial "Air Quality Modeling in the Gulf of Mexico Region" study to determine impacts. Pollutants included the emissions inventory support analysis of air quality impacts in terms of impacts on the attainment of the NAAQS and on air quality-related values (AQRVs), including acid deposition and visibility. The results of the emissions inventory study and air modeling study are discussed later in this chapter. The initial "Air Quality Modeling in the Gulf of Mexico Region" study includes technical support documents (**Appendices B-D**) that provide detailed descriptions of the emissions data, meteorological and photochemical grid, modeling parameters and methodology, and the results of the air quality impact analysis. As noted above, the initial air quality modeling is currently being revised, and the results of the final air quality modeling will be included in a future NEPA analysis that will be available for public review and comment. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as a reference for NEPA analysis. The air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated. In addition, no activities beyond certain ancillary activities are actually authorized by the lease; therefore, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1**). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts.

Table 4-1. Air Quality Impact-Producing Factors That Are Reasonably Foreseeable.

Air Quality	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Drilling	Minor	Minor	Minor	Minor	None
Production	Minor	Minor	Minor	Minor	None
Vessel Support during Drilling and Production	Minor	Minor	Minor	Minor	None
Routine Flaring and Venting	Minor	Minor	Minor	Minor	None
Decommissioning	Minor	Minor	Minor	Minor	None
Accidental Impacts					
Emergency Flaring and Venting	Minor	Minor	Minor	Minor	None
Oil Spills	Minor	Minor	Minor	Minor	None
Cumulative Impacts					
Incremental Contribution[2]	Minor	Minor	Minor	Minor	None
OCS Oil and Gas[3]	Moderate				
Non-OCS Oil and Gas[4]	Moderate				

[1] The analysis supporting these conclusions is discussed in detail in the environmental consequences “Environmental Consequences” chapter below.
[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.
[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.
[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

Impact-Level Definitions

The following impact categories and definitions are used:

- **Negligible** – No measurable impact(s).
- **Minor** – Most impacts on the affected resource could be avoided with proper mitigation; if impacts occur, the affected resource would recover completely without mitigation once the impacting stressor is eliminated.
- **Moderate** – Impacts on the affected resource are unavoidable. The viability of the affected resource is not threatened although some impacts may be irreversible, or the affected resource would recover completely if proper mitigation is applied or proper remedial action is taken once the impacting stressor is eliminated.

- **Major** – Impacts on the affected resource are unavoidable. The viability of the affected resource may be threatened although some impacts may be irreversible, and the affected resource would not fully recover even if proper mitigation is applied or remedial action is implemented once the impacting stressor is eliminated.

BOEM's Gulf of Mexico OCS Region manages the responsible development of oil, gas, and mineral resources for the 430 million ac in the WPA, CPA, and a small portion of the EPA on the OCS comprising the GOM region. The Gulf of Mexico OCS area of possible influence includes the States of Texas, Louisiana, Mississippi, Alabama, and Florida, and is depicted on **Figure 4-1**. However, the Clean Air Act Amendments of 1990 designated air quality authorities in the GOM, giving BOEM air quality jurisdiction westward of 87°30' W. longitude and USEPA air quality jurisdiction eastward of 87°30' W. longitude. The USEPA air quality jurisdiction includes part of the CPA and all of the EPA, while BOEM's air quality jurisdiction includes most of the CPA and all of the WPA. In 2006, oil and gas leasing operations within 125 mi (201 km) of the Florida coastline were placed under moratorium until 2022 under the Gulf of Mexico Energy Security Act (GOMESA). The GOMESA moratoria area is depicted in **Figure 4-1**.

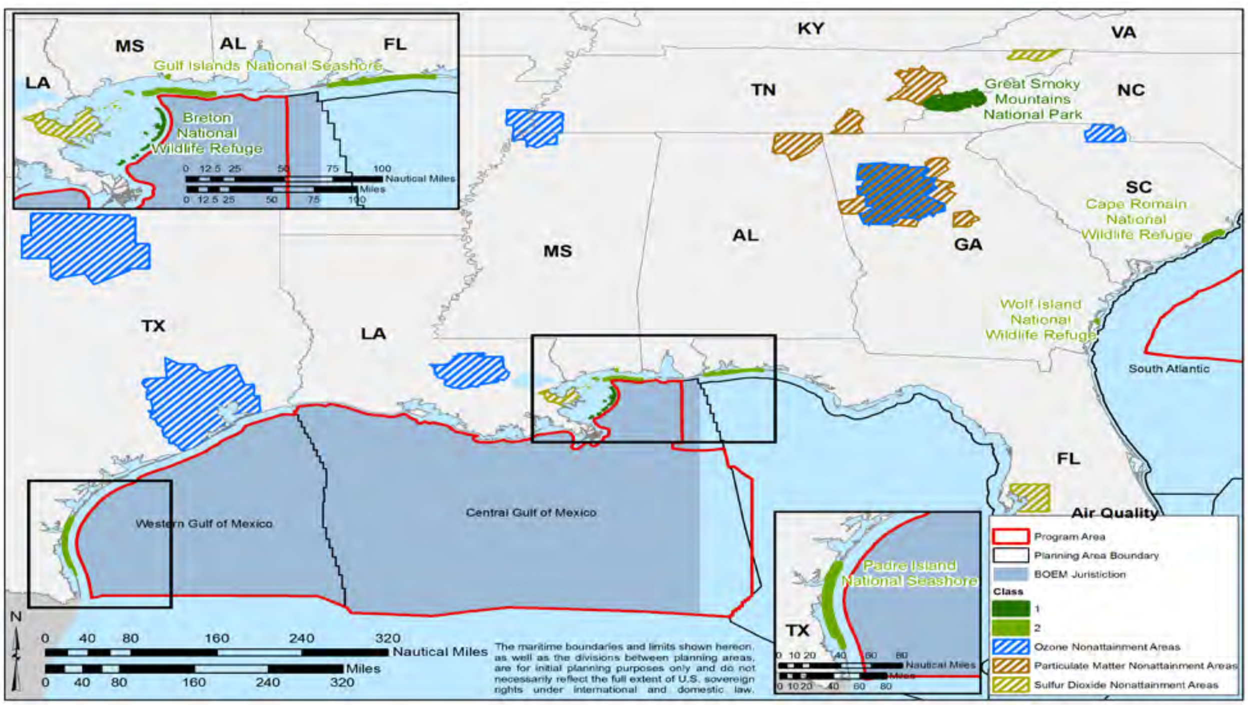


Figure 4-1. Gulf of Mexico Region with the Planning Areas, Nonattainment Areas, and Class I (dark green) and Sensitive Class II (light green) Areas. (Note: The South Atlantic Planning Area was removed from the 2017-2022 Five-Year Program. Also, USEPA has redesignated the Baton Rouge, Louisiana, 8-hour ozone nonattainment area as a maintenance area effective March 21, 2017.)

BOEM is required under the OCSLA (43 U.S.C. § 1334(a)(8)) to develop regulations to ensure compliance with the NAAQS to the extent that OCS offshore oil and gas exploration, development, and production sources do not significantly affect the air quality of any state pursuant to the NAAQS. Since the primary NAAQS are designed to protect human health, BOEM focuses this Supplemental EIS analysis on the impact of these activities on the States, where there are permanent human populations. However, the potential impacts for the whole Gulf of Mexico region were modeled, including the impacts at the State/seaward boundary of Gulf Coast States (3-9 nmi [3.45-10.36 mi; 5.56-16.67-km] from shore, depending on the State). Detailed potential impacts from the "Air Quality Modeling in the Gulf of Mexico Region" study are included in **Appendix D**.

4.1.1 Description of the Affected Environment

For this Supplemental EIS analysis, the affected environment comprises the WPA, CPA, and EPA, including the States of Texas, Louisiana, Mississippi, Alabama, and Florida, and the respective State waters, as these are the areas that BOEM's Gulf of Mexico OCS Region manages. This area also includes national parks and Federal wilderness areas where air quality and AQRVs (primarily visibility) are protected more stringently than under the NAAQS. These protected Class I areas in the GOM region, and therefore the areas that BOEM's Gulf of Mexico OCS Region manages, include the following: the Breton Wilderness Area in Louisiana; and the Bradwell Bay Wilderness Area, Chassahowitza National Wilderness Area, Everglades National Park, and St. Marks Wilderness Area in Florida.

The Clean Air Act Amendments of 1977 designated 156 Class I areas, consisting of national parks and wilderness areas that are offered special protection for air quality and the AQRVs. The Class I areas, compared to the Class II areas, have lower Prevention of Significant Deterioration (PSD) air quality increments that new sources may not exceed and are protected against excessive increases in several AQRVs, including visibility impairment, acid (sulfur and nitrogen) deposition, and nitrogen eutrophication. The Regional Haze Rule (40 CFR § 51.308) has a goal of natural visibility conditions by 2064 at Class I areas, and States must submit Regional Haze Rule State Implementation Plans that demonstrate progress towards that goal. **Figure 4-1** displays the locations of the mandatory Class I areas in the GOM region.

While not included in the Clean Air Act Amendments of 1977 as an area of special protection, Federal management agencies have designated certain other areas as sensitive Class II areas for tracking PSD increment consumption and AQRV impacts. The sensitive Class II areas, designated as such in the GOM region, include the Padre Island National Seashore and Gulf Islands National Seashore. Since Class I and sensitive Class II areas are of concern, the areas located in or nearby the GOM region are discussed in this Supplemental EIS and are shown in **Figure 4-1**.

Clean Air Act and the Clean Air Act Amendments Overview

The Clean Air Act of 1970 established the NAAQS, which include the primary standards to protect public health and secondary standards to protect public welfare including visibility and vegetation. Under the Clean Air Act, the USEPA is periodically required to review and, as appropriate, modify the criteria based on the latest scientific knowledge. Several revisions to the NAAQS have occurred in the past few years as more is understood about the effects of the pollutants. The current NAAQS, shown in **Table 4-2**, address six pollutants: carbon monoxide (CO); nitrogen dioxide (NO_2); particulate matter ($PM_{2.5}$ and PM_{10}); sulfur dioxide (SO_2); lead (Pb); and ozone (O_3).

Table 4-2. National Ambient Air Quality Standards.

Pollutant (Final Rule Citation)		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO) (*Federal Register*, 2011)		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead (Pb) (*Federal Register*, 2008a)		Primary and Secondary	Rolling 3-month average	$0.15\ \mu g/m^3$ [1]	Not to be exceeded
Nitrogen Dioxide (NO_2) (*Federal Register*, 2010a) (*Federal Register*, 1996)		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and Secondary	Annual	53 ppb [2]	Annual mean
Ozone (O_3) (*Federal Register*, 2015b)		Primary and Secondary	8-hour	0.070 ppm [3]	Annual 4^{th}-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (*Federal Register*, 2013) (*Federal Register*, 2006a)	$PM_{2.5}$	Primary	Annual	$12\ \mu g/m^3$	Annual mean, averaged over 3 years
		Secondary	Annual	$15\ \mu g/m^3$	Annual mean, averaged over 3 years
		Primary and Secondary	24-hour	$35\ \mu g/m^3$	98^{th} percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24-hour	$150\ \mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2) (*Federal Register*, 2010b) (*Federal Register*, 1973)		Primary	1-hour	75 ppb [4]	99^{th} percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) The Final Rule was signed on October 15, 2008. The 1978 lead standard ($1.5\ \mu g/m^3$ as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard. Areas designated nonattainment under the 1978 standard remain in effect until implementation plans are approved to attain or maintain the 2008 standard.

(2) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(3) The final rule was signed on October 1, 2015, and became effective on December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

[(4)] The Final Rule was signed on June 2, 2010. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until 1 year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

Notes: PM – particulate matter; ppb – parts per billion; ppm – parts per million.

Source: USEPA, 2017a.

The Clean Air Act establishes classification designations based on regional monitored levels of ambient air quality. These designations impose mandated timetables and other requirements necessary for attaining and maintaining healthful air quality in the U.S. based on the seriousness of the regional air quality problem. These designations are nonattainment, attainment, and unclassifiable. Nonattainment is any area that does not meet the national primary or secondary ambient air quality standard for the pollutant. When measured concentrations of these regulated pollutants exceed the standards established by the NAAQS, the number of exceedances and the concentrations determine the nonattainment classification of an area. The Clean Air Act Amendments of 1990 established these designations as marginal, moderate, serious, severe, and extreme. Attainment is any area that meets the national primary or secondary ambient air quality standard for the pollutant. Unclassifiable is any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant. **Figure 4-1** depicts all of the current nonattainment areas in the GOM region.

The Federal OCS waters are unclassifiable. The OCS areas are not classified because there is no regulatory provision for any classification in the Clean Air Act for waters outside of the boundaries of State waters. Only areas within State boundaries can be classified as either attainment or nonattainment.

Gulf of Mexico OCS Region Attainment Status

After promulgation of a NAAQS, the USEPA designates areas that fail to achieve the NAAQS as nonattainment areas, and States are required to submit State Implementation Plans to the USEPA; these plans contain emission control plans and a demonstration that the nonattainment area would achieve the NAAQS by the required date. After an area comes into attainment of the NAAQS, the area can be redesignated as a maintenance area and must continue to demonstrate compliance with the NAAQS. **Figure 4-1** depicts all the current nonattainment areas in the GOM region while **Table 4-3** summarizes the nonattainment and maintenance areas in the GOM region. Sulfur dioxide (SO_2) and lead (Pb) nonattainment areas are focused around specific large industrial sources of SO_2 or Pb emissions, whereas ozone nonattainment areas are more regional in nature, reflecting the formation of ozone as a secondary pollutant from emissions of nitrogen oxides (NO_x) and VOC precursors from a wide range of sources. (*Note: Effective March 21, 2017, USEPA redesignated the Baton Rouge, Louisiana, area as being in attainment of Federal health-based ozone standards. The State of Louisiana requested that the redesignation, based on 3 years of air quality data showing the metropolitan areas of Ascension, East Baton Rouge, Iberville, Livingston,* *and West Baton Rouge Parishes, meet the 2008 8-hour ozone standard of 0.075 parts per million [ppm]. The USEPA also approved the State's plan for maintaining the standard.*)

Table 4-3. Nonattainment and Maintenance Areas in the Gulf of Mexico Region.

State	Area	8-hr O_3 (1997)	8-hr O_3 (2008)	SO_2 (2010)	Lead (2008)
Alabama	Troy				NAA
Florida	Tampa				NAA
	Hillsborough County			NAA	
	Nassau County			NAA	
Louisiana	Baton Rouge	M	M		
	St. Bernard Parish			NAA	
Texas	Beaumont-Port Arthur	M			
	Houston-Galveston-Brazoria	NAA	NAA		
	Frisco				NAA

M = maintenance area; NAA = nonattainment area; O_3 = ozone; SO_2 = sulfur dioxide.
Blank cells indicate the area is in attainment of the National Ambient Air Quality Standards.

As previously mentioned, the USEPA periodically modifies the NAAQS criteria based on new scientific knowledge. On October 1, 2015, the USEPA strengthened the 8-hour NAAQS for ozone to 0.07 ppm (70 parts per billion [ppb]). Under this more stringent ozone NAAQS, there may be more areas in the southeastern U.S. designated as nonattainment. The USEPA plans to make attainment and nonattainment designations for the revised standards by October 2017, with the designations based on 2014-2016 air quality monitoring data.

On December 14, 2012, USEPA revised the $PM_{2.5}$ primary NAAQS by lowering the annual $PM_{2.5}$ NAAQS threshold from 15.0 micrograms per cubic meter (μg/m^3) to 12.0 μg/m^3. The USEPA retained the 24-hour $PM_{2.5}$ primary NAAQS at 35 μg/m^3. The 24-hour PM_{10} NAAQS was also retained at 150 μg/m^3.

The carbon monoxide NAAQS has remained essentially unchanged since it was originally promulgated in 1971. As of September 27, 2010, all prior CO nonattainment areas throughout the country have been redesignated as maintenance areas.

In February 2010, the USEPA issued a new 1-hour NO_2 NAAQS with a threshold of 100 ppb (98^{th} percentile daily maximum average over 3 years), and a new 1-hour SO_2 NAAQS was promulgated in June 2010 with a threshold of 75 ppb (99^{th} percentile averaged over 3 years). The USEPA has not yet designated the nonattainment areas for the 1-hour NO_2 and 1-hour SO_2 NAAQS.

A lead NAAQS was issued in 2008; nonattainment areas for lead are associated with specific industrial sources.

Emissions Inventories

One of the most accurate methods for estimating air emissions is by developing a comprehensive emissions inventory. To develop a calendar year 2011 inventory of criteria pollutants, criteria precursors, and greenhouse gas emissions for all OCS oil and gas production-related sources in the GOM, BOEM collected activity data from platform operators during the year 2011. On September 15, 2010, NTL 2010-G06 was published to introduce the “2011 Gulfwide OCS Emissions Inventory (Western Gulf of Mexico)” and inform operators about the mandatory data collection. Affected operators are lessees and operators of Federal oil, gas, and sulfur leases in the Gulf of Mexico OCS region west of latitude 87.5°. The USEPA jurisdiction has air quality jurisdiction east of latitude 87.5°.

2011 GWEI Pollutants

NAAQS: CO, NO_x, $PM_{2.5}$, PM_{10}, SO_2

Criteria Precursors: VOC

Greenhouse Gases: CO_2, CH_4, N_2O

BOEM updated and distributed a Microsoft® Visual Basic® program for platform operators to use to collect activity data on a monthly basis and submit to BOEM on an annual basis. The program, known as GOADS-2011, was used by operators to submit activity data for a number of production platform emission sources. Operators used the Gulfwide Offshore Activity Data System (GOADS) software to collect activity data for amine units, boilers/heaters/burners, diesel engines, drilling equipment, fugitives, combustion flares, glycol dehydrators, losses from flashing, mud degassing, natural gas engines, natural gas/diesel/dual-fuel turbines, pneumatic pumps, pressure/level controllers, storage tanks, and cold vents. These activity data were used to calculate CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$, and VOC emissions estimates, as well as CO_2, CH_4, and nitrous oxide (N_2O). The Gulfwide Oracle® DBMS calculates and archives the activity data and the resulting emissions estimates. Database users can query by pollutant, month, equipment type, platform, etc. Emission estimates for non-platform sources on the Gulf of Mexico OCS include both oil and natural gas production-related sources, as well as non-oil and natural gas sources. Production sources consist of survey vessels, drilling rigs, pipe-laying operations, and support vessels and helicopters. Non-oil and natural gas sources include commercial marine vessels, the Louisiana Offshore Oil Platform (LOOP), and biogenic and geogenic sources. Ultimately, State agencies and Regional Planning Organizations will use these offshore oil and gas platform and non-platform inventories to perform modeling for ozone and regional haze for use in their State Implementation Plans, and BOEM will use the emission inventory for the cumulative impact analysis in NEPA documents.

Emissions estimates calculated in the study were used to support analysis of air quality modeling impacts. In this inventory, emissions estimates are provided for directly emitted pollutants. While there are national air quality standards for six common air quality pollutants, only five of these pollutants (i.e., CO, Pb, NO_2, SO_2, and PM) are directly emitted. Indirect emissions and the formation of other pollutants, as well as pollutants not included in the inventory, are analyzed below.

- *Greenhouse Gases*. Fluorinated gases, hydrofluorocarbons, and sulfur hexafluoride are not covered in this inventory because they are used in trace amounts and at no time are deliberately emitted into the atmosphere.
- *Lead*. Lead (Pb), a NAAQS criteria pollutant, is not covered in this inventory because oil and gas sources have negligible lead emissions. Since unleaded fuels have been phased out, lead remains a trace contaminant in other fuels (USEPA, 2016a).
- *Nitrogen Dioxide*. Nitrogen dioxide (NO_2), a NAAQS criteria pollutant, is one of a group of highly reactive gases known as nitrogen oxides (NO_x). Nitrogen oxides are stated as an equivalent mass of NO_2; consequently, NO_x is used instead of NO_2.
- *Particulate Matter*. Particulate matter (PM), a NAAQS criteria pollutant expressed as $PM_{2.5}$ and PM_{10}, can be emitted directly or it can be formed in the atmosphere when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react in the atmosphere. According to USEPA's "Particulate Matter Emissions Report," coarse PM (PM_{10}) is composed largely of primary particles, while a much greater portion of fine PM ($PM_{2.5}$) contains secondary particles. "Primary" particles are those released directly to the atmosphere whereas "secondary" particles are formed in the atmosphere from chemical reactions involving primary gaseous emissions. While both $PM_{2.5}$ and PM_{10} are included the inventory, the secondary formation is not included the inventory because secondary PM is not directly emitted. Since the USEPA has not developed separate $PM_{2.5}$ and PM_{10} emissions factors per source, particulate-matter emission estimates of $PM_{2.5}$ and PM_{10} are similar. Therefore, PM_{10} values have been used in this chapter to represent particulate matter emission estimates.
- *Ozone*. Ozone (O_3), an NAAQS pollutant, is not directly emitted into the air but is formed by photochemical reactions of NO_x and VOCs in the presence of sunlight. Since NO_x and VOCs are directly emitted pollutants, they are included in the emissions inventory, and their resulting emission estimates are used in the air quality model to analyze the air quality impacts of O_3.

Summary of Results of the Year 2011 Gulfwide Emissions Inventory

Total emissions estimates include

- *total non-OCS oil and gas source emissions,*
- *total OCS oil and gas non-platform source emissions, and*
- *total OCS oil and gas platform production source emissions.*

The Year 2011 GWEI results indicate that OCS oil and gas production platform and non-platform sources emit the majority of NAAQS criteria pollutants, VOCs, and greenhouse gases on the Gulf of Mexico OCS, with the exception of SO_2 (primarily emitted from commercial marine vessels), and N_2O

(from biological sources) (Wilson et al., 2014). The total platform and non-platform emission estimates for criteria pollutants and the total platform and non-platform emission estimates for greenhouse gases are depicted in **Figures 4-2 and 4-3**, respectively. In both figures, total emission estimates are subdivided into three main categories: total non-OCS oil/gas source emissions; total OCS oil/gas non-platform source emissions; and total OCS oil/gas platform source emissions.

Natural gas engines on platforms represented the largest CO emission source, and support vessels were the highest emitters of both NO_x and PM_{10}. Oil and natural gas production platform vents account for the highest percentage of the VOC emissions. Support vessels; production platform natural gas, diesel, and dual-fuel turbines; and commercial marine vessels emit the majority of the greenhouse gas emissions.

Platform sources include

- *criteria pollutants,*
- *emissions in (TPY),*
- *greenhouse gases, and*
- *emissions in (TPY).*

The Year 2011 GWEI results for criteria pollutant and greenhouse gas emissions (in tons/year) from platform sources are depicted in **Figures 4-4 and 4-5**, respectively. In both figures, each platform source emission type is represented per pollutant in tons/year.

The Year 2011 GWEI results for criteria pollutant and greenhouse gas emissions (in tons/year) from non-platform sources (not pictured) indicate that support vessels emit the majority of the greenhouse gas emissions, as well as the highest emitter of both NO_x and PM_{10} criteria pollutants.

The Year 2011 GWEI was one of several inventories and models used to develop the emissions scenarios for BOEM's "Air Quality Modeling in the Gulf of Mexico Region" study. Other emissions inventories and models used in the modeling study include the USEPA's 2011 National Emissions Inventory (NEI), the USEPA's Clean Air Markets Division (CAMD) data, onshore mobile source emissions from the USEPA's MOVES model, and the 2008 Mexico National Emissions Inventory (MNEI). Several other inventories and models were used for emissions from natural sources. The modeling protocol for the "Air Quality Modeling in the Gulf of Mexico Region" study, including the emissions scenarios, is discussed further in **Chapter 4.1.2.3** and a full description is presented in **Appendix C**.

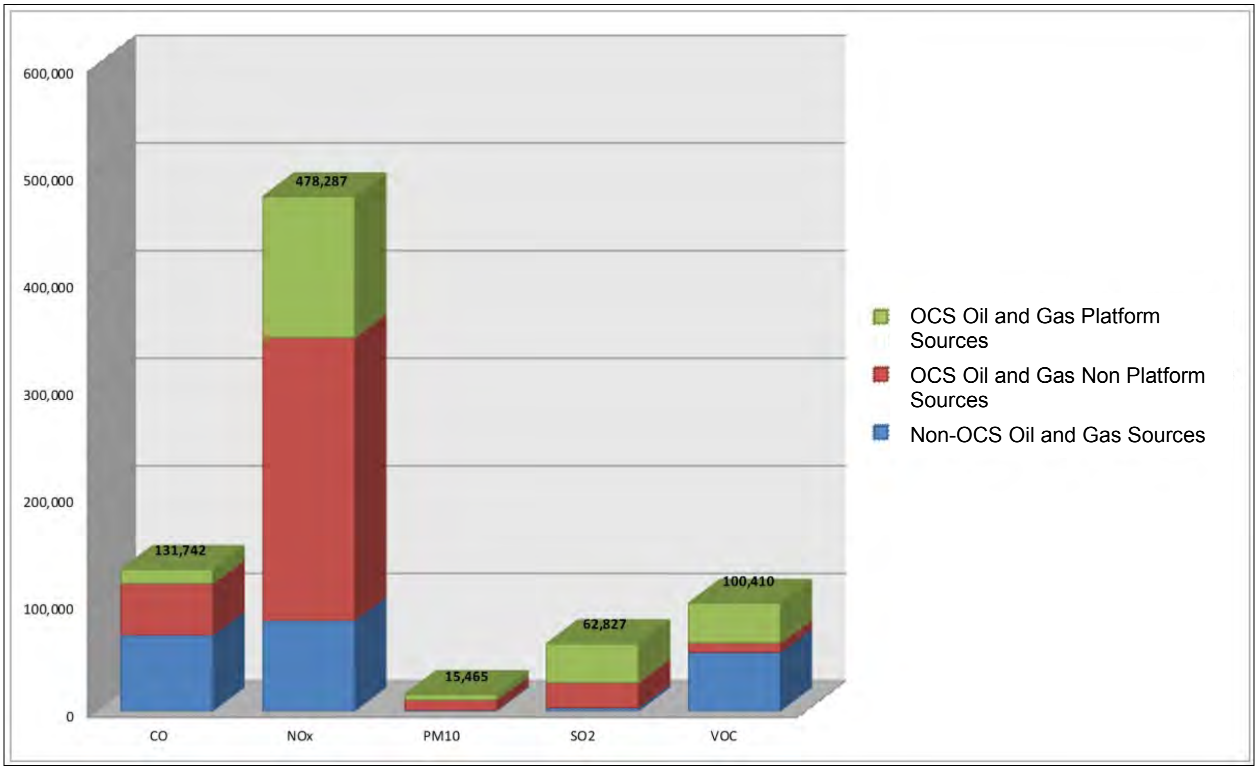


Figure 4-2. Year 2011 Gulfwide Emission Inventory Results for Total Platform and Non-Platform Criteria Pollutant Emissions (TPY).

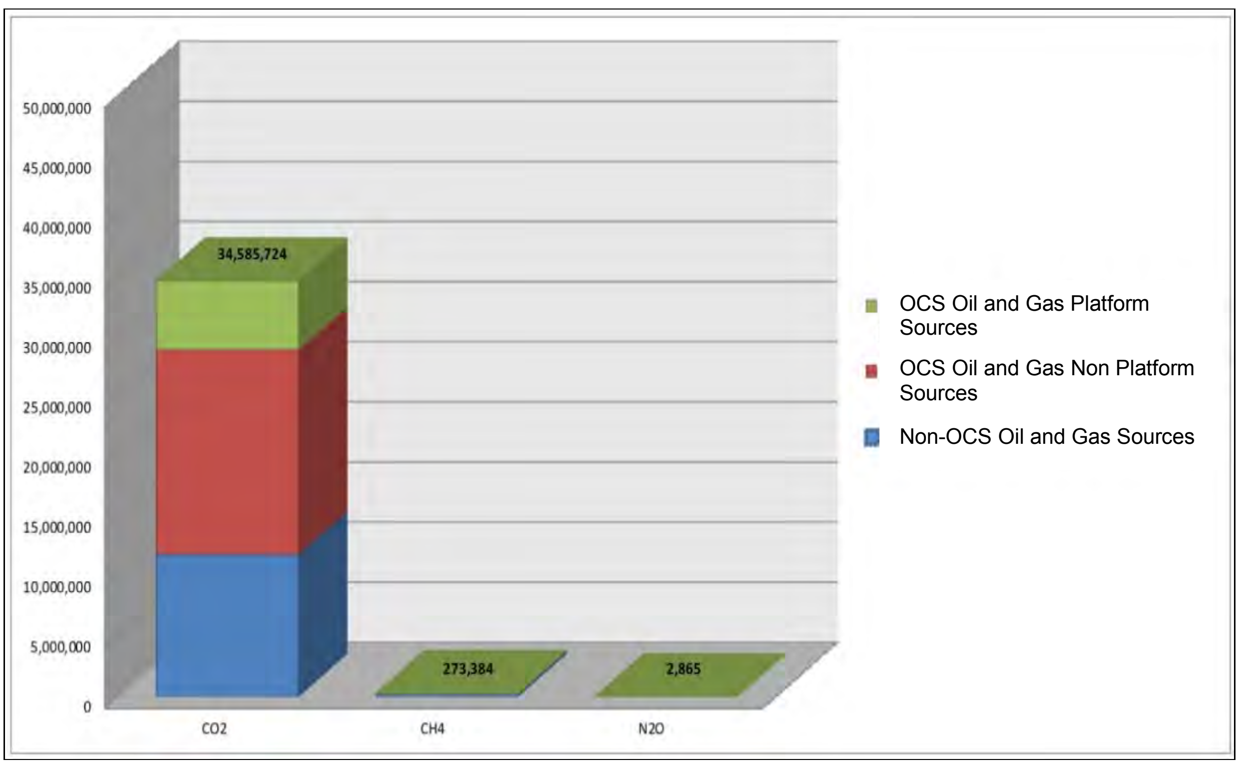


Figure 4-3. Year 2011 Gulfwide Emission Inventory Results for Total Platform and Non-Platform Greenhouse Gas Emissions (TPY).

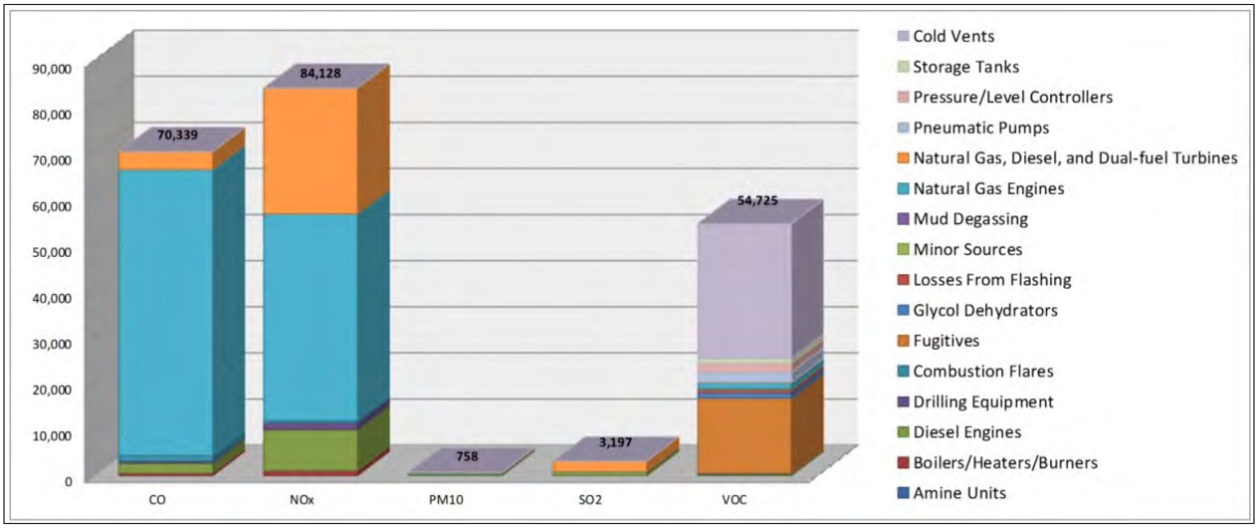


Figure 4-4. 2011 Criteria Pollutant Emissions (TPY) from Platform Sources.

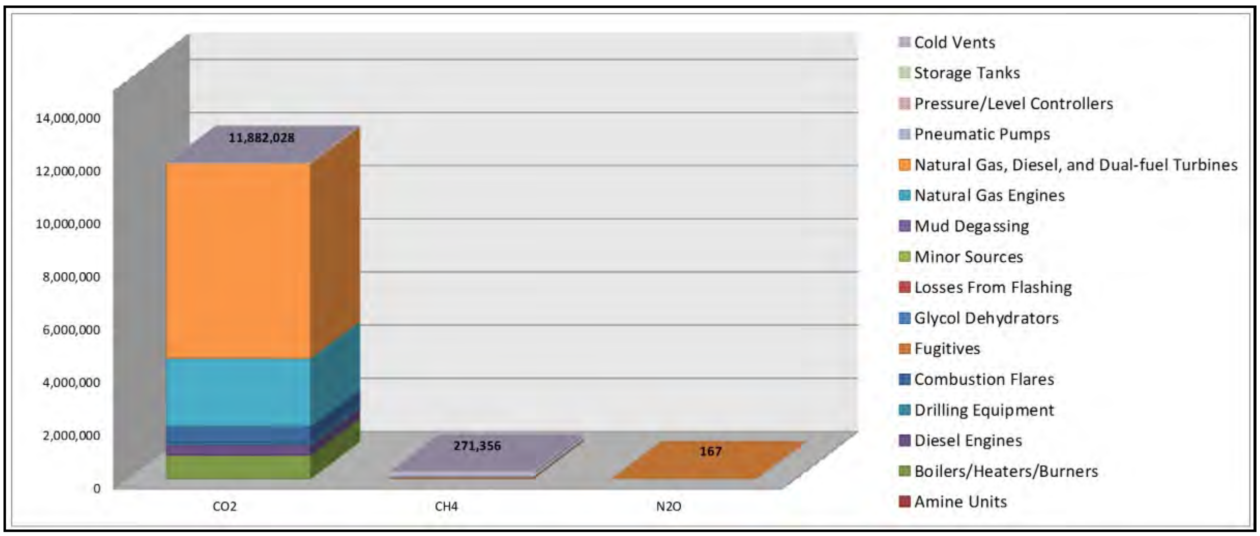


Figure 4-5. 2011 Greenhouse Gases (TPY) from Platform Sources.

4.1.2 Environmental Consequences

The impact-producing factors and their potential impacts identified for routine activities, accidental events, cumulative impacts, and incomplete or available information would apply, in general, to Alternatives A-D. These analyses are then applied to each alternative based on the varying degrees of forecasted levels of activities by geographical area and water depth. Following this environmental consequences discussion, there will be a summary of the potential impacts as they relate to the alternatives.

As discussed in the air quality introduction, the following list of impact-producing factors can occur in routine activities, accidental events, and cumulative impacts. The impact-producing factors include (1) OCS oil- and gas-related emissions sources related to drilling and associated vessel support, production, and the connected action of vessel support, flaring and venting, decommissioning, and oil spills; (2) non-OCS oil- and gas-related emissions such as State oil and gas programs, onshore industrial and transportation sources, and natural events; and (3) the incremental contribution of all postlease activities as a result of a single proposed lease sale. These impact-producing factors can produce greenhouse gas and fugitive emissions, which are discussed below.

Greenhouse Gases and Fugitive Emissions

Greenhouse Gases Including Downstream Gas

Chief among drivers of climate change are increasing atmospheric concentrations of CO_2 and other greenhouse gases, such as CH_4 and N_2O. These greenhouse gases reduce the ability for solar radiation to re-radiate out of the Earth's atmosphere and into space. Although all three have natural sources, these three greenhouse gases comprise the majority of greenhouse gases released from anthropogenic sources; CO_2 and N_2O are released in association with combustion and CH_4 and N_2O are released as a byproduct of agriculture and also oil and gas production. Hydrofluorocarbons and sulfur hexafluoride are two fluorinated greenhouse gases that are used on the OCS, but they are used in trace amounts and are at no time deliberately emitted into the atmosphere.

The activities associated with a proposed action would increase global greenhouse gas (GHG) emissions from the use of vessels, drilling equipment, and other activities that burn fossil fuels. In addition, CH_4, also known as natural gas, is removed from wells and brought onto OCS facilities along with oil being produced. Sometimes CH_4 is released as a fugitive gas that can escape unintentionally from leaks in equipment used by operators. Operators have the four following methods of managing natural gas removed from wells: (1) production – selling the natural gas, provided there is a sufficient quantity, favorable market conditions, and infrastructure (e.g., natural gas pipelines) to justify production; (2) reinjection – the natural gas is directed back into the reservoir to aid in oil extraction; (3) venting – the deliberate release of natural gas into the atmosphere; and (4) flaring – burning the natural gas, converting it to CO_2 and water, and in some cases, also releasing N_2O and black carbon. The practice of releasing N_2O and black carbon via flaring is rare on the Gulf of Mexico OCS.

Because each greenhouse gas impacts the atmosphere at a different strength and for a different period of time, for analytical purposes, they typically are converted to what the strength would be if emissions were exclusively CO_2; this is referred to as the CO_2-equivelent (CO_2e) to facilitate comparison. CH_4 and N_2O are much more effective climate forcers than CO_2, meaning 1 ton of CH_4 or N_2O has a greater impact on climate change than 1 ton of CO_2. However, CH_4 and N_2O are removed from the atmosphere through natural processes more efficiently than CO_2. Accounting for these factors, CO_2e conversion for CH_4 and N_2O are 25 and 298, respectively (Brander, 2012). This means that 1 ton of CH_4 is estimated to have the same warming potential as 25 tons of CO_2, and 1 ton of N_2O would have the same impact as 298 tons of CO_2. Because black carbon is not a greenhouse gas and functions differently, it is not possible to convert it using the CO_2e method. However, because black carbon is a specific kind of $PM_{2.5}$, it is possible to use the

$PM_{2.5}$ concentration to estimate the maximum amount of black carbon released. BOEM has regulatory authority on the OCS for $PM_{2.5}$, along with several other air quality pollutants.

As a result of exploration, development, and production of oil and gas on the OCS, the activities associated with a proposed action are expected to release greenhouse gases and black carbon from the use of combustion engines in vessels, construction, drilling, and other equipment, as well as through the deliberate or accidental release of CH_4. Emissions estimates for the activities associated with a proposed action, and for cumulative BOEM-related OCS emissions, were calculated using the Offshore Environmental Cost Model. These estimates are for the high-price scenario, which would likely result in the highest level of potential emissions for a proposed action. Cumulative numbers include current operations, the activities associated with a proposed action, and expected future development beyond a proposed action. Unlike the greenhouse gases, which warm the planet generally, black carbon's potential to contribute to climate change has a spatial component. Compared with the 2012-2017 Five-Year Program, the activities associated with a proposed action would result in an overall increase in the rate of CO_2e emissions from OCS oil- and gas-related activities.

In addition to the direct emissions from OCS oil- and gas-related operations presented above, BOEM has evaluated greenhouse gas emissions covering the lifecycle of OCS oil and gas production and consumption. This includes both the "downstream" consumption and onshore processing of oil and gas products, as well as the "upstream" emissions from offshore exploration, development, and production.

The expected greenhouse gas emissions for the low- and high-price scenarios include numerous assumptions (Wolvovsky and Anderson, 2016); therefore, while being a reasonable approximation, these numbers are an estimate and not a forecast. However, because the methodology used to compare the two price scenarios and the No Action Alternative are the same, the analysis can be assumed to provide a relative comparison. There is a significant degree of uncertainty in these numbers, and they do not take into account future Federal, State, and/or local economic, social, policy, regulatory, and legislative changes that could affect the amount of greenhouse gases released. In addition, this analysis is bounded by U.S. consumption and the upstream domestic and overseas production supporting American consumption. This means that the likely overseas reduction in consumption under the No Action Alternative is not calculated in this analysis.

The activities associated with the proposed action's lifecycle emissions fluctuate over the course of the 2017-2022 Five-Year Program in the GOM, with early emissions largely coming from OCS sources. The greenhouse gas emissions would peak in the 2030s and 2040s, at the same time as production peaks. Overall, the greenhouse gases from the activities associated with the proposed action would be similar to but slightly lower than the No Action Alternative in both low- and high-price scenarios. This similarity is due to the economic substitution effects from onshore and overseas sources expected under the No Action Alternative.

Fugitive Emissions

Fugitive emissions are not intentionally released through a stack, vent, or flare, but they are instead caused by leaks or intermittently escapes from pressurized equipment from sealed surfaces in various components of the facility. Fugitive emissions are mainly comprised of VOCs and methane (CH_4). Sources of fugitive emissions typically include valves, flanges, connectors, pumps, and compressor seals, but they may also include other platform components such as pneumatic controllers. Fugitive emissions can occur during all phases of OCS oil- and gas-related activity.

According to the Year 2011 GWEI study, fugitive emissions constitute one of the largest VOCs and CH_4 emissions sources from offshore oil and gas platforms, behind only cold vents. The BSEE personnel have indicated that the infrared camera surveys, performed to detect hydrocarbon leaks during inspections of offshore platforms, show very few, if any, hydrocarbon leaks. This could imply that the current emission factors may be overestimating VOC and methane emissions. Houston-Galveston-Brazoria has been designated nonattainment for ozone. Since ozone is formed by the combination of VOCs and NO_x, the OCS emissions inventory for VOCs needs to be as accurate as possible. In addition, the Government Accountability Office has published *Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases* (U.S. Government Accountability Office, 2010), recommending that the former Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) improve data and reduce emissions from oil and gas production facilities on the OCS. After the reorganization of BOEMRE into BOEM and BSEE, the recommedations listed in the 2010 Government Accountability Office report were assigned to the appropriate bureau. Based on the Government Accountability Office's recommendation, BOEM was assigned to look to reduce CH_4 emissions by the installation of control technology on platforms. Before control technology is required, the OCS emissions inventory for CH_4 also needs to be as accurate as possible.

Based on the results of the emission inventory study, as well as correspondence with BSEE, and the Government Accountability Office's report, BOEM wants to further assess emissions from fugitive equipment leaks on offshore oil and gas platforms operating on the Gulf of Mexico OCS. Under BOEM's Contract Number M16PC00010, "Fugitive Emissions Update in the Outer Continental Shelf," the objective is to visit offshore production platforms to identify and conduct the testing of fugitive equipment leaks in order to develop updated VOC, select hazardous air pollutant, and methane emission factors. These updated emission factors would be used by BOEM to develop improved and contemporary emissions inventories that will be used for a variety of purposes, including future photochemical grid modeling conducted by states in the Gulf of Mexico region for State Implementation Plan compliance demonstrations. However, if the OCS emissions inventories are overestimating VOC and methane emissions, then possibly control technologies would not be required. These study results are projected to be available by spring of 2019. Otherwise, BOEM would determine the appropriate use of control technologies on the platforms during postlease reviews.

4.1.2.1 Routine Activities

The primary routine impact-producing factors associated with the proposed action that could potentially affect air quality and that also could contribute to climate change include (1) drilling and production and the associated vessel support, (2) flaring and venting, and (3) decommissioning of facilities. These routine activities result in pollutant emissions. Emissions of air pollutants from these activities would occur during exploration, development, production, and decommissioning activities.

Drilling and Production with Associated Vessel Support

Since both drilling and production activities include associated vessel support, the activities are analyzed together in this section. Emissions during exploration are higher than emissions during development due to power requirements for drilling a deeper wellbore hole. During drilling, diesel engines are used to power the drilling (top drive) assembly, draw works, electrical generators, mud pumps, vessel propulsion (drillships and support vessels), and dynamic positioning systems of the drilling rig (if a dynamic positioning semisubmersible or dynamic positioning drillship is used). For the purpose of the emissions inventory, BOEM considers drillships and well stimulation vessels to be non-platform sources of emissions. Combustion of fuel to run the engines generates NAAQS criteria pollutants, VOCs, and greenhouse gases. More information about the pollutants that are generated by specific equipment and activities is available in the *Year 2011 Gulfwide Emission Inventory Study* (Wilson et al., 2014). As illustrated in **Figure 3-2**, during a 50-year analysis period, exploratory drilling mainly occurs during the first decade and development drilling extends throughout the first and second decade.

We know from **Chapter 3** that, during production, pollutants emitted during routine activities may be combustion products of burning fuel to power pumps, compressors, or generators, or they may consist of fugitive VOCs, which escape from the un-combusted hydrocarbons. The platform emission sources include boilers, turbines, pneumatic pumps, diesel engines, combustion flares, fugitives, glycol dehydrators, natural gas engines, pressure/level controllers, storage tanks, cold vents, and others. As illustrated in **Figure 3-2**, during a 50-year analysis, most production occurs during the second and third decade. Because the levels of activity in the 2011 GWEI are projected to be less than a proposed lease sale, these emission values are used to project potential impacts as described below.

The OCS emissions in tons per year for the criteria pollutants and for the greenhouse gases from platform sources are indicated in **Figures 4-4 and 4-5**. The distribution of emissions across various platforms sources would be expected to be similar. These figures show the following: criteria pollutants – the major pollutant emitted is NO_x, while PM_{10} is the least emitted pollutant; and greenhouse gases – the major pollutant emitted is CO_2, while N_2O is the least emitted pollutant. Combustion-intensive operations such as platform operations, well drilling, and service-vessel activities contribute mostly NO_x and CO_2; platform operations are also the major contributors of VOC emissions. As a result of a proposed lease sale, multiple platforms would be installed on the leases, and platform construction emissions would contribute appreciable amounts of all pollutants over the resulting lease sale's 50-year analysis period. Emissions from a singular platform construction are temporary in nature and generally occur for a period of 3-4 months. Typical construction emissions result from the derrick barge placing the jacket and various modular components and from various service vessels supporting this operation. Drilling operations contribute considerable amounts of all pollutants. These emissions are temporary in nature and typically occur over a 90-day per well drilling period. Support vessels for OCS oil- and gas-related activities, as described in Chapter 3.1.4.3 of the 2017-2022 GOM Multisale EIS, include emissions of NO_x, $PM_{2.5,}$ PM_{10}, CO, and CO_2. These emissions are directly proportional to the number and type of OCS operations requiring support activities. Most emissions from these support activities occur during transit between the port and offshore facilities; a smaller percentage of the emissions occur during idling at the platform.

Currently, there are minor impacts occurring to air quality from drilling and production with associated vessel support impacts as shown in the model. As described in **Table 4-5**, Source Group B represents new platforms sources and their support vessels and aircraft associated with this Supplemental EIS. According to the modeling results, the impacts of criteria pollutants from Source Group B to air quality are below the NAAQS for all pollutants, except for ozone. The potential impacts of a single proposed lease sale would be **minor** because the affected resource could be avoided with proper mitigation. The activities' impacts would vary in intensity based on the type and location of the activity.

Flaring and Venting

Flaring and venting are important safety measures at oil and gas production facilities. It safely disposes of gas during emergencies, power and equipment failures, or other upsets in production that might otherwise pose hazards to the offshore and onshore communities.

Flaring may involve the disposal of sweet gas or sour gas. Sweet gas is natural gas that does not contain hydrogen sulfide (H_2S), while sour gas is natural gas that does contain H_2S. Flaring of sweet gas has not had individually notable impacts on the onshore or offshore environments. Substantial emissions can occur from the flaring of sour gas or the burning of liquid hydrocarbons. Flaring of sour gas or burning of liquid hydrocarbons can occur at rates and volumes sufficient to raise concern for human health and safety in the offshore environment and to raise concern for impacts on onshore. However, an operator must request and receive approval from BSEE's Regional Supervisor to flare or vent natural gas, except in specific situations that are outlined in BSEE's operating regulations at 30 CFR § 250.1160. A main function of BSEE's regulation is to specify operational processes to ensure that environmental and safety standards are being met when operators flare and vent associated gas.

In the past, gas losses from flaring and venting, in comparison to the overall volumes of natural gas recovered and processed, were considered insignificant. However, advances in technology (e.g., infrared cameras) have revealed losses much greater than originally thought (U.S. Government Accountability Office, 2010). Consequently, the Government Accountability Office has been examining how to improve regulations and address instances of flaring and venting during natural gas production for the past 13 years. These Government Accountability Office reports show the progression of U.S. regulations and the actions of BSEE in recent years.

As previously discussed, the 2010 Government Accountability Office report recommended that BOEMRE improve data and reduce emissions from oil and gas production facilities on the OCS. In response to the recommendations, BSEE enlisted the help of BOEM and contracted Argonne National Laboratories to conduct a study to explore possibilities that may exist for the increased capture of gas that would otherwise be vented and flared in offshore operations. The "Analysis of Potential Opportunities to Reduce Venting and Flaring on the OCS" study is intended to support the advancement of knowledge about venting and flaring practices in offshore operations and to foster improvements in the oversight and regulation of venting and flaring activities.

The Global Gas Flaring Reduction Partnership groups the processes of flaring and venting into two categories: intermittent and continuous. Intermittent flaring and venting can be further divided into unplanned situations (e.g., emergency situations and equipment failures) and planned situations (e.g., platform startups, maintenance, and tests) (Global Gas Flaring Reduction Partnership, 2009). Continuous flaring and venting can occur during normal operations when it is not economical to recover the gas. This may occur in the absence of sufficient gas production facilities or amenable geology to re-inject the produced gas, though re-injection is not a common practice in the Gulf of Mexico. The goals for regulating intentional instances of flaring and venting vary depending on when and how the activity takes place. With respect to continuous events, if cost effective to do so, operators of production platforms would be expected to invest in capturing gas rather than flaring or venting. In contrast, intermittent events are typically addressed through improved operational practices that minimize the numbers and durations of events, resulting in venting and flaring volumes.

Reasonably foreseeable flaring and venting emissions operations occur intermittently for short periods of time (typically 2-14 days) over the life of the lease. During the flaring of gas containing H_2S, the gas entering the flare would largely combust to SO_2. The contribution of flaring sour gas to SO_2 is regulated in 30 CFR part 250 subpart K. The SO_2 levels from reasonably foreseeable flaring are evaluated as part of the postlease plans review process. Requests for approval to flare or vent a gas are denied unless deemed absolutely necessary by BSEE.

Hydrogen sulfide is a flammable, colorless gas that can be detected by a characteristic rotten egg odor. It can be released from volcanoes, mineral springs, swamps, bogs, and other stagnant bodies of water, as well as petroleum/natural gas drilling and refining. Hydrogen sulfide is also associated with municipal sewers and sewage treatment plants, landfill gases, manure handling operations, and pulp and paper operations.

The primary route of exposure is inhalation, and the gas is rapidly absorbed by the lungs. The human nose is very sensitive and can detect extremely low levels of H_2S in air. However, exposure to high concentrations and prolonged low levels of concentrations can cause olfactory fatigue or paralysis. Therefore, relying on odor or the sense of smell would not be a reliable warning signal to detect H_2S presence. Concentrations of H_2S around 500 ppm cause nearly instantaneous incapacitation with death shortly thereafter. All operators on the OCS involved in the production of sour hydrocarbons that could result in atmospheric H_2S concentrations above 20 ppm are required to file an H_2S contingency plan that includes procedures to ensure the safety of the workers on the production facility. Portable monitors worn by workers, as well as visual and audible alarms and H_2S sensors on platforms to activate when the presence of H_2S is detected, can help to prevent loss of life.

The concentration of H_2S occurring naturally in crude oil varies from formation to formation and even varies to some degree within the same reservoir. The natural gas in deepwater reservoirs has been mainly sweet (i.e., low in sulfur content), but the oil averages between 1 and 4 percent sulfur content by weight. By far, most of the documented production of sour gas (i.e., high sulfur content) lies within 150 km (93 mi) of the Breton Wilderness Area Class I area. Hydrogen sulfide is a naturally occurring compound that is formed from the breakdown of organic matter in low oxygen environments. The effects of H_2S depend on the magnitude, duration, and frequency of exposure, as well as the susceptibility of the individual organism or environment. Since the actual locations and concentrations of H_2S cannot be accurately forecasted, evaluation of sour gas operations is currently best handled at the postlease stage in a site-specific environmental review.

According to the National Park Service, Gulf Islands National Seashore visitors have complained about H_2S odors. BOEM expects that concentrations at the park, resulting from OCS sources of H_2S, to be at very low nuisance levels. The source of odors in the park may include releases from the local marsh muds or nearby State oil and gas activity. Therefore, several contributing factors could be responsible for the odors at the Gulf Islands National Seashore.

Before BSEE considers granting approval to flare or vent gas, BOEM conducts an analysis of the air quality impacts, as well as making a determination regarding the destruction of the natural gas and oil resources. To conserve these resources, high-volume, long-term flaring is prohibited. Most flaring events that have been evaluated have been deemed to be below the NAAQS. With the distance to shore for some deepwater projects, it is possible for flaring events to be below the NAAQS but still be above the Significant Impact Levels established by USEPA for the protection of human health and welfare in offshore areas near the flare. These levels are considered when evaluating a project. The established review process at the flare/burn request stage should continue to be effective in identifying the potentially substantial flare/burn requests.

Impacts to air quality from reasonably foreseeable flaring and venting are expected to be **minor** because, while the release likely dissipates before reaching coastal areas due to distance for some deepwater projects, it is possible for flaring events to be below the NAAQS but still be above the USEPA's Significant Impact Levels. The impacts would vary in intensity based on the type of flare and location of the activity. The potential impacts from emergency operations are described in the "Accidental Events" chapter below, summarized in **Chapter 3.2.3** of this Supplemental EIS, and described in detail in Chapter 3.2.3 of the 2017-2022 GOM Multisale EIS.

Decommissioning

Although decommissioning of oil and gas facilities may have long-term environmental benefits, the process of removing the facilities has the potential to cause adverse impacts to air quality and other resources. Much of the equipment used to dismantle, lift, and transport the elements of the platform runs on fossil fuel, usually diesel, which essentially occurs during all phases of the decommissioning process. The exhaust from diesel fuel combustion contains CO, NO_2, PM, SO_2, CO_2, CH_4, N_2O, and VOCs.

Advancements in drilling technology have made previously unreachable areas more accessible. As deepwater production increases, platform support structures have increased in size. Deepwater platforms are generally farther from shore and less densely spaced than operations on the shelf. Equipment for deepwater operations is usually larger and more powerful than that used in shallower waters and, therefore, is a source of greater emissions. Because platform removal would be performed with diesel engines, a simple but reliable rule is that the deeper the water in which a platform is set and the higher the percentage of the platform that is to be removed, salvaged, and disposed, the greater the associated air pollution emissions would be. Thus, from an emissions perspective, the partial removal, salvage, and disposal of a platform set in 150 ft (46 m) of water would generate considerably less air pollution than the partial or complete removal, salvage, and disposal of a platform set in water depths ≥1,000 ft (305 m) (Berstein et al., 2014).

As emissions from deepwater activities are transported shoreward by prevailing winds, they are additive with emissions generated by OCS operations on the continental shelf, i.e., additive both in the OCS and within the coastal counties and parishes. During a 50-year analysis period, most decommissioning occurs during years 20-40. There are two primary methodologies used in the GOM for cutting decommissioning targets: nonexplosive and explosive severance. Nonexplosive methods include abrasive cutters, mechanical cutters, diamond wire cutting devices, and cutting facilitated by commercial divers using arc/gas torches. Though a relatively slow process and potentially dangerous for offshore workers, nonexplosive-severance activities have little to no impact on air quality. Explosive-severance activities use specialized charges to achieve target severance. Unlike most nonexplosive methods, severance charges can be deployed on multiple targets and detonated nearly simultaneously, effecting rapid severances. Though a relatively faster yet safer process for offshore workers with the omission of diver cutting, the detonation of cutting charges occurs mainly underwater and, therefore, would have little impact on air quality.

The main concern of air quality from decommissioning is the exhaust from support equipment. The less time that heavy equipment must be employed during decommissioning, the less air quality would be negatively impacted. Overall, impacts to air quality from decommissioning would be **minor**.

4.1.2.2 Accidental Events

The greatest impact-producing factors associated with a proposed action that could potentially affect air quality from a reasonably foreseeable accidental event include (1) emergency flaring and venting, and (2) oil spills. Accidental air emissions are described in Chapter 3.2.3 of the 2017-2022 GOM Multisale EIS.

Emergency Flaring and Venting

Emergency flaring is distinguished from routine flaring by the magnitude, frequency, and duration of flaring events. Emergency flaring events are the result of operating conditions that are outside normal process and equipment operations. Emergency flaring is generally characterized by infrequent occurrence, high-emission rates, and short durations. Potential impacts to air quality are not expected to be significant, except in the rare case of a catastrophic event, which is not part of a proposed action and not reasonably foreseeable. Emergency flaring may be conducted to manage excess natural gas during an accidental event, such as damage to a pipeline that transports the gas to shore, or a process upset. In the absence of safety flares, plants would be at a higher risk for fires and explosions. The flare is operated temporarily until the emergency situation is resolved. Flaring would result in the release of NO_x emissions from the flare; SO_2 emissions would be dependent on the sulfur content of the crude oil; and particulate matter from the flare would affect visibility.

Venting would result in the release of mainly CH_4 emissions. Emergency venting may be necessary where flaring of the gas is not possible or in situations precluding the use of a flare gas system, such as insufficient hydrocarbon content in the gas stream to support combustion or a lack of sufficient gas pressure to allow it to enter the flare system. Therefore, the potential impacts of a reasonably foreseeable accidental gas release analyzed in this Supplemental EIS would be localized and short term, and would have no impact to coastal areas, including the Bradwell Bay Wilderness Area, Breton Wilderness Area, Chassahowitza National Wilderness Area, Everglades National Park, and St. Marks Wilderness Area, or the Padre Island National Seashore and Gulf Islands National Seashore. The accidental event's impacts on air quality over the OCS and adjacent onshore areas on accidental gas releases are expected to be **minor**.

The accidental release of hydrocarbons related to a proposed lease sale would result in the emission of air pollutants. The OCS accidents would include the release of oil, condensate, or natural gas or chemicals used offshore or pollutants from the burning of these products. The air pollutants include criteria NAAQS pollutants, volatile and semi-volatile organic compounds, hydrogen sulfide, and methane. These pollutants are discussed above. These accidental events may potentially affect the air quality at the Bradwell Bay Wilderness Area, Breton Wilderness Area, Chassahowitza National Wilderness Area, Everglades National Park, and St. Marks Wilderness Area, as well as the Padre Island National Seashore and Gulf Islands National Seashore, during a 50-year analysis period.

Emergency flaring may be conducted to manage excess natural gas during an accidental event such as damage to a pipeline that transports the gas to shore or a process upset. In the absence of safety flares, plants would be at a higher risk for fires and explosions. The flare is operated temporarily until the emergency situation is resolved. Flaring would result in the release of

NO_x emissions from the flare; SO_2 emissions would be dependent on the sulfur content of the crude oil; and particulate matter from the flare would affect visibility.

Oil Spills

Accidental oil spills, though not considered a routine OCS oil- and gas-related activity, have the potential to occur during each phase of oil and gas operations. In April 2010, the *Deepwater Horizon* explosion and oil spill was a catastrophic event that occurred on the Gulf of Mexico OCS. The impacts on air quality from the *Deepwater Horizon* explosion and oil spill have been well documented. BOEM does not expect accidental events to resemble the *Deepwater Horizon* explosion and oil spill. BOEM is not analyzing the rare, catastrophic *Deepwater Horizon* explosion and oil spill as an accidental event in this chapter but rather is using the information to describe the potential impacts common to spills and accidental events regardless of size. Additionally, BOEM has assessed the potential impacts resulting from a low-probability catastrophic event, and the analysis is presented in the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b). To date, air monitoring conducted following the *Macondo* loss of well control and spill has not found any pollutants at levels expected to cause long-term harm (USEPA, 2010). The loss of well control and blowouts are rare events and of a short duration. Potential impacts to air quality are not expected to be significant, except in the rare case of a catastrophic event, which is not reasonably foreseeable and not part of a proposed action. Therefore, potential impacts as a result of the much smaller reasonably foreseeable accidental spills analyzed in this Supplemental EIS would be localized and short term, and would have no impact to coastal areas, including the Bradwell Bay Wilderness Area, Breton Wilderness Area, Chassahowitza National Wilderness Area, Everglades National Park, and St. Marks Wilderness Area, as well as the Padre Island National Seashore and Gulf Islands National Seashore. The accidental event's impact on air quality over the OCS and adjacent onshore areas on oil spills is therefore expected to be **minor**.

In the Gulf of Mexico, evaporation from an oil spill would result in concentrations of VOCs in the atmosphere, including chemicals that are classified as being hazardous. Benzene, toluene, ethylbenzene and xylene (BTEX) are a category of VOCs that occur naturally in crude oil, as well as during the process of making of gasoline and other fuels from crude oil. The VOC concentrations would occur anywhere where there is an oil slick, but they would be highest at the source of the spill because the rate of evaporation depends on the volume of oil present at the surface. The VOC concentrations would decrease with distance as the layer of oil gets thinner. The lighter compounds of VOCs, such as BTEX, would be most abundant in the immediate vicinity of the spill site. The heavier compounds would be emitted over a longer period of time and over a larger area. Some of the compounds emitted could be hazardous to workers in close vicinity of the spill site. In hazardous conditions, the Occupational Safety and Health Administration and USCG regulations require workers to use breathing protection. The hazard to workers can also be reduced by limiting exposure through limited work shifts, rotating workers in close vicinity of the spill site, and pointing vessels into the wind. While the reasonably foreseeable spills analyzed as part of this Supplemental EIS are significantly smaller than the catastrophic *Deepwater Horizon* explosion and oil spill, air samples collected during that event by individual offshore workers of British Petroleum (BP), the

Occupational Safety and Health Administration (OSHA), and the USCG showed levels of BTEX that were mostly under detection levels. All samples had concentrations below the OSHA permissible exposure limits and the more stringent American Conference of Governmental Industrial Hygienists threshold limit values (U.S. Dept. of Labor, OSHA, 2010). Therefore, the reasonably foreseeable oil spills would be expected to be even smaller.

The VOC emissions that result from the evaporation of oil contribute to the formation of particulate matter ($PM_{2.5}$) in the atmosphere (Brock et al., 2012). In addition, VOCs could cause an increase in ozone levels, especially if the release were to occur on a hot, sunny day with sufficient concentrations of NO_x present in the lower atmosphere. Effects to ozone concentrations would depend on distance of the proposed lease sale area from shore and the accidental spill size. If there were any effects to onshore ozone concentrations to a state, they would likely be temporary in nature and last, at most, the length of time of the spill's duration.

Removal and containment efforts to respond to an ongoing offshore spill would likely require multiple technologies, including source containment, mechanical cleanup, in-situ burning of the slick, and chemical dispersants (Chapter 3.2.7 of the 2017-2022 GOM Multisale EIS). In-situ burning would result in ambient concentrations of CO, CO_2, NO_x, PM_{10}, $PM_{2.5}$, and SO_2 very near the site of the burn and would generate a plume of black smoke. The levels of $PM_{2.5}$ could be a hazard to personnel working in the area, but this could be effectively mitigated through monitoring and relocating vessels to avoid areas of highest concentrations.

4.1.2.3 Cumulative Impacts

An analysis of the cumulative impacts in the GOM region is described in this chapter. This cumulative analysis considers OCS oil- and gas-related and non-OCS oil- and gas-related activities that could occur and adversely affect air quality during the 50-year analysis period.

Under BOEM Contract Number M14PC00007, "Air Quality Modeling in the Gulf of Mexico Region" study, photochemical grid modeling was conducted to assess the impacts to nearby states of existing and proposed future OCS oil and gas exploration, development, and production. Initial results from the modeling conducted for this study have become available and are being included in this Supplemental EIS to disclose potential cumulative and incremental air quality impacts of the proposed lease sales. These initial results represent the best available science at this time and are included in **Appendices B-D**.

BOEM is in the process of updating the air quality modeling based on public comments, and the results of the final air quality modeling will be included in a future NEPA analysis that will be available for public review and comment. The revised air quality model run will not be completed before the publication of this Final Supplemental EIS. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as a reference for NEPA analysis. The air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated.

At the lease issuance stage, no activities beyond certain ancillary activities are actually authorized by the lease; therefore, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1**). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts. During its review of any plan submitted postlease, BOEM conducts an air quality review to determine if additional controls are necessary. At this postlease stage, BOEM has the authority to disapprove or require additional mitigation to reduce impacts from site-specific activities as additional information related to the revised air quality modeling becomes available. It is anticipated that new air quality modeling results will be available for consideration before any plan is submitted on a block leased as a result of proposed Lease Sale 250. Therefore, while additional air quality data would be useful in consideration of this lease sale, it is not necessary for a decision on this lease sale. Any concerns raised by the modeling study will be further refined by the time plans are submitted and/or additional plan-specific modeling may be required consistent with BOEM's regulations when the plan is submitted for approval.

The air quality modeling study examines the potential impacts of the proposed lease sales with respect to (1) the NAAQS for the criteria pollutants O_3, NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}; (2) the Class I and Class II PSD increments; and (3) the AQRVs, including visibility and acid deposition (sulfur and nitrogen) in the nearby Class I and sensitive Class II areas.

Results of each impact analysis are compared with applicable "thresholds of concern," which have typically been used in air quality impact evaluations by other Federal actions, including onshore oil and gas leasing programs. The applicable comparison thresholds for criteria pollutant impacts are the corresponding NAAQS. For acid (i.e., sulfur and nitrogen) deposition impacts, thresholds are based on (1) incremental impacts considered sufficiently small as to have no consequential effect on the receiving ecosystems, i.e., Deposition Analysis Thresholds, and (2) critical load levels above which cumulative ecosystem effects are likely to or have been observed. For visibility impacts, thresholds are based on incremental changes in light extinction below the level at which they would be noticeable to the average human observer. Additional information about these various thresholds is provided in relevant chapters in the remainder of this Supplemental EIS.

Overview of Modeling Approach

The Comprehensive Air-quality Model with extensions (CAMx) and Community Multiscale Air Quality (CMAQ) photochemical grid models were used to simulate the dispersion and chemical transformation of pollutants over the study area. Similar to other air quality models, CAMx/CMAQ require several input datasets, including meteorology and an emissions inventory. **Figure 4-6** presents an overview of how these project datasets fit together for the "Air Quality Modeling in the Gulf of Mexico Region" study. Photochemical modeling was conducted for two emission scenarios:

(1) a Base Case scenario using the 2012 base year (BY) emissions inventory described in **Appendix C** to evaluate model performance and to define current baseline air quality conditions; and

(2) a Future Year development scenario (FY) using an emissions inventory that includes potential new sources associated with the lease sales analyzed for the Supplemental EIS and the projections of emissions to 2017 for all other sources as described in **Appendix C** to estimate the cumulative and incremental air quality and AQRV impacts of the lease sales analyzed in this Supplemental EIS.

NOTE: *Both scenarios used the same 2012 meteorological dataset and the same photochemical model configuration.* (*In determining the Base Case [base year] for the "Air Quality Modeling in the Gulf of Mexico Region" study emissions inventory, 2011 was initially selected based on data availability. Calendar year 2011 emissions data are readily available for most sources from the USEPA's National Emissions Inventory [USEPA, 2017b and 2017c] and the BOEM's Year 2011 Gulfwide Emissions Inventory Study [Wilson et al., 2014]. However, 2011 was an unusually hot and dry year in the Gulf of Mexico region, particularly in Texas, which experienced record heat and dry conditions during the summer of 2011 and which had a very high incidence of wildfires. Therefore, 2012 was selected as the base year as more representative of "typical" conditions in the Gulf of Mexico region.*)

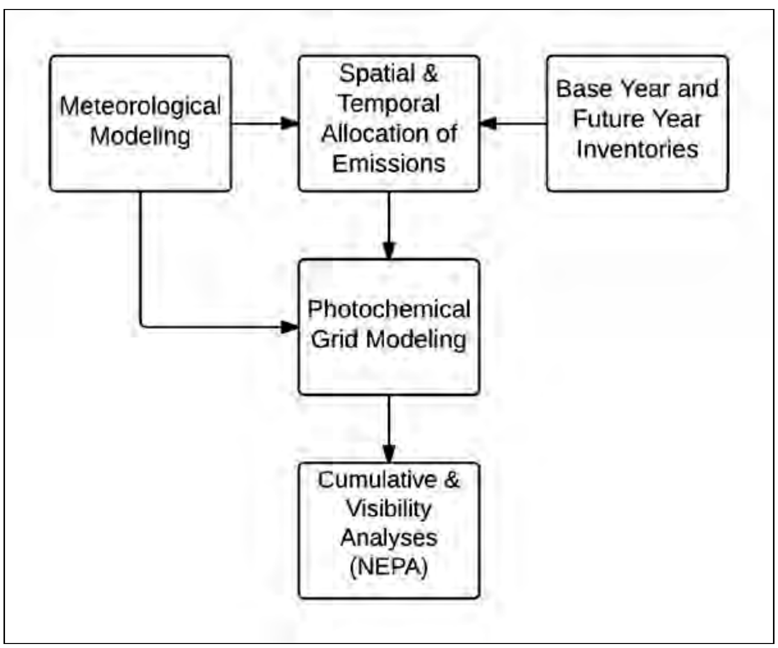


Figure 4-6. Overview of the Gulf of Mexico Region's Cumulative and Visibility Impacts Assessment.

Modeling Input – Meteorological Modeling

Meteorological datasets required to determine the rate that pollutants disperse and react in the atmosphere include spatially and temporally varying parameters such as wind speed, wind direction, air temperature, and humidity, among others. Sources of meteorological information include datasets of measurements gathered at various locations within the Gulf of Mexico region domain, i.e., the area of interest where geographic features influence transport patterns. Results of these meteorological models provide the inputs needed to exercise the photochemical grid air quality dispersion models used in the "Air Quality Modeling in the Gulf of Mexico Region" study. For this study, the Advanced Research version of the Weather and Research Forecasting (WRF) model, as described in **Appendix B**, was applied over a system of nested modeling grids. **Figure 4-7** shows the WRF modeling grids at horizontal resolutions of 36, 12, and 4 km. All WRF grids were defined on a Lambert Conformal Conic (LCC) projection centered at 40° N. latitude, 97° W. longitude with true latitudes at 33° N. latitude and 45° N. latitude (the "standard RPO" projection). In **Figure 4-7**, the outermost domain (outer box) with 36-km resolution includes the entire continental U.S. and parts of Canada and Mexico, and captures synoptic-scale (storm system-scale) structures in the atmosphere. The inner 12-km regional grid (d02) covers the southeastern U.S. and is used to ensure that large-scale meteorological patterns across the region are adequately represented and to provide boundary conditions to the 4-km domain. The 4-km domain (d03) is centered on the coastal areas of the southeastern U.S. and over-water portions of the Gulf of Mexico. The 4-km domain area, which includes parts of Alabama, Georgia, Louisiana, Mississippi, and Texas, and all of Florida, as well as the WPA, CPA, and EPA, and part of the Atlantic Ocean, was the main focus of the emissions inventory efforts. However, the focus of this Supplemental EIS analysis are the coastal areas adjacent to the WPA, CPA, and EPA, which include Texas, Louisiana, Mississippi, Alabama, and Florida.

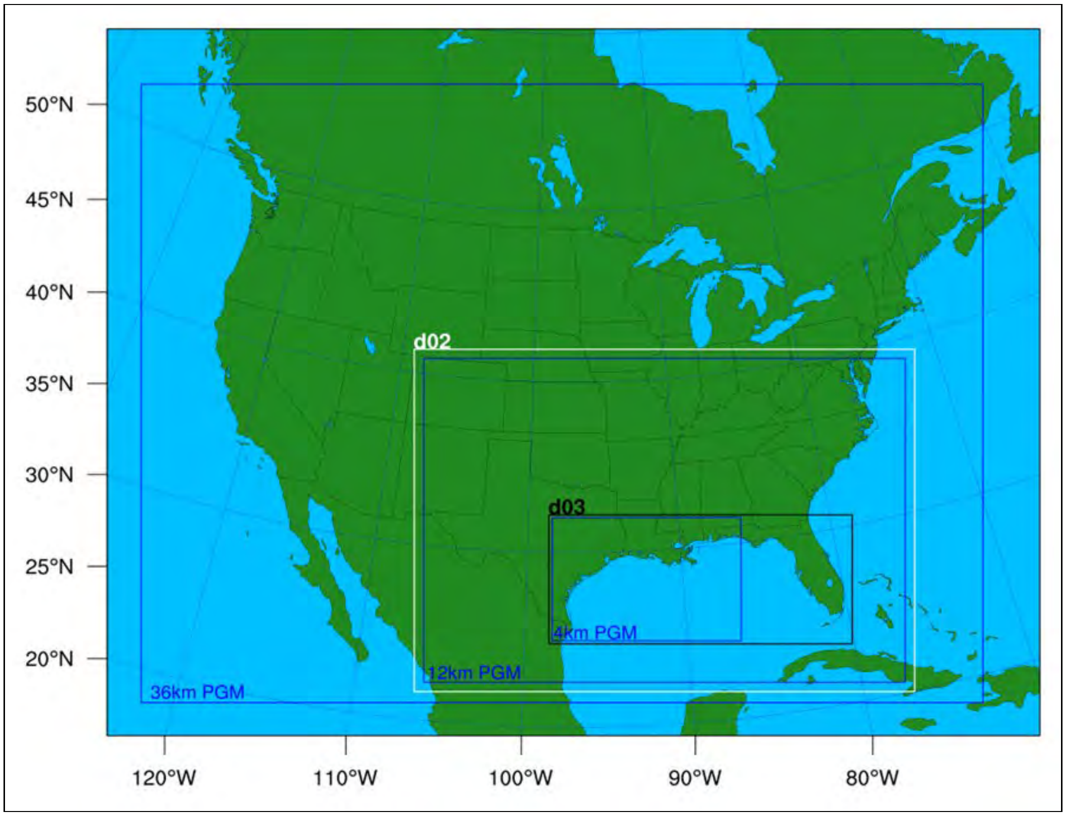


Figure 4-7. Geographic Domain of the "Air Quality Modeling in the Gulf of Mexico" Region" Study.

Modeling Input – Emissions Inventories

Analysis of the cumulative air quality impacts of this Supplemental EIS required the development of both a contemporary base year emissions inventory for the base case analysis and a projected future year inventory that includes emissions from all cumulative sources, as well as additional emissions anticipated to occur under this Supplemental EIS' alternative in which additional exploratory drilling and construction of new shallow and deepwater platforms to support oil and gas production would occur. Both the base case and future year cumulative source inventories represent comprehensive compilations of pollutant emissions from all human activities as well as emissions from biogenic and geogenic sources. Specific details on the development of the emission inventory are presented in **Appendix C**. The scope of the air pollutant emissions inventory for the "Air Quality Modeling in the Gulf of Mexico Region" study is defined in terms of pollutants, representative time periods for the base case and future year analysis, geographical domain, and sources to be included.

Pollutants included in the inventories were selected to support analysis of air quality impacts in terms of impacts on attainment of the NAAQS and on AQRVs, including acid deposition and visibility. The selected pollutants are as follows: the NAAQS criteria pollutants – CO, NO_x (which includes NO and NO_2 and is stated in terms of equivalent mass of NO_2), $PM_{2.5}$, fine plus coarse PM (PM_{10}), and SO_2; criteria precursors – VOCs (which are precursors to the formation of ozone and organic particulates) and ammonia (NH_3) (which is a precursor to particulate matter formation). As previously mentioned in **Chapter 4.1.1**, lead (Pb) was not included in the inventory. While the cumulative air quality impact analysis did not focus specifically on air toxics, the compilation of VOC emissions by source type, together with VOC speciation profiles by source type, provides a mechanism for estimating emissions of individual air toxic species.

Overview of Modeling Results

Source apportionment, as applied in CAMx, provides a means of assessing the contributions of specified sources or categories of sources to predicted ozone and PM concentrations and their precursors under the air quality conditions being simulated. Source contributions were calculated for ozone and PM using the Ozone and Particulate Source Apportionment Technology (OSAT and PSAT) routines included in CAMx. Source apportionment analyses were applied to the future year scenario in order to analyze the pre- and postlease OCS oil- and gas-related impacts to short-term and annual NAAQS, AQRVs, and PSD increments. BOEM selected a set of 10 source categories (SC) for source apportionment as listed in **Table 4-4**, but only four (i.e., SC3, SC4, SC5, and SC6) are appropriate for this Supplemental EIS analysis because they apply to the Gulf of Mexico region.

Table 4-4. Source Categories for Source Apportionment Calculations.

Category ID	Sources
SC1	Fires (U.S., Canada, and Mexico)
SC2	Biogenic and other natural sources (e.g., lightning NO_x and sea salt)
SC3	Additional BOEM OCS oil and gas production platforms associated with this Supplemental EIS (with Action)
SC4	Additional BOEM oil and gas production support vessels and helicopters associated with this Supplemental EIS (with Action)
SC5	BOEM's OCS oil and gas production platforms, support vessels, and helicopters under the base case (No Action)
SC6	All other marine vessel activity in the Gulf of Mexico not associated with OCS oil and gas development, exploration, or production
SC7	Other anthropogenic U.S. sources*
SC8	Mexican and Canadian anthropogenic sources**
SC9	Initial Conditions
SC10	Boundary Conditions)

SC = source category.

* Includes onshore oil and gas production sources and oil and gas production sources in State waters.

** Also includes oil and gas production sources.

These source categories aggregate similar sources based on jurisdiction (i.e., sources under BOEM's jurisdiction versus other Federal agencies) and sources beyond direct domestic regulatory control (e.g., natural emission sources and foreign sources). Additional OCS oil and gas production platforms and additional support vessel and helicopter trips associated with this Supplemental EIS are included as a separate source category, thus providing estimates of the impacts of these new sources, which are projected to occur under the future year scenario associated with this

Supplemental EIS. Platforms and support vessels and helicopters projected for the future year scenario under the Base Case (No Action) scenario are also included as a separate source apportionment category.

Isolating fires and biogenic emissions shows the component of the air quality concentrations that are typically beyond the control of Federal agencies and the States. Similarly, the Mexican and Canadian anthropogenic emissions are beyond the control of U.S. regulators.

4.1.2.3.1 Impacts Assessment

Model results were post-processed for analysis of air quality impacts with respect to the NAAQS and AQRVs; PSD increments were also calculated for information purposes and are described below. For analyzing the NAAQS and AQRV impacts at Class I and sensitive Class II areas, the thresholds of concern used were defined by the Federal Land Manager that manages each Class I/II area. The post-processed results described below are still initial results, but they are being used to disclose the potential cumulative impacts to coastal areas. Specific cumulative impact analysis results from the "Air Quality Modeling in the Gulf of Mexico Region" study are presented in **Appendix D**.

The CAMx source apportionment results for individual source categories were used to evaluate the incremental impacts of each of a set of hierarchical source groups as defined in **Table 4-5**. Note that Source Group B represents all new direct emissions associated with this Supplemental EIS and that Source Group C represents these sources in addition to all existing OCS platforms and associated support vessel and aircraft activity. Also, note that Source Group E includes Source Groups A-D, along with all other anthropogenic sources, but excludes fires and other natural sources (i.e., biogenics, lightning, NO_x, and sea salt) and the contribution of Boundary Conditions.

Table 4-5. Source Group for Incremental Impacts Analysis.

Source Group	Included Source Categories (SC)	Comment
A	SC3	New oil and gas platform sources under this Supplemental EIS
B	SC3, SC4	Add support vessels and aircraft associated with new platform sources
C	SC3, SC4, SC5	Add oil and gas platforms and associated support vessels and aircraft under the No Action alternative
D	SC3, SC4, SC5, SC6	Add all other marine vessel activity in the GOM
E	SC3, SC4, SC6, SC6, SC7, SC8	Add all other U.S. and non-U.S. anthropogenic sources
F	SC1, SC2, SC8, SC10	Natural and non-U.S. sources (including U.S. sources outside of the 12-km modeling domain)

NAAQS Impacts

The impacts for the NAAQS criteria pollutants ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), fine particulate matter with aerodynamic diameter less than 2.5 µm ($PM_{2.5}$), and fine plus coarse particulate matter with aerodynamic diameters less than 10 µm (PM_{10}) are discussed below.

Comparison to the NAAQS

Results of each impact analysis are compared with applicable "thresholds of concern," which have typically been used in air quality impact evaluations by other Federal actions, including onshore oil and gas leasing programs. The applicable comparison thresholds for criteria pollutant impacts are the corresponding NAAQS (**Table 4-6**).

The CAMx future year scenario predicted that the total concentrations from all emission sources were post-processed for comparison to the applicable NAAQS in two different ways. First, the CAMx predictions were compared directly against each NAAQS. This is referred to as the "absolute" prediction comparison. These absolute prediction comparisons may be misleading in cases in which the model exhibits significant prediction bias. In recognition of this, USEPA modeling guidance (USEPA, 2007 and 2014) recommends using the model in a relative sense when projecting future year ozone, $PM_{2.5}$, and regional haze levels, and USEPA has developed the Modeled Attainment Test Software (MATS; Abt., 2014) for making such future year projections. This approach uses the ratio of future year to current year modeling results to develop Relative Response Factors (RRFs) that are applied to observed current year Design Values (abbreviated as either DVC or DVB) to make future year Design Value (DVF) projections (i.e., DVF = DVC x RRF). The MATS was applied to the prediction of both ozone and $PM_{2.5}$ DVFs.

Table 4-6. NAAQS and PSD Increments.

Pollutant	Pollutant/Averaging Time	NAAQS	PSD Class I Increment[1]	PSD Class II Increment[1]
CO	1-hour[2]	**35 ppm** 40,000 µg/m^3	--	--
CO	8-hour[2]	**9 ppm** 10,000 µg/m^3	--	--
NO_2	1-hour[3]	**100 ppb** 188 µg/m^3	--	--
NO_2	Annual[4]	**53 ppb** 100 µg/m^3	2.5 µg/m^3	25 µg/m^3
O_3	8-hour[5]	**0.070 ppm** 137 µg/m^3	--	--
PM_{10}	24-hour[6]	**150 µg/m^3**	8 µg/m^3	30 µg/m^3
PM_{10}	Annual[7]	--	4 µg/m^3	17 µg/m^3
$PM_{2.5}$	24-hour[8]	**35 µg/m^3**	2 µg/m^3	9 µg/m^3
$PM_{2.5}$	Annual[9]	**12 µg/m^3**	1 µg/m^3	4 µg/m^3

Pollutant	Pollutant/Averaging Time	NAAQS	PSD Class I Increment[1]	PSD Class II Increment[1]
SO_2	1-hour[10]	**75 ppb** 196 µg/m^3		
SO_2	3-hour[11]	**0.5 ppm** 1,300 µg/m^3	25 µg/m^3	512 µg/m^3
SO_2	24-hour	--	5 µg/m^3	91 µg/m^3
SO_2	Annual[4]	--	2 µg/m^3	20 µg/m^3

µg/m^3 = microgram per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; O_3 = ozone; $PM_{2.5}$ = particulate matter less than or equal to 2.5 µm; PM_{10} = particulate matter less than or equal to 10 µm; ppb = parts per billion; ppm = parts per million; PSD = Prevention of Significant Deterioration; SO_2 = sulphur dioxide.

[1] The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD increment consumption analysis.
[2] No more than one exceedance per calendar year.
[3] 98th percentile, averaged over 3 years.
[4] Annual mean not to be exceeded.
[5] Fourth-highest daily maximum 8-hour ozone concentrations in a year, averaged over 3 years, NAAQS promulgated December 28, 2015.
[6] Not to be exceeded more than once per calendar year on average over 3 years.
[7] 3-year average of the arithmetic means over a calendar year.
[8] 98th percentile, averaged over 3 years.
[9] Annual mean, averaged over 3 years, NAAQS promulgated December 14, 2012.
[10] 99th percentile of daily maximum 1-hour concentrations in a year, averaged over 3 years.
[11] No more than one exceedance per calendar year (secondary NAAQS).

Ozone

The ozone NAAQS is defined as an 8-hour averaging time that is expressed as a 3-year average of the 4th highest maximum daily average. Since only one calendar year of modeling results are available for the base year and future year outcome, the future year 4th highest maximum daily average 8-hour ozone concentration is used as a pseudo-NAAQS comparison metric. The USEPA's Model Attainment Test Software (MATs) was used to make future year ozone future design values projections using the CAMx 2012 Base Case and Future Year Scenario modeling results.

The impacts to air quality from ozone for of all proposed and existing oil and gas emissions from Gulf of Mexico OCS sources and their support vessels/aircraft (Source Group C) are **moderate** because the future year design values were above the current year design value (which was already above the NAAQS). The modeling suggests that the maximum contribution of all proposed and existing oil and gas emissions from Gulf of Mexico OCS sources and their support vessels/aircraft (Source Group C) occur in Galveston, Texas (a nonattainment area).

The impacts to air quality from O_3 for Source Group B (new platforms and associated support vessels and aircraft under this Supplemental EIS) are **minor** because the future year design values were lower than the current year design values. The modeling suggests that the maximum contribution of Source Group B is centered in the GOM offshore of Louisiana; maximum impacts from the State seaward boundaries inland along the coast of Cameron Parish, Louisiana. Source

Group A (new platforms under this Supplemental EIS) maximum contributions occur in the same location, but the support vessel and helicopter activities (from Source Group B) are responsible for the greater impacts landward of the State seaward boundary.

NOTE: *For the ozone impacts assessment, please note that the States will not designate under the 2015 ozone standard of 70 ppb until 2017, with the earliest attainment date of March 2021 for marginal areas. For this impacts assessment, the non-OCS source emissions were based on the USEPA's 2017 emission projections, with a future modeled year of 2017 and compared with the 70-ppb standard. This assessment is assuming the standard will be attained in advance of the actual attainment date but wanted to give maximum OCS oil and gas impacts under the new 70-ppb ozone standard.*

Particulate Matter (PM)

$PM_{2.5}$

There are two $PM_{2.5}$ NAAQS: one for the 24-hour averaging time that is expressed as a 3-year average of the annual 98th percentile in a year and an annual average over 3 years. With 1 year of photochemical grid modeling, the annual 98th percentile would correspond to the 8th highest 24-hour $PM_{2.5}$ concentration in a year. As described for the ozone NAAQS analysis, the MATS was used to calculate DVFs for the 24-hour and annual $PM_{2.5}$ NAAQS.

All future year modeled concentrations for 24-hour and annual $PM_{2.5}$ are below the NAAQS. The impacts to air quality from 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ are **minor** because the future year design values were lower than the current year design values at all sites except one. While the annual $PM_{2.5}$ current year modeled concentration exceeded the NAAQS in Harris County, Texas, the projected future year design value at this location is below the NAAQS.

24-hour $PM_{2.5}$: All current and future year design values are below the NAAQS, and the future year design values are projected to be lower than the current year design values at all sites. The modeling suggests that the highest 24-hour $PM_{2.5}$ impacts occur at the State seaward boundary off the coast of Louisiana. There were no monitoring sites with the 24-hour $PM_{2.5}$ in excess of the NAAQS, with future year modeling projecting no design value exceedances. The maximum contributions due to emissions from all existing and proposed GOM platform and support equipment to the 8th highest 24-hour $PM_{2.5}$ concentrations occurs right on the State seaward boundary off the coast of Houma, Louisiana.

Annual Average $PM_{2.5}$: The modeling suggests that the highest annual $PM_{2.5}$ impacts occur right at the State seaward boundary off the coast of Louisiana. There was one monitoring site with annual $PM_{2.5}$ design value concentrations above the NAAQS (in Harris County [Houston], Texas) but reduced to below the NAAQS in the future year. The maximum contribution to annual $PM_{2.5}$ future design values due to emissions from all existing and proposed GOM platform and support equipment occurs at the State seaward boundary off the coast of Louisiana.

PM_{10}

There is only one PM_{10} NAAQS: one for the 24-hour averaging time that is expressed as a 3-year average not to be exceeded more than once per calendar year. With 1 year of photochemical grid modeling, the annual 98th percentile will correspond to the 8th highest 24-hour $PM_{2.5}$ concentration in a year. The impacts to air quality from PM_{10} are **minor** because, while there are concentrations increases in water farther offshore, no overall standards were exceeded.

24-Hour PM_{10}: The OCS oil- and gas-related impacts for the 24-hour PM_{10} are similar to the 24-hour $PM_{2.5}$ future year modeling, projecting no future design value exceedances. The modeled 2nd highest daily average PM_{10} concentrations can be compared with the 24-hour average PM_{10} NAAQS for the base and future scenarios and the base-future differences. The modeling suggests areas of elevated PM_{10} are evident in urban and port areas and in fire zones along the Gulf Coast of Texas and Louisiana (impacts of fires on PM_{10} are also seen). The PM_{10} decreases between the current and future year are modeled along the Louisiana coast, with increases in waters farther offshore associated with new emissions from proposed action sources. The maximum contribution of all oil and gas platforms and support vessels and helicopters (Source Group C) are below the NAAQS, and the maximum contribution of the new platforms and associated support vessels and aircraft under this Supplemental EIS (Source Group B) are below the NAAQS.

Nitrogen Dioxide (NO_2)

There are two nitrogen dioxide NAAQS: one for the 1-hour averaging time that is expressed as a 3-year average of the annual 98th percentile in a year and an annual average over 3 years. With 1 year of photochemical grid modeling, the annual 98th percentile would correspond to the 8th highest 24-hour NO_2 concentration in a year. Results are included below for both the 1-hour NO_2 and the annual NO_2 averaging times. All modeled concentrations for NO_2 are below the NAAQS. The impacts to air quality from 1-hour NO_2 and annual NO_2 are **minor** because overall, concentrations decrease between the base and future year scenarios at most locations. While there was in increase between the base and future year scenarios for annual NO_2 in Vermilion Parish, Louisiana, no standards were exceeded.

1-hour NO_2: All modeled 1-hour NO_2 concentrations are below the NAAQS. The overall, concentrations decrease between the base and future year scenarios at most locations. The modeling suggests that the maximum contributions from new platforms and support vessels and helicopters associated with this Supplemental EIS (Source Group B) are dominated by vessel and possibly helicopter traffic in the port areas, most notably in Vermilion Parish, Louisiana; and the maximum combined contributions from new and existing platforms and support vessels and helicopters (Source Group C) are dominant in the area of the LOOP.

Annual NO_2: These results are similar to those for 1-hour NO_2. The maximum impacts of new and existing platforms and support vessels and helicopters associated with this Supplemental EIS (Source Group C) showed increases between the base and future year scenarios to occur near the entrance to the Freshwater Bayou Canal in Vermilion Parish, Louisiana, and somewhat larger increases modeled in the Permian Basin of west Texas. However, overall no standards were exceeded.

Sulfur Dioxide (SO_2)

There are two sulfur dioxide NAAQS: one for a 1-hour averaging time that is expressed as a 3-year average of the annual 99th percentile in a year and a 3-hour average not to be exceeded more than once per year. All modeled concentrations for SO_2 are below the NAAQS. The impacts to air quality from 1-hour SO_2 and 3-hour SO_2 are **minor** because overall, concentrations decrease between the base and future year scenarios at most locations as sources retire or apply control equipment.

1-hour SO_2: All modeled values are below the NAAQS. While maximum contributions are located from sources in areas with deepwater platforms, concentrations decrease in most locations in the future year scenario as sources are retired or apply control equipment with projected maximum impacts all below the NAAQS.

3-hour SO_2: All modeled values are below the NAAQS. These results are similar to those for the 1-hour SO_2 described above.

Carbon Monoxide (CO)

There are two carbon monoxide NAAQS: a 1-hour averaging time and an 8-hour average not to be exceeded more than once per year. All modeled concentrations for SO_2 are below the NAAQS. The impacts to air quality from 1-hour CO_2 and 8-hour CO are **minor** because overall, concentrations decrease between the base and future year scenarios at all locations.

1-hour CO: The modeled 1-hour CO design values (based on the annual 2nd highest daily maximum 1-hour average) for the base, future, and future-base scenarios show all values are below the NAAQS.

8-hour CO: The modeled 8-hour CO design values (based on the annual 2nd highest non-overlapping running 8-hour average) for the base, future, and future-base scenarios show the maximum predicted 8-hour design value in the future year occurs at the entrance to the Freshwater Bayou Canal in Vermilion Parish, Louisiana, but no over standard was exceeded.

Incremental Impacts of PSD Pollutants with Respect to PSD Class I and Class II Increments

As mentioned in the **Chapter 4.1.1**, the WPA, CPA, and EPA include national parks and Federal wilderness areas where air quality and AQRVs (primarily visibility) are protected more stringently than under the NAAQS. The Class I areas, compared with Class II areas, have lower PSD increments that new sources may not exceed and that are protected against excessive increases in several AQRVs, including visibility impairment. **Table 4-7** lists those areas that are located along the Gulf Coast and, thus, are of greatest interest to this analysis.

The incremental AQ/AQRV contributions associated with emissions from each source group listed in **Table 4-4** were calculated for the Class I and sensitive Class II areas listed in **Table 4-7**. The selected areas include all Class I and sensitive Class II areas within the 4-km modeling domain plus additional Class I areas within the 12-km modeling domain (Bradwell Bay).

The Class I and sensitive Class II increments analyses results are expressed in terms of the maximum increment consumption over all Class I and sensitive Class II areas within the 4-km modeling domain. Incremental impacts of each source group at Class I and sensitive Class II areas were calculated for all pollutants for which PSD increments have been set (NO_2, SO_2, PM_{10}, and $PM_{2.5}$) and are discussed below.

Table 4-7 Class I and Sensitive Class II Areas in Gulf Coast and Nearby States.

Type	Name	Agency	State	Modeling Domain
Class I	Breton Wilderness	FWS	LA	4 km
Class II	Breton NWR	FWS	LA	4 km
Class II	Gulf Islands NS	NPS	MS, FL	4 km
Class II	Padre Island NS	NPS	TX	4 km
Class I	Bradwell Bay	FS	FL	12 km

FL = Florida; FS = Forest Service; FWS = Fish and Wildlife Service; LA = Louisiana; MS = Mississippi; NPS = National Park Service; NS = National Seashore; NWR = National Wildlife Refuge; TX = Texas.

Comparison at the Class I and Sensitive Class II Areas

The maximum contribution of new oil and gas production sources under this Supplemental EIS were reported for each Class I and sensitive Class II area and were compared against the PSD increments given in **Table 4-6**. Comparisons of impacts from a proposed action with maximum allowed PSD increments are presented here as an evaluation of a “threshold of concern” for potentially significant adverse impacts, but they do not represent a regulatory PSD increment consumption analysis. (*Note: This analysis does not constitute a regulatory PSD increment consumption analysis as would be required for major sources subject to the New Source Review program requirements of the Clean Air Act. Under the Clean Air Act, a PSD increment consumption analysis requires major stationary sources subject to PSD review to demonstrate that emission increases from the proposed source, in conjunction with all other emissions increases or reductions in the impacted area (typically within 50 km [31 mi]), will not cause or contribute to concentrations of air pollutants that exceed PSD increments. The PSD increments have been established for NO_x, SO_2, and PM in Class I and* sensitive *Class II areas. Actions to be authorized by BOEM under this Supplemental EIS typically fall under BOEM's air quality jurisdiction and are not typically subject to PSD permits or review. However, a comparison of ambient concentrations from an accumulation of new oil and gas sources within the entire study area to PSD increments at specific Class I and* sensitive *Class II areas is included in this analysis for information purposes. This information is presented to aid State agencies in tracking potential minor source increment consumption and to aid Federal Land Managers or Tribal governments responsible for protecting air resources in Class I areas).*

The CAMx source apportionment results for individual source categories were used to evaluate the incremental impacts of each of a set of hierarchical source groups as defined in **Table 4-5**. Note that Source Group B represents all new direct emissions associated with this Supplemental EIS, and Source Group C represents these sources in addition to all existing OCS platforms and associated support vessel and aircraft activity.

The impacts to Class I areas from contributions of new platforms and its associated support vessels and aircraft are **minor** because proposed activities exceed the 24-hour $PM_{2.5}$ Class I PSD increments by 10 percent at the Breton Wilderness Area, which are a result of support vessels and helicopter traffic associated with the activities. The impacts to Class I areas from contributions of all activities from past, present, and future lease sales are **moderate** because proposed activities exceed the annual and 24-hour $PM_{2.5}$, 24-hour PM_{10}, and annual NO_2 Class I PSD increments at the Breton Wilderness Area. BOEM has been in consultation with FWS and will be conducting further refined modeling. It is anticipated that these air quality results will be updated in a Supplemental EIS as soon as these data are available.

The impacts to sensitive Class II areas from contributions of all activities as a result of a single proposed lease sale are **minor** because, while maximum increases occur at the Gulf Islands National Seashore for all PSD pollutants and averaging times and increases occur for annual NO_2 at the Breton Wilderness Area, there are no exceedances of the PSD Class II increment. The impacts to sensitive Class II areas from contributions of all activities from past, present, and future lease sales are **moderate** because proposed activities exceed the annual 24-hour $PM_{2.5}$ Class II PSD increments at the Gulf Islands National Seashore.

Class I Areas

For all source groups described in **Table 4-5**, the maximum contributions for all PSD pollutants and averaging times occur at the Breton Wilderness Area Class I area. Concentration increments from Source Groups A and B are less than the maximum allowed PSD increments for all pollutants and averaging times, except for the 24-hour $PM_{2.5}$ increment from Source Group B at the Breton Wilderness Class I area where the maximum impact exceeds the Class I PSD increment. The difference in the maximum Source Group A 24-hour average $PM_{2.5}$ increment and the maximum Source Group B 24-hour average $PM_{2.5}$ indicates that support vessels or helicopter traffic associated with new offshore platforms, rather than emissions from the platforms themselves, are largely responsible for pushing the maximum impact above the Class I PSD increment at Breton Wilderness Area. However, when the 24-hour $PM_{2.5}$ impact from Source Group B is averaged over all grid cells covering the Breton Wilderness Class I area, the impact is below the Class PSD increment. The maximum impacts from Source Group C exceeds the annual and 24-hour $PM_{2.5}$, 24-hour PM_{10}, and annual NO_2 Class I PSD increments at the Breton Wilderness Area.

Sensitive Class II Areas

For Source Groups A-D described in , the maximum contributions occur at the Gulf Islands National Seashore for all PSD pollutants and averaging times except annual NO_2, which occurs at the Breton Wilderness Area. The cumulative impacts (Source Group C) exceed the annual 24-hour $PM_{2.5}$ Class II PSD increments at the Gulf Islands National Seashore.

AQRV Impacts – Including Visibility and Acid Deposition

While visibility and acid deposition are not directly regulated by BOEM, an analysis of the potential impacts is provided below.

Results of each impact analysis are compared with applicable "thresholds of concern," which have typically been used in air quality impact evaluations by other Federal actions, including onshore oil and gas leasing programs. The applicable comparison thresholds for visibility impacts are based on incremental changes in light extinction below the level at which they would be noticeable to the average human observer. The applicable comparison thresholds for acid (i.e., sulfur and nitrogen) deposition impacts are based on (1) incremental impacts considered sufficiently small as to have no consequential effect on the receiving ecosystems, i.e., Deposition Analysis Thresholds, and (2) critical load levels above which cumulative ecosystem effects are likely to or have been observed.

Comparison to Visibility and Acid Deposition

Visibility impacts were calculated for each source group using incremental concentrations as quantified by the CAMx PSAT tool. For each source group, the estimated visibility degradation at the Class I areas and sensitive Class II areas due to the source group are presented in terms of the number of days that exceed a threshold change in deciview relative to background conditions. The number of days with a deciview greater than 0.5 and 1.0 are reported.

The initial results of impacts of all activities as a result of a single proposed lease sale to visibility impairment from a proposed lease sale is expected to be **minor** to **moderate** as modeled results show exceedances of the visibility thresholds at several of the Class I and sensitive Class II areas in the Gulf of Mexico region. The initial results of impacts of all activities as a result of all contributions of all activities from past, present, and future lease sales to visibility impairment from a proposed lease sale is expected to be **minor** to **moderate** as modeled results show exceedances of the visibility thresholds at several of the Class I and sensitive Class II areas in the Gulf of Mexico region.

The initial results of impacts of all activities as a result of a single proposed lease sale to acid deposition is expected to be **minor** to **moderate** as modeled results show incremental nitrogen deposition exceeds the western and eastern Deposition Analysis Thresholds at all three locations (i.e., the Breton Wilderness Area, Gulf Islands National Seashore, and Padre Island National Seashore). Additionally, incremental sulfur deposition is below the Deposition Analysis Thresholds in all cases except the sulfur deposition at the Breton Wilderness Area and Gulf Islands National Seashore, which exceed the western Deposition Analysis Thresholds but not the eastern Deposition Analysis Thresholds.

The initial results of impacts of all from contributions of all activities from past, present, and future lease sales to acid deposition is expected to be **minor** to **moderate** as modeled results show cumulative maximum nitrogen deposition to continue exceeding the critical load thresholds under the future year scenario for all areas except the Padre Island National Seashore. Additionally, cumulative sulfur deposition values are lower, and larger sulfur emission reductions help to reduce sulfur deposition from above the critical load to below the critical load at the Breton Wilderness Area and Breton National Wildlife Refuge (based on maximum grid cell values). Nevertheless, the maximum grid cell sulfur deposition still exceeds the critical load at the Gulf Islands National Seashore by a small margin.

Visibility

For visibility impacts, thresholds are based on incremental changes in light extinction below the level at which they would be noticeable to the average human observer. Incremental visibility impacts were calculated for each source group, as well as the cumulative impact of all sources combined. The changes in light extinction from CAMx model concentration increments due to emissions from each source group were calculated for each day at grid cells that intersect Class I and sensitive Class II areas within the 12/4-km modeling domain-km (7/2-mi) modeling domain. For Source Group A, the annual 8th highest change in deciview exceed the 1.0 threshold at the Breton Wilderness Area, Breton National Wildlife Refuge, and Gulf Islands National Seashore. Incremental impacts for Source Group B are larger and include days with the 8th highest change in deciview greater than 1.0 at the Padre Island National Seashore in addition to the areas mentioned above, as well as values greater than 0.5 at the Chassahowitzka Wilderness Area and St. Marks National Wildlife Refuge. For Source Group A, the annual 8th highest deciview exceed the 1.0 threshold at the Breton Wilderness Area, Breton National Wildlife Refuge, and Gulf Islands National Seashore.

Incremental impacts for Source Group B are larger and include days with 8th highest deciview greater than 1.0 at Padre Island National Seashore in addition to the areas mentioned above as well as values greater than 0.5 at Chassahowitzka Wilderness Area and St. Marks National Wildlife Refuge.

Acid Deposition

The CAMx-predicted that wet and dry fluxes of sulfur- and nitrogen-containing species were processed to estimate total annual sulfur (S) and nitrogen (N) deposition values at each Class I and sensitive Class II area. The maximum annual S and N deposition values from any grid cell that intersects a Class I receptor area was used to represent deposition for that area, in addition to the average annual deposition values of all grid cells that represent a Class I receptor area. Although the convention in the past has been to report just the maximum deposition in any receptor in a Class I/II area, since deposition relates to the total amount deposited across an entire watershed, the average metric may be considered a more relevant parameter for evaluating potential environmental effects. Maximum and average predicted S and N deposition impacts are reported separately for each source group.

As a screening analysis, incremental deposition values in Class I and II areas for combined Source Groups A (new platforms associated with the highest emissions year of the 10 proposed lease sales) and B (new platforms and associated support vessels and helicopters associated with the 10 proposed lease sales) were compared to the eastern and western U.S. Deposition Analysis Thresholds. Comparison of deposition impacts from cumulative sources to the Deposition Analysis Thresholds is not appropriate. Deposition results were also obtained for all other sensitive areas throughout the 12-km (7-mi) modeling domain, but the highest deposition values all occurred within the 4-km (2-mi) domain. The dividing line between the eastern and western Deposition Analysis Thresholds specified in the FLAG guidance is the Mississippi River, which makes sense for most locations in the U.S.; however, it is not necessarily clear which Deposition Analysis Threshold would be most appropriate for coastal locations along the Gulf Coast, so results are compared here against both Deposition Analysis Thresholds.

Incremental nitrogen deposition exceeds the western and eastern Deposition Analysis Thresholds at all three locations (i.e., the Breton Wilderness Area, Gulf Islands National Seashore, and Padre Island National Seashore). Incremental sulfur deposition is below the Deposition Analysis Thresholds in all cases except the sulfur deposition from Source Group B at the Breton Wilderness Area and Gulf Islands National Seashore, which exceeds the western Deposition Analysis Thresholds but not the eastern Deposition Analysis Thresholds.

Cumulative nitrogen deposition from all sources combined for the base case and future year scenarios were compared against applicable critical load levels in each Class I and II area for which critical loads were identified. Cumulative nitrogen deposition is projected to decrease in all areas between the 2012 base case and the 2017 future year, which is consistent with an overall reduction in NO_x emissions. Nevertheless, maximum nitrogen deposition is modeled to continue exceeding the critical load thresholds under the future year scenario for all areas except the Padre Island National Seashore. Sulfur deposition values are lower, and larger sulfur emission reductions help to reduce sulfur deposition from above the critical load to below the critical load at the Breton Wilderness Area and Breton National Wildlife Refuge (based on maximum grid cell values). Nevertheless, the maximum grid cell sulfur deposition still exceeds the critical load at the Gulf Islands National Seashore by a small margin.

OCS Oil- and Gas-Related Impacts

This section includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales. Emissions contributing to air quality degradation come from many sources. Air pollutants on the NAAQS list are commonly referred to as criteria pollutants because they are ubiquitous. Although these pollutants occur naturally, elevated levels are usually the result of anthropogenic activities. The OCS oil- and gas-related activities that could impact air quality include the following: platform construction and emplacement; platform operations; drilling activities; flaring; service-vessel trips; fugitive emissions; the release of oil, condensate, natural gas, and chemicals used offshore, or pollutants from the burning of these products; and a low-probability catastrophic spill, which is not part of the proposed action and not likely expected to occur. Based on the air quality modeling results from the "Air Quality Modeling in the Gulf of Mexico Region" study, cumulative impacts would be **moderate** because, while there are exceedances to the thresholds of concern, the impacts are just enough to push over the standard.

In the air quality modeling study, Source Group C represents all proposed (new) and existing oil- and gas-related emissions from Gulf of Mexico OCS sources and their support vessels/aircraft. According to the modeling results, the impacts of criteria pollutants from Source Group C to air quality are below the NAAQS for all pollutants, except ozone which shows an increase in the future year design values occurring in Galveston, Texas, which is a nonattainment area. At the Galveston, Texas, monitor, the contribution of Source Group A (new platforms) alone was sufficient to bump the future year design value from just below the NAAQS to just above the NAAQS (recall comparisons to the 70-ppb NAAQS are made after truncating design values to the nearest ppb).

According to the modeling results, the incremental impacts of PSD pollutants from Source Group C to the Class I area exceed the annual and 24-hour $PM_{2.5}$, 24-hour PM_{10}, and annual NO_2 Class I PSD increments at the Breton Wilderness Area. The incremental impacts of PSD pollutants from Source Group C to the sensitive Class II area exceed the annual 24-hour $PM_{2.5}$ Class II PSD increments at the Gulf Islands National Seashore.

Non-OCS Oil- and Gas-Related Impacts

Non-OCS oil- and gas-related impacts include other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program. Onshore emission sources from non-OCS oil- and gas-related activities include power generation, industrial processing, manufacturing, refineries, commercial and home heating, and motor vehicles (Chapter 3.3.2.5 of the 2017-2022 GOM Multisale EIS). The total impact from the combined onshore and offshore emissions would have an effect on the ozone nonattainment area in southeast Texas.

State oil and gas programs (Chapter 3.3.2.1 of the 2017-2022 GOM Multisale EIS) onshore, in territorial seas, and in coastal waters also generate emissions that affect the air quality of any state. These emissions are regulated by State agencies and/or the USEPA. Reductions in emissions have been achieved through the use of low sulfur fuels, catalytic reduction, and other efforts and, as a result, constitute minor impacts to the air quality of any state.

Other major factors influencing offshore environments, such as sand borrowing (Chapter 3.3.2.6.6 of the 2017-2022 GOM Multisale EIS), commercial transportation (Chapter 3.3.2.2 of the 2017-2022 GOM Multisale EIS), military vessels, and recreational vessels also generate emissions that can affect air quality. These emissions are regulated by State agencies and/or the USEPA. Reductions have been achieved through the use of low sulfur fuels and catalytic reduction and, as a result, constitute slight impacts to onshore air quality.

Hurricanes (Chapter 3.3.2.9.2 of the 2017-2022 GOM Multisale EIS) mainly cause damage to offshore infrastructures and pipelines, which may result in an oil spill. A hurricane would cause minor effects on the onshore air quality since air emissions in the event of a hurricane are temporary sources. For the cumulative scenario, the emissions from an oil spill and the associated response activities and infrastructure repair activities are expected to be the same as a proposed lease sale and to have lesser effects on the onshore air quality.

Additionally, recent information shows that intercontinental dust transport may have impacts on the GOM's air quality. For example, dust from Central America and North Africa has been found in the Texas atmosphere. Fine particulates ($PM_{2.5}$), such as ammonium sulfate, can be suspended in the atmosphere and can impair visibility and adversely affect human health. Once in the atmosphere, these fine particulates can be transported for long distances. It has been observed that a substantial amount of the fine particulates observed in Texas comes from Mexico and Central America, and enters into the United States across Texas' southern border. As a result, it reduces the visibility at Big Bend and Guadalupe Mountains National Parks, both Class I (pristine with respect to visibility) areas. The results of air dispersion modeling indicate that as much as half of the visibility impairment (occurring on 20% of the most visibility impaired days) at Big Bend comes from international transport (State of Texas, Commission on Environmental Quality, 2014). The trans-Atlantic transport of North African dust by summertime trade winds occasionally increases ambient particulate matter (PM) concentrations in Texas above air quality standards (Bozlaker et al., 2013). These results indicate that an increase in visibility impairment in Texas is likely due to intercontinental transport of dust rather than OCS oil- and gas-related emission sources.

The activities associated with a proposed action would increase global GHG emissions from the use of vessels, drilling equipment, and other activities that burn fossil fuels. In addition, methane

(CH_4,) also known as natural gas, is removed from wells and brought onto OCS oil- and gas-related facilities along with oil being produced. Sometimes CH_4 is released as a fugitive gas that can escape unintentionally from leaks in equipment used by operators. As a result of exploration, development, and production of oil and gas on the OCS, the activities associated with a proposed action are expected to release GHGs and black carbon from the use of combustion engines in vessels, construction, drilling, and other equipment, as well as through deliberate or accidental release of CH_4. In addition to the direct emissions from OCS oil and gas operations presented above, BOEM has evaluated GHG emissions covering the lifecycle of OCS oil and gas production and consumption. This includes both the "downstream" consumption and onshore processing of oil and gas products, as well as the "upstream" emissions from offshore exploration, development, and production. This Supplemental EIS tiers from and updates the 2017-2022 GOM Multisale EIS, which tiers from the 2017-2022 Five-Year Program EIS. In the 2017-2022 Five-Year Program EIS, the potential impacts of the Program's activities on climate change were assessed in Chapter 4.2.1 (Climate Change), which specifically addressed the GOM proposed lease sales in that analysis (USDOI, BOEM, 2016b).

Incremental Contribution of a Single Proposed Lease Sale to Overall Cumulative Impacts

In the air quality modeling study, incremental contributions are categorized as the impacts of pollutants from new platforms and their associated support vessels and aircraft. The forecasted data used to support modeling analyses include emissions resulting from the 10 proposed lease sales annualized by using BOEM's Resource Evaluation's mid-case scenario. To understand how these results would apply to a single proposed lease sale, the level of projected activity was compared between the modeled highest year of the 10 proposed lease sales to a single proposed lease sale. A regionwide lease sale has not previously been analyzed, and historic trend data are limited. In the scenario in **Chapter 3.1**, the projected activities of a single regionwide lease sale is based on a range of historic observations and provides a reasonable expectation of oil and gas production anticipated from a single proposed lease sale. The projected activities of 10 proposed regionwide lease sales' mid-case scenario, which was used in the model, falls within the range of a single proposed lease sale. This is conservative because the current price of oil equals the low range of the scenario. Using these assumptions, the potential impacts of a single proposed lease sale would be **minor** because the affected resource could be avoided with proper mitigation. The modeling results show that ozone exceeds the NAAQS in Galveston, Texas, and 24-hour $PM_{2.5}$ exceeds the Class I PSD increment at the Breton Wilderness Area. The impacts were sufficient to increase the future year design value from just below the NAAQS for ozone and over the Class I PSD increment, respectively.

In the air quality modeling study, Source Group B represents new platforms and emissions and their support vessels and aircraft. According to the modeling results, the impacts of criteria pollutants from Source Group B to air quality are below the NAAQS for all pollutants, except for ozone. At the Galveston, Texas, monitor, the contribution of Source Group A (new platforms) alone was sufficient to bump the future year design value from just below the NAAQS to just above the NAAQS.

The impacts to Class I areas from contributions of new platforms and their associated support vessels and aircraft show that proposed activities exceed the 24-hour $PM_{2.5}$ Class I PSD increments by 10 percent at the Breton Wilderness Area, which are a result of support vessels and helicopter traffic associated with the activities.

The impacts to sensitive Class II areas from contributions of all activities as a result of a single proposed lease sale are **minor** because, while maximum increases occur at the Gulf Islands National Seashore for all PSD pollutants and averaging times and increases occur for annual NO_2 at the Breton Wilderness Area, there are no exceedance of the PSD Class II increment.

4.1.2.4 Incomplete or Unavailable Information

This chapter discusses the incomplete or unavailable information needed to assess the impacts from OCS oil- and gas-related activities. Relevant final air modeling study results are unavailable at this time. However, BOEM has used initial results, which are provided in **Appendices B-D** in its place. These initial results were incorporated into the analysis and is the best science available. Furthermore, BOEM relied on data gathered from recent Gulf of Mexico OCS emission inventories, along with scenarios or estimates of future production. The scenarios provide (1) the assumptions for and estimates of future activities, (2) the rationale for the scenario assumptions and estimates, and (3) the type, frequency, and quantity of emissions from offshore sources associated with a proposed lease sale. Finally, emissions as a result of a proposed lease sale would be regulated at the postlease stage under air quality plan reviews. Additional monitoring measures and air quality dispersion modeling can be requested of the operator if a further analysis is needed and mitigation would be required as necessary.

BOEM determined the projected total emissions that would result from the activities on a lease based on estimated emissions from various OCS non-platform and OCS platform equipment types, such as diesel engines and generators, and the level of offshore activity projected in **Chapter 3.1**. These same emissions estimates were used as inputs for modeling scenarios to predict future impacts. As noted earlier, BOEM is in the process of updating the air quality modeling based on public comments, and the results of the final air quality modeling will be included in a future NEPA analysis that will be available for public review and comment. The revised air quality model run will not be completed before the publication of this Final Supplemental EIS. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as a reference for NEPA analysis. The air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated. Because no activities beyond certain ancillary activities are actually authorized by the lease, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1**). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts. During its review of any plan submitted postlease, BOEM conducts an air quality review to determine if additional controls are necessary. At this postlease stage, BOEM has the authority to disapprove or require additional mitigation to reduce impacts from site-specific activities as additional information related to the revised air quality modeling becomes available. It is anticipated that new air quality modeling results will be available for consideration before any plan is submitted on a block leased as a result of proposed Lease Sale 250. Therefore, while additional air quality data would be useful in consideration of this lease sale, it is not necessary for a decision on this lease sale. Any concerns raised by the modeling study will be further refined by the time plans are submitted and/or additional plan-specific modeling may be required consistent with BOEM's regulations when the plan is submitted for approval. However, to address data gaps and current impacts for this analysis, BOEM used the initial air quality modeling results, emissions inventory data, available studies, postlease plan information, and current proposed lease sale scenario data, as well as previous proposed action scenario data, to reach the impact conclusions.

The air quality in the GOM can be affected by the pollution emitted from OCS oil- and gas-related sources as well as non-OCS oil- and gas-related sources. These pollution sources can also emit a wide variety of pollutants. To improve air quality and reduce air pollution, the Clean Air Act Amendments set regulatory limits on pollutants that help to ensure basic health and environmental protection from air pollution. To assess the amount of pollution being emitted, pollutants have to be measured. To determine impacts from these pollutants, emission-related conditions (e.g., rate of emission, height, and distance of sources from coastline) and environmental conditions (e.g., wind speed and direction, humidity, temperature, and height of the atmospheric surface layer where pollutants are transported) are calculated.

Emissions from activities related to prior lease sales are represented by the 2011 GWEI database. Emissions from BOEM's proposed lease sales are estimated from the exploration and development scenario and have been included in the emission inventory that will be used in the model to determine routine impacts. The initial "Air Quality Modeling in the Gulf of Mexico Region" study includes development of meteorological datasets appropriate for air quality modeling of the study area (which includes a proposed lease sale), comprehensive emissions inventory of all sources in the GOM region, and air quality modeling for the cumulative impacts and visibility assessment. As noted earlier, BOEM is in the process of updating the air quality modeling based on public comments, and the results of the final air quality modeling will be included in a future NEPA analysis that will be available for public review and comment. The revised air quality model run will not be completed before the publication of this Final Supplemental EIS. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as a reference for NEPA analysis. The air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated. Because no activities beyond certain ancillary activities are actually authorized by the lease, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1**). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts. During its review of any plan submitted postlease, BOEM conducts an air quality review to determine if additional controls are necessary. At this postlease stage, BOEM has the authority to disapprove or require additional mitigation to reduce impacts from site-specific activities as additional information related to the revised air quality modeling becomes available. It is anticipated that new air quality modeling results will be available for consideration before any plan is submitted on a block leased as a result of proposed Lease Sale 250. Therefore, while additional air quality data would be useful in consideration of this lease sale, it is not necessary for a decision on this lease sale. Any concerns raised by the modeling study will be further refined by the time plans are submitted and/or additional plan-specific modeling may be required consistent with BOEM's regulations when the plan is submitted for approval. Given that BOEM does not have the final results from the ongoing air quality modeling study yet, for this Supplemental EIS, BOEM relied on emissions inventory data, available studies on OCS oil- and gas-related activities, postlease exploration and development plan information, and the initial modeling results to fill data gaps. This approach was adequate because it assessed a combination of pollutants from OCS oil- and gas-related activities, non-OCS oil- and gas-related activities, and non-oil and gas activities.

4.1.2.5 Alternative A—Regionwide OCS Lease Sale (The Preferred Alternative)

As mentioned in **Chapter 3**, for a proposed lease sale under Alternative A, BOEM projects that no more activity would occur than has resulted in the past from the highest CPA lease sale combined with the highest WPA lease sale. The contribution of routine and accidental events of a proposed lease sale to air quality would result in **minor** impacts because most impacts on the affected resource could be avoided with proper mitigation. The emission sources would not produce emissions sufficient to overwhelm the effects of wind and transport in a single area, causing deterioration of air quality over the regionwide OCS. The incremental contribution of a single regionwide proposed lease sale would likely have a **minor** impact on coastal areas because most impacts on the affected resource could be avoided with proper mitigation. The support vessels and aircraft associated with new platforms are a leading contributor to the increased impacts in the area.

4.1.2.6 Alternative B—Regionwide OCS Proposed Lease Sale Excluding Available Unleased Blocks in the WPA Portion of the Proposed Lease Sale Area

Since this Alternative excludes the available unleased blocks in the WPA, it would result in activity concentrated in the CPA/EPA. As mentioned in **Chapter 3**, for a proposed lease sale under Alternative A, BOEM projects that no more activity would occur than has resulted in the past from the highest CPA lease sale combined with the highest WPA lease sale. Therefore, because most activity is forecast to occur in the CPA/EPA, the impacts as a result of Alternative B would be very similar to Alternative A. The incremental contribution of a single CPA/EPA proposed lease sale would likely have a **minor** impact on coastal nonattainment areas because most impacts on the affected resource could be avoided with proper mitigation.

4.1.2.7 Alternative C—Regionwide OCS Proposed Lease Sale Excluding Available Unleased Blocks in the CPA/EPA Portions of the Proposed Lease Sale Area

Since this Alternative excludes the available unleased blocks in the CPA/EPA, it would result in activity concentrated in the WPA. As mentioned in **Chapter 3**, a maximum of 13 percent of the oil production and associated activity and 19 percent of the gas production and associated activity would occur in the WPA. While the WPA is a smaller area with less projected activity than is proposed for the CPA/EPA under Alterative B, the smaller area could decrease impacts to communities from production platforms and also increase total emissions due to travel distances for marine vessels; the potential impacts would remain **minor**. The incremental contribution of a single WPA proposed lease sale would likely have a **minor** impact on coastal areas because most impacts on the affected resource could be avoided with proper mitigation.

4.1.2.8 Alternative D—Alternative A, B, or C, with the Option to Exclude Available Unleased Blocks Subject to the Topographic Features, Live Bottom (Pinnacle Trend), and/or Blocks South of Baldwin County, Alabama, Stipulations

Alternative D would have the same analysis and potential impacts as Alternative A, B, or C because there are so few unleased blocks subject to the Topographic Features, Live Bottom (Pinnacle Trend), and Blocks South of Baldwin County, Alabama, Stipulations. The difference between Alternatives A, B, and C with and without any combination of these stipulations is **minor** for air quality. The impacts under Alternative D would not be much different and likely not even measurable when compared with the other alternatives.

4.1.2.9 Alternative E—No Action

For Alternative E, the cancellation of a proposed lease sale would result in no new activities associated with a proposed lease sale; therefore, the incremental impacts would be **none**. There could, however, be some incremental increase in impacts caused by a compensatory increase in imported oil and gas to offset reduced OCS production, but it would likely be **negligible**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative.

4.2 WATER QUALITY

Summary

BOEM has reexamined the analysis for water quality presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for water quality presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of water quality, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.2 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Water quality is a term used to describe the condition or environmental health of a waterbody or resource, reflecting its particular biological, chemical, and physical characteristics and the ability of the waterbody to maintain the ecosystems it supports and influences. It is an important measure for both ecological and human health. For the purposes of this analysis, the GOM is divided into coastal and offshore waters. Coastal waters are defined to include all bays and estuaries from the Rio Grande River in Texas to the Florida Bay. Offshore waters are defined to include those waters extending from outside the barrier islands to the Exclusive Economic Zone, located within State waters and the Federal OCS. The inland extent is defined by the CZMA. Offshore waters are divided into three regions: the continental shelf west of the Mississippi River; the continental shelf east of the Mississippi River; and deep water (>1,000 ft; 305 m).

Protective Measures for Water Quality

The USEPA (Regions 4 and 6) regulates all waste streams generated from offshore oil- and gas-related activities. Section 403 of the Clean Water Act requires that National Pollutant Discharge Elimination System (NPDES) permits be issued for discharges to the territorial seas (baseline to 3 mi [5 km]), the contiguous zone, and the ocean in compliance with USEPA's regulations for preventing unreasonable degradation of the receiving waters.

The authority for the NPDES program is given at 40 CFR part 125 subpart M, "Ocean Discharge Criteria." The purpose of the NPDES program is to prevent the unreasonable degradation of the marine environment as described in 40 CFR § 125.122. In accordance with definitions stated at 40 CFR § 125.121, "unreasonable degradation of the marine environment" means (1) significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities; (2) threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; or (3) loss of aesthetic, recreational, scientific, or economic values, which is unreasonable in relation to the benefit derived from the discharge.

Regulated wastes include drilling fluids, drill cuttings, deck drainage, produced water, produced sand, well treatment fluids, well completion fluids, well workover fluids, sanitary wastes, domestic wastes, and miscellaneous wastes. The bulk of waste materials produced by offshore oil- and gas-related activities are produced water (formation water) and drilling muds and cuttings (USEPA, 2009b). There are two general NPDES permits that cover the Gulf of Mexico. Permit GMG290000, issued by USEPA Region 6, covers the WPA and most of the CPA; and Permit GEG460000, issued by USEPA Region 4, covers the EPA and a small part of the CPA. The USEPA Regions' jurisdictional areas are shown in Figure 3-10 of the 2017-2022 GOM Multisale EIS.

To meet the goal of preventing unreasonable degradation of the marine environment, Section B of the NPDES permits specifies effluent limitations and monitoring requirements for offshore oil and gas facilities. Discharged regulated wastes may not contain free oil or cause an oil sheen on the water surface, and the oil/grease concentration may not exceed 42 milligrams per liter (mg/L) daily maximum or 29 mg/L monthly average. Discharge of drilling fluids containing oil additive or formation oil is prohibited, except that which adheres to cuttings and certain small volume discharges. Barite used in drilling fluids may not contain mercury or cadmium at levels exceeding certain concentrations (1.0 mg/kg mercury and 3.0 mg/kg cadmium). Discharged regulated wastes must also be characterized using a whole effluent toxicity test, where a population of mysid shrimp or inland silverside minnows are exposed to a certain concentration of the waste stream, and mortality of the population must not exceed 50 percent. The NPDES permits allow a mixing zone as defined at 40 CFR § 125.121 to meet compliance using an approved plume model. The NPDES permits require no discharge within 1,000 m (3,281 ft) of an area of biological concern. Region 4 also requires no discharge within 1,000 m (3,281 ft) of any federally designated dredged material ocean disposal site.

Analysis

Coastal water impacts associated with routine activities include increases in turbidity resulting from pipeline installation and navigational canal maintenance, discharges of bilge and ballast water from support vessels, and runoff from shore-based facilities. Offshore water impacts associated with routine activities result from the discharge of drilling muds and cuttings, produced water, and residual chemicals used during workovers. The discharge of drilling muds and cuttings causes temporary increased turbidity and changes in sediment composition. The discharge of produced water results in increased concentrations of some metals, hydrocarbons, and dissolved solids. Structure installation and removal and pipeline placement disturb the sediments and cause increased turbidity. In addition, offshore water impacts result from supply and service-vessel bilge and ballast water discharges.

The activity associated with a proposed lease sale could contribute a small percentage of activity in addition to existing and future OCS oil- and gas-related activities. The specific discharges, drill muds, cuttings and produced water, and accidents resulting in spills would occur in proportion to production and, therefore, would add a small increase to the currently anticipated impacts. Furthermore, the vessel traffic and related discharges associated with a proposed lease sale are a fraction of the current ongoing commercial shipping and military activity in the Gulf of Mexico. The impact of discharges, sediment disturbances, and accidental releases are a small percentage of the current overall activity and the overall impacts to coastal and offshore waters.

Impacts on water quality from operational discharges related to a proposed lease sale are expected to be minimal because of the following: (1) USEPA regulations to prevent unreasonable degradation of the marine environment; (2) prohibitions on discharge of some waste types; (3) prohibitions on discharge near sensitive biological communities; (4) monitoring requirements and toxicity testing; (5) mixing zone and dilution factors; (6) operational discharges are temporary in nature; and (7) any effects from elevated turbidity would be short term, localized, and reversible. As such, assuming compliance with applicable regulations, the impacts from the discharge of regulated wastes from routine operations would require no additional mitigation.

Impact-Level Definitions

For the purpose of the following discussion, the significance of impact-producing factors on water quality is discussed below. The criteria for significance reflect consideration of the context and intensity of impact (40 CFR § 1508.27) based on four parameters: detectability (i.e., measurable or detectable impact); duration (i.e., short term, long term); spatial extent (i.e., localized, extensive); and severity (i.e., severe, less than severe). For water quality, the significance criteria have been broadly defined as follows:

- **Negligible** – Impacts are defined as short-term (less than 1 year), localized contaminants and turbidity that present little to no detectable impact.
- **Minor** – Impacts are defined as detectable, short-term, localized, or extensive but less than severe; however, detectable contaminant concentrations may exceed regulatory levels. Minor impacts may have little to no effect on marine life.
- **Moderate** – Impacts are defined as detectable, short term, extensive, and severe; or impacts are detectable, short term or long term, localized and severe; or impacts are detectable, long term, extensive, or localized but less than severe. Moderate impacts may result in acute or chronic effects to marine life.
- **Major** – Impacts are defined as detectable, short term or long term, extensive, and severe; however, major impacts may result in acute or chronic effects to marine life and may potentially cause human health effects.

The OCS oil- and gas-related, impact-producing factors listed in **Table 4-8** below help the reader quickly identify the level of potential impacts for each of these factors. This table also illustrates the impact-level conclusions for each impact-producing factor reached in this chapter's impact analysis.

Table 4-8. Water Quality Impact-Producing Factors That Are Reasonably Foreseeable.

Water Quality	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Geological Sampling	Negligible	Negligible	Negligible	Negligible	None
Bottom Area Disturbance	Negligible	Negligible	Negligible	Negligible	None
Operational Discharges and Wastes	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	None
Pipeline Installation	Negligible	Negligible	Negligible	Negligible	None

Water Quality	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Decommissioning and Removal Operations	Negligible	Negligible	Negligible	Negligible	None
Accidental Impacts					
Drilling Fluid Spills	Minor	Minor	Minor	Minor	None
Chemical and Waste Spills	Minor	Minor	Minor	Minor	None
Oil Spills					
Without Mitigation	Moderate	Moderate	Moderate	Moderate	None
With Mitigation	Moderate	Moderate	Moderate	Moderate	None
Cumulative Impacts					
Incremental Contribution[2]	Negligible	Negligible	Negligible	Negligible	None
OCS Oil and Gas Program[3]	Negligible				
Non-OCS Oil and Gas[4]	Negligible				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.2 of the 2017-2022 GOM Multisale EIS.

[2] This impact level is the incremental contribution of a single proposed lease sale to all cumulative impacts in the GOM.

[3] This impact level is the cumulative impacts of all past, present, and reasonably forseeable OCS oil- and gas-related activities in the GOM.

[4] This impact level is the cumulative impacts of all past, present, and reasonably foreseeable activities in the GOM.

The impacts of OCS Program-related routine operational discharges (Chapter 3.1.5.1 of the 2017-2022 GOM Multisale EIS and summarized in **Table 4-8** of this Suppplemental EIS) on water quality are considered **negligible** (beyond 1,000 m; 3,281 ft) to **moderate** (within 1,000 m; 3,281 ft) of the source. The potential impacts from OCS Program-related oil spills on water quality are considered **moderate**, even with the implementation of mitigating measures. This is because activities to address oil spills may cause secondary impacts to water quality, such as the introduction of additional hydrocarbons into the dissolved phase through the use of dispersants and the sinking of hydrocarbon residuals from burning. The impacts from a proposed action are a small addition to the cumulative impacts on water quality when compared with inputs from hypoxia, potentially leaking shipwrecks, chemical weapon dumpsites, natural oil seeps, and natural turbidity. The incremental contribution of the routine activities and accidental events associated with a proposed action to the cumulative impacts on water quality is expected to be **negligible** for any of the action alternatives. For Alternative E, the cancellation of a proposed lease sale would result in no new activities associated with a proposed lease sale; therefore, the incremental impacts would be **none**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of water quality can be found in Chapter 4.2 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

The level of impacts to water quality from a proposed action would be similar for Alternatives A, B, C, and D. Under Alternative E, there would be no new activities associated with a proposed lease sale; however, activities associated with past lease sales and non-OCS oil- and gas-related activities would continue.

Incomplete or Unavailable Information

In preparation for this Supplemental EIS, BOEM has reviewed the latest information available relative to the potential impact-producing factors on water quality, which is presented in **Chapter 3**. Much of the information pertaining to water quality impacts from the *Deepwater Horizon* oil spill and response has been discussed in previous NEPA documents, and water quality has recovered from the *Deepwater Horizon* oil spill and response. BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on water quality. Much of this information relates to non-OCS oil- and gas-related impacts. Specifically, potentially polluting shipwrecks and chemical weapon disposal areas may cause potential impacts to water quality and the marine environment. There are no publicly available data regarding these potential impacts because no agency has been tasked with this responsibility. It is not foreseen that this information would be publicly available to include in this NEPA analysis regardless of the costs or resources needed. BOEM has used the best available scientific information to date and believes that any additional information would not likely change the ranking of impacts and is not essential to a reasoned choice among alternatives.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including Google Scholar Alerts) were examined to assess recent information regarding water quality that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for water quality presented in the 2017-2022 GOM Multisale EIS with the understanding that no new information on water quality has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for water quality presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.3 COASTAL HABITATS

4.3.1 Estuarine Systems (Wetlands and Seagrass/Submerged Vegetation)

Summary

BOEM has reexamined the analysis for estuarine systems presented in the 2017-2022 GOM Multisale EIS based on the information presented below. No new information was discovered that would alter the impact conclusion for estuarine systems presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of estuarine systems, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with the proposed action are presented in Chapter 4.3.1 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

The estuarine system is the transition zone between freshwater and marine environments. It can consist of many habitats, including wetlands and submerged vegetation. While some seagrass species can be found farther offshore, the majority is within the coastal area of the GOM and will be covered in this chapter. The approach of the analysis is to focus on the potential impact-producing factors from routine OCS oil- and gas-related activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts. The impact-level definitions and the analyses supporting these conclusions are discussed below.

Analysis

In this chapter, BOEM reviewed and analyzed routine OCS oil- and gas-related activities and reasonably foreseeable accidental events. Routine activities associated with a proposed lease sale that take place on the OCS, where wells are drilled and platforms and pipelines are installed, would not impact the wetlands or submerged vegetation that is located miles away. Other routine activities that support offshore oil and gas exploration, such as increased vessel traffic (**Chapter 3.1.2.5**), maintenance dredging of navigation canals (Chapter 3.1.3.3.4 of the 2017-2022 GOM Multisale EIS), pipeline installation (**Chapter 3.1.2.2**), disposal of OCS oil- and gas-related wastes (Chapter 3.1.5.1 of the 2017-2022 GOM Multisale EIS), and construction and maintenance of support infrastructure in the coastal areas (**Chapter 3.1.2.2**), could potentially impact wetlands. Of these impact-producing factors, vessel traffic was not analyzed with respect to seagrass and submerged vegetation because OCS vessels (due to their size and use of commercial ports) are generally not in areas shallow enough to have large submerged vegetation beds. An analysis of the potential impacts from accidental events, primarily oil spills, associated with a proposed lease sale is summarized in this chapter, as is the incremental contribution of a proposed action to the cumulative impacts to wetlands and submerged vegetation. Cumulative impacts were analyzed for OCS oil- and gas-related activities and for other sources that could affect wetlands and submerged vegetation communities (i.e., human impacts, storms, and vessel traffic). Additional factors that could affect estuarine systems include subsidence and sea-level rise.

Impact-Level Definitions

For this analysis, the following definitions were used to categorize impacts to wetlands and submerged vegetation:

- **Negligible** – Little to no measurable impacts in the surrounding habitat (i.e., wetland segment and seagrass bed).
- **Minor** – Noticeable but short-term or localized impacts.
- **Moderate** – Damage to coastal habitats that is noticeable, spatially extensive, and long term or permanent.
- **Major** – Widespread, permanent loss of habitat; changes in species composition and abundance and/or altered ecological function well beyond that of normal variability. Changes would likely be both long lasting and spatially extensive for such an effect.

The potential magnitude for each of these impact-producing factors is provided in **Table 4-9** to help the reader quickly identify the level of potential impacts for each of these factors.

Table 4-9. Estuarine Systems Impact-Producing Factors That Are Reasonably Foreseeable.

Estuarine Systems	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Pipeline Construction and Maintenance	Negligible	Negligible	Negligible	Negligible	None
Navigation Channel Maintenance Dredging	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	None
Vessel Operation (support use of navigation channels)	Moderate	Moderate	Minor	Moderate	None
Construction and Use of Coastal Support Infrastructure	Negligible	Negligible	Negligible	Negligible	None
Accidental Impacts					
Oil Spills	Minor	Minor	Minor	Minor	None
Disposal of OCS Oil- and Gas-Related Wastes	Negligible	Negligible	Negligible	Negligible	None

Estuarine Systems	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Cumulative Impacts					
Incremental Contribution[2]	Moderate	Moderate	Minor	Moderate	None
OCS Oil and Gas[3]	Major				
Non-OCS Oil and Gas[4]	Major				

1 The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.3.1 of the 2017-2022 GOM Multisale EIS.

2 This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.

3 This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.

4 This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as the proposed action, but they are not related to the OCS Oil and Gas Program.

The impacts to estuarine systems from routine activities associated with a proposed action are expected to be **minor** to **moderate**. **Minor** impacts would be due to the projected low probability for any new pipeline landfalls (0-1 projected), the minimal contribution to the need for maintenance dredging, and the mitigating measures expected to be used to further reduce or avoid these impacts (e.g., the use of modern techniques such as directional drilling). However, impacts caused by vessel operations related to a proposed action over 50 years would be **moderate** considering the permanent loss of hundreds of acres of wetlands. Overall, impacts to estuarine habitats from oil spills associated with activities related to a proposed action would be expected to be **minor** because of the distance of most postlease activities from the coast, the expected weathering of spilled oil over that distance, the projected low probability of large spills near the coast, the resiliency of wetland vegetation, and the available cleanup techniques.

Cumulative impacts to estuarine habitats are caused by a variety of factors, including the OCS oil- and gas-related and non-OCS oil- and gas-related activities outlined in Chapter 4.3 of the 2017-2022 GOM Multisale EIS and human and natural impacts. Development pressures in the coastal regions of the GOM have been largely the result of tourism and residential beach-side development, and this trend is expected to continue. Storms will continue to impact the coastal habitats and have differing impacts. The incremental contribution of a proposed action to the cumulative impacts on estuarine habitats is expected to be **minor** to **moderate** depending on the selected alternative. Under Alternative E, the cancellation of a proposed lease sale would result in no new activities associated with a proposed lease sale. There could, however, be some incremental increase in impacts caused by a compensatory increase in imported oil and gas to offset reduced OCS production, but it would likely be **negligible**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of estuarine habitats can be found in Chapter 4.3 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

The impacts to estuarine systems from routine activities and accidental events associated with a proposed action are expected to be **minor** to **moderate**, depending on the alternative. The impacts of a proposed action on coastal wetlands under Alternative A is expected to be **moderate**. The impacts of Alternative B would be similar to those of Alternative A, except that there would be **negligible** impacts to coastal wetlands and submerged vegetation in Texas because no new OCS oil- and gas-related activity is forecasted in the WPA along the Texas coast with this alternative. For this reason, the incremental contribution of Alternative B to the cumulative impacts on coastal wetlands is expected to be **moderate**. The impacts of Alternative C would be less than those of Alternative A, as only a fraction of the resulting activity forecast for Alternative A is projected under Alternative C. For this alternative, there would be **negligible** impacts to coastal wetlands and submerged vegetation in Louisiana; **negligible** impacts to Mississippi, Alabama, and the panhandle of western Florida; and incrementally more impacts to the wetlands and submerged vegetation of Texas, compared with Alternative A. Therefore, because the effects of impact-producing factors on estuarine habitats would be less for Alternative C than for Alternative A, the incremental contribution of Alternative C to the cumulative impacts on coastal wetlands is expected to be **minor**. The impacts of Alternative D would be nearly identical to those of Alternative A because the available unleased blocks with topographic features do not contain wetlands or submerged vegetation and are too distant (over 25 km; 16 mi) from the coast to have indirect impacts either. If a proposed action does not occur (Alternative E), there would be no additional impacts to estuarine habitats; however, cumulative impacts from all sources, including OCS oil- and gas-related and non-OCS oil- and gas-related sources, would be the same as the cumulative for Alternative A, or **major**. This major impact is due to cumulative OCS oil- and gas-related spills resulting from all past and present leasing activities, including the millions of barrels that entered the Gulf of Mexico from the *Deepwater Horizon* oil spill. There could be some incremental increase in impacts caused by a compensatory increase in imported oil and gas to offset reduced OCS production, but it would likely be **negligible**.

Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information regarding estuarine habitat. There is incomplete information about impacts resulting from routine activities, as the scenario forecast is only an estimate and many global factors can affect OCS oil- and gas-related activity. There also remains unavailable information about the future rates of oil spills, as well as spill locations and volumes of oil.

There are unknowns regarding the future restoration efforts that are being planned, such as what projects would ultimately be constructed and how successful they may be. In addition, the future rates of relative sea-level rise are not known with certainty, and thus, resulting impacts to wetlands are unknown. Future rates of coastal development are unknown, as is the extent of impacts to estuarine systems thereof.

BOEM acknowledges that there remains incomplete or unavailable information that may be relevant to reasonably foreseeable significant impacts on estuarine systems. This incomplete or unavailable information includes potential data on the *Deepwater Horizon*, explosion, oil spill, and response that may be forthcoming. As there is substantial information available since the *Deepwater Horizon* explosion, oil spill, and response, which is included in the 2017-2022 GOM Multisale EIS, BOEM believes that the incomplete or unavailable information regarding the effects of the *Deepwater Horizon* explosion, oil spill, and response on estuarine systems would likely not be essential to a reasoned choice among alternatives. Regardless of the costs involved, it is not within BOEM's ability to obtain this information from the NRDA process within the timeline contemplated in the NEPA analysis for this Supplemental EIS. BOEM's subject-matter experts have used what scientifically credible information is available in their analyses and applied it using accepted scientific methodology.

Many studies have been produced that demonstrate the effects of exposure of wetland plants to crude oil, covering a wide range of exposure intensity, longevity, and oil characteristics. Much has been learned about the different survival and recovery rates of various plant species. In addition, studies have been produced regarding the long-term impacts of canal dredging and pipeline installation on wetlands.

The potential for impacts from changes to the affected environment (post-*Deepwater Horizon*) and cumulative impacts remains whether or not the No Action or an action alternative is chosen. A proposed lease sale would result in a relatively minor addition to existing routine activities and accidental events, and therefore, the incremental contribution to wetland impacts from a proposed lease sale would be **minor** to **moderate** (depending on the alternative), given what is currently known.

BOEM used reasonably accepted scientific methodologies to extrapolate from existing information in completing this analysis and formulating the conclusions presented here.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including the U.S. Department of the Interior, Geological Survey; National Wetlands Research Center; Gulf of Mexico Alliance; NOAA; Journal of Marine Science and Engineering; Marine Pollution Bulletin; and scientific publication databases including Science Direct, Elsevier, and JSTOR) were examined to assess recent information regarding estuarine systems that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for estuarine systems presented in the 2017-2022 GOM Multisale EIS with the understanding that no new information on estuarine systems has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for estuarine systems presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.3.2 Coastal Barrier Beaches and Associated Dunes

Summary

BOEM has reexamined the analysis for coastal barrier beaches and associated dunes presented in the 2017-2022 GOM Multisale EIS based on the information presented below. No new information was discovered that would alter the impact conclusion for coastal barrier beaches and associated dunes presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of coastal barrier beaches and associated dunes, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action, are presented in Chapter 4.3.2 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

The coastal barrier beaches and associated dunes are those beaches and dunes that line the coast of the northern GOM, including both barrier islands and beaches on the mainland. Barrier beaches and associated dune habitats from Texas to the Florida panhandle may be impacted by activities resulting from a proposed action. These areas are comprised of the following geologic subareas:

- the barrier island complex of southern Texas;
- the Chenier Plain of eastern Texas and western Louisiana;
- the Mississippi River Delta complex of southeastern Louisiana;
- the barrier-island and Pleistocene Plain complex of Mississippi and Alabama; and
- the Florida panhandle.

Barrier islands make up more than two-thirds of the northern GOM shore (Morton et al., 2004). These shorelines are usually sandy beaches that can be divided into several interrelated environments. Generally, beaches consist of a shoreface, foreshore, and backshore. The shoreface slopes downward and seaward from the low-tidal water line, under the water. The nonvegetated foreshore slopes up from the water to the beach berm-crest. The backshore is found between the beach berm-crest and the dunes, and may be sparsely vegetated. The dune zone of a barrier landform can consist of a single low dune ridge, several parallel dune ridges, or a number of curving dune lines that may be stabilized by vegetation. These elongated, narrow landforms are composed of wind-blown sand and other unconsolidated, predominantly coarse sediments.

Analysis

In this chapter, BOEM reviewed and analyzed OCS oil- and gas-related routine activities and reasonably foreseeable accidental events. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts (**Table 4-10**). The impact-level definitions and the analyses supporting these conclusions are discussed below. Routine activities associated with a proposed action that take place on the OCS, where wells are drilled and platforms and pipelines are installed, would not impact the coastal barrier beaches, which are located from 3 to greater than 200 nmi (3.5 to 230.2 mi; 5.6 to 370.4 km) away. Other routine activities that support offshore oil and gas exploration, such as increased vessel traffic, maintenance dredging of navigation canals, pipeline installation, and construction of support infrastructure in the coastal areas, could potentially impact beaches and dunes. An analysis of the potential impacts from accidental events, primarily oil spills but also trash and debris, associated with a proposed action is summarized in this chapter, as is the incremental contribution of a proposed action to the cumulative impacts to beaches and dunes. Cumulative Impacts were analyzed for OCS oil- and gas-related activities and for other sources that could affect coastal barrier beaches and dunes (i.e., human impacts, storms, vessel traffic, subsidence, and sea-level rise).

Impact-Level Definitions

For this analysis, the following definitions were used to categorize impacts to coastal beaches and dunes:

- **Negligible** – Little to no measurable impacts in species composition and abundance and/or altering of beach profile or ecological function.
- **Minor** – Measureable but short-term or localized impacts to species composition and abundance and/or altering of beach profile or ecological function.
- **Moderate** – Damage to coastal habitats (impacts to species composition and abundance and/or altering of beach profile or ecological function) that is detectable, spatially extensive, but temporary and not severe. Can also be used to describe localized land loss.
- **Major** – Severe, bringing about detectable changes in species composition and abundance and/or altering of beach profile or ecological function well beyond that of normal variability. Changes would likely need to be both long lasting and spatially extensive to have such an effect.

The potential magnitude for each of these impact-produring factors is provided in **Table 4-10** to help the reader quickly identify the level of potential impacts for each of these factors.

Table 4-10. Coastal Barrier Beaches and Associated Dunes Impact-Producing Factors.

Coastal Barrier Beaches and Associated Dunes	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Pipeline Construction and Maintenance	Negligible	Negligible	Negligible	Negligible	None
Navigation Channel Maintenance Dredging	Minor	Minor	Minor	Minor	None
Vessel Operation (Support Use of Navigation Channels)	Negligible	Negligible	Negligible	Negligible	None
Construction and Use of Coastal Support Infrastructure	Negligible	Negligible	Negligible	Negligible	None
Accidental Impacts					
Oil Spills	Minor	Minor	Minor	Minor	None
Disposal of OCS Oil- and Gas-Related Wastes	Negligible	Negligible	Negligible	Negligible	None
Cumulative Impacts					
Incremental Contribution[2]	Minor	Minor	Minor	Minor	None
OCS Oil and Gas[3]	Major				
Non-OCS Oil and Gas[4]	Major				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.3.2 of the 2017-2022 GOM Multisale EIS.

[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.

[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.

[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

The impacts to coastal barrier beaches and dunes from routine activities associated with a proposed action are expected to be **minor** due to the minimal number of projected onshore pipelines, the minimal contribution to vessel traffic and to the need for maintenance dredging, and the mitigating measures that would be used to further reduce or avoid these impacts. The greater threat from an oil spill to coastal beaches is from a coastal spill as a result of a nearshore vessel accident or pipeline rupture, and cleanup activities. Overall, impacts to coastal barrier beaches and dunes from oil spills associated with OCS oil- and gas-related activities related to a proposed action would be expected to be **minor** because of the distance of most of the resulting activities from the coast, expected weathering of spilled oil, projected low probability of large spills near the coast, and available cleanup techniques.

Cumulative impacts to coastal barrier beaches and dunes are caused by a variety of factors, including the OCS oil- and gas-related and non-OCS oil- and gas-related activities outlined in Chapter 4.3.2 of the 2017-2022 GOM Multisale EIS and other human and natural impacts. Cumulative OCS oil- and gas-related spills resulting from all past and present leasing activities, including the millions of barrels that entered the Gulf of Mexico from the *Deepwater Horizon* oil spill, are estimated to have had a **major** impact on coastal barrier beaches and dunes. However, the incremental increase in impacts from reasonably foreseeable oil spills related to a proposed action is expected to be **minor**. The overall incremental contribution of a proposed action to the cumulative impacts on coastal barrier beaches and dunes is expected to be **minor**. Non-OCS oil- and gas-related activities, such as development pressures in the coastal regions of the GOM, have been largely the result of tourism and residential beach-side development, and this trend is expected to continue. Efforts to stabilize the GOM shoreline through the construction of manmade structures can deprive natural restoration of barrier beaches through sediment nourishment and sediment transport, which have adversely impacted coastal beach landscapes. Storms will continue to impact the coastal habitats and have differing impacts. Under Alternative E, the cancellation of a proposed lease sale, the resulting additional impacts to coastal barrier beaches and dunes would be **negligible**; however, cumulative impacts from all sources, including OCS oil- and gas-related and non-OCS oil- and gas-related sources, would remain. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of coastal barrier beaches and associated dunes can be found in Chapter 4.3.2 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

Impacts from most routine activities and accidental events related to a proposed action under Alternative A would be expected to be **minor** since most routine activities are located far from coastal beaches. The impacts of Alternative B would be similar to those of Alternative A, except that there would be **negligible** impacts to coastal barrier beaches and dunes in Texas because no OCS oil- and gas-related activity is forecast in the WPA along the Texas coast with this alternative. The impacts of Alternative C would be less than those under Alternative A, as only a fraction of the resulting activity forecasted for Alternative A is projected for Alternative C. For this alternative, there would be **negligible** incremental impacts to coastal barrier beaches and dunes in Louisiana; and zero to **negligible** impacts to Mississippi, Alabama, and the panhandle of western Florida; and incrementally more impacts to the beaches and dunes of Texas. However, Alternative C would have less potential for impact than Alternative A or B as the level of projected OCS oil- and gas-related activities and impact-producing factors are much less in the WPA. The impacts of Alternative D would be nearly identical to those of the alternative it is combined with because the available unleased blocks with topographic features do not contain coastal barrier beaches and dunes and are too distant (over 25 km; 16 mi) from the coast to have indirect impacts. The incremental contribution of Atlernatives A-D to the cumulative impacts to coastal barrier beaches and associated dunes is expected to be **minor**. If a proposed lease sale does not occur (Alternative E), there would be no additional impacts to barrier beaches and associated dunes as a result of a proposed lease sale; however, cumulative impacts of current and past activities, however, would continue to occur under this alternative. There could be some incremental increase in impacts caused by a compensatory increase in imported oil and gas to offset reduced OCS production, but it would likely be **negligible**.

Incomplete or Unavailable Information

BOEM acknowledges that there remains incomplete or unavailable information regarding coastal barrier beaches and associated dunes in the GOM. There is incomplete information about routine impacts, as the scenario forecast is only an estimate and many global factors can affect OCS oil- and gas-related activity. There also remains unavailable information about future rates of oil spills, as well as the locations and volumes of oil. Future rates of coastal development are unknown, as is the extent of such impacts to coastal barrier beaches. There are also unknowns regarding the future restoration efforts being planned, such as what specific projects would ultimately be constructed and how successful they may be. In addition, the future rates of relative sea-level rise are not known with certainty (Hausfather, 2013); thus, the resulting impacts to coastal barrier beaches and associated dunes are unknown.

A large body of information regarding impacts of the *Deepwater Horizon* explosion, oil spill, and response upon coastal barrier beaches and associated dunes has been developed and continues to be developed through the NRDA process, but information remains incomplete. As there is substantial information available since the *Deepwater Horizon* explosion, oil spill, and response, which has been analyzed for the 2017-2022 GOM Multisale EIS, BOEM believes that the incomplete or unavailable information regarding the effects of the *Deepwater Horizon* explosion, oil spill, and response on coastal barrier beaches and dunes would likely not be essential to a reasoned choice among alternatives. The incomplete information would not be available within the timeframe contemplated by the NEPA analysis of this Supplemental EIS. However, much is known about the extent of the oiling of beaches and the continuing degradation of the remaining oil.

BOEM has determined that the information is not essential to a reasoned choice among alternatives. BOEM's subject-matter experts have used what scientifically credible information is available in their analyses and applied it using accepted scientific methodology. Many studies have been produced that demonstrate the effects of exposure of beaches to crude oil, covering a wide range of exposure intensity, longevity, and oil characteristics. Much has been learned about the effect of oil-spill cleanup on beaches and the degradation rates of oil over time. In addition, studies have been produced regarding the long-term impacts of navigation canal dredging on beaches and barrier islands. A proposed lease sale would result in a relatively minor addition to existing routine activities and accidental events, and therefore, the incremental increase in impacts to coastal barrier beaches and dunes from a proposed lease sale would be **minor** given what is currently known. The potential for impacts from changes to the affected environment (post-*Deepwater Horizon*) and cumulative impacts remains whether or not the No Action or an action alternative is chosen.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including the U.S. Department of the Interior, Geological Survey; National Wetlands Research Center; Gulf of Mexico Alliance; NOAA;, Louisiana

State University; and scientific publication databases including Science Direct, Elsevier, and JSTOR) were examined to assess recent information regarding coastal barrier beaches and associated dunes that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for coastal barrier beaches and associated dunes presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on coastal barrier beaches and associated dunes has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for coastal barrier beaches and associated dunes presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.4 DEEPWATER BENTHIC COMMUNITIES

Summary

BOEM has reexamined the analysis for deepwater benthic communities presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for deepwater benthic communities presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of deepwater benthic communities, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.4 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

BOEM defines “deepwater benthic communities” as including both chemosynthetic communities (chemosynthetic organisms plus seep-associated fauna) and deepwater coral communities (deepwater coral plus associated fauna). These communities are typically found in water depths of 984 ft (300 m) or deeper throughout the GOM, although deepwater benthic habitats are relatively rare compared with ubiquitous soft bottoms.

Chemosynthetic communities are based on the presence of various organisms that do not depend on photosynthetic processes for metabolism. In the GOM, they are formed around natural hydrocarbon seepages. Most GOM deepwater corals require exposed hard substrate for attachment and growth. They often co-occur on authigenic substrates (substrates that have been generated where they are found) created by chemosynthetic processes; however, deepwater coral also routinely colonize other natural or artificial hard substrates not associated with hydrocarbon seepage.

Protective Measures for Deepwater Benthic Communities

Protective measures have been developed over time based on the nature and sensitivity of various benthic habitats and their associated communities, as understood from decades of BOEM-funded and other environmental studies. NTL 2009-G40, "Deepwater Benthic Communities," provides operators with relevant information and consolidates guidance for the avoidance and protection of the various types of potentially suitable habitat for chemosynthetic organisms and deepwater coral. As detailed in NTL 2009-G40, all plans submitted for permitted deepwater (300 m [984 ft] or greater) activities are reviewed for the presence of deepwater benthic communities that may be impacted by the proposed activity. Lessees must provide site-specific survey and narrative information regarding sensitive benthic features with each exploration plan (EP), development operations coordination document, and development and production plan. These plans are reviewed by subject-matter experts on a case-by-case basis to determine whether a proposed operation could impact a benthic community. If an impact from drilling or other seafloor disturbance (e.g., anchors, anchor chains, rig emplacement, pipeline emplacement) is judged likely based on site-specific information derived from the geohazard survey data, BOEM's databases and studies, other published research, or another credible source, the operator would be required to relocate the proposed operation (i.e., distancing) or undertake other appropriate mitigations to prevent such an impact. As detailed above, BOEM's subject-matter experts make use of the best available datasets to identify probable habitat that could support deepwater chemosynthetic and coral communities, including BOEM's publicly available database of water-bottom anomalies (USDOI, BOEM, 2015). This analysis assumes continuation of the protective measures outlined in NTL 2009-G40.

Analysis

This chapter presents an analysis of the potential impacts on deepwater benthic communities as a result of routine activities and accidental events associated with a proposed action and a proposed action's incremental contribution to cumulative impacts. The analysis is not exhaustive of all possible impacts of routine activities and accidental events; rather, it focuses on those most relevant for decisionmakers. Potential impacts from a catastrophic oil spill, including long-term impacts and recovery, are detailed in the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b).

Because of the similarity and overlap of the effects of many activities that occur in the OCS, the primary, reasonably foreseeable routine and accidental impact-producing factors for deepwater benthic habitats can be grouped into three main categories:

(1) bottom-disturbing activities (Chapter 3.1.3.3.2 of the 2017-2022 GOM Mulitsale EIS; routine and accidental);

(2) drilling-related sediment and waste discharges (Chapter 3.1.5.1 of the 2017-2022 GOM Multisale EIS; routine and accidental); and

(3) oil spills (**Chapter 3.2.2**; accidental).

Cumulative impacts were also considered in two steps: impacts resulting from OCS oil- and gas-related activities (same as routine activities and accidental events); and impacts resulting from non-OCS oil- and gas-related sources, namely fishing and climate change.

Some impact-producing factors relevant to deepwater benthic communities are already analyzed in greater detail in other chapters. Refer to **Chapter 4.7** ("Fishes and Invertebrate Resources") for additional analyses. Several additional impact-producing factors described in **Chapter 3** were evaluated for potential impacts on deepwater benthic communities. These impact-producing factors were not carried forward for full analysis because any potential effects were judged to be either not reasonably foreseeable or having such a miniscule impact that they would not rise to even the level of negligible impact. Refer to Chapter 4.4 of the 2017-2022 GOM Multisale EIS for discussion on the impact-producing factors not carried forward for full analysis.

The impact significance criteria and resulting conclusions presented in **Table 4-11** focus on the overall functioning, resilience, and ecosystem level importance of deepwater benthic communities throughout U.S. waters of the GOM. The potential magnitude of impact for each of these impact-producing factors that are reasonably foreseeable is provided in **Table 4-11** to help the reader quickly identify the level of potential impacts for each impact-producing factor, shown in the table both with and without the anticipated BOEM mitigations to make clear the considerable difference that results from these mitigations. The impact-level definitions and the analyses supporting these conclusions are discussed below. Postlease, site-specific analyses would focus more on potential localized impacts of individual development activities (e.g., proposed drilling of a well) to individuals, discrete communities, and small patches of benthic habitat. Those analyses would also detail site-specific protective mitigations required prior to approval of such activities.

Impact-Level Definitions

For this analysis, the following definitions were used to categorize impacts to deepwater benthic communities:

- **Negligible** – Impacts to deepwater benthic communities are largely undetectable. There is some potential for even undetectable impacts to cause slight changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but any such changes would be spatially localized, short term in duration, and would not alter the overall status of GOM deepwater benthic communities.

- **Minor** – Impacts to deepwater benthic communities are detectable but cannot be clearly distinguished from natural variation. Such impacts could result in changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but would be spatially localized, short term in duration, and would not alter the overall status of GOM deepwater benthic communities.
- **Moderate** – Impacts to deepwater benthic communities detectably cause substantial, population-level changes in species composition, community structure, and/or ecological functioning. These impacts would be expected to be spatially extensive but are expected to only temporarily alter the overall status of GOM deepwater benthic communities; long-term recovery to pre-impact levels is likely.
- **Major** – Impacts to deepwater benthic communities detectably cause substantial, population-level changes in species composition, community structure, and/or ecological functioning. These impacts would be expected to be spatially extensive and noticeably alter the overall status of GOM deepwater benthic communities such that long-term recovery to pre-impact levels is unlikely.

Table 4-11. Deepwater Benthic Communities Impact-Producing Factors That Are Reasonably Foreseeable.

Deepwater Benthic Communities	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Bottom-Disturbing Activities and Drilling-Related Sediment and Waste Discharges					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Minor to Major	Minor to Moderate	Minor to Moderate	Minor to Major	None
Accidental Impacts					
Bottom-Disturbing Activities and Drilling-Related Sediment and Operational Waste Discharges					
With Mitigation	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	None
Without Mitigation	Minor to Major	Minor to Moderate	Minor to Moderate	Minor to Major	None
Oil Spills					
With Mitigation	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	None
Without Mitigation	Minor to Major	Minor to Moderate	Minor to Moderate	Minor to Major	None

Cumulative Impacts					
Incremental Contribution[2]	Negligible	Negligible	Negligible	Negligible	None
OCS Oil and Gas Program[3]	Negligible to Minor				
Non-OCS Oil and Gas Activities[4]	Negligible to Major				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.4 of the 2017-2022 GOM Multisale EIS.

[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.

[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.

[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

The OCS oil- and gas-related, impact-producing factors for deepwater benthic communities can be grouped into three main categories: (1) bottom-disturbing activities; (2) drilling-related sediment and waste discharges; and (3) noncatastrophic oil spills. These impact-producing factors have the potential to damage individual deepwater habitats and disrupt associated benthic communities if insufficiently distanced or otherwise mitigated. However, impacts from individual routine activities and accidental events are usually temporary, highly localized, and expected to impact only small numbers of organisms and substrates at a time. Moreover, use of the expected site-specific plan reviews/mitigations will distance activities from deepwater benthic communities, greatly diminishing the potential effects. Therefore, at the regional, population-level scope of this analysis, and assuming adherence to all expected regulations and mitigations, the incremental contribution would be expected to be **negligible** for any of the action alternatives. Impacts from accidental events would be expected to be **negligible** to **minor** for any of the action alternatives. The expected OCS oil- and gas-related activities from a proposed action would also contribute incrementally to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative effects experienced by deepwater benthic communities, but only by a **negligible** amount. Under Alternative E, the potential for impacts would be **none** because new impacts to deepwater benthic communities related to a cancelled lease sale would be avoided entirely. The overall OCS oil- and gas-related cumulative impacts to deepwater benthic communities are estimated to be **negligible** to **minor**. Non-OCS oil- and gas-related activities such as commercial fishing (currently negligible) and shifting baseline environmental conditions related to climate change (currently negligible but likely to increase to major over time should current trends continue or worsen) could cause more noticeable impacts on deepwater benthic communities over the next 50 years. A full analysis of deepwater benthic communities can be found in Chapter 4.4 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

At the regional, population-level scope of this analysis, and assuming adherence to all expected regulations and mitigations, impacts from reasonably foreseeable routine activities would be expected to be **negligible** for any of the action alternatives. For Alternative B, proposed OCS oil- and gas-related activities would also contribute incrementally, but only a **negligible** amount, to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative effects experienced by deepwater benthic communities, assuming the continuation of expected mitigation practices. Alternative C would not fundamentally alter the conclusions reached for Alternative A, but it would reduce the potential impacts of a proposed lease sale in the available unleased blocks in the CPA/EPA. Although the area proposed for leasing in the WPA is relatively smaller than the proposed area of the CPA/EPA and would experience less projected OCS oil- and gas-related activity (refer to **Chapter 3**), deepwater benthic communities are found throughout all deep waters of the GOM and, therefore, the impacts associated with Alternative C could still potentially cause some population-level effects. Alternative D would do relatively little to reduce the impacts as a result of the routine activities, accidental events, or cumulative impacts to deepwater benthic communities. Deepwater benthic communities are generally found in depths >300 m (984 ft), and the vast majority of lease blocks covered by the exclusion areas in Alternative D are in shallower waters. It is believed that existing mitigation practices would continue to be applied to the proposed activities under Alternatives A-D, reducing the expected level of impacts from a single proposed lease sale to **negligible** for any of the action alternatives. Under Alternative E, a proposed lease sale would be cancelled; therefore, the potential for impacts of that proposed action would be **none** because new impacts to deepwater benthic communities related to a cancelled lease sale would be avoided entirely but existing activity would continue. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative.

Incomplete or Unavailable Information

For decades, BOEM has funded research related to deepwater benthic environments in order to further the scientific understanding necessary for informed decisionmaking. However, due in part to the inherent difficulty of data collection in deepwater environments, there is (and likely always would be) incomplete or unavailable information about deepwater benthic communities. BOEM has specifically identified incomplete information for OCS oil- and gas-related impacts related to the following: locations of deepwater benthic communities in the GOM; toxicity of oil and dispersants to deepwater benthic organisms; long-term effects of the totality of the presence of OCS oil- and gas-related infrastructure; long-term effects associated with various climate change-related factors; cascading ecological effects and interactions between deepwater benthic communities and deepwater fish communities; and long-term impacts from the *Deepwater Horizon* explosion, oil spill, and response (refer to the *Catastrophic Spill Events Analysis* white paper [USDOI, BOEM, 2017b]).

BOEM's databases of confirmed deepwater benthic communities and 3D seismic water-bottom anomalies are used when reviewing deepwater exploration and development plans. As part of postlease, site-specific development plans, operators must provide a variety of high-resolution survey data, including assessments of potential habitat for sensitive benthic communities. If data are sparse or additional detail is needed, site-specific video or photographic surveys can be requested and used to develop appropriate mitigations. While extremely helpful, BOEM's databases and survey data are not comprehensive of all deepwater benthic communities. For example, available information may not always be of sufficient resolution to identify small areas of scattered hard substrate, such as dead clam shells, that may support small patches of deepwater benthic habitat, as discussed by Quattrini et al. (2013).

To help fill data gaps about locations of deepwater benthic communities, BOEM may also be able to make use of additional datasets created by other Federal agencies. For example, NOAA's Deep Sea Coral Research and Technology Program and NOAA's National Centers for Coastal Ocean Science have been compiling a database of known observations of deepwater corals and sponges (USDOC, NOAA, 2015). This database of confirmed deepwater coral observations could be used as an ancillary information source during site-specific plan reviews. However, even with the continued additions of observation records over time, it is unlikely that the majority of deepwater coral communities would be directly observed and documented because of the inherent logistical difficulties involved in deepwater research and data collection. Past research by NOAA (Kinlan et al., 2013) has also included efforts to predictively model suitable habitat for deepwater coral and sponges based on the best available physical/environmental datasets. Future research may improve on these efforts and expand to include chemosynthetic communities. New datasets and models such as these, once they are complete, scientifically vetted, and publicly available, could provide helpful ancillary information to further assist BOEM's site-specific evaluations.

BOEM will continue to analyze and support the continued collection of the best available scientific information related to deepwater benthic communities. However, the best available information does not provide all of the data necessary for a complete understanding of these communities. For example, there is incomplete information with respect to potential long-term effects resulting from exposure to spilled oil, including potential impacts of a catastrophic spill such as the *Deepwater Horizon* oil spill. Known information about the potential impacts of a theoretical catastrophic spill is detailed in the *Catastrophic Spill Events Analysis* white paper (USDOI, BOEM, 2017b), and further information was made available with the publication of NOAA's *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* in 2016 (Deepwater Horizon Natural Resource Damage Assessment Trustees, 2016). The content of that report was reviewed as part of this analysis. Some information related to impacts specific to the *Deepwater Horizon* explosion, oil, spill, and response, such as long-term monitoring results, is still incomplete or unavailable. Impending reports are not expected to reveal additional significant effects that would alter the overall conclusions about reasonably foreseeable impact-producing factors associated with a proposed action. In completing this analysis and in making conclusions, BOEM used the best available science to determine the range of reasonably foreseeable impacts, applying accepted scientific methodologies to both integrate existing information and extrapolate potential outcomes. Therefore, BOEM has determined that the incomplete information is not essential to a reasoned choice among alternatives.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including literature from relevant peer-reviewed journals and reports) were examined to assess recent information regarding deepwater benthic communities that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for deepwater benthic communities presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on deepwater benthic communities has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for deepwater benthic communities presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.5 *SARGASSUM* AND ASSOCIATED COMMUNITIES

Summary

BOEM has reexamined the analysis for *Sargassum* and associated communities presented in the 2017-2022 GOM Multisale EIS based on the information presented below. No new information was discovered that would alter the impact conclusion for *Sargassum* and associated communities presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of *Sargassum* and associated communities, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with the proposed action are presented in Chapter 4.5 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Sargassum is a genus of large brown seaweed (a type of algae) that floats in island-like masses (USDOC, NOAA, Office of Ocean Exploration and Research, 2014). In the Gulf of Mexico, *Sargassum* and the organisms that reside within or around the matrix of plants are some of the most widely distributed and easily recognizable species in the GOM. *Sargassum*, as pelagic algae, is a widely distributed resource that is ubiquitous throughout the northern GOM and northwest Atlantic, and is part of a cycle that spans most of the Northern Hemisphere of the Atlantic Ocean, including the Caribbean Sea. As such, *Sargassum* might be potentially vulnerable to OCS oil- and gas-related activities, and it is necessary to examine the potential impact-producing factors and determine the susceptibility to these impacts as they relate to a proposed action.

Sargassum in the GOM is comprised of *S. natans* and *S. fluitans* (Lee and Moser, 1998; Stoner, 1983; Littler and Littler, 2000) and is characterized by a brushy, highly branched thallus with numerous leaf-like blades and berrylike pneumatocysts (Coston-Clements et al., 1991; Lee and Moser, 1998; Littler and Littler, 2000). The *Sargassum* cycle is expansive, encompassing most of the western Atlantic Ocean and the Gulf of Mexico with the growth, death, and decay of these plant and epiphytic communities, which may play a substantial role in the global carbon cycle (Gower and King, 2008).

To facilitate a discussion on the spatial extent of the *Sargassum* cycle and to put the impact-producing factors in context, **Figure 4-8** depicts how these plants move around the Northern Hemisphere. The *Sargassum* loop system initiates in the Sargasso Sea. Atmospheric conditions create wind patterns that push *Sargassum* south, into the Caribbean Sea where it is pushed west by the oceanic and atmospheric currents carrying it into the Gulf of Mexico. There it washes ashore on the Gulf Coast or gets swept out the Florida Strait via the Gulf Stream (Gower et al., 2013; Frazier et al., 2015). **Figure 4-8** represents the spatial extent of *Sargassum*, demonstrating that there is a high degree of connection among the Gulf of Mexico OCS planning areas and other oceanic basins and large-scale oceanic features (e.g., Gulf Stream).

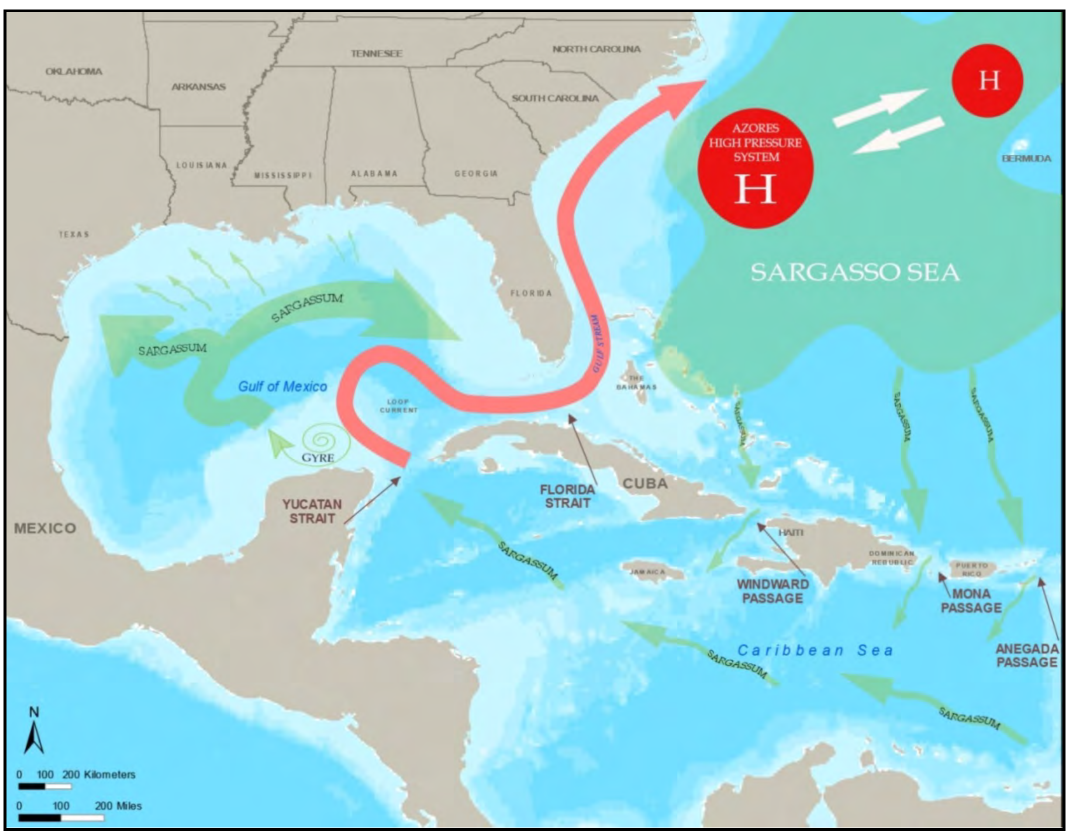


Figure 4-8. Sargassum *Loop System (adapted from Gower et al., 2013, and Frazier et al., 2015).*

Analysis

The analysis is focused on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), accidental events, and cumulative activities (**Table 4-12**). The impact-level definitions and the analyses supporting these conclusions are discussed below. During this analysis, many potential impact-producing factors were identified; however, only several posed enough of a potential threat to carry forward to a full analysis. (Refer to Chapter 4.5 of the 2017-2022 GOM Multisale EIS for a discussion of these analyses.) As such, only the following impact-producing factors were identified as having the potential to impact *Sargassum* and were carried forward to a full analysis:

- vessel operations (**Chapter 3.1.2.5**; routine and accidental, including discharges);
- chemical and drilling-fluid spills (**Chapter 3.2.1.1**; accidental only);
- oil spills (**Chapter 3.2.2**; accidental only); and
- oil-spill cleanup (**Chapter 3.2.3**; accidental only).

Impact-Level Definitions

For this analysis, the following criteria were used to categorize the effects of impact-producing factors to *Sargassum* and associated communities:

- **Negligible** – Impacts are undetectable or limited in scale to the immediate area of the impact-producing factor. This may include mortality of the plants or animals associated with *Sargassum*. Such impacts may result in changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but any such changes would be spatially localized, short term in duration, and would not alter the overall status of *Sargassum* or associated communities in the GOM.
- **Minor** – Impacts are detectable and result in changes beyond the immediate area of the impact-producing factor. Such impacts could result in noticeable changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but would be spatially localized, short term in duration, and would not alter the overall status of *Sargassum* or associated communities in the GOM.
- **Moderate** – Impacts cause substantial, population-level changes in species composition, community structure, and/or ecological functioning beyond the immediate area of the impact-producing factor. These impacts would be expected to be spatially extensive and may impact communities that rely on *Sargassum* for the transportation of larvae, settlement, or food beyond the area of the impact-producing factor. However, impacts to *Sargassum* and associated

communities are expected to be temporary, and there would be no disruption of the global *Sargassum* cycle.

- **Major** – Impacts result in the loss of *Sargassum* over large sections of the GOM. This would result in substantial, population-level changes in species composition, community structure, and/or ecological functioning for *Sargassum* and communities that rely on *Sargassum* for the transportation of larvae, settlement, or food beyond the area of the impact-producing factor. These impacts would be expected to be spatially extensive and possibly disrupt the global *Sargassum* cycle.

The potential magnitude of impact for each of these impact-producing factors is provided in **Table 4-12** to help the reader quickly identify the level of potential impacts for *Sargassum* and its associated communities.

Table 4-12. *Sargassum* and Associated Communities Impact-Producing Factors That Are Reasonably Foreseeable.

Sargassum and Associated Communities	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Vessel Operations	Negligible	Negligible	Negligible	Negligible	None
Drilling Operations	Negligible	Negligible	Negligible	Negligible	None
Accidental Impacts					
Drilling Operations	Negligible	Negligible	Negligible	Negligible	None
Vessel Operations	Negligible	Negligible	Negligible	Negligible	None
Oil Spill and Cleanup	Negligible	Negligible	Negligible	Negligible	None
Cumulative Impacts					
Incremental Contribution[2]	Negligible	Negligible	Negligible	Negligible	None
OCS Oil and Gas[3]	Minor to Moderate				
Non-OCS Oil and Gas[4]	Negligible				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.5 of the 2017-2022 GOM Multisale EIS.

[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.

[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.

[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

Several impact-producing factors can affect *Sargassum*, including vessel-related operations, oil and gas drilling discharges, operational discharges, accidental spills, non-OCS oil- and gas-related vessel activity, and coastal water quality. Routine vessel operations and accidental events that occur during drilling operations or vessel operations, and oiling due to an oil spill were the impact-producing factors that could be reasonably expected to impact *Sargassum* populations in the GOM. All of these impact-producing factors would result in the death or injury to the *Sargassum* plants or to the organisms that live within or around the plant matrix. However, the unique and transient characteristics of the life history of *Sargassum* and the globally widespread nature of the plants and animals that use the plant matrix buffer against impacts that could occur at any given location. Impacts to the overall population of the *Sargassum* community are therefore expected to be **negligible** from either routine activities or reasonably foreseeable accidental events for any of the action alternatives. The incremental impact of a proposed action on the population of *Sargassum* would be **negligible** when considered in the context of cumulative impacts to the population. Under Alternative E, a proposed lease sale would be cancelled and the potential for impacts from routine activities and accidental events would be **none**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. Impacts from changing water quality would be much more influential on *Sargassum* than OCS development and would still occur without the presence of OCS oil- and gas-related activities.

Comparison of Alternatives

Sargassum has a yearly cycle that promotes quick recovery from impacts. Therefore, most routine and accidental impact-producing factors for Alternatives A-D would be expected to result in **negligible** impacts because they only impact a small percentage of the population and because impacts would be limited in size and scope as new plants rapidly replace the impacted plants. Under Alternative E, a proposed lease sale would be cancelled and the potential for impacts from routine activities and accidental events would be **none**. Under Alternative E, impacts to *Sargassum* would be limited to cumulative impacts associated with past, present, and future OCS oil- and gas-related development and non-OCS oil- and gas-related activities.

Incomplete or Unavailable Information

Although much is known about *Sargassum* and its life history, incomplete or unavailable information still remains. This incomplete or unavailable information includes information on the effects of *in situ* oil exposure and the factors influencing the movement patterns of *Sargassum.* BOEM used existing information and reasonably accepted scientific methodologies to extrapolate in completing the analysis above. BOEM has determined that there are few foreseeable significant adverse impacts to the *Sargassum* population associated with a proposed action, using publications such as Frazier et al. (2015), Gower and King (2011), Gower et al. (2013), and Powers et al. (2013). Gower and King (2011) and Gower et al. (2013) suggest that *Sargassum* is continually present in the west-central GOM and that it moves in a general west-to-east pattern during the growing season; however, movements at a finer temporal or spatial scale are more difficult to predict. Frazier et al. (2015) built upon these studies and developed a more finite life cycle for *Sargassum* that links the Sargasso Sea *Sargassum* populations with the GOM populations. With respect to the effects of oiling from the *Deepwater Horizon* oil spill, Liu et al. (2014) noted that the toxicity or the presence of oil across the surface waters of the GOM was also variable at any given time, suggesting that it is difficult to predict the effects of *Sargassum* coming into contact with surface oil. Additionally, Lindo-Atichati et al. (2012) suggested that patterns of larval fish in the surface currents in the northern GOM were not consistent spatially or temporally and that they were highly dependent on mesoscale current structures like the Loop Current and associated eddies. Combined, these studies suggest that, as *Sargassum* is passively moved in the surface waters, its presence at any given location or at any given time is difficult to predict, especially as the population grows exponentially during the growing season. Ultimately, the ephemeral and wide-ranging nature across the northern GOM and the reproductive capabilities of *Sargassum* provide a life history that is resilient towards localized or short-term deleterious impacts, such as those expected to be associated with OCS oil- and gas-related routine activities and noncatastrophic oil or synthetic-based fluid spills. Therefore, BOEM has determined that the incomplete information on *Sargassum* is not essential to a reasoned choice among alternatives and that the information used in lieu of the unavailable information is acceptable for this analysis.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including the U.S. Department of the Interior, NOAA, Fisheries and Ocean Canada, Texas A&M University, University of Southern Mississippi, and scientific publication databases including Science Direct, Elsevier, and JSTOR) were examined to assess recent information regarding *Sargassum* and associated communities that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for *Sargassum* and associated communities presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on *Sargassum* and associated communities has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for *Sargassum* and associated communities presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.6 LIVE BOTTOM HABITATS

This chapter describes shallow-water, hard/live bottom habitats in Gulf of Mexico OCS planning areas. Hard bottoms are naturally occurring, rocky, consolidated substrates that are geological (e.g., exposed sedimentary bedrock) or biogenic (e.g., carbonate relic coral reef) in origin. These habitats occur throughout the GOM but are relatively rare compared with the soft bottoms that are ubiquitous. Hard bottoms, particularly those having measurable vertical relief, can serve as important habitat for a wide variety of marine organisms. Encrusting algae and sessile invertebrates such as corals, sponges, sea fans, sea whips, hydroids, anemones, ascidians, and bryozoans may attach to and cover hard substrates, thereby creating “live bottoms,” a term first coined by Cummins et al. (1962). The attached flora and fauna of live bottoms, such as large sponges and structure-forming corals, further enhance the structural complexity of the benthic environment. Complex structure offers shelter that can be attractive to smaller invertebrates and fishes (Fraser and Sedberry, 2008), which, in turn, can provide food for a variety of larger fishes, including some commercially important fisheries (Szedlmayer and Lee, 2004; Gallaway et al., 2009). Refer to **Chapter 4.7** ("Fishes and Invertebrate Resources") and the *Essential Fish Habitat Assessment* white paper (USDOI, BOEM, 2016c) for more detail. Seagrasses can also be considered a type of live bottom, but they have very different physical characteristics and species assemblages than the above and are thus analyzed separately in **Chapter 4.3.1**.

Defined topographic features (**Chapter 4.6.1**) are a subset of GOM hard bottom habitats that are large enough to have an especially important ecological role, with specific protections defined in the Topographic Features Stipulation. In **Figure 4-9**, the smaller black polygons represent the 38 named topographic features. Pinnacle features are much smaller in size than these topographic features and are found on specific lease blocks in the CPA and EPA (i.e., the areas shown in red in **Figure 4-9**), with the highest known concentrations of other live bottom features. The Topographic Features Stipulation and Live Bottom (Pinnacle Trend) Stipulation are described in Appendix D of the 2017-2022 GOM Multisale EIS. The Secretary of the Interior has decided in the Record of Decision for the 2017-2022 Five-Year Program to include the Protection of Biologically Sensitive Underwater Features as landscape mitigation for the 10 proposed lease sales in the GOM (USDOI, BOEM, 2017c). Live bottom habitats found outside the stipulation lease blocks are not specifically included in the stipulations, but they are still given site-specific protections by BOEM during site-specific plan reviews (refer to Appendix B of the 2017-2022 GOM Multisale EIS). The GOM live bottoms are not limited to the features/areas identified in **Figure 4-9**.

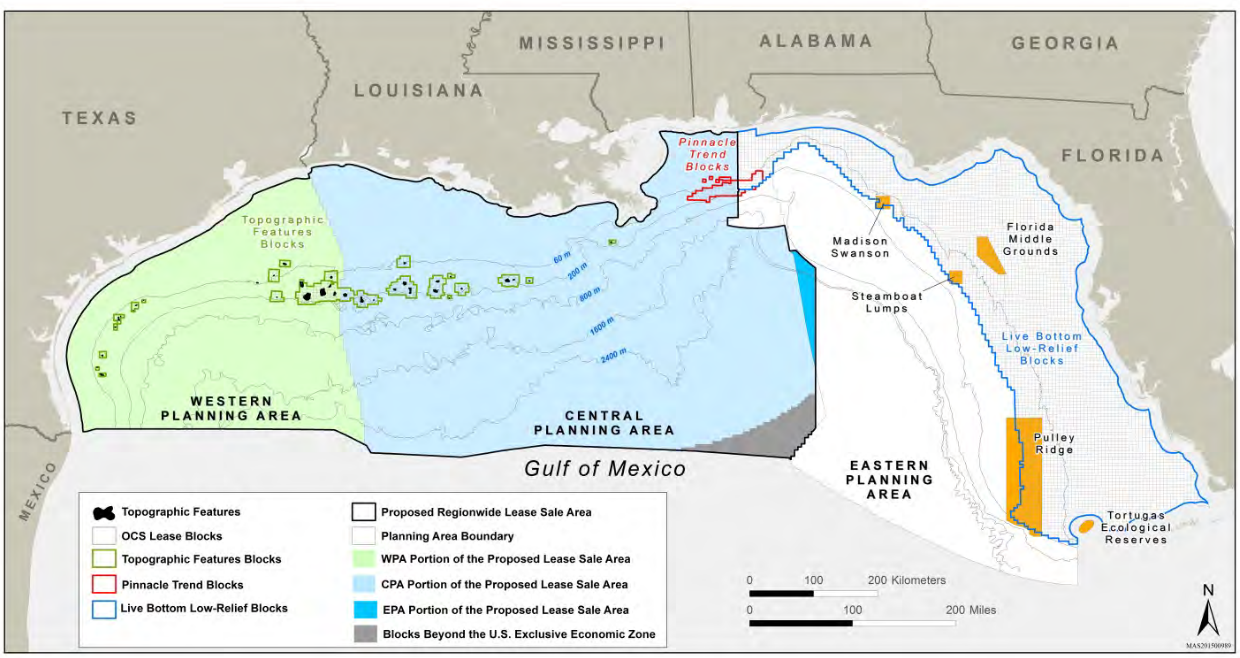


Figure 4-9. Lease Blocks Subject to the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations.

4.6.1 Topographic Features and Associated Communities

Summary

BOEM has reexamined the analysis for topographic features and associated communities presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for topographic features and associated communities presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of topographic features and associated communities, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.6.1 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS. Any new information that has become available since that document was published is presented below.

Introduction

Topographic features (also called banks) are a subset of hard bottom habitats found in the GOM that are large enough in individual size to have a particularly important role in the GOM ecosystem. Although large in size, these features (and hard bottom habitats as a whole) are relatively rare compared with the expansive soft bottoms found throughout the GOM (Parker et al., 1983). Topographic features can be created through the uplift of bedrock by underlying salt diapirs or by the exposure of fossilized barrier islands, or they can be formed from relic carbonate reefs (Rezak and Bright, 1981a and 1981b; Berryhill et al., 1987). Regardless of origin, these subsea banks provide areas of hard substrate that support benthic and fish communities with relatively high biomass, diversity, and abundance. The structurally complex habitats of these features also provide shelter, food, and nursery grounds that support large numbers of commercially and recreationally important fishes (Johnston et al., 2015; Nash et al., 2013). Many of these habitats remain relatively pristine and have a high aesthetic and scientific value, in part because they represent ecological and/or geographic extremes for many species (Rezak and Bright, 1981a; Nash et al., 2013; Johnston et al., 2015).

Topographic features and associated communities in the GOM are subject to an array of environmental conditions, resulting in a large number of ecological community types. This includes a range from the highly productive hermatypic (i.e., reef building) corals found at the Flower Garden Banks to habitats such as Dunn Bar that posess less productive and less diverse benthic habitats, yet are still known to concentrate fishes (Rezak and Bright, 1981b; Nash et al., 2013).

Protective Measures for Topographic Features

Within the Gulf of Mexico, BOEM has identified 38 topographic features with sufficiently unique geography and ecology (Rezak and Bright, 1981a; Rezak et al., 1983) to continue warranting some degree of protection from OCS oil- and gas-related activities. There are 22 topographic features in the WPA, 16 in the CPA, and 0 in the EPA (**Figure 4-9**). In the Gulf of Mexico, topographic features are known to function as large-sized, hard substrate habitats that enable settlement of sensitive benthic organisms, concentrate fishes, and substantially contribute to the ecology of the GOM. Many of these features have been identified as locations of particular value that may require a greater degree of protection from OCS oil- and gas-related activities. As such, beginning in 1973, BOEM's predecessor agency established and implemented a Topographic Features Stipulation (also referred to in this chapter just as "the Stipulation") that applies conditions to OCS oil- and gas-related activities occurring in the vicinity of these features.

Adherence to the provisions of this stipulation helps protect the resources by distancing OCS oil- and gas-related activities away from the most sensitive areas of topographic features in order to minimize any negative impacts of routine activities and accidental events on associated benthic communities. Historically, this stipulation has been applied consistently to all leases in OCS areas with defined topographic features. With the approval of the 2017-2022 Five-Year Program, the Topographic Features Stipulation is now a required mitigation. The Stipulation establishes a No Activity Zone around the most ecologically sensitive core area of each identified topographic feature, within which no bottom-disturbing activities are allowed. Additionally, BOEM extends a 500-ft (152-m) buffer around each of these No Activity Zone boundaries, further restricting bottom-disturbing activity. The additional 500-ft (152-m) buffer policy was developed in consultation with NOAA to further protect areas of topographic features that were not originally included in the defined No Activity Zones. In addition, for most of the features, the Stipulation also establishes variably sized concentric shunting zones surrounding the No Activity Zones, within which BOEM requires that drill cuttings and drilling fluids be shunted to near the seafloor to minimize the seafloor area affected by the cuttings and fluids.

Refer to Appendix D of the 2017-2022 GOM Multisale EIS for further details of the Stipulation and NTL 2009-G39, "Biologically-Sensitive Underwater Features and Areas," which provides information and consolidates guidance to help operators understand BOEM's requirements related to sensitive shallow-water benthic habitats. These requirements are designed to prevent or limit any impacts resulting from routine activities and accidental events to topographic features. This analysis assumes that these (or functionally equivalent) protections will continue to be a requirement for OCS oil- and gas-related activities resulting from a proposed action throughout the 50-year analysis period. Furthermore, the Secretary of the Interior has decided in the Record of Decision for the 2017-2022 Five-Year Program to include the Protection of Biologically Sensitive Underwater Features as landscape mitigation for the 10 proposed lease sales in the GOM (USDOI, BOEM, 2017c).

Analysis

This analysis considers the reasonably foreseeable impacts of a proposed action's routine activities, accidental events, and incremental contribution to cumulative impacts on GOM topographic features and these physical features' associated benthic communities (hereafter referred to as "topographic features") over a 50-year period. Because a catastrophic oil spill is not considered reasonably foreseeable, those potential impacts (including long-term recovery) are addressed in the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b). The impact significance criteria and resulting conclusions presented here (**Table 4-13**) focus on the overall functioning, resilience, and ecosystem level importance of topographic features throughout U.S. waters of the GOM.

Because of the similarity and overlap of the effects of many OCS oil- and gas-related activities that occur in the OCS, the impact-producing factors considered for topographic features can be divided into three broad categories: drilling and exploration operations; vessel operations; and oil spill and associated cleanup activities. An in-depth analysis of these potential impact-producing factors determined that, although many may occur within the GOM, few could occur at an extent sufficient to cause impacts to the topographic features as a whole (**Table 4-13**), partly because these topographic features are spread widely across the GOM. The potential magnitude of impact for each of the analyzed impact-producing factors is provided in **Table 4-13** to help the reader quickly identify the level of potential impacts for each impact-producing factor. The impact-level definitions and the analyses supporting these conclusions are discussed below. The following impact-producing factors were carried forward to a full analysis for routine activities and accidental events:

- Routine Activities
  - Drilling, exploration, and decommissioning (bottom-disturbing activities)
  - Vessel operation (bottom-disturbing activities)
- Accidental Events
  - Drilling, exploration, and decommissioning
    - Bottom-disturbing activities
    - Chemical and drilling-fluid spills
  - Vessel operation (bottom-disturbing activities)
  - Oil spill and associated cleanup
    - Large and small spills resulting from surface or subsea sources
    - Cleanup operations not related to vessel operations

Of all the possible impact-producing factors, it was determined that bottom-disturbing activities associated with drilling, exploration, and vessel operations were the only impact-producing factors from routine activities that could be reasonably expected to substantially impact topographic features. The impact-producing factors also include the release of sediments and toxins during drilling operations. Oil-spill response-related activities were also considered to be a potential source of impacts to topographic features. Refer to Chapter 4.6.1 of the 2017-2022 GOM Multisale EIS for further detail on the analyses in this chapter and for the analyses that were not carried forward.

Impact-Level Definitions

For this analysis, the following definitions were used to categorize impacts to topographic features and associated communities:

- **Negligible** – Impacts to topographic feature communities are largely undetectable. There is some potential for even undetectable impacts to cause slight changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but any such changes would be spatially localized, short term in duration, and would not impact other topographic features.
- **Minor** – Impacts to topographic feature communities are detectable but cannot be distinguished from natural variation. Such impacts could result in noticeable changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but would be spatially localized, short term in duration, and recovery would be expected.
- **Moderate** – Impacts to topographic feature communities that result in substantial, population-level changes in species composition, community structure, and/or ecological functioning. These impacts would be expected to be spatially extensive, spanning across several topographic features, but impacts are expected to result in temporary changes and recovery would be likely.
- **Major** – Impacts to topographic feature communities that result in substantial, population-level changes in species composition, community structure, and/or ecological functioning. These impacts would be expected to be spatially extensive and noticeably alter the overall status of many topographic features in the GOM. Long-term recovery to pre-impact community structure, species abundance, or ecological function is unlikely.

Table 4-13. Topographic Features and Associated Communities Impact-Producing Factors That Are Reasonably Foreseeable.

Topographic Features	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Bottom-Disturbing Activities Associated with Drilling, Exploration, and Decommissioning					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Moderate	Moderate	Moderate	Negligible	None

Topographic Features	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Bottom-Disturbing Activities Associated with Vessel Operations					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Moderate	Moderate	Moderate	Negligible	None
Accidental Impacts					
Bottom-Disturbing Activities Associated with Drilling, Exploration, and Decommissioning					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Moderate	Moderate	Moderate	Negligible	None
Chemical and Drilling-Fluid Spills					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Moderate	Moderate	Moderate	Negligible	None
Vessel Operations					
Bottom-Disturbing Activities Associated with Vessel Operations					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Moderate	Moderate	Moderate	Negligible	None
Oil Spills and Associated Cleanup Activities					
Large and Small Spills Resulting from Surface or Subsea Sources					
With Mitigation	Negligible	Negligible	Negligible	Negligible	N/A
Without Mitigation	Moderate	Moderate	Moderate	Negligible	None
Cleanup Operations Not Related to Vessel Operation					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Moderate	Moderate	Moderate	Negligible	None
Cumulative Impacts					
Incremental Contribution[2]	Negligible	Negligible	Negligible	Negligible	None
OCS Oil and Gas[3]	Negligible				
Non-OCS Oil and Gas[4]	Negligible to Moderate				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.6.1 of the 2017-2022 GOM Multisale EIS.

[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.

[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.

[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

Adherence to the Topographic Features Stipulation (a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision) is analyzed in each action alternative and detailed in Appendix D of the 2017-2022 GOM Multisale EIS. Application of the Topographic Features Stipulation would assist in preventing or at least minimizing potential impacts to topographic feature communities by increasing the distance of OCS oil- and gas-related activities from these features. The historical application of this stipulation has resulted in **negligible** impacts of a proposed action to topographic features from routine activities and accidental events. The incremental contribution of a proposed action to the overall cumulative impacts is also expected to be **negligible**, with adherence to the required Topographic Features Stipulation. Under Alternative E, the potential for new incremental impacts to topographic features from a cancelled lease sale would be **none** because they would be avoided entirely. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. Impacts ranging from **negligible** to **moderate** may still be expected from non-OCS oil- and gas-related activities factors such as fishing, pollution, and climate change; however, the incremental impact of the proposed activities should not result in a meaningful augmentation of overall expected impacts. A full analysis of topographic features can be found in Chapter 4.6.1 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

Overall, given adherence to the Topographic Features Stipulation (which is a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision), reasonably foreseeable impacts to topographic features from routine activities, accidental events, and the cumulative impacts for any of the action alternatives (i.e., Alternatives A-D) are expected to be **negligible**. Alternative B or C would not fundamentally alter the conclusions reached under Alternative A. Many OCS lease blocks near the features are already leased, and impacts from non-OCS oil- and gas-related activities are not expected to decrease. Under Alternative D, BOEM could hold a lease sale excluding leasing of any and/or all blocks subject to the Topographic Features, Live Bottom (Pinnacle Trend), and Blocks South of Baldwin County, Alabama, Stipulations. Topographic features could experience fewer impacts through the additional distancing of OCS oil- and gas-related activities, further reducing the probability of impacts. An accidental spill may still reach a topographic feature, but it is expected that the increased distance would provide more dispersal time as the spill travels the additional distance across unleased blocks. Alternative D would do little to change the overall cumulative impacts to topographic features. Many OCS lease blocks near the features are already leased, and impacts from non-OCS oil- and gas-related activities are not expected to decrease. Under Alternative E, a proposed lease sale would be cancelled. Therefore, the potential for new incremental impacts would be **none** because new OCS oil- and gas-related impacts to topographic features related to the cancelled lease sale would be avoided entirely. However, the level of cumulative impacts could still potentially increase over time, even eventually rising to **moderate**, should current trends of these activities continue or worsen, regardless of whether or not a single proposed lease sale would be held.

Incomplete or Unavailable Information

BOEM recognizes that there is incomplete or unavailable information related to topographic features and associated communities in general and specifically in relation to routine activities, accidental events, and cumulative impacts. However, the information that is known is adequate to come to a determination with respect to reasonably foreseeable impact-producing factors associated with a proposed action.

Research in offshore marine systems is logistically complex and requires substantial resources. As such, the total amount of research on these features and their communities is relatively limited, although BOEM and its predecessor agencies have funded numerous studies over the past 40 years. For example, our understanding of the possible impacts of surface oil spills to topographic features in the GOM was determined by combining research on the depth and concentration of the physical mixing of surface oil with the known depths of topographic features. Even though oil measurements were not collected at every feature under every condition, the available results suggest that topographic features exist at depths deeper than lethal concentrations of oil would be expected (Lange, 1985; McAuliffe et al., 1975 and 1981; Tkalich and Chan, 2002; Rezak et al., 1983; Wyers et al., 1986). Mixing to depth might occur, but it would be limited to unusual combinations of conditions such as when tropical storms pass directly over oiled surface waters (e.g., Silva et al., 2015). Moreover, the amounts of oil/dispersant mixture involved in that situation greatly exceeds the amounts considered in the "Accidental Events" analysis in Chapter 4.6.1 of the of the 2017-2022 GOM Multisale EIS. Given the geographic and temporal scope of a proposed action, it is believed that even impacts resulting from that particular situation would still only have a slight impact on the overall status of the topographic features and associated communities. However, the example demonstrates the point that the body of literature supporting impact analysis is still growing and requires continual review by BOEM.

Since the 1970s, BOEM and its predecessor agencies have supported continuous monitoring of the Flower Garden Banks for any impacts related to OCS oil- and gas-related activities. At the Flower Garden Banks, corals have generally flourished (refer to Johnston et al., 2015, and references therein) even as OCS oil- and gas-related development has occurred, sometimes just outside of the No Activity Zone. Since corals are generally considered to be more fragile than most other types of organisms found on topographic features, it is also reasonable to conclude that topographic features with more resilient organisms than the Flower Garden Banks have not been negatively affected by OCS oil- and gas-related development in the GOM. However, given the ecological sensitivity of benthic communities on topographic features, continued research and monitoring efforts are necessary to maintain a sufficient understanding of the various potential impacts from OCS oil- and gas-related and non-OCS oil- and gas-related activities. A recent example illustrates how conditions could potentially change. In August 2017, a routine National Marine Sanctuary/BOEM long-term monitoring cruise in the East Flower Garden Bank documented a mortality event affecting corals and other benthic organisms in a localized area. At the time of this writing, tissue and water quality samples have been collected but not yet analyzed, and no causes have been indicated. BOEM will continue cooperating with the Sanctuary and other partners to evaluate information as it becomes available and will update future Supplemental EISs as necessary.

BOEM has used existing information and reasonably accepted scientific methodologies to extrapolate from available information in completing this analysis and formulating the conclusions presented here. Known information about potential impacts of a theoretical catastrophic spill is detailed in the *Catastrophic Spill Events Analysis* white paper (USDOI, BOEM, 2017b), and further information was made available with the publication of the Trustees' PDARP/PEIS in 2016 (Deepwater Horizon Natural Resource Damage Assessment Trustees, 2016). The content of that report was reviewed as part of this analysis. Some information related to impacts specific to the *Deepwater Horizon* explosion, oil, spill, and response, such as long-term monitoring results, is still incomplete or unavailable. Impending reports are not expected to reveal additional significant effects that would alter the overall conclusions about reasonably foreseeable impact-producing factors associated with a proposed action. BOEM has determined that such additional information could not be timely acquired and incorporated into the current analysis. However, the currently available body of evidence supports past analyses and does not indicate severe adverse impacts to topographic features linked to the *Deepwater Horizon* explosion, oil, spill, and response for topographic features. Impending reports are not expected to reveal additional significant effects that would alter the overall conclusions about reasonably foreseeable impact-producing factors associated with a proposed action. Therefore, BOEM has determined that the incomplete or unavailable information is not essential to a reasoned choice among alternatives.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including literature from relevant peer-reviewed journals and reports) were examined to assess recent information regarding topographic features and associated communitites that may be pertinent to a proposed action. New information relevant to an analysis of the potential impacts of OCS oil- and gas-related activities on topographic features and associated communities has been released since publication of the 2017-2022 GOM Multisale EIS.

In August 2016, a routine National Marine Sanctuary/BOEM long-term monitoring cruise in the East Flower Garden Bank documented a mortality event affecting corals and other benthic organisms in a localized area. At the time of this writing, tissue and water quality samples have been collected and some analyses completed. The Flower Garden Banks National Marine Sanctuary is awaiting reports from the participating laboratories; no specific causes have been identified. BOEM will continue cooperating with the Sanctuary and other partners to evaluate information as it becomes available and will update future Supplemental EISs as necessary.

Conclusion

BOEM has reexamined the analysis for topographic features and associated communities presented in the 2017-2022 GOM Multisale EIS based on the additional information presented above. No new information was discovered that would alter the impact conclusion for topographic features and associated communities presented in the 2017-2022 GOM Multisale EIS, and the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.6.2 Pinnacles and Low-Relief Features and Associated Communities

Summary

BOEM has reexamined the analysis for Pinnacles and low-relief features and associated communities presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for Pinnacles and low-relief features and associated communities presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of Pinnacles and low-relief features and associated communities, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.6.2 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

The terms live bottom and hard bottom are often used interchangeably, but they are actually distinct, since it is possible to have hard bottom that is not live bottom. Hard substrates can form crusts, pavements, pinnacles, ledges, outcrops, and other reefal features (Jenkins, 2011). These harder substrates may or may not be covered by a thin veneer of muddy or sandy sediments that can be deposited and removed over time by currents and storms. Hard substrates with the lowest vertical relief are the most likely to be routinely buried and exposed. Encrusting algae and sessile invertebrates regularly attach to and cover exposed hard substrates, creating live bottoms. For the purposes of the Live Bottom Stipulation, which is a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision, "live bottom areas" have been defined as communities or areas that contain biological assemblages consisting of sessile invertebrates such as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or areas whose lithotope (substrate type) favors the accumulation of turtles, fishes, and other fauna. Large, shallow-water coral reefs created via biogenic deposition of calcium carbonate are only known to be present at the southern end of the EPA and on a few topographic features in the WPA and CPA (refer to **Chapter 4.6.1** above). While the general public often thinks of such biogenic coral reefs as the only natural habitat for corals, for most of their geological history, corals have existed in less extensive epibenthic communities that are not built upon large biogenic reefs. These types of corals and associated epibenthic communities are the focus of this chapter on pinnacles and low-relief features.

The Pinnacle Trend is an approximately 64 x 16 mi (103 x 26 km) area in water depths ranging from approximately 200 to 650 ft (60 to 200 m). It is in the northeastern portion of the CPA at the outer edge of the Mississippi-Alabama shelf between the Mississippi River and De Soto Canyon (**Figures 2-4 and 4-9**). Outside of the Pinnacle Trend area, low-relief, live bottom epibenthic communities occur in isolated locations in shallow waters (<984 ft; 300 m) throughout the GOM wherever there exists suitable hard substrate and other physical conditions (e.g., depth, turbidity, etc.), allowing for community development. Hard bottom habitats occur throughout the GOM but are relatively rare compared with ubiquitous soft bottoms.

Protective Measures for Pinnacle and Low-Relief Features and Associated Communities

Protective measures have been developed over time based on the nature and sensitivity of various live bottom habitats and their associated communities, as understood from decades of BOEM-funded and other environmental studies. These protections were developed into stipulations historically applied to OCS leases in areas with known concentrations of live bottom features. The Pinnacle Trend is a specific series of high- and low-relief hard/live bottom features occurring just east of the Mississippi River. BOEM has historically and consistently applied the Live Bottom (Pinnacle Trend) Stipulation to 74 OCS lease blocks covering this area. As of the approval of the 2017-2022 Five-Year Program, the Live Bottom (Pinnacle Trend) Stipulation is a required mitigation. The CPA blocks directly adjacent to the stipulation blocks are included in a proposed action and some of the alternatives; therefore, potential impacts of routine activities and accidental events originating in those adjoining blocks are analyzed here. A full list of the stipulation blocks with required mitigation can be found in Appendix D of the 2017-2022 GOM Multisale EIS.

Live bottom habitats are found outside the blocks where the Topographic Features and Live Bottom Stipulations have been historically applied. Such habitats are not specifically included in those stipulations (now a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision), but they are still routinely given protections during site-specific NEPA reviews of permitted activities, as described in NTL 2009-G39, "Biologically-Sensitive Underwater Features and Areas." That NTL provides information and consolidates guidance to help operators understand BOEM's requirements related to sensitive benthic habitats both within and outside the required mitigation blocks.

Lessees must provide site-specific seafloor survey data and interpretive information (including about hard bottom features) with each EP, DOCD, and DPP. Site-specific NEPA reviews are conducted on these plans by BOEM's subject-matter experts on a case-by-case basis to determine whether a proposed operation could impact a live bottom feature. If an impact is judged likely based on site-specific information derived from BOEM's studies/databases, other published research, geohazard survey data, or another credible source, the operator may be required to distance/relocate the proposed operation or undertake other mitigations to prevent an impact. This analysis assumes continuation of the protective measures outlined in NTL 2009-G39, as they are routinely applied (when and where appropriate) during all site-specific plan reviews. The Live Bottom Stipulation, which historically was applied to individual lease sales at the discretion of the decisionmaker and has been consistently applied to the same lease blocks for decades, is now a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision. The types of potential impacts to pinnacle and low-relief feature communities described in this chapter would become more likely and more severe without the continued application of these stipulations.

Analysis

This analysis considers the impacts of routine activities, accidental events, and a proposed action's incremental contribution to cumulative impacts on GOM pinnacle and low-relief features and their associated benthic communities (or just "feature communities" for short) over a 50-year period. This analysis is not exhaustive of all possible impacts of routine activities and accidental events; rather, it focuses on those related to a proposed action. A summary of the potential magnitude of impact for each of these impact-producing factors is provided in **Table 4-14** to help the reader quickly identify the level of potential impacts for each relevant impact-producing factor. The impact-level definitions and the analyses supporting these conclusions are discussed below. Because a catastrophic oil spill is not considered reasonably foreseeable, those potential impacts (including long-term recovery) are addressed in the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b). The impact significance criteria and resulting conclusions presented here (**Table 4-14**) focus on the overall functioning, resilience, and ecosystem level importance of live bottom pinnacle and low-relief feature communities throughout U.S. waters of the GOM. Postlease, site-specific analyses would focus more on the potential localized impacts of individual development activities (e.g., proposed drilling of a specific well) to individuals, discrete communities, and small patches of live bottom habitat. Those analyses would also detail site-specific protective mitigations required prior to approval of such activities. Appendix B of the 2017-2022 GOM Multisale EIS provides detail on some of the potential site-specific mitigations that could be applied as necessary.

The primary relevant, reasonably foreseeable impacts of routine activities and accidental events to live bottom Pinnacle Trend and low-relief features and associated communities described in this chapter can be grouped into the following three general categories:

(1) bottom-disturbing activities (routine and accidental);

(2) drilling-related sediment and waste discharges (routine and accidental); and

(3) oil spills (accidental).

These impacts are analyzed in detail under the "Routine Activities" and "Accidental Events" sections in Chapter 4.6 of the 2017-2022 GOM Multisale EIS and are summarized below. Cumulative impacts were also considered in two steps: cumulative impacts resulting from OCS oil- and gas-related activities and impacts resulting from non-OCS oil- and gas-related activities. Some impact-producing factors relevant to live bottom communities (such as anthropogenic sounds) are analyzed in detail in Chapter 4.7 ("Fishes and Invertebrate Resources") of the 2017-2022 GOM Multisale EIS. Some theoretically possible impact-producing factors were not carried forward for full analysis in the 2017-2022 GOM Multisale EIS because any potential effects were judged to be either not reasonably foreseeable or having such a miniscule impact that they would not rise to the level of negligible impact. Refer to Chapter 4.6.2 of the 2017-2022 GOM Multisale EIS for more detail on these analyses.

Impact-Level Definitions

For this analysis, the definitions below were used to categorize impacts to pinnacles and low-relief features and associated communities.

- **Negligible** – Impacts to pinnacle and low-relief feature communities are largely undetectable. There is some potential for even undetectable impacts to cause slight changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but any such changes would be spatially localized, short term in duration, and would not alter the overall status of GOM pinnacle and low-relief feature communities.
- **Minor** – Impacts to pinnacle and low-relief feature communities are detectable but cannot be distinguished from natural variation. Such impacts could result in noticeable changes to a local community's species abundance and composition, community structure, and/or ecological functioning, but any such changes would be spatially localized, short term in duration, and would not alter the overall status of GOM pinnacle and low-relief feature communities.
- **Moderate** – Impacts to pinnacle and low-relief feature communities detectably cause substantial, population-level changes in species composition, community structure, and/or ecological functioning. These impacts would be expected to be spatially extensive, but they are expected to only temporarily alter the overall status of GOM pinnacle and low-relief feature communities such that long-term recovery to pre-impact levels is likely.
- **Major** – Impacts to pinnacle and low-relief feature communities detectably cause substantial, population-level changes in species composition, community structure, and/or ecological functioning. These impacts would be expected to be spatially extensive and to noticeably alter the overall status of GOM pinnacle and low-relief feature communities such that long-term recovery to pre-impact levels is unlikely.

Table 4-14. Pinnacles and Low-Relief Features and Associated Communities Impact-Producing Factors That Are Reasonably Foreseeable.

Pinnacles and Low-Relief Features	Magnitude of Potential Impact1				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Bottom-Disturbing Activities and Drilling-Related Sediment and Waste Discharges					
With Mitigation	Negligible	Negligible	Negligible	Negligible	None
Without Mitigation	Minor to Major	Minor to Moderate	Negligible to Minor	Negligible to Minor	None

Accidental Impacts					
Bottom-Disturbing Activities and Drilling-Related Sediment and Operational Waste Discharges					
With Mitigation	Negligible to Minor	Negligible to Minor	Negligible	Negligible	None
Without Mitigation	Minor to Major	Minor to Moderate	Negligible to Minor	Negligible to Minor	None
Oil Spills					
With Mitigation	Negligible to Minor	Negligible to Minor	Negligible	Negligible	None
Without Mitigation	Minor to Major	Minor to Moderate	Negligible to Minor	Negligible to Minor	None
Cumulative Impacts					
Incremental Contribution[2]	Negligible to Minor	Negligible to Minor	Negligible	Negligible	None
OCS Oil and Gas[3]	Negligible to Minor				
Non-OCS Oil and Gas[4]	Minor to Major				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.6.2 of the 2017-2022 GOM Multisale EIS.
[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.
[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.
[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

The impact-producing factors for pinnacles and low-relief live bottom features and associated communities can be grouped into three main categories: (1) bottom-disturbing activities; (2) drilling-related sediment and waste discharges; and (3) oil spills. These impact-producing factors have the potential to damage individual pinnacle and low-relief features and associated benthic communities if insufficiently distanced or otherwise mitigated. The Live Bottom Stipulation (which is a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision), along with site-specific reviews of permit applications and associated distancing requirements, would mitigate potential impacts to the communities as a result of both routine activities and accidental disturbances. At the broad geographic and temporal scope of this analysis, and assuming adherence to all expected lease stipulations and typically applied regulations and mitigations, routine activities are expected to have largely localized and temporary effects. Although accidental events have the potential to cause severe damage to specific pinnacle and low-relief feature communities, the number of such events is expected to be very small. Therefore, at the regional, population-level scope of this analysis, the incremental contribution of impacts from reasonably foreseeable routine activities and accidental activities to the overall cumulative impacts is expected to be **negligible** to **minor**. Proposed OCS oil- and gas-related activities would also contribute incrementally to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative effects experienced by pinnacle and low-relief feature habitats. Under Alternative E, the potential for impacts to pinnacle and low-relief feature communities related to a cancelled lease sale would be **none** because new impacts would be avoided entirely. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. The OCS oil- and gas-related cumulative impacts to pinnacle and low-relief feature communities are estimated to be **negligible** to **minor**. A full analysis of pinnacles and low-relief features can be found in Chapter 4.6.2 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

Overall, given adherence to the Live Bottom (Pinnacle Trend) Stipulation (which is a required mitigation as a result of the 2017-2022 Five-Year Program's Record of Decision), reasonably foreseeable impacts to pinnacle and low-relief feature communities from routine activities, accidental events, and the cumulative impacts for any of the action alternatives (i.e., Alternatives A-D) are expected to be **negligible** or **negligible** to **minor**, depending on the alternative. Alternative B would not fundamentally alter the overall conclusion reached under Alternative A for incremental impacts from a lease sale. Many OCS lease blocks near the features are already leased, and non-OCS oil- and gas-related activities are not expected to decrease. Under Alternative C, BOEM could hold a lease sale excluding the CPA/EPA available unleased blocks and would only offer all available unleased blocks in the WPA. Alternative C would not fundamentally alter the conclusions reached under Alternative A or B, but it would reduce the potential impacts of a proposed lease sale of the available unleased CPA/EPA blocks, including known high concentrations of pinnacle and low-relief feature communities in the Pinnacle Trend blocks and other portions of the northeastern CPA (**Figure 4-9**). Under Alternative D, BOEM could hold a lease sale excluding leasing on any and/or all blocks subject to the Topographic Features, Live Bottom (Pinnacle Trend), and Blocks South of Baldwin County, Alabama, Stipulations. Known pinnacle and low-relief features in the Pinnacle Trend area would be further protected by the increased distancing of OCS oil- and gas-related activities, reducing the probability of impacts. An accidental spill may still reach a feature, but it is expected that the increased distance would provide more dispersal time as the spill travels the additional distance across unleased blocks. Under Alternative E, a proposed lease sale would be cancelled. Therefore, the potential for new incremental impacts would be **none** because new OCS oil- and gas-related impacts to pinnacle and low-relief feature communities related to a cancelled lease sale would be avoided entirely. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative.

Incomplete or Unavailable Information

BOEM recognizes that there is incomplete or unavailable information related to GOM live bottom habitats in general and specifically in relation to routine activities, accidental events, and cumulative impacts for OCS oil- and gas-related activities and cumulative non-OCS oil- and gas-related activities. However, the information that is known is adequate to come to a determination with respect to reasonably foreseeable impact-producing factors associated with a proposed action.

Research in offshore marine systems is logistically complex and requires substantial resources to conduct. The total amount of research on live bottom habitats has therefore been limited, although BOEM and its predecessor agencies have funded numerous studies over the past 40 years. An example of incomplete knowledge about this resource would be that the exact distribution of GOM live bottom habitats at any given time is not perfectly understood. This is due in part to limits on data collection but also due to the frequent burial and exposure of low-relief hard bottoms. To help address this knowledge gap, BOEM requires operators to provide detailed, updated, site-specific survey information about potential live bottom habitats; this information is reviewed by subject-matter experts prior to approval of individual proposed activities, and appropriate protective mitigations are applied where appropriate.

Although BOEM has acquired and applies a large amount of knowledge about possible impacts to live bottom habitats, a perfect understanding of all conceivable impacts is unattainable. For example, only recently did a study (Silva et al., 2015) provide compelling evidence that the mixing of a surface oil/dispersant mixture to the depths of the Pinnacle Trend live bottom features can actually occur, given a very unusual combination of conditions, and could then have a localized impact. Given the geographic and temporal scope of a proposed action, it is believed that even impacts resulting from that particular scenario would still only have a slight impact on the overall status of GOM pinnacle and low-relief feature communities. Moreover, the amount of oil/dispersant mixture in that catastrophic situation greatly exceeded the amounts considered in the "Accidental Events" analysis in Chapter 4.6.2 of the 2017-2022 GOM Multisale EIS. However, the example demonstrates the point that the body of literature supporting impact analysis is still growing and requires continual review by BOEM.

Known information about potential impacts of a theoretical catastrophic spill is detailed in the *Catastrophic Spill Events Analysis* white paper (USDOI, BOEM, 2017b), and further information was made available with the publication of Trustees' PDARP/PEIS in 2016 (Deepwater Horizon Natural Resource Damage Assessment Trustees, 2016). The content of that report was reviewed as part of this analysis. Some information related to impacts specific to the *Deepwater Horizon* explosion, oil, spill, and response, such as long-term monitoring results, is still incomplete or unavailable. Impending reports are not expected to reveal additional significant effects that would alter the overall conclusions about reasonably foreseeable impact-producing factors associated with a proposed action. Therefore, BOEM has determined that it is not possible to obtain this information within the timeframe contemplated for the NEPA analysis in this Supplemental EIS, regardless of the cost or resources needed.

BOEM will continue to analyze and support collection and analysis of the best available scientific information related to live bottom habitats. BOEM used reasonably accepted scientific methodologies to extrapolate from existing information in completing this analysis and formulating the conclusions presented here. BOEM has determined that the incomplete information is not essential to a reasoned choice among alternatives.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including literature from relevant peer-reviewed journals and reports) were examined to assess recent information regarding Pinnacles and low-relief features and associated communities that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for Pinnacles and low-relief features presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new relevant information on Pinnacles and low-relief features and associated communities has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for Pinnacles and low-relief features and associated communities presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.7 FISHES AND INVERTEBRATE RESOURCES

Summary

BOEM has reexamined the analysis for fish and invertebrate resources presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for fish and invertebrate resources presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of fish and invertebrate resources, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with the proposed action are presented in Chapter 4.7 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS. Any new information that has become available since that document was published is presented below.

Introduction

Fish and invertebrate resources of the GOM comprise a large and diverse group of species (Felder et al., 2009). The distribution of fishes and invertebrates varies widely, and species may be associated with different habitats at various life stages. This analysis highlights behaviors and habitat preferences, but it does not attempt to provide a comprehensive list of all potentially impacted fauna. For purposes of this analysis, habitat preferences can be divided into three broad categories: estuarine; coastal; and oceanic. Exposure to specific impact-producing factors generated by OCS oil- and gas-related routine activities and accidental events can vary among these categories. Coastal and oceanic resources are further broken into benthic and pelagic zones to address differences in potential exposure to impact-producing factors within a given habitat category. Ichthyoplankton bridges all three categories. Egg and larval stages of most fishes and invertebrates can be found in the upper layer of the water column, exposing these species' early life stages to similar impact-producing factors. For these reasons, the description of the affected environment for fish and invertebrate resources is broken into estuarine, coastal, and oceanic habitats, with ichthyoplankton being treated separately due to the potentially broader distribution of egg and larval lifestages across these habitats. A detailed description of the affected environment for fish and invertebrate resources can be found in in Chapter 4.7.1 of the 2017-2022 GOM Multisale EIS, along with a brief discussion of the federally managed species.

Analysis

This chapter provides a summary of the information detailed in the 2017-2022 GOM Multisale EIS regarding the impact-producing factors from routine activities, accidental events, and cumulative impacts described in **Chapter 3** and their potential effects on fish and invertebrate resources that would potentially result from a proposed action or the alternatives. This analysis applies to all considered alternatives. While the WPA is a smaller area with less projected activity than is proposed for the CPA/EPA (refer to **Chapter 3**), the distribution of fishes and invertebrate species is nonrandom; species are associated with habitat preferences. However, within the Gulf of Mexico, the distribution of species may generally be considered even throughout their range of habitat within the planning areas. As such, the potential for impacts to populations is independent of the planning area(s) analyzed. Differences in the specific populations potentially exposed to impact-producing factors and the potential impacts may be more easily estimated as specific sites and activities become known. Therefore, because of the diversity and distribution of species in the Area of Interest, the level of impacts would be the same for Alternatives A, B, C, and D. However, Alternative E would have no impacts as a proposed action would not be implemented; therefore, the only impacts would be those associated with the continuing effects from past lease sales and non-OCS oil- and gas-related activities.

Preliminary analysis of the routine OCS oil- and gas-related activities and reasonably foreseeable accidental events identified eight impact-producing factors with the potential to affect marine fishes and invertebrates and/or their habitat. Many OCS oil- and gas-related activities affect the environment similarly. For example, vessel traffic, exploratory drilling, geophysical activities, and offshore construction all produce sound. The impact-producing factor, "anthropogenic sound," was analyzed taking all sound-producing OCS oil- and gas-related activities into consideration. The following are impact-producing factors that were considered and analyzed in this resource analysis:

- anthropogenic sound (Chapter 3.3.2.7 of the 2017-2022 GOM Multisale EIS);
- bottom-disturbing activity (Chapter 3.1.3.3.2 of the 2017-2022 GOM Multisale EIS);
- habitat modification; and
- oil spills (**Chapter 3.2.2**).

Two of the eight impact-producing factors that were considered for fishes and invertebrate resources were determined to be insignificant under all reasonably foreseeable circumstances due to the limited exposure and/or response expected for fish and invertebrate resources and are, therefore, not analyzed in this chapter. These impact-producing factors are entrainment (Chapter 3.1.5.1.6 of the 2017-2022 GOM Multisale EIS) and offshore lighting (Chapter 3.1.3.4.3 of the 2017-2022 GOM Multisale EIS). A Joint Industry Biological Baseline Study was completed for USEPA Region 6 in June 2009 (LGL Ecological Research Associates, Inc., 2009), and an industry-wide cooling water intake structure entrainment monitoring study, approved by USEPA Region 6, was completed in 2014 (Continental Shelf Associates, Inc. and LGL Ecological Research Associates, Inc., 2014). The results of these two studies support BOEM's finding that entrainment is insignificant as an impact-producing factor for the purpose of this analysis. Analyses of two additional impact-producing factors that could potentially impact resources ecologically important to fishes and invertebrates were addressed in earlier chapters. Discussions of onshore construction and manufacturing (**Chapters 3.1.2.2 and 4.3**, "Coastal Habitats") and regulated discharges (Chapter 3.1.5.1 of the 2017-2022 GOM Multisale EIS and **Chapter 4.2** of this Supplemental EIS, "Water Quality") were found to sufficiently address the potential for adverse impacts to fish and invertebrate habitats and are not duplicated in this chapter.

Analysis of potential impacts considered the estimated scale of source activities and used the best available science to evaluate how specific impact-producing factors could affect resources within the expected environment. Cumulative impacts (discussed in detail in Chapter 4.7.3 of the 2017-2011 GOM Multisale EIS) were analyzed for OCS oil- and gas-related activities and for other sources that could affect fishes and invertebrates (e.g., coastal development, commercial shipping, fisheries, and environmental). Because of the diversity of fishes and invertebrates, detailed criteria for potential impact levels are not reasonable.

Though two protected fish species (Gulf sturgeon [*Acipenser oxyrhynchus desotoi*] and smalltooth sawfish [*Pristis pectinata*]) are found near the Area of Interest, they inhabit and have critical habitat in onshore waters (i.e., shallow waters near the shoreline). A third protected species, Nassau grouper (*Epinephalus striatus*), is a transient or rarely occurring species in the Area of Interest. These species are not considered to be impacted by a proposed action because they are found away from activities that could cause an impact. The impact-level definitions and analyses supporting these conclusions are discussed below.

Impact-Level Definitions

For this analysis, the potential impact-level criteria can be described in terms of population-level effects.

- **Negligible** – localized and temporary impacts that are expected to be indistinguishable from natural variations in population distribution and abundance.
- **Minor** – localized and temporary impacts that are expected to be indistinguishable from natural variations in population distribution and abundance. Community-level variations may be locally detectable, such as species mix and relative abundance following the removal of OCS oil- and gas-related infrastructure.
- **Moderate** – Impacts would be expected to exceed natural variations in population abundance or distribution, but not result in a long-term decline.
- **Major** – Impacts would be expected to exceed natural variations and inherently result in a long-term decline in populations.

The impact-producing factors analyzed and the impact-level conclusions reached from the analysis in this chapter are presented in **Table 4-15** to help the reader quickly identify the level of potential impacts for fishes and invertebrate resources.

Table 4-15. Fish and Invertebrate Resources Impact-Producing Factors That Are Reasonably Foreseeable.

Fish and Invertebrate Resources	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Anthropogenic Sound	Minor	Minor	Minor	Minor	None
Bottom-Disturbing Activity	Negligible	Negligible	Negligible	Negligible	None
Habitat Modification	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	None
Accidental Impacts					
Oil Spills	Negligible	Negligible	Negligible	Negligible	None

Fish and Invertebrate Resources	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Cumulative Impacts					
Incremental Contribution[2]	Minor	Minor	Minor	Minor	None
OCS Oil and Gas[3]					
Anthropogenic Sound	Minor				
Bottom-Disturbing Activity	Negligible				
Habitat Modification	Negligible to Moderate				
Non-OCS Oil and Gas[4]					
Anthropogenic Sound	Moderate				
Fisheries	Negligible to Moderate				
Habitat Modification	Minor				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.7 of the 2012-2022 GOM Multisale EIS.

[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.

[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.

[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

The distribution of fishes and invertebrates varies widely and species may be associated with different habitats at various life stages, as discussed further in Chapter 4.7 of the 2017-2022 GOM Multisale EIS. The impact-producing factors affecting these resources are anthropogenic sound, bottom-disturbing activities, habitat modification, and accidental oil spills. The impacts from routine activities, excluding infrastructure emplacement, would be expected to be **negligible** or **minor** due to short-term localized effects. The installation of OCS oil- and gas-related infrastructure constitutes a long-term modification of the local habitat and is hypothesized to have resulted over the life of the program in **moderate** changes in the distribution of some species. Although this effect is not necessarily adverse and infrastructure is expected to be decommissioned and sites restored to natural habitat, the cumulative impact over the life of the OCS Program is spatiotemporally extensive. Accidental spills have been historically low-probability events and are typically small in size. The expected impact to fishes and invertebrate resources from accidental oil spills is **negligible**. Commercial and recreational fishing are expected to have the greatest direct effect on fishes and invertebrate resources, resulting in impact levels ranging from **negligible** for most species to potentially **moderate** for some targeted species (e.g., hogfish spp., gray triggerfish [*Balistes capriscus*], and greater amber jack [*Seriola dumerili*]). The analysis of routine activities and accidental events indicates that the *incremental contribution* to the overall cumulative impacts on fishes and invertebrate resources as a result of a single proposed lease sale would be **minor**. Under Alternative E, the expected impacts on fish and invertebrate resources would be **none**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of fish and invertebrate resources can be found in Chapter 4.7 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

With respect to fishes and invertebrate resources, the effects associated with the selection of any of the proposed action alternatives (i.e., Alternatives A-D) would be equal because of the diversity and distribution of fish and invertebrate species throughout the potential area of interest. The analyses assume a nonrandom distribution of species (i.e., distribution is associated with habitat preference and habitat availability) and consider impacts to fishes and invertebrate resources occurring in a wide range of habitats across all planning areas. While the WPA is a smaller area with less projected activity than is proposed for the CPA/EPA (refer to **Chapter 3**), the distribution of fishes and invertebrate species is nonrandom; species are associated with habitat preferences. However, within the Gulf of Mexico, the distribution of species may generally be considered even throughout their range of habitat within the planning areas. As such, the potential for impacts to populations is independent of the planning area(s) analyzed. Differences in the specific populations potentially exposed to impact-producing factors and the potential impacts may be more easily estimated as specific sites and as activities become known. Therefore, at a planning area scale, it is expected that a similar mix of species would be exposed to the analyzed impact-producing factors, regardless of the specific action alternative selected. The activities proposed under Alternatives A-D would directly impact fishes and invertebrate resources within the GOM and would contribute incrementally to the cumulative effects on these resources. Therefore, the analysis of routine OCS oil- and gas-related activities, accidental events, and the cumulative impacts of OCS oil- and gas-related and non-OCS oil- and gas-related activities indicates that the expected overall impact to fishes and invertebrate resources, depending upon the impact-producing factor and the affected species, would range from **negligible** to **moderate** for the period analyzed. For example, muds and cuttings discharged at the surface for a well drilled at a water depth of 5,000 ft (1,524 m) would have a negligible impact on coastal species, such as menhaden, whereas a small spill in coastal waters and subsequent response activities could disrupt a spawning event or temporarily displace coastal fishes from the affected area (minor). Moderate impacts would only be expected if impact-producing factors affected habitat or populations to an extent that would be expected to exceed natural variations in population abundance or distribution but not result in a long-term decline. Under Alternative E, the incremental impacts on fishes and invertebrate resources within the Gulf of Mexico would be **none**; however, impacts would continue from ongoing OCS oil- and gas-related activity.

Incomplete or Unavailable Information

BOEM identified incomplete or unavailable information related to impacts to fishes and invertebrate resources resulting from OCS oil- and gas-related activities and non-OCS oil- and gas-related activities in the GOM. Anthropogenic sound and habitat modification directly or indirectly affect large areas of the GOM and potentially impact thousands of species. However, the response of individuals, groups of conspecifics (members of the same species), and communities are highly variable and inconsistent. In addition, BOEM recognizes that there is incomplete information with respect to potential long-term effects resulting from exposure to spilled oil. Although additional information on these impact-producing factors may be relevant to the evaluation of impacts to fishes and invertebrate resources, BOEM has determined that the incomplete information is not essential to a reasoned choice among alternatives. Analyses of routine activities, accidental events, and cumulative impacts drew upon the most current and best available research to assess the potential effects on many species and habitats. The findings collectively indicate that impacts are likely, but limited, and are not expected to induce a population-level response. BOEM recognizes the potential that populations with spatially limited distributions or increased sensitivity to an impact-producing factor may be more severely impacted than current research suggests. However, sufficient data to conduct a thorough assessment of all potentially affected species are not available or obtainable within the timeline contemplated in the NEPA analysis of this Supplemental EIS. BOEM used the best available science to determine the range of reasonably foreseeable impacts and applied accepted scientific methodologies to integrate existing information and extrapolate potential outcomes in completing this analysis and formulating the conclusions presented here.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including Elsevier, PLoS ONE, Taylor and Francis Online, NOAA’s NCCOS Publications Explorer, and Wiley Online Library) were examined to assess recent information regarding fish and invertebrate resources that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for fish and invertebrate resources presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information essential to an analysis of fish and invertebrate resources has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for fish and invertebrate resources presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.8 BIRDS

Summary

BOEM has reexamined the analysis for birds presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for birds presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of birds, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.8 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

This description of birds focuses on the factors that control the relative vulnerability of different bird groups to impacts. Passerines, or songbirds, represent many of the breeding and wintering birds within the Gulf Coast States. They are only found offshore when migrating across the Gulf of Mexico, and they cannot stop and rest or feed on the water. Some species of birds (some seabirds) live primarily offshore except when breeding and, therefore, are rarely observed in the nearshore environment. The remaining species are found within coastal and inshore habitats and may be more susceptible to potential deleterious effects resulting from OCS oil- and gas-related activities since many of these species largely overlap spatially and temporally with OCS oil- and gas-related activities because of their abundance or density and due to the potential of oil impacting their habitat or food resources.

Analysis

This chapter provides a summary of the information detailed in the 2017-2022 GOM Multisale EIS regarding the impact-producing factors from the routine activities, accidental events, and cumulative impacts described in **Chapter 3** and their potential effects on birds that could potentially be impacted by a proposed action or the alternatives. This analysis would apply to all alternatives considered; however, the level of impacts would be different for each alternative, as discussed below.

The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, production, and decommissioning), as well as accidental events and cumulative impacts, and to define the impact levels for each impact-producing factor. The impact-producing factors considered and analyzed include discharges and wastes, noise, platform severance with explosives, geophysical surveys with airguns, platform presence and lighting, emergency air emissions, platform or pipeline oil spills, spill response, oil- and gas-related activities in State waters, the hypoxic "dead zone" of the Mississippi

River, net coastal wetland gain or loss, urbanization, a large tanker spill, military activities, recreation, boat traffic, impacts on bird habitat, collisions with vehicles and buildings, predation by domestic cats, commercial fishing, climate change, and wetland subsidence. The potential magnitude of impact for each of these impact producing factors is provided in **Table 4-16** to help the reader quickly identify the level of potential impacts for each impact-producing factor. The impact-level definitions and the analyses supporting these conclusions are discussed below.

Impact-producing factors considered but not analyzed include obstruction lighting, which is under the jurisdiction of USCG. Other impact-producing factors that were not analyzed because they do not apply to birds include geological ancillary activities, all onshore infrastructure emplacement and presence, offshore platform emplacement, other commissioning activities, and onshore waste disposal.

Seven species found in the area of interest are listed under the ESA, and BOEM has initiated formal consultation with FWS for those species. Those species have life histories that are similar to those of the birds covered in this chapter, but the cumulative impact could be greater. BOEM recognizes this, consults on these species, and requires mitigations that would decrease the potential for greater impacts due to small population size or limited distribution. For more information on the listed bird species, refer to **Chapter 4.9.4** of this Supplemental EIS and Chapter 4.9.4 of the 2017-2022 GOM Multisale EIS.

Impact-Level Definitions

Two concepts important in the impact-level definitions below are populations and population sizes. In ecology, a population is often defined as a group of individuals with similar genes (i.e., species and subspecies). Such a population lives in one or more natural geographic areas where its habitats are located. Human-made areas (e.g., the planning areas) are also important to the analysis. Natural areas overlap with the planning areas. Bird species described in this chapter are considered to have large populations and to be widely distributed Flock size and population, mentioned below in the impact-level definitions, have ranges of impacts that can vary by bird species. Examples of flock sizes and population sizes are given in the "Description of the Environment" section of Chapter 4.8 of the 2017-2022 GOM Multisale EIS. Abundance, as used in this chapter, means the number or biomass (total weight) of a particular species in a general area (this definition is taken from Krebs, 2009). Chronic, as used in this chapter, means of indefinitely high frequency or of indefinitely long duration.

The impact-level definitions for birds are as follows:

- **Negligible** – Impacts would not affect a substantial abundance of birds. Impacts would especially not affect species with low abundances prior to impacts. Estimates of continued population viability, including predicted annual rates of recruitment or survival, would not change. Any impacts would be acute and reversible. Further, no injury to or mortality of a small number of individuals or a small flock would occur.

- **Minor** – Impacts would not affect a substantial abundance of birds. Impacts would especially not affect species with low abundances prior to impacts. Estimates of continued population viability, including predicted annual rates of recruitment or survival, would not change. Additionally, one or both of the two following conditions must be met: (1) small numbers of individuals or small flocks of birds would experience chronic impact-producing factors and would be chronically disturbed or affected, resulting in chronic but reversible behavioral changes; and/or (2) one or more incidents would occur where small numbers of individuals or small flocks of birds would experience injury or mortality, but with no measurable impact on a population.

- **Moderate** – Impacts would affect a substantial abundance of birds. Estimates of continued population viability, including predicted annual rates of recruitment or survival, would not change. Additionally, one or both of the two following conditions must be met: (1) a large flock of birds (e.g., a shorebird flock of 500 or 1,000 birds) would experience chronic impact-producing factors and would be chronically disturbed or affected, resulting in chronic behavioral changes or mortality over time; and/or (2) one or more incidents would occur where substantial numbers of individuals, including large flocks, would experience chronic behavior changes or mortality that would affect a large flock, but with no measurable impact on a population.

- **Major** – Impacts would affect a substantial abundance of birds. Estimates of continued population viability, including predicted annual rates of recruitment or survival, would change. Additionally, one or both of the two following conditions must be met: (1) at least one large population of birds would have a reduction in the estimates of continued population viability, including predicted annual rates of mortality, recruitment or survival, some or all of which would seriously decline (causing sublethal impacts to be irreversible); and/or (2) one or more incidents would occur where at least one large population would experience chronic behavior changes or mortality that would affect a large population and with measurable impact on a population.

Table 4-16. Birds Impact-Producing Factors That Are Reasonably Foreseeable.

Birds	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Impacts					
Discharges and Wastes	Negligible	Negligible	Negligible	Negligible	None
OCS Oil- and Gas-Related Noise and Disturbance	Negligible	Negligible	Negligible	Negligible	None
Platform Severance and Rigs-to-Reefs	Minor	Minor	Minor	Minor	None
Geophysical Surveys with Airguns	Minor	Minor	Minor	Minor	None
Platform Presence and Lighting	Minor	Minor	Minor	Minor	None
Accidental Impacts					
Oil Spills	Moderate	Moderate	Moderate	Moderate	None
Oil-Spill Response	Minor	Minor	Minor	Minor	None
Emergency Air Emissions	Minor	Minor	Minor	Minor	None
Cumulative Impacts					
Incremental Contribution[2]	Moderate	Moderate	Moderate	Moderate	None
OCS Oil- and Gas[3]	Moderate				
Non-OCS Oil- and Gas[4]	Major				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.8 of the 2017-2022 GOM Multisale EIS. Moderate impact levels could be possible, only if a large oil spill were to occur.

[2] This impact level is the incremental contribution of a single proposed lease sale to all cumulative impacts in the GOM.

[3] This impact level is the cumulative impacts of all past, present, and reasonably forseeable OCS oil- and gas-related activities in the GOM.

[4] This impact level is the cumulative impacts of all past, present, and reasonably foreseeable activities in the GOM.

The affected species of birds include both terrestrial songbirds and many groups of waterbirds. Routine impacts to coastal, marine, and migratory birds that were considered include routine discharges and wastes, noise, platform severance with explosives (barotrauma), underwater noise from geophysical surveys with airguns, platform presence and lighting, construction of OCS oil- and gas-related onshore facilities, and pipeline landfalls. The impacts to birds from routine OCS oil-and gas-related activities are similar wherever they may occur in the GOM, and all are considered **negligible** to **minor**. Negligible to minor impacts would not affect a substantial number of birds. Any impacts would be acute and reversible. Further, no injury to or mortality of a small number of individuals or a small flock would occur. Accidental impacts to birds are caused by oil spills, spill cleanup activities, and emergency air emissions. Seabirds may not always experience the greatest impacts from a spill but may take longer for populations to recover because of their unique population ecology (demography). Some species of seabirds, such as gulls, have larger clutches (laughing gulls usually have 3 eggs per clutch, except in the tropics) and may recover quite quickly. However, many species of seabirds can have a clutch size of just one egg, relatively long life spans, and often have delayed age at first breeding. Because of the latter case, impacts on seabirds from overall accidental events would be expected to be **moderate**. Impacts from overall accidental events on other waterbirds farther inshore would also be expected to be **moderate** because of the extensive overlap of their distributions with oiled inshore areas and shorelines expected from a large oil spill (≥1,000 bbl). Moderate impacts could affect a substantial abundance of birds.

The incremental contribution of a proposed action to the overall cumulative impacts is considered **moderate**, but only because of the potential impacts that could result from a large oil spill (≥1,000 bbl). This conclusion is based on the increment of a proposed action compared with all cumulative OCS oil- and gas-related and non-OCS oil- and gas-related impacts. Alternative E would offer no new lease blocks for exploration and development; therefore, incremental impacts to birds would be **none**. However, there would be continuing impacts associated with the existing oil and gas activities from previously permitted activities and previous lease sales. A full analysis of coastal and migratory birds can be found in Chapter 4.8 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

Since Alternative A is regionwide, which includes the WPA, CPA, and EPA portions of the proposed lease sale area, it would have more OCS oil- and gas-related activities than the other alternatives; therefore, it would have more potential for impacts. Impacts from the other alternatives would follow in a graded fashion. However, offshore pelagic seabird habitat is distributed throughout the planning areas. Therefore, activities occurring only in specific planning areas pose similar potential impacts to offshore pelagic seabird populations as do activities occurring in all planning areas. Therefore, because of the diversity and distribution of offshore pelagic seabird species in the Area of Interest, the level of impacts would be the same for Alternatives A, B, C, and D. Alternative E would offer no new lease blocks for exploration and development; therefore, no impacts from a proposed lease sale would occur. However, there would be continuing impacts associated with the existing oil and gas activities from previously permitted activities and previous lease sales.

Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information related to impacts on birds resulting from OCS oil- and gas-related activities and non-OCS oil- and gas-related activities in the GOM. BOEM's subject-matter experts have used the available scientifically credible evidence presented below and applied accepted scientific methodologies to integrate existing information and extrapolate potential outcomes in completing this analysis and formulating the conclusions presented here.

The impact of artificial light along the coast on birds has not been studied,and it is unkown if it is relevant to evaluating whether adverse mpacts on the human environment are significant, but it is not essential to a reasoned choice of among alternatives. BOEM used available information to fill the data gap. Existing information (Longcore and Rich, 2004) shows that outdoor lights at night can have both lethal impacts from collisions and sublethal impacts from a variety of mechanisms on birds. The impact level of obstruction lighting located on platforms would also need further study. The best available information was obtained from a study done by observers on platforms, from a model of energy reserves of migratory birds, and from several studies of the effect of light on birds. This scientific information presented in the 2017-2022 GOM Multisale EIS was used to conclude that platform lighting, in general, has **minor** impacts.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including websites of 5 Federal agencies [i.e., FWS, USEPA, USGS, NOAA, and BOEM]; 5 State agencies [i.e., Texas Parks and Wildlife Department; Louisiana Department of Wildlife and Fisheries; Mississippi Department of Wildlife, Fisheries, and Parks; Alabama Wildlife and Freshwater Fisheries Division; and Florida Fish and Wildlife Conservation Commission]; and 5 nonprofit stakeholders (i.e., Sierra Club, National Fish and Wildlife Foundation, Nature Conservancy, Barataria-Terrebonne National Estuary Program, and the National Audubon Society]) were examined to assess recent information regarding birds that may be pertinent to a proposed action. Environmental journal articles were also located online using four search engines (i.e., JSTOR, EBSCO, Google Advanced Scholar Search, and Google Advanced Book Search). New information has been published comparing feathers from birds at a site oiled from the *Deepwater Horizon* explosion, oil spill, and response and an unoiled site. Carbon isotope data from feathers indicate that terrestrial birds (seaside sparrows) in coastal Louisiana, collected from an oiled site, were contaminated by *Deepwater Horizon* oil when compared with sparrows' feathers collected from an unoiled site (Bonisoli-Alquati et al., 2016). Numerous experiments (never done before) approximately imitated short-term light oiling and small amounts of briefly ingested oil in birds observed after the *Deepwater Horizon* explosion, oil spill, and response (Bursian et al., 2017). The ultimate fate of such birds affected by the spill was unknown but the studies mimicked their fate. The tests showed that slight doses of orally delivered oil or small amounts applied to plumage could affect the overall health of birds. Results were extrapolated from the experiments to expected impacts from an oil spill. Even birds exposed to a little oil would probably have difficulty if they were migrating. Impacts that are sublethal over the short term could be lethal over the long term (Bursian et al., 2017). However, this new information does not change the conclusions since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for birds presented in the 2017-2022 GOM Multisale EIS with the understanding that no new information on birds has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for birds presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.9 PROTECTED SPECIES

The Endangered Species Act of 1973 (ESA), as amended, establishes a national policy designed to protect and conserve threatened and endangered species and the ecosystems upon which they depend. In fulfilling these requirements, each agency must use the best scientific and commercial data available. The FWS and NMFS share responsibility for implementing the ESA.

The Marine Mammal Protection Act of 1972 (MMPA) prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the United States. The NMFS and FWS are also responsible for the MMPA.

For the Gulf of Mexico, NMFS is charged with protecting all cetaceans, while manatees are under the jurisdiction of FWS. Details on BOEM's consultations and coordination with NMFS and FWS are presented in **Chapter 5.2** ("Endangered Species Act").

Protected species, for the purposes of this Supplemental EIS, include ESA- and MMPA-listed species and associated designated critical habitat under the ESA. The species considered in this chapter, pursuant to our consultations and coordination, and within **Table 4-17** are those that could be affected within the Area of Interest and that are subject to the proposed activities under the alternatives. For those species not considered further because they are unlikely to be affected by the proposed activities, refer to Appendix F of the 2017-2022 GOM Multisale EIS. Critical habitats noted within the Area of Interest are shown in **Figure 4-10** and are mentioned in this chapter, but details on many of these habitats can be found in **Chapters 4.3** ("Coastal Habitats"), **4.5** ("*Sargassum* and Associated Communities"), and **4.6** ("Live Bottom Habitats").

The analyses of the reasonably foreseeable potential impacts of routine activities and accidental events associated with a proposed action and a proposed action's incremental contribution to the cumulative impacts are presented in the chapters below. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts, and to define impact-levels for each impact-producing factor for protected species, as summarized in **Table 4-18**. The impact-level definitions and the analyses supporting these conclusions are discussed below. These impacts are across all action alternatives (i.e., Alternatives A, B, C, and D) except for beach mice and protected corals. Beach mice are not found in the WPA; therefore, they are not relevant for Alternative B, and the ranges given for potential impacts to protected corals are based on whether or not stipulations are placed on leases.

Table 4-17. Species within the Gulf of Mexico That Are Protected Under the Endangered Species Act and/or the Marine Mammal Protection Act.

Common Name	Scientific Name	Common Name	Scientific Name
Marine Mammals		Sea Turtles	
Atlantic spotted dolphin*	*Stenella frontalis**	Green sea turtle[2]	*Chelonia mydas*[2]
Blainville's beaked whale*	*Mesoplodon densirostris**	Hawksbill sea turtle[3]	*Eretmochelys imbricata*[3]
Bottlenose dolphin*	*Tursiops truncatus**	Kemp's ridley sea turtle[3]	*Lepidochelys kempii*[3]
Bryde's whale*	*Balaenoptera edeni**	Northwest Atlantic Ocean loggerhead sea turtle[2]	*Caretta caretta*[2]
Clymene dolphin*	*Stenella clymene**	Leatherback sea turtle (Atlantic Northwest)[3]	*Dermochelys coriacea*[3]
Cuvier's beaked whale*	*Ziphius cavirostris**	Beach Mice	
Dwarf sperm whale*	*Kogia sima**	Alabama beach mouse[3]	*Peromyscus polionotus ammobates*[3]
False killer whale*	*Pseudorca crassidens**	Choctawhatchee beach mouse[3]	*Peromyscus polionotus allophrys*[3]
Fraser's dolphin*	*Lagenodelphis hosei**	Perdido Key beach mouse[3]	*Peromyscus polionotus trissyllepsis*[3]
Gervais' beaked whale*	*Mesoplodon europaeus**	St. Andrew beach mouse[3]	*Peromyscus polionotus peninsularis*[3]
Killer whale*	*Orcinus orca**	Birds	
Melon-headed whale*	*Peponocephala electra**	Cape Sable Seaside Sparrow[3]	*Ammodramus maritimus mirabilis*[3]
Pantropical spotted dolphin*	*Stenella attenuate**	Mississippi Sandhill Crane[3]	*Grus canadensis pulla*[3]
Pygmy killer whale*	*Feresa attenuata**	Piping Plover[2]	*Charadrius melodus*[2]
Pygmy sperm whale*	*Kogia breviceps**	Rufa Red knot[2]	*Calidris canutus rufa*[2]
Risso's dolphin*	*Grampus griseus**	Roseate Tern[2]	*Sterna dougallii dougallii*[2]
Rough-toothed dolphin*	*Steno bredanensis**	Whooping Crane[3]	*Grus americana*[3]
Short-finned pilot whale*	*Globicephala macrorhynchus**	Wood Stork[2]	*Mycteria americana*[2]
Sperm whale[1]	*Physeter macrocephalus*[1]	Corals	
Spinner dolphin*	*Stenella longirostris**	Elkhorn coral[2]	*Acropora palmata*[2]
Striped dolphin*	*Stenella coeruleoalba**	Staghorn coral[2]	*Acropora cervicornis*[2]
West Indian manatee[1]	*Trichechus manatus*[1]	Boulder star coral[2]	*Orbicella franksi*[2]
		Lobed star coral[2]	*Orbicella annularis*[2]
		Mountainous star coral[2]	*Orbicella faveolata*[2]

* This species is protected under the Marine Mammal Protection Act (MMPA).

1 This species/subspecies is listed under the Endangered Species Act (ESA) as "endangered" and is also protected under the MMPA.

2 This species/subspecies is listed under the ESA as "threatened."

3 This species/subspecies is listed under the ESA as "endangered."

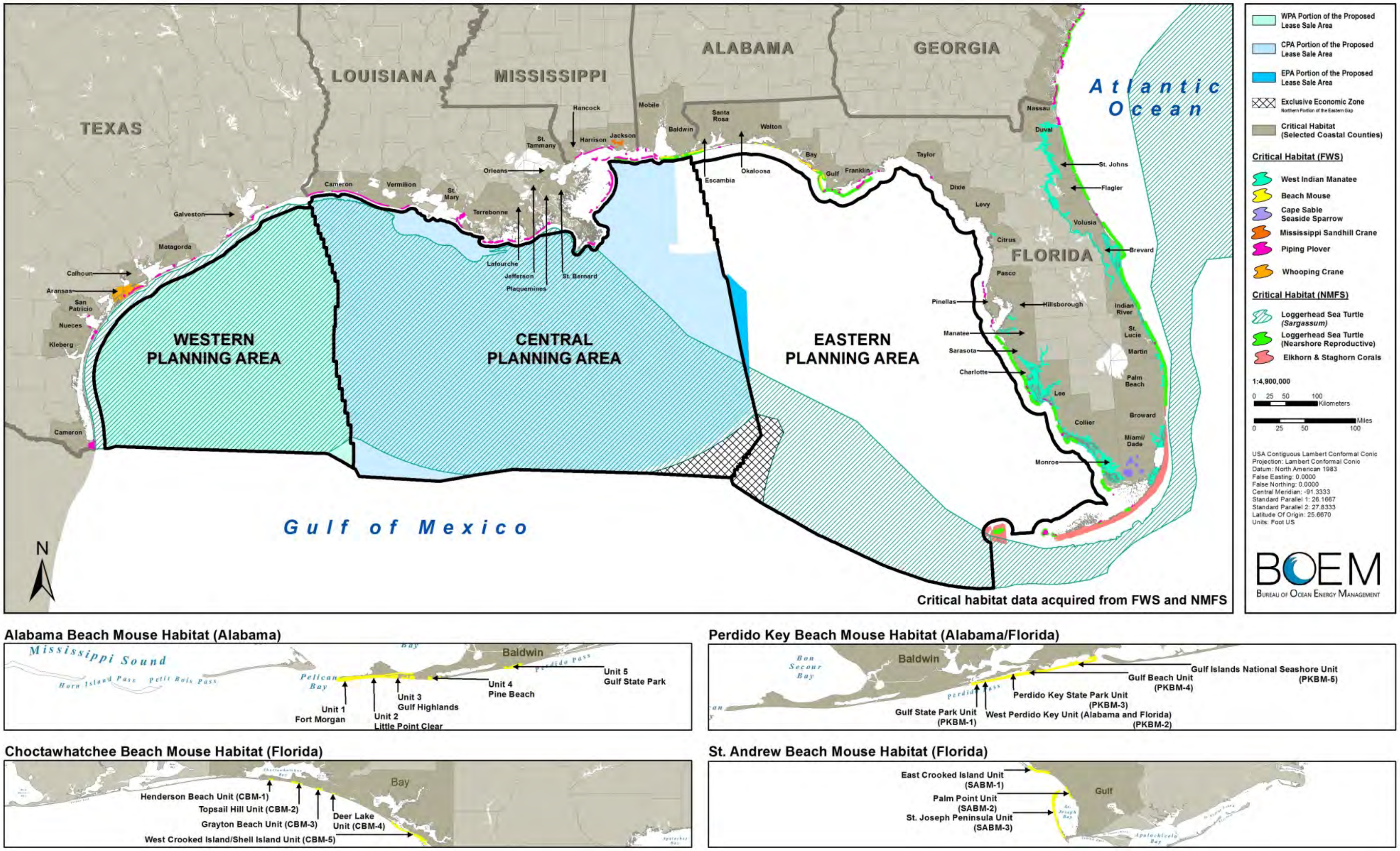


Figure 4-10. Gulf of Mexico Protected Species' Critical Habitats.

Impact-Level Definitions

As the routine activities, accidental events, and cumulative impacts are considered for specific listed species, each is given criteria per level of impact represented below.

- **Negligible** – An individual or group of animals would be subject to nominal to slight measurable impacts. No mortality or injury to any individual would occur, and no disruption of behavioral patterns would be expected. The disturbance would last only as long as the human-caused stimulus was perceptible to the individual or group.
- **Minor** – An individual or group of animals would be subject to a human-caused stimulus and be disturbed, resulting in an acute behavioral change. No mortality or injury to an individual or group would occur.
- **Moderate** – An individual or group of animals would be subject to a human-caused stimulus and be disturbed, resulting in a chronic behavioral change. Individuals may be impacted but at levels that do not affect the fitness of the population. Some impacts to individual animals may be irreversible.
- **Major** – An individual or group of animals would be subject to a human-caused stimulus, resulting in physical injury or mortality, and would include sufficient numbers that the continued viability of the population is diminished, including annual rates of recruitment or survival. Impacts would also include permanent disruption of behavioral patterns that would affect a species or stock.

The potential magnitude of impact for each of these impact-producing factors is provided in **Table 4-18** to help the reader quickly identify the level of potential impacts for each impact-producing factor.

Table 4-18. Protected Species Impact-Producing Factors That Are Reasonably Foreseeable.

Protected Species	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Marine Mammals	Sea Turtles	Beach Mice[2]	Protected Birds	Protected Corals[3]
Routine Impacts					
Geological and Geophysical Activities	Negligible to Moderate	Negligible to Moderate	N/A*	N/A	N/A
Transportation (vessel strikes)	Negligible	Negligible	N/A	N/A	N/A
Discharges (air and water quality degradation)	Negligible	Negligible	N/A	Negligible	N/A
Decommissioning (explosive severance)	Negligible to Minor	Negligible to Moderate	N/A	N/A	Negligible

Protected Species	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Marine Mammals	Sea Turtles	Beach Mice[2]	Protected Birds	Protected Corals[3]
Noise	Negligible to Minor	Negligible to Minor	N/A	Negligible	N/A
Drilling and Exploration (bottom-disturbing activities)	N/A	N/A	N/A	N/A	Negligible
Offshore Lighting/Platform Presence	N/A	N/A	N/A	Negligible	N/A
Vessel Operation (bottom-disturbing activities)	N/A	N/A	N/A	N/A	Negligible
Accidental Impacts					
Oil Spills[4]	Negligible to Moderate	Negligible to Moderate	Negligible	Negligible to Moderate	Negligible
Oil-Spill Response Activities	Negligible to Minor	Negligible to Minor	Negligible	Negligible to Minor	Negligible
Marine Trash and Debris	Negligible	Negligible	Negligible	Negligible	Negligible
Cumulative Impacts					
Incremental Contribution[5]	Negligible	Negligible	Negligible	Negligible	Negligible
OCS Oil and Gas [6]	Negligible to Moderate	Negligible to Moderate	Negligible	Negligible to Moderate	Negligible
Non-OCS Oil and Gas[7]	Negligible to Major	Negligible to Major	Negligible to Major	Negligible to Major	Negligible to Major

* N/A represents those impact-producing factors that are not applicable to that protected species group.
[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.9 of the 2017-2022 GOM Multisale EIS.
[2] Beach mice are not found in the WPA; therefore, they are not likely to be impacted by Alternative B.
[3] Ranges for the potential impacts to protected corals are based on whether or not protected stipulations are placed on leases.
[4] Accidental oil spills are those <10,000 bbl.
[5] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.
[6] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.
[7] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

For protected coral impact-producing factors, refer to **Table 4-13** in **Chapter 4.6.1** ("Topographic Features") since coral impact-producing factors are covered there and would apply to protected corals as well. For protected birds impact-producing factors, refer to **Table 4-16** in **Chapter 4.8** ("Birds") since the impact-producing factors that impact coastal, marine, and migratory birds (the listed birds are either found in coastal areas or are migratory and utilize coastal areas as part of their life history) are covered there. For beach mice, the most relevant impact-producing factors are those causing harm to the populations by affecting their habitat (i.e., beaches). **Table 4-10** in **Chapter 4.3.2** ("Coastal Barrier Beaches and Associated Dunes") covers the impact-producing factors that affect beaches and dunes, and information on impacts to beach mouse habitat that can be found there.

BOEM understands that mitigations greatly reduce the likelihood of an impact-producing factor, but mitigations do not guarantee that a protected species would not be impacted. There is a very low probability that a protected species may not be sighted despite all of the mitigative precautions taken to reduce impact. Unlikely scenarios such as these may cause major impacts to a protected species with a very low population because some impact-producing factors may negatively impact the reproductive success of an individual and, therefore, the continued viability of the population. However, based on credible scientific research and that within the GOM, there is a long-standing and well-developed OCS Program (more than 60 years); scenarios such as these are highly speculative. There are no data to suggest that activities from the previous OCS Programs are significantly impacting protected species populations. Therefore, for purposes of this analysis, BOEM has considered the potential affects of impact-producing factors that are reasonably foreseeable to occur.

Current baselines (including past and present events) are described for all protected species under their respective "Affected Environment" sections in the 2017-2022 GOM Multisale EIS. The altered baseline includes individual species directly affected by the *Deepwater Horizon* explosion, oil spill, and response, which was an unexpected, unique catastrophic event. BOEM understands that each oil-spill event is unique and that its outcome depends on several factors, including time of year and location of the release relative to winds, currents, land, and sensitive resources, as well as specifics of the well and response effort. Specific to the *Deepwater Horizon* explosion, oil spill, and response, the Trustees have completed the PDARP/PEIS (Deepwater Horizon Natural Resource Damage Assessment Trustees, 2016), which its intention was assessing and creating restoration plans to relieve injuries from the *Deepwater Horizon* explosion, oil spill, and response to natural resourses and services. The injuries assessed within the PDARP/PEIS do not necessarily equate the baseline as defined in NEPA. BOEM continues to analyze the *Deepwater Horizon* explosion, oil spill, and response as information becomes available, and it was evaluated as part of the baseline for resources in this Supplemental EIS.

BOEM analyzed a low-probability catastrophic event (USDOI, BOEM 2017b) in conjunction with its analysis of potential effects, as requested by the CEQ pursuant to its regulation at 40 CFR § 1502.22. The CEQ (2010) recommended that BOEM should "ensure that NEPA documents provide decision makers with a robust analysis of reasonably foreseeable impacts, including an analysis of reasonably foreseeable impacts associated with low probability catastrophic spills for oil and gas activities on the Outer Continental Shelf." A low-probability catastrophic spill is, by definition, *not* reasonably certain to occur. The return period of a catastrophic oil spill in OCS areas is estimated to be 165 years, with a 95-percent confidence interval between 41 years and more than 500 years (Ji et al., 2014). The use of other methods of analysis in this evaluation are significantly limited in their applicability and availability and they would not provide any meaningful or useful information to be used to assess risk of catastrophic spill occurrence at this programmatic level of OCS oil- and gas-related activities in the GOM.

4.9.1 Marine Mammals

Summary

BOEM has reexamined the analysis for marine mammals presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for marine mammals presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of marine mammals, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.9.1 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

The Gulf of Mexico marine mammal community is diverse and distributed throughout the GOM, including northern Gulf of Mexico U.S. waters. Twenty-one species of cetaceans and one species of sirenian (West Indian manatee) regularly occur in the GOM and are identified in NMFS' Gulf of Mexico Stock Assessment Reports (Jefferson et al., 1992; Davis et al., 2000; Waring et al., 2016). The GOM's Cetacea include the suborders Mysticeti (i.e., baleen whales) and Odontoceti (i.e., toothed whales), and the order Sirenia, which includes the West Indian manatee. Most marine mammal distributions vary widely across the northern GOM with very little known about their respective breeding and calving grounds, as well as any potential migratory routes.

Along with stock assessment reports, NMFS also calculates the Potential Biological Removal (PBR) for cetaceans, which is defined under the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (U.S. Marine Mammal Commission and USDOC, NMFS, 2007). The PBR can be used as a conservative tool, most often for commercial fisheries, to help with management of the different marine mammal stocks because a potential impact-producing factor may have a more serious impact on a marine mammal stock that has a lower PBR and a less serious impact to a marine mammal stock with a higher PBR. Here, the PBR is used as a conservative analysis tool to give perspective of how different impact-producing factors may potentially affect various marine mammal stocks differently.

While all marine mammals are protected under the MMPA, the sperm whale is listed as endangered and the West Indian manatee is listed as threatened under the ESA, as described in detail in the 2017-2022 GOM Multisale EIS. On December 8, 2016, NMFS announced a 12-month finding on a petition to list the GOM Bryde's whale (*Balaenoptera edeni)* and proposed that it be listed as endangered under the ESA (*Federal Register*, 2016b). If NOAA issues a final rule listing the Bryde's whale as endangered, the species will receive additional protections, and Federal agencies will be required to consult under Section 7 for Federal actions that may affect the species.

Refer to Chapter 4.9.1 of the of the 2017-2022 GOM Multisale EIS for the full analyses of marine mammals. For the Gulf of Mexico, NMFS is charged with protecting all cetaceans, while manatees are under the jurisdiction of FWS. Details on BOEM's consultations and coordination with NMFS and FWS are presented in **Chapter 5.2** ("Endangered Species Act"). BOEM's protective measures for marine mammals are described below.

Protective Measures for Marine Mammals

The NTL 2016-BOEM-G02, "Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program," provides guidance to protect marine mammals and sea turtles during seismic operations. This NTL clarifies how operators should implement seismic survey mitigating measures, including ramp-up procedures, the use of a minimum sound source, airgun testing, shutdowns, and protected species observation and reporting. The Protected Species Stipulation, if applied, would make compliance with the guidance identified in the NTL mandatory for lessee activities. In addition, NMFS, BOEM, and BSEE collaborated to publish National Standards for a Protected Species Observer Program, which provides guidance on how to reduce impacts to protected species from G&G activities by standardizing the variation in and improving the management of the program (Baker et al., 2013), although this guidance is not mandatory.

More detailed information on Gulf of Mexico G&G activities can be found in the *Gulf of Mexico Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas—Final Programmatic Environmental Impact Statement* (USDOI, BOEM, 2017d), which BOEM prepared with BSEE and the National Oceanic and Atmospheric Administration's NMFS as cooperating agencies, to evaluate the potential environmental impacts of multiple G&G activities within Federal waters of the Gulf of Mexico's OCS and adjacent State waters.

BOEM issued NTL 2016-BOEM-G01, "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting," which explains how operators must implement measures to minimize the risk of vessel strikes to protected species and to report observations of injured or dead protected species. The Protected Species Stipulation, when applied, would make compliance with the guidance identified in the NTL mandatory for lessee activities. Adherence to the NTL protocols is expected to reduce but not eliminate the risk of potential vessel strikes with marine mammals.

To address the potential impacts of marine debris, BSEE issued NTL 2015-BSEE-G03, "Marine Trash and Debris Awareness and Elimination," which provides information on the marine trash and debris awareness training video and slide show, and both postal and email addresses for submitting annual training reports. The information provided is intended to greatly minimize the amount of debris that is accidentally lost overboard by offshore personnel; however, these directives do not eliminate the accidental release of debris, which could impact an individual or group of individuals if they become entangled in or ingest accidentally released debris. The Protected Species Stipulation, if applied, would make compliance with the guidance identified in the NTL mandatory for lessee activities.

BOEM (then the Bureau of Ocean Energy Management, Regulation and Enforcement) issued "Decommissioning Guidance for Wells and Platforms" (NTL 2010-BSEE-G05) to offshore operators; it provides clarification and interpretation of regulations regarding decommissioning, as well as guidance to operators proposing to use explosives to perform well/casing severance. These guidelines specify and reference mitigation, monitoring, and reporting requirements, and are designed to reduce impacts to marine mammals and sea turtles. As noted in Chapter 3.1.6 of the 2017-2022 GOM Multisale EIS and as summarized in **Chapter 3** of this Supplemental EIS, decommissioning for wells and platforms are site specific and are reviewed by BSEE and BOEM.

Analysis

This chapter provides a summary of the information detailed in the 2017-2022 GOM Multisale EIS regarding the impact-producing factors from routine activities, accidental events, and cumulative impacts from activities described in **Chapter 3** and their potential impacts that could result from a single proposed lease sale and a proposed lease sale's incremental contribution to the cumulative impacts to marine mammals.. Potential impact-level criteria are defined in **Chapter 4.9** ("Protected Species") and apply to marine mammal species analyzed in this chapter. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts, that are reasonably foreseeable and to define the impact levels for each impact-producing factor in relation to the best available population estimates (refer to **Table 4-18** in **Chapter 4.9** ["Protected Species"]). The potential magnitude of impact and impact-level definitions for each of these impact-producing factors is provided in **Table 4-18** to help the reader quickly identify the level of potential impacts for each impact-producing factor that is reasonably foreseeable. The analyses supporting these conclusions are discussed below. Some impact-producing factors may have different potential impact levels to different marine mammal species due to their various population sizes, as well as their wide-ranging behavior; thus, some potential impact-producing factors are described in a range. Where information was incomplete or unavailable, BOEM complied with its obligations under NEPA to determine if the information was relevant to reasonably foreseeable significant adverse impacts. Refer to the "Incomplete or Unavailable Information" section below for a more detailed discussion.

BOEM understands that mitigations greatly reduce the likelihood of an impact-producing factor, but mitigations do not guarantee that a protected species (e.g., marine mammal) would not be impacted. There is a very low probability where a protected species may not be detected despite all of the mitigative precautions taken to reduce impact. Unlikely scenarios such as these may cause major impacts to a marine mammal species with a very low population because some impact-producing factors may negatively impact the reproductive success of an individual and therefore the continued viability of the population. However, based on credible scientific research and that within the GOM, there is a long-standing and well-developed OCS Program (more than 60 years); scenarios such as these are speculative. There are no data to suggest that routine activities from the previous OCS Programs are significantly impacting marine mammal populations. Therefore, for purposes of this analysis, BOEM has considered the potential effects of impact-producing factors that are reasonably foreseeable based on credible scientific research and past data for the following analysis. This analysis applies to all considered alternatives analyzed in **Chapter 4**.

As discussed in Chapter 4.9.1.1 of the 2017-2022 GOM Multisale EIS, the PBR of a marine mammal species plays an important role in marine mammal management due to the fact that the same impact-producing factor may have a more serious impact on a marine mammal stock that has a lower PBR and a less serious impact to a marine mammal stock with a higher PBR. In other words, if an impact-producing factor were to negatively affect a number of individuals of a marine mammal stock that exceeds its respective PBR estimate, it could possibly diminish the continued viability of the stock, including the annual rates of recruitment or survival. BOEM understands that PBR is a very conservative estimate and that the abundance estimates used in estimating PBR may not accurately reflect the actual abundances of marine mammal stocks. Nevertheless, this tool helps give a perspective on how different impact-producing factors may potentially affect various marine mammal stocks differently. The following evaluation considers how the impact-producing factors from reasonably foreseeable routine activities, accidental events, and cumulative impacts from activities described in **Chapter 3** may potentially impact a marine mammal species based on its respective PBR (refer to Table 4-14 of the 2017-2022 GOM Multisale EIS for list of marine mammal species and their respective PBR). BOEM has made conscientious efforts to comply with the spirit and intent of NEPA and to be comprehensive in its analyses of potential environmental impacts to marine mammals, including species that are poorly studied.

The major potential impact-producing factors affecting marine mammals in the GOM as a result of cumulative past, present, and reasonably foreseeable OCS energy-related activities are decommissioning activities, operational discharges, G&G activities, noise, transportation, marine debris, and accidental oil-spill and spill-response activities. Accidental events involving large spills, particularly those continuing to flow fresh hydrocarbons into oceanic and/or outer shelf waters for extended periods (i.e., days, weeks, or months), pose an increased likelihood of impacting marine mammal populations inhabiting GOM waters. While accidental events cannot be predicted and have the potential to impact marine mammal species, the number of such events is expected to be very small based on OSRA (refer to Appendix E of the 2017-2022 GOM Multisale EIS). Events involving very large spills such as the *Deepwater Horizon* oil spill and response are considered a low-probability catastrophic spill event and are not reasonably certain to occur as part of a proposed action. Therefore, low-probability catastrophic spill events are not analyzed in this chapter. Impacts of a catastrophic spill are analyzed in the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b).

Proposed OCS oil- and gas-related activities would also contribute incrementally to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative impacts experienced by marine mammal populations. At the regional, population-level scope of this analysis, impacts from reasonably foreseeable routine activities and accidental events could be **negligible** to **moderate** for any of the action alternatives. However, the incremental contribution of a proposed action to the cumulative impacts to marine mammal populations, depending upon the affected species and their respective population estimate, even when taking into consideration the potential impacts of the *Deepwater Horizon* explosion, oil spill, and response; non-OCS oil- or gas-related factors; and the minimization of the OCS oil- or gas-related impacts through lease stipulations and regulations, would be expected to be **negligible**. Under Alternative E, the cancellation of a proposed lease sale, the incremental impacts on marine mammals within the Gulf of Mexico would be **none**. However, cumulative impacts from previous lease sales and non-OCS oil- and gas-related activities would remain. A full analysis of marine mammals can be found in Chapter 4.9.1 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

The effects associated with selection of any of the alternatives would be equivalent because of the diversity and distribution of marine mammal species throughout the potential areas of interest. The analyses assumed a wide distribution of species and considered impacts to marine mammal species occurring in a wide range of habitats across all planning areas. While a proposed WPA lease sale (Alternative C) would be in a smaller area with less projected activity than a regionwide (Alternative A) or CPA/EPA lease sale (Alternative B) as described in **Chapter 3**, marine mammal species are widely distributed throughout the planning areas and may travel great distances across the GOM. As such, activities isolated to specific planning areas pose similar potential impacts to populations as do activities occurring in all planning areas. Therefore, a similar mix of species would be exposed to the analyzed impact-producing factors, regardless of the specific action alternative selected. For example, if a marine mammal species were to be accidentally struck by an OCS vessel, it would have the same impact to that individual and its respective population estimate in the WPA as it would in the CPA or EPA. Although it can be speculated that a smaller leased area resulting in less projected OCS oil- and gas-related activity would decrease the likelihood of OCS oil- and gas-related activities impacting marine mammal populations, there are not enough conclusive data on the density, distributions, and migratory behaviors of marine mammal populations in the GOM throughout the year to support that speculation. Therefore, because of the diversity and wide distribution of species in the Area of Interest, the level of impacts would be the same for Alternatives A, B, C, and D. Under Alternative E, there would be no new activities associated with a proposed lease sale; however, activities associated with past lease sales and non-OCS oil- and gas-related activities would continue.

Incomplete or Unavailable Information

Throughout this chapter, where information was incomplete or unavailable, BOEM complied with its obligations under NEPA to determine if the information was relevant to reasonably foreseeable significant adverse impacts; if so, whether it was essential to a reasoned choice among alternatives; and, if it was essential, whether it can be obtained and whether the cost of obtaining the information is exorbitant, as well as whether credible scientific information applied using generally accepted scientific methodologies can be used in its place (40 CFR § 1502.22). BOEM has made conscientious efforts to comply with the spirit and intent of NEPA and to be comprehensive in its analyses of potential environmental impacts.

BOEM has identified incomplete information regarding impacts of the *Deepwater Horizon* explosion, oil spill, and response on marine mammals in the GOM. This incomplete information may be relevant to the evaluation of adverse impacts because it could provide changes in the baseline environmental conditions for marine mammals in the affected environment from the *Deepwater Horizon* oil spill and response, exacerbating any impacts from a proposed action. In NEPA, the term "baseline" usually consists of the pre-project environmental conditions. For the purpose of this Supplemental EIS, the baseline is the condition of resources in the vicinity of the project as they exist at the time this environmental analysis began. The injuries assessed within the PDARP/PEIS do not necessarily equate to the current baseline as defined in NEPA. Quantification of a new baseline has several difficulties, including the lack of pre-spill data, the interpretation of post-spill data, and other potential parameters that may have contributed to the quantification of the new baseline. The difference between the state of the resources in an earlier injury assessment and in a current baseline assessment equals any recovery that may have occurred. In addition, the injury assessment reviews a worst-case impact scenario while a baseline assessment determines a reasonable understanding of the current state of the resource.

On December 13, 2010, NMFS declared an unusual mortality event (UME) for cetaceans (whales and dolphins) in the Gulf of Mexico; it was later closed in May 2016. Evidence of the UME was first noted by NMFS as early as February 2010, before the *Deepwater Horizon* explosion, oil spill, and response. During this UME, spatial and temporal boundaries of stranded cetaceans were defined as far as the Florida Panhandle and west to the Louisiana-Texas border (USDOC, NMFS, 2015a). However, these boundaries were redefined by NOAA, based upon analysis of stranding data, to include all cetaceans that stranded in Alabama, Mississippi, and Louisiana from March 2010 through July 2014 and all cetaceans other than bottlenose dolphins that stranded in the Florida Panhandle (Franklin County through Escambia County) from March 2010 through July 2014. The NOAA has claimed that these boundaries could be adjusted in the future based upon the availability of new results or analyses (USDOC, NMFS, 2016a). As of May 2016, a total of 1,141 cetaceans (5% stranded alive and 95% stranded dead) stranded during the UME between Franklin County, Florida, and the Louisiana/Texas border. These stranding numbers are significantly greater than reported in past years, though it should be further noted that stranding coverage (i.e., effort in collecting strategies) has increased considerably due to the *Deepwater Horizon* explosion, oil spill, and response (USDOC, NMFS, 2016a).

The UME investigation and the Deepwater Horizon NRDA process determined that the *Deepwater Horizon* explosion, oil spill, and response resulted in the death of marine mammals and is the most likely explanation of the persistent, elevated stranding numbers in the northern Gulf of Mexico after the spill. Data have supported that the adrenal and lung disease observed in dolphins was most likely due to exposure to petroleum products from the spill. This has resulted in both dolphin mortalities, which peaked from March 2010 through July 2014, and fetal loss. Research, while ongoing, suggests that the effect on these populations has not ended, with evidence of failed pregnancies found in 2015 (USDOC, NMFS, 2016a).

Although data suggest that exposure to petroleum products may result in reproductive failure, other factors have the potential to affect marine mammal reproduction and were also observed during the timeframe of this UME. In addition to investigating all other potential causes, scientists are still investigating what role *Brucella* plays in the northern Gulf of Mexico UME. *Brucella* is a gram-negative, intracellular bacterium that has been isolated from many marine mammal species globally (Nymo et al., 2011; Guzmán-Verri et al., 2012; Hernández-Mora et al., 2013) and that may cause placentitis and sporadic late-term abortion (Miller et al. 1999; Dagleish et al., 2008; Guzmán-Verri et al., 2012; Hernández-Mora et al., 2013). As of October 27, 2015, 68 out of 210 dolphins tested were positive or suspected positive for *Brucella*. More detail on *Brucella* and its role in the UME can be found on NMFS' website (USDOC, NMFS, 2016a). Future investigations on immune function in Gulf of Mexico dolphins are needed to determine whether exposure to hydrocarbons during the *Deepwater Horizon* oil spill or other environmental stressors may have caused an increased susceptibility to infectious agents that affect the fetal-placental unit or other conditions leading to late-term fetal loss (Colegrove et al., 2016). Furthermore, a study by Carmichael et al. (2012) suggested that natural stressors, combined with the *Deepwater Horizon* explosion, oil spill, and response, may have created a "perfect storm" for bottlenose dolphins in the northern Gulf of Mexico. Many coastal species in the northern Gulf of Mexico, including dolphins, experienced unusually harsh winter conditions in early 2010, which were followed by the *Deepwater Horizon* explosion, oil spill, and response. A third potential stressor was introduced in January 2011 when large volumes of cold freshwater, associated with melt water from an unusually large winter snowfall near the Mobile Bay watershed, entered the nearshore coastal systems very rapidly. This event happened days prior to the start of unusually high numbers of perinatal (near term to neonatal) bottlenose dolphin mortalities in the northern Gulf of Mexico from January to April 2011. Although various environmental stressors known to cause death to marine mammals were also present during the *Deepwater Horizon* explosion, oil spill, and response, it is unclear at this time what level of impact these stressors contributed to the increase in strandings (Carmichael et al., 2012).

According to NMFS' website referenced above, evidence of the UME was first documented by NMFS as early as March 2010, a month prior to the *Deepwater Horizon* explosion and oil spill. The NMFS has also documented an additional 12 UMEs that have been previously declared in the GOM for cetaceans (an additional 7 specific to manatees only) since 1991 (USDOC, NMFS, 2015b). However, studies published from the NRDA process evaluating the possible impacts of the *Deepwater Horizon* explosion, oil spill, and response on bottlenose dolphins exposed to oiling have shown overall poor health and prevalence of poor body condition, disease, and abnormalities as compared with bottlenose dolphins in the Gulf of Mexico that were not exposed to oiling (Schwacke et al., 2013; Venn-Watson et al., 2015). Bacterial pneumonia was also identified from dolphins before and during the UME, but it was detected more in the UME dolphins (Venn-Watson et al., 2015). While this information may ultimately be useful in expanding the available knowledge on baseline environmental conditions following the *Deepwater Horizon* explosion, oil spill, and response, it remains difficult to draw specific conclusions regarding the current overall bottlenose dolphin population in the GOM.

Even with recent publications, such as the Venn-Watson et al. (2015) marine mammal study, the best available information on impacts to GOM marine resources does not yet provide a complete understanding of the population impacts of the oil spill and active response/cleanup activities from the *Deepwater Horizon* explosion and oil spill on marine resources as a whole in the GOM. Relevant data on the status of marine mammal populations after the UME and *Deepwater Horizon* explosion, oil spill, and response may take years to acquire and analyze, and impacts from the *Deepwater Horizon* explosion, oil spill, and response may be difficult or impossible to discern from other factors. For example, even 20 years after the *Exxon Valdez* spill, the long-term impacts to marine mammal populations are still being investigated (Matkin et al., 2008). Therefore, it is not possible for BOEM to obtain this information within the timeframe contemplated for the NEPA analysis in this Supplemental EIS, regardless of the cost or resources needed.

Unavailable information provides challenges in understanding the baseline conditions and changes within marine mammal populations. The impacts of tropical storms and hurricanes in the GOM have never been determined and the impacts remain very difficult to quantify. The impacts associated with the *Deepwater Horizon* explosion, oil spill, and response makes an understanding of the cumulative impacts less defined. The process, timeline, and determination of NMFS' proposal to list the Bryde's whale as endangered is unknown, but it is not essential to a reasoned choice among alternatives because, if listed, BOEM would need to consult under ESA Section 7 (refer to **Chapter 5.2**). BOEM used existing information and accepted scientific methodologies to extrapolate from publicly available information on marine mammals in completing the relevant analysis of marine mammal populations. There are existing leases in the GOM with ongoing or the potential for exploration, drilling, and production activities. In addition, non-OCS oil- and gas-related activities would continue to occur in the GOM irrespective of a proposed action (e.g., fishing, military activities, and scientific research). Therefore, BOEM concludes that the unavailable information from these events may be relevant to foreseeable significant adverse impacts to marine mammals because the full extent of impacts on marine mammals is not known. However, BOEM has determined that the information is not essential to a reasoned choice among alternatives for this Supplemental EIS (including the No Action and Action Alternatives) because none of the sources reveal reasonably foreseeable significant adverse impacts to marine mammals that were not otherwise considered in this Supplemental EIS.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including publications from Federal agencies and journal articles) were examined to assess recent information regarding marine mammals that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for marine mammals presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on marine mammals has been published that would change the conclusions since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for marine mammals presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program. The incremental contribution of a proposed lease sale (i.e., Alternatives A, B, C, and D) to cumulative impacts to marine mammal populations, depending upon the affected species and their respective population estimate, even when taking into consideration the potential impacts of the *Deepwater Horizon* explosion, oil spill, and response; non-OCS oil- or gas-related factors; and the minimization of OCS oil- or gas-related impacts through lease stipulations and regulations, would be expected to be **negligible**.

4.9.2 Sea Turtles

Summary

BOEM has reexamined the analysis for sea turtles presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for sea turtles presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of sea turtles, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.9.2 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Five sea turtle species are known to inhabit the waters of the GOM (Pritchard, 1997): the loggerhead (*Caretta caretta*); Kemp's ridley (*Lepidochelys kempii*); green (*Chelonia mydas*); leatherback (*Dermochelys coriacea*); and hawksbill (*Eretmochelys imbricata*). All five species are highly migratory with individuals migrating into nearshore waters as well as other areas of the GOM, North Atlantic Ocean, and the Caribbean Sea, and they use beaches along these coasts during nesting season. These sea turtles are protected under the Endangered Species Act of 1973. The FWS and NMFS share Federal jurisdiction for sea turtles. The FWS has responsibility for monitoring and managing sea turtles (i.e., nesting turtles, eggs, and hatchlings) on the beaches; and NMFS has jurisdiction for sea turtles in the marine environment. Refer to Chapter 4.9.2 of the of the 2017-2022 GOM Multisale EIS for the full analyses of sea turtles. BOEM's protective measures for sea turtles are provided below.

Protective Measures for Sea Turtles

Seismic operations have the potential to harm sea turtles in close proximity to active airgun arrays. The Protected Species Stipulation and NTL 2016-BOEM-G02, “Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program,” minimize the potential of harm from seismic operations to sea turtles that could be within the exclusion zone. These mitigations for sea turtles and marine mammals include, but are not limited to, onboard observers, ramp-up procedures, shutdowns, and the use of a minimum sound source. Noise impacts on turtles from seismic surveys are described in the “Noise” section in Chapter 4.9.2 of the 2017-2022 GOM Multisale EIS. More detailed information on the seismic surveying technology and techniques that could be used is provided in BOEM’s, with BSEE and the National Oceanic and Atmospheric Administration’s NMFS as cooperating agencies, *Gulf of Mexico Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas—Final Programmatic Environmental Impact Statement* to evaluate the potential environmental impacts of multiple G&G activities within Federal waters of the Gulf of Mexico’s OCS and adjacent State waters (USDOI, BOEM, 2017d).

There have been no documented sea turtle strikes with drilling and service vessels in the GOM; however, collisions with small or submerged sea turtles may go undetected. Based on sea turtle density estimates in the GOM, the encounter rates between sea turtles and vessels would be expected to be greater in water depths <200 m (656 ft) (USDOC, NMFS and USDOI, FWS, 2007). To further minimize the potential for vessel strikes, NTL 2016-BOEM-G01, “Vessel Strike Avoidance and Injured/Dead Protected Species Reporting,” was issued; this NTL provides NMFS’ guidelines for monitoring procedures related to vessel strike avoidance measures for sea turtles and other protected species. In the past, compliance with this NTL and other protective measures has been mandatory as a result of the Protected Species Stipulation, which has been applied at the lease sale stage. With the implementation of these measures and the avoidance of potential strikes from OCS vessels, the risk of collisions between oil- and gas-related vessels (including those for G&G, drilling, production, decommissioning, and transport) and sea turtles is appreciably reduced, but strikes may still occur. BOEM and BSEE monitor for any takes that have occurred as a result of vessel strikes and require that any operator immediately report the striking of any animal (NTL 2016-BOEM-G01).

Operators must comply with the guidelines provided in NTL 2015-BSEE-G03, “Marine Trash and Debris Awareness and Elimination.” Should a proposed lease sale be held, the NTLs would become mandatory under the expected application of the Protected Species Stipulation. The BSEE prohibits the disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR § 250.300).

The NTL, “Decommissioning Guidance for Wells and Platforms” (NTL 2010-BSEE-G05), provides guidelines for offshore operators that specify and reference NMFS’ biological opinion mitigation requirements currently in place for protected species, including sea turtles and are designed to reduce impacts. In addition, terms and conditions, and reasonable and prudent measures identified during consultation for decommissioning would be required conditions of approval in any decommissioning authorizations. The regulations at 30 CFR part 550 outline the environmental, monitoring, and mitigation information that operators must submit with plans for exploration, development, and production. This regulation requires OCS energy-related activities to be conducted in a manner that is consistent with the provisions of the ESA. Additionally, NMFS has implemented a protected species observer program for structure decommissioning.

Analysis

This chapter provides a summary of the information detailed in the 2017-2022 GOM Multisale EIS regarding the impact-producing factors from routine activities, accidental events, and cumulative impacts from activities described in **Chapter 3** and their potential impacts that could result from a single proposed lease sale and a proposed lease sale's incremental contribution to the cumulative impacts to sea turtles. Potential impact-level criteria are defined in **Chapter 4.9** ("Protected Species") and apply to sea turtles. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts, that are reasonably foreseeable and to define the impact levels for each impact-producing factor in relation to the best available population estimates (refer to **Table 4-18** in **Chapter 4.9** ["Protected Species"]). The potential magnitude of impact and impact-level definitions for each of these impact-producing factors is provided in **Table 4-18** to help the reader quickly identify the level of potential impacts for each impact-producing factor that is reasonably foreseeable based on credible scientific research. The analyses supporting these conclusions are discussed below. This analysis applies to all considered alternatives.

Five ESA-listed sea turtle species are present throughout the northern GOM year-round; however, only Kemp's ridley and loggerhead sea turtles commonly nest on beaches in the GOM during the nesting season. Due to the expected implementation of mitigations (e.g., BOEM and BSEE proposed compliance with NTLs under the proposed Protected Species Stipulation and conditions of approval on postlease activities), routine activities (e.g., noise or transportation) and accidental events (e.g., oil spills) related to a proposed action are not expected to have long-term adverse effects on the population size or productivity of any sea turtle species or populations in the northern GOM. Lethal effects could occur from chance collisions with OCS oil- and gas-related service vessels or ingestion of accidentally released plastic materials from OCS oil- and gas-related vessels and facilities. Most routine activities and accidental events as a result of a proposed action are therefore expected to have **negligible** to **moderate** impacts. For example, a minor impact might be a behavioral change in response to noise while a moderate impact might be a spill contacting an individual and causing injury or mortality.

Historically, intense harvesting of eggs, loss of suitable nesting beaches, and fisheries-related mortality led to the rapid decline of sea turtle populations. Anthropogenic actions continue to pose the greatest threat to sea turtles since their listing under the ESA, as well as natural threats including climate change, disease, and natural disasters. The incremental contribution of a proposed action to the cumulative impacts on sea turtles would be expected to be **negligible**. Population-level impacts are not anticipated. Under Alternative E, the cancellation of a proposed lease sale, impacts on sea turtles within the Gulf of Mexico would be **none**. However, cumulative impacts from previous lease sales and non-OCS oil- and gas-related activities would remain. A full analysis of sea turtles can be found in Chapter 4.9.2 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

The effects associated with selection of any of the action alternatives would be equivalent because of the diversity and distribution of sea turtles throughout the potential Area of Interest. The analyses assumed a wide distribution of species and considered impacts to sea turtles occurring in a wide range of habitats across all planning areas. While a WPA lease sale (Alternative C) would be in a smaller area with less projected activity than a regionwide (Alternative A) or CPA/EPA lease sale (Alternative B) as described in **Chapter 3**, sea turtles are distributed throughout the planning areas. As such, activities isolated to specific planning areas pose similar potential impacts to populations as do activities occurring in all planning areas. Therefore, because of the free-swimming ability and wide distribution of species across the Area of Interest, the level of impacts would be the same for Alternatives A, B, C, and D. However, Alternative E, No Action, would avoid impacts from a proposed lease sale and the related postlease activities as the lease sale would not be held; only impacts from past lease sales and associated postlease activities or other G&G permits would continue.

Incomplete or Unavailable Information

Unavailable information provides challenges in understanding the baseline conditions and changes within sea turtle populations. The impacts associated with the *Deepwater Horizon* explosion, oil spill, and response makes an understanding of the cumulative impacts less defined but overall changes the baseline as in less numbers of individual species. Not all of the information collected during the NRDA process, which was used as a basis for their determinations, is yet publicly available. BOEM used existing information and reasonably accepted scientific methodologies to extrapolate from publicly available information on sea turtles in completing the relevant analysis of sea turtle populations. There are existing leases in the GOM with ongoing or the potential for exploration, drilling, and production activities. In addition, non-OCS oil- and gas-related activities would continue to occur in the GOM irrespective of a proposed action (e.g., fishing, military activities, and scientific research). Also, little is known about the early life history of leatherbacks regarding the “lost years” (Carr, 1986). Therefore, BOEM concludes that the unavailable information from these events may be relevant to foreseeable significant adverse impacts to sea turtles because the full extent of impacts on sea turtles is not known; however, BOEM has determined that the information is not essential to a reasoned choice among alternatives for this Supplemental EIS (including the No Action and action alternatives).

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including NOAA/NMFS’ Office of Protected Resources website and Sea Turtle Stranding and Salvage Network website, Gulf Spill Restoration site (PDARP/PEIS), FWS’ Environmental Conservation Online System, National Park Service, JSTOR, and Google Scholar) were examined to assess recent information regarding sea turtles that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for sea turtles presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on sea turtles has been published that would change the conclusions since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for sea turtles presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program. The incremental contribution of a proposed action to the cumulative impacts on sea turtles would be expected to be **negligible**.

4.9.3 Beach Mice (Alabama, Choctawhatchee, Perdido Key, and St. Andrew)

Summary

BOEM has reexamined the analysis for beach mice presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for beach mice presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of beach mice, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.9.3 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

The following four subspecies of beach mouse (*Peromyscus polionotus*) occupy restricted habitats in the mature coastal dunes of Florida and Alabama and are federally listed as endangered: Alabama (*P.p. ammobates*); Perdido Key (*P.p. trisyllepsis*); and Choctawhatchee (*P.p. allophrys*) (listed June 6, 1985; *Federal Register*, 2006b); and St. Andrew (*P.p. peninsularis*) (listed December 18, 1998; *Federal Register*, 1998). Current critical habitat is included in the critical habitat map (**Figure 4-10**). Populations of the listed subspecies have fallen to levels approaching extinction. These four subspecies of beach mice are similar in appearance but can be identified by pelage color and location (Bowen, 1968).

Protective Measures for Beach Mice

Impacts to beach mice may occur directly to the animal or its habitat. Marine trash and debris could affect beach mice due to the potential to ingest and/or become entangled. The BSEE has taken measures to reduce marine debris by imposing marine debris awareness and prevention measures on the oil and gas industry through NTL 2015-BSEE-G03, which provides guidance to industry operators regarding the reduction of trash and debris elimination into the marine environment and informing operators of regulations set by other regulatory agencies (i.e., USEPA and USCG). This mitigation is a binding part of leases through the Protected Species Stipulation. The OCS oil- and gas-related proposed activities may contribute minimal marine debris or disruption to beach mouse areas, but the impacts would be **negligible**. Due to the proximity of the beach mouse habitat to any OCS oil- and gas-related activity, any accidental loss of debris as a result of OCS oil- and gas-related activities would be minimal.

Analysis

The approach of this analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts, and to define the impact levels for each impact-producing factor (refer to **Table 4-18** in **Chapter 4.9** [“Protected Species”]). The potential magnitude of impact and impact-level definitions for each of these impact-producing factors is provided in **Table 4-18** to help the reader quickly identify the level of potential impacts for each impact-producing factor. The analyses supporting these conclusions are discussed below.

This chapter provides a summary of the information detailed in the 2017-2022 GOM Multisale EIS regarding the impact-producing factors from routine activities, accidental events, and cumulative impacts from the activities described in **Chapter 3** that are associated with non-OCS oil- and gas-related and OCS oil- and gas-related activities. This analysis applies to all considered alternatives.

Beach mice rely on dune systems as favorable habitat for foraging and maintaining burrows. Due to the distance between beach mouse habitat and OCS oil- and gas-related activities, routine activities are not likely to affect beach mouse habitat except under very limited situations. Pipeline emplacement or construction, for example, could cause temporary degradation of beach mouse habitat; however, these activities are not expected to occur in areas of designated critical habitat. Accidental oil spills and associated spill-response efforts are not likely to impact beach mice or their critical habitat because the species live above the intertidal zone where contact is less likely. Habitat loss from non-OCS oil- and gas-related activities (e.g., beachfront development) and predation have the greatest impacts to beach mice. Overall, the incremental contribution of impacts from reasonably foreseeable routine activities and accidental events to the overall cumulative impacts on beach mice is expected to be **negligible**. Under Alternative E, the cancellation of a proposed lease sale, impacts on beach mice would be **none**. However, cumulative impacts from previous lease sales and other non-OCS oil- and gas-related activities would remain. A full analysis of beach mice can be found in Chapter 4.9.3 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

Because of the distribution of species in the Area of Interest, the level of impacts would be generally the same for Alternatives A, B, and D. Alternative C would have no impacts since no beach mice habitat exists near the WPA proposed lease sale area. The WPA is approximately 380 mi (612 km) from known beach mouse habitat; OSRA modeling calculated a <0.05 to 1 percent chance of oil from a catastrophic spill contacting beach mouse habitat 30 days post-spill. Alternative E, No Action, would only have impacts associated with ongoing activities from past lease sales and non-OCS oil- and gas-related activities.

Incomplete or Unavailable Information

BOEM has determined that there is no incomplete or unavailable information regarding the listed beach mice relevant to the potential impacts from a proposed action or alternatives, and no such information was essential to a reasoned choice among alternatives. BOEM used existing information and reasonably accepted scientific methodologies from available information on beach mice in completing the relevant analysis of impacts.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed journal articles and Internet sources were examined to assess recent information regarding beach mice that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for beach mice presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on beach mice has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for beach mice presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.9.4 Protected Birds

Summary

BOEM has reexamined the analysis for protected birds presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for protected birds presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of protected birds, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.9.4 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Protected birds are species or subspecies listed under the ESA by FWS as threatened or endangered due to the decrease in their population sizes or loss of habitat; therefore, a proposed action could have a greater impact. BOEM is undergoing consultation with FWS to minimize the potential impacts to ESA-listed species. The protected birds analyzed in this Supplemental EIS include those species that use the OCS or coastal counties/parishes along the Gulf of Mexico during any part of their lifecycle and that are listed under the Endangered Species Act as threatened or endangered. Other species that met these criteria were excluded if their habitats were more upland or away from the coast (Appendix F of the 2017-2022 GOM Multisale EIS). All of the following protected bird species are also protected under the Migratory Bird Treaty Act. The impact-producing factors that could affect protected birds are outlined in **Table 4-18** in **Chapter 4.9** ("Protected Species"). A review of a description of associated impact-producing factors for these species is discussed and can be referenced from **Chapter 4.8** ("Birds"). However, similar impact-producing factors that may affect protected species may have greater impacts to protected species and their associated critical habitat due to their small population size and ESA-listing status. Those impacts are considered in the following analysis.

The habitats of the protected bird species described in this Supplemental EIS vary from upland habitat, freshwater wetlands, estuarine, coastal beaches, and tidal flats to offshore migration and foraging; impacts to the physical aspects of the coastal habitats are identified in **Chapter 4.3** ("Coastal Habitats"). Critical habitat is presented in **Figure 4-10**.

Collectively, the bird species included in this analysis are distributed across the GOM region from southern Florida to eastern Texas as year-round residents or migratory with a strong seasonal component. Many of the migratory bird species are less abundant along the GOM during the season when they are on their breeding grounds and have higher densities and/or wider distributions during migration and non-breeding season.

Protective Measures for Protected Birds

Marine debris produced by OCS oil- and gas-related activities as a result of accidental disposal into the water may affect protected birds by entanglement or ingestion. Regulations prohibiting intentional disposal of items, beach-cleaning efforts to remove debris from certain locations, and the use of marine debris awareness and prevention measures on the oil and gas industry through NTL 2015-BSEE-G03 (formerly NTL 2012-BSEE-G01), which provides guidance to industry operators regarding the reduction of trash and debris elimination into the marine environment and which informs operators of regulations set by other regulatory agencies (i.e., the USEPA and USCG), help reduce impacts to protected birds. Implementation of BSEE's Marine

Trash and Debris NTL is required through ESA consultation with FWS and is expected to be applied by the oil and gas industry for associated OCS oil- and gas-related activity.

Analysis

The analyses of the potential impacts of routine activities and accidental events associated with a proposed action and a proposed action's incremental contribution to the cumulative impacts to ESA-listed birds are presented in this chapter. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts, and to define the impact levels for each impact-producing factor (refer to **Table 4-18** in **Chapter 4.9** ["Protected Species"]). The potential magnitude of impact and impact-level definitions for each of these impact-producing factors is provided in **Table 4-18** to help the reader quickly identify the level of potential impacts for each impact-producing factor. The analyses supporting these conclusions are discussed below.

This chapter provides a summary of the information detailed in the 2017-2022 GOM Multisale EIS regarding the impact-producing factors from routine activities, accidental events, and cumulative impacts from activities described in **Chapter 3** and their potential effects that could potentially result from a single proposed lease sale or the alternatives. This analysis applies to all considered alternatives. Because of the distribution of the different protected bird species in the Area of Interest, the level of impacts would vary from Alternatives A, B, C, and D. However, Alternative E, No Action, would only have impacts associated with continuing effects from past lease sales and non-OCS oil- and gas-related activities. This chapter will include a summary of the potential impacts as they relate to the action alternatives and the protected bird species. The analyses of applicable impact-producing factors are the same as those for birds in general (refer to **Chapter 4.8**, "Birds"); however, the resulting level of impact would differ, as defined under the protected species impact criteria.

Impacts from routine activities, which include discharges and wastes affecting air and water quality, noise, and possibly artificial lighting, would be **negligible** to protected birds. The listed bird species considered are typically coastal birds and would not be exposed to much of the OCS oil- and gas-related activities. Waste discharges to air or water produced as a result of routine activities are regulated by USEPA and BOEM and are subject to limits to reduce potential impacts; therefore, due to precautionary requirements and monitoring, the impacts to protected birds would be **negligible** for any of the action alternatives. The major impact-producing factors resulting from accidental events associated with a proposed action that may affect protected birds include accidental oil spills and response efforts. In the case of an accidental oil spill, impacts would be **negligible** to **moderate** depending on the magnitude and spatiotemporal proximity of such an event. Major impacts could occur if a large oil spill occurred with direct contact to a protected bird species or if the habitat became contaminated resulting in mortality of a listed species. Marine debris produced by OCS oil- and gas-related activities as a result of accidental disposal into the water may affect protected birds by entanglement or ingestion. Due to the regulations prohibiting the intentional disposal of items, impacts would be expected to be **negligible**; however, impacts may scale up to **moderate** if the accidental release of marine debris caused mortality of a listed bird.

Overall, BOEM would expect **negligible** to **moderate** impacts to protected birds considering routine activities, accidental events, and cumulative impacts for any of the action alternatives. Due to the precautionary requirements and monitoring discussed above, the incremental impacts to protected birds would be **negligible** for any of the action alternatives (i.e., Alternatives A-D). For Alternative E, the cancellation of a proposed lease sale, the additional incremental impacts to ESA-protected birds or their habitats would be **none**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of protected birds can be found in Chapter 4.9.4 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

Due to the precautionary requirements and monitoring discussed above, the impacts to protected birds would be **negligible** for any of the action alternatives (i.e., Alternatives A-D). The impacts of Alternative B would be the same as Alternative A for all previously specified protected bird species, with the exception of the whooping crane with the listed population in Texas in the WPA and which is outside of the CPA or EPA. The Cape Sable seaside sparrow, roseate tern, and the Mississippi sandhill crane are not found off Texas; therefore, they would not be impacted by a proposed lease sale in the WPA. The impacts of Alternative D would be the same as Alternative A, B, or C because the areas of potential exclusion are specific to areas that do not have any impact on ESA-protected bird species or their habitats. The impacts of Alternative E would yield no additional incremental impacts to ESA-protected birds or their habitats.

Incomplete or Unavailable Information

Refer to **Chapter 4.8** (“Birds”) for existing incomplete or unavailable Information related to protected birds. The conclusions remain unchanged.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed journal articles and Internet sources were examined to assess recent information regarding protected birds that may be pertinent to a proposed action. No new relevant information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for protected birds presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on protected birds has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for protected birds presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.9.5 Protected Corals

Summary

BOEM has reexamined the analysis for protected corals presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for protected corals presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of protected corals, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.9.5 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Corals in the GOM that are protected under the ESA include those listed in **Table 4-17**. Distribution of those listed species within the U.S. Exclusive Economic Zone ranges from the State of Florida to Flower Garden Banks National Marine Sanctuary and the U.S. territories of Puerto Rico, U.S. Virgin Islands, and Navassa Island. Critical habitat was designated for the elkhorn (*Acropora palmata*) and staghorn (*Acropora cervicornis*) coral species by NMFS in 2008 and includes four counties in the State of Florida (i.e., Palm Beach, Broward, Miami-Dade, and Monroe Counties), as well as the U.S. territories of the U.S. Virgin Islands (St. John/St. Thomas and St. Croix) and Puerto Rico (*Federal Register*, 2008b). However, this designated critical habitat is located outside of the GOM and is not expected to be affected by a proposed action, as seen in **Figure 4-10**. Though the listed species are protected, they would experience the same types of potential impact-producing factors from a proposed action as other coral species inhabitating live bottom habitats. For a detailed description and impact analysis of live bottom habitats in the GOM, refer to **Chapter 4.6**.

Protective Measures for Protected Corals

Potential routine impact-producing factors on protected corals are the same as those analyzed and described in **Chapter 4.6.1**. Impacts resulting from both routine activities and accidental events are mitigated through the Topographic Features Stipulation. Protective measures are detailed in NTL 2009-G39. The site-specific survey information required for postlease reviews of permit applications would allow BOEM to identify and protect live bottom features (which protected corals may inhabit) from potential harm by proposed OCS oil- and gas-related activities by requiring that bottom-disturbing activity be distanced from live bottom features. Further, it is believed that most, if not all, of the protected corals occur either within the boundaries of the Flower Garden Banks National Marine Sanctuary, which is an area currently excluded from future leasing, or far from the area of proposed activities in shallow waters in and around the Florida Keys and Dry Tortugas in State or Federal waters of the EPA that are subject to the Congressional leasing moratorium that is in effect through 2022.

Analysis

This chapter provides information regarding the protected coral species. However, the types of impact-producing factors affecting these species are the same as those described in **Chapter 4.6.1** ("Topographic Features"); therefore, they are briefly summarized here in the context of the protected coral species. A wider impact analysis for live bottom habitats (which protected corals may inhabit) can be found in **Chapter 4.6** ("Live Bottom Habitats"). However, the level of impact from OCS oil- and gas-related and non-OCS oil- and gas-related activities does differ from those seen in **Chapter 4.6.1** because the protected coral species have smaller population sizes, and localized impacts could have a magnified effect. Therefore, the impact levels for protected coral species are described separately in **Table 4-18**. The potential magnitude of impact and impact-level definitions for each of the impact-producing factors is provided in **Table 4-18** to help the reader quickly identify the level of potential impacts for each impact-producing factor. The analyses supporting these conclusions are discussed below.

Some activities as a result of a proposed lease sale have the potential to directly impact protected coral habitat within the GOM. Because of the similarity and overlap of the effects of many activities that occur in the OCS, the relevant impact-producing factors can result from bottom-disturbing activities (i.e., routine activities and accidental events) and the potential accidental release of drilling muds and contaminants.

Elkhorn, staghorn, boulder star, lobed star, and mountainous star corals are listed by NMFS as threatened due to the decrease in their population sizes; therefore, the relative impacts from a proposed action on a particular group of coral colonies could have disproportionately higher population-level impacts than what might be realized by other, non-listed coral species. BOEM understands this and therefore performs a consultation with NMFS to minimize any potential impacts to these species. Though the listed species are protected (given ESA status), they could experience the same types of potential impact-producing factors from a proposed action as other coral species. Without effective mitigations, routine activities and accidental events resulting from a proposed action could directly impact coral habitats within the GOM. The site-specific survey information required for postlease reviews of permit applications would allow BOEM to identify and protect live bottom features (which protected corals may inhabit) from potential harm by proposed OCS oil- and gas-related activities by requiring that bottom-disturbing activity be distanced from live bottom features. Assuming adherence to the expected lease stipulations and other postlease protective restrictions and mitigations, the routine activities related to a proposed action could have short-term, localized and temporary effects on protected corals, if any. While accidental events have the potential to cause severe damage to specific coral communities, the number of such events is expected to be small, and any impacts would be reduced or prevented by the lease stipulations and postlease distancing requirements. Furthermore, the OCS lease blocks in the EPA that are closest to ESA-defined critical habitat areas for listed corals are not being offered in a proposed lease sale due to the current leasing moratorium and are, therefore, too distant to be reasonably affected by routine activities or accidental events. In addition, many of the protected corals occur within the Flower Garden Banks National Marine Sanctuary, which, under the current boundaries, is not proposed for future leasing under any of the alternatives in this Supplemental EIS or in the 2017-2022 GOM Multisale EIS. Therefore, the incremental contribution of activities resulting from a proposed action to the overall cumulative impacts to protected corals is expected to be **negligible** for any of the action alternatives. Proposed OCS oil- and gas-related activities would contribute incrementally to the overall OCS oil- and gas-related and non-OCS oil- and gas-related cumulative impacts experienced by corals. The non-OCS oil- and gas-related cumulative impacts to protected corals are expected to be dramatically greater than any impacts related to OCS oil and gas activities. Under Alternative E, the cancellation of the proposed action, the impacts on protected corals would be **none**. However, cumulative impacts from previous lease sales and non-OCS oil- and gas-related activities would remain. A full analysis of protected corals can be found in **Chapter 4.9.5** of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

Under Alternatives A, B, and C, the proposed activities would have the same impact levels to protected corals whether they occur in the WPA, CPA, or EPA. While the WPA is a smaller area with less projected activity than is proposed for the CPA/EPA (refer to **Chapter 3**), many of the protected corals either occur in the Flower Garden Banks National Marine Sanctuary, which is not proposed for leasing under any alternative, or are far from the area of proposed activities. Additional protection is provided through lease stipulations and postlease activity reviews and associated site-specific information requirements and (when necessary) mitigations. Because of these protective measures and because protected corals occur far from areas of proposed activities, impacts from reasonably foreseeable routine activities and accidental events are both expected to be **negligible**. A negligible impact would be largely undetectable and may cause slight, localized changes to a protected coral species community in which recovery from the impact is expected. No mortality or injury to an individual or group would be expected to occur. Under Alternative B, a proposed lease sale would not occur in the WPA, which includes the Flower Garden Banks National Marine Sanctuary; therefore, impacts to protected corals as a result of a proposed lease sale would not be reasonably foreseeable to occur. There would, however, be ongoing cumulative impacts to the resources associated with ongoing OCS oil- and gas-related activities resulting from previous lease sales and from non-OCS oil- and gas-related activities and conditions. Development of oil and gas would, in all likelihood, be postponed to a future lease sale decision; in that case, the overall level of OCS oil- and gas-related activity would be delayed, not reduced, at least in the short term. It would take several cancelled lease sales before there would likely be a noticeable decrease in postlease activities from previous oil and gas lease sales. Under Alternative D, should the blocks subject to the Topographic Features Stipulation be excluded, protected corals would be further protected by distancing OCS oil- and gas-related activities farther from these habitats, thereby reducing the probability of potential impacts from routine activities or accidental events. Under Alternative E, there would be no new activities associated with a proposed lease sale; however, activities associated with past lease sales and non-OCS oil- and gas-related activities and conditions would continue.

Incomplete or Unavailable Information

Refer to **Chapter 4.6** ("Live Bottom Habitats") for incomplete or unavailable information related to protected corals.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources, including literature from relevant peer-reviewed journals and reports, were examined to assess recent information regarding protected corals that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for protected corals presented in the 2017-2022 GOM Multisale EIS based on the additional information presented above. No new information was discovered that would alter the impact conclusion for protected corals presented in the 2017-2022 GOM Multisale EIS, and the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.10 Commercial Fisheries

Summary

BOEM has reexamined the analysis for commercial fisheries presented in the 2017-2022 GOM Multisale EIS. Updated data on baseline commercial fishing activity has become available. However, no new information was discovered that would alter the impact conclusion for commercial fisheries presented in the 2017-2022 GOM Multisale EIS. The analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of commercial fisheries, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.10 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

The Gulf of Mexico is home to a large and complex commercial fishing industry. Finfish and shellfish landings in the Gulf of Mexico comprised 19 percent of total U.S. landings in 2014 (based on USDOC, NMFS, 2016b). Some of the most economically important commercial fisheries in the Gulf of Mexico are white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), eastern oysters (*Crassostrea virginica*), Gulf menhaden (*Brevoortia patronus*), blue crab (*Callinectes sapidus*), red grouper (*Epinephelus morio*), red snapper (*Lutjanus campechanus*), and tunas (*Thunnus* spp.). Fisheries are managed by NOAA Fisheries (NMFS), as advised by the regional fisheries management councils. Commercial fisheries are regulated by various mechanisms, including permitting, closures, quotas, and gear restrictions. Some of the most common gear types are trawls (for shrimp), purse seines (for menhaden), dredges (for oysters), traps (for blue crab), and longlines (for various finfish). Chapter 4.10.1 of the 2017-2022 GOM Multisale EIS presents data on landings revenues in each Gulf Coast State and data on the economic impacts of these revenues. The biological aspects for the targeted species are discussed in Chapter 4.7 ("Fish and Invertebrate Resources") and in greater detail in the same Chapter 4.7 of the 2017-2022 GOM Multisale EIS.

Analysis

The analyses of the potential impacts of routine activities and accidental events associated with a proposed action and a proposed action's incremental contribution to the cumulative impacts to commercial fisheries are presented below. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts, and to define the impact levels for each impact-producing factor (**Table 4-19**). The potential magnitude of impact for each impact-producing factor is provided in **Table 4-19** to help the reader quickly identify the level of potential impacts for commercial fisheries. The impact-level definitions and the analyses supporting these conclusions are summarized in this chapter. The analysis in this chapter relies on the analysis and conclusions reached in **Chapter 4.7** ("Fish and Invertebrate Resources"). Therefore, in general, the impact-producing factors identified in **Chapter 4.7** would have the potential to impact commercial fisheries as well.

Impact-Level Definitions

In this chapter (and in the analyses of the alternatives), the impact levels are defined in terms of the duration, intensity, and geographical extent of the impacts to the human uses of commercial fisheries along the Gulf Coast. Long-term impacts are those lasting more than 1 year. Extensive impacts are those for which it is difficult to find substitute fishing sources nearby, while severe impacts mostly or completely prevent commercial fishing in an area. In particular, the impacts of each impact-producing factor are summarized in **Table 4-19**, using the impact-level definitions below.

- **Beneficial** – Impacts would be positive. The level of benefical impacts are specified in the analysis, which could be low, medium, or high.
- **Negligible** – Little or no detectable adverse impact.
- **Minor** – Adverse impacts are detectable but less than severe.
- **Moderate** – Adverse impacts are severe but are short term and/or not extensive.
- **Major** – Adverse impacts are long term, extensive, and severe.

Table 4-19. Commercial Fisheries Impact-Producing Factors That Are Reasonably Foreseeable.

Commercial Fisheries	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Activities					
Fish Population	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Space-Use Conflicts	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Production Structure Emplacement and Removal	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Accidental Events					
Oil Spills	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Cumulative Impacts					
Incremental Contribution[2]	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
OCS Oil and Gas[3]	Beneficial to Moderate				
Non-OCS Oil and Gas[4]	Beneficial to Major				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.10 of the 2017-2022 GOM Multisale EIS.
[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.
[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.
[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

A proposed action could affect commercial fisheries by affecting fish populations or the socioeconomic aspects of commercial fishing. The impacts of a proposed action on fish populations are presented in **Chapter 4.7**. Routine activities such as seismic surveys, drilling activities, and service-vessel traffic can cause space-use conflicts with fishermen. Structure emplacement could have positive or negative impacts, depending on the location and species. For example, structure emplacement prevents trawling in the associated area and, thus, could impact the shrimp fishery. On the other hand, production platforms can facilitate fishing for reef fish such as red snapper and groupers. The eventual removal of production platforms would reverse these positive and negative impacts. Accidental events, such as oil spills, could cause fishing closures and have other impacts on the supply and demand for seafood. However, accidental events that could arise from a proposed action would likely be small and localized. A proposed action would be relatively small when compared with the overall OCS Oil and Gas Program, State oil and gas activities, overall vessel traffic, tropical storms/hurricanes, economic factors, Federal and State fisheries management strategies, and other non-OCS oil- and gas-related factors. Therefore, the incremental contribution of a proposed action to the cumulative impacts to commercial fisheries would range from **beneficial** to **minor** for any of the action alternatives. A full analysis of commercial fisheries can be found in Chapter 4.10 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

The level of impacts to commercial fisheries would range from **beneficial** to **minor** for Alternatives A, B, C, and D. While there are some differences in the amount of activities associated with the alternatives, many of the impacts associated with the alternatives are similar because the types of activities that occur are similar and the differences are not large enough to change the range of impact conclusions. The exact impacts would depend on the locations of activities, species affected, intensity of commercial fishing activity in the affected area, and substitutability of any lost fishing access. Alternative E would prevent these impacts from occurring, except for potential **negligible** impacts arising from adjustments to incomes in the economy. Under Alternative E, fisheries would still be subject to the impacts from the OCS Oil and Gas Program, as well as the impacts from non-OCS oil- and gas-related activities.

Incomplete or Unavailable Information

BOEM has determined that there is incomplete or unavailable information related to commercial fisheries. Some of this incomplete or unavailable information relates to fish populations that support commercial fishing, which is discussed in **Chapter 4.7**. For example, there is incomplete or unavailable information regarding the long-term impacts of acute and chronic exposure to oil on fish and invertrebrates that support commercial fishing. This information is unavailable because these impacts would only become evident through time. In lieu of the incomplete or unavailable information, BOEM used various data sources and studies, including the most recent NMFS landings data, as well as the information in Carroll et al. (2016), to estimate the affected environment and impacts of OCS oil- and gas-related and non-OCS oil- and gas-related activities for commercial fishing. BOEM has determined that the incomplete or unavailable information is not essential to a reasoned choice among alternatives because existing data sources are sufficient for BOEM to reasonably estimate impacts.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various sources (such as NMFS and Internet searches) were examined to assess recent information regarding commercial fisheries that may be pertinent to a proposed action. The NMFS recently released its *Fisheries Economics of the United States 2015* report (USDOC, NMFS, 2017). This report provides various data on commercial fishing landings and their associated economic impacts, which improves BOEM's understanding of the basline environment for commercial fisheries. There were $858 million in total landings revenues in the Gulf of Mexico in 2015, compared with $746 million in 2012, $942 million in 2013, and $1.05 billion in 2014. The decline in landings revenues compared with the prior 2 years was primarily due to a decline in shrimp revenues. While shrimp landings declined slightly in 2015, the decline in 2015 shrimp revenues was primarily due to a decline in shrimp prices. The 2015 landings revenues for most other species were similar to or greater than revenues observed in prior years. The information in this report does not change BOEM's impact conclusions from the 2017-2022 GOM Multisale EIS because overall commercial fishing activity in 2015 was within the ranges observed in prior years.

Conclusion

BOEM has reexamined the analysis for commercial fisheries presented in the 2017-2022 GOM Multisale EIS. No new information was discovered that would alter the impact conclusion for commercial fisheries presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.11 RECREATIONAL FISHING

Summary

BOEM has reexamined the analysis for recreational fishing presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. Updated data on baseline recreational fishing activity have become available. However, no new information was discovered that would alter the impact conclusion for recreational fishing presented in the 2017-2022 GOM Multisale EIS. The analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of recreational fishing, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.11 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Recreational fishing is a popular pastime in many parts of the Gulf of Mexico. The GOM's extensive estuarine habitats (**Chapter 4.3**), live bottom habitats (**Chapter 4.6**), and artificial substrates (including artificial reefs, shipwrecks, and oil and gas platforms) support several valuable recreational fisheries. Fisheries are managed by NOAA Fisheries (NMFS), as advised by the regional fisheries management councils. Recreational landings and effort data for Louisiana, Mississippi, Alabama, and Florida are provided by NMFS; recreational fishing data for Texas is provided by the Texas Parks and Wildlife Department. These data, along with data on the economic impacts of recreational fishing, are presented in the 2017-2022 GOM Multisale EIS. The biological aspects of the affected environment are discussed in **Chapter 4.7** ("Fishes and Invertebrate Resources") of this Supplemental EIS and Chapter 4.7 of the 2017-2022 GOM Multisale EIS.

Analysis

The analyses of the potential impacts of routine activities and accidental events associated with a proposed lease sale and a proposed lease sale's incremental contribution to the cumulative impacts to recreational fishing are presented below. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), as well as the accidental events and cumulative impacts, and to define the impact levels for each impact-producing factor. The analysis in this chapter relies on the analysis and conclusions reached in **Chapter 4.7** ("Fish and Invertebrate Resources"). Therefore, in general, the impact-producing factors identified in **Chapter 4.7** would have the potential to impact recreational fishing as well.

Impact-Level Definitions

In this chapter (and in the analyses of the alternatives), the impact levels are defined in terms of the intensity, duration, and geographical extent of the impacts to the human uses of recreational fisheries along the Gulf Coast. Long-term impacts are those lasting more than 1 year. Extensive impacts are those for which it is difficult to find substitute fishing sources nearby, while severe impacts mostly or completely prevent recreational fishing in an area. The impacts of each impact-producing factor are summarized in **Table 4-20** using the impact-level definitions below to help the reader quickly identify the level of potential impacts for recreational fishing. The analyses supporting these conclusions are summarized below.

- **Beneficial** – Impacts would be positive. The level of benefical impacts are specified in the analysis, which could be low, medium, or high.
- **Negligible** – Little or no detectable adverse impact.
- **Minor** – Adverse impacts are detectable but less than severe.
- **Moderate** – Adverse impacts are severe but are short term and/or not extensive.
- **Major** – Adverse impacts are long term, extensive, and severe.

Table 4-20. Recreational Fishing Impact-Producing Factors That Are Reasonably Foreseeable.

Recreational Fishing	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Activities					
Anthropogenic Sound	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Bottom-Disturbing Activities	Negligible	Negligible	Negligible	Negligible	Negligible
Space-Use Conflicts	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible

Recreational Fishing	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Production Structure Emplacement and Removal	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Accidental Events					
Oil Spills	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Cumulative Impacts					
Incremental Contribution[2]	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
OCS Oil and Gas[3]	Beneficial to Moderate				
Non-OCS Oil and Gas[4]	Beneficial to Major				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.11 of the 2017-2022 GOM Multisale EIS.
[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.
[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.
[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

Alternatives A-D can affect recreational fishing by affecting fish populations or by affecting the socioeconomic aspects of recreational fishing. The impacts of Alternatives A-D on fish populations are presented in **Chapter 4.7** ("Fishes and Invertebrate Resources"). Vessel traffic associated with a proposed action can cause space-use conflicts with anglers. Structure emplacement generally enhances recreational fishing, although this positive effect will be offset during decommissioning unless a structure were maintained as an artificial reef. Accidental events, such as oil spills, can cause fishing closures and can affect the aesthetics of fishing in an area. However, accidental events that could arise would likely be small and localized. Alternatives A-D should also be viewed in light of overall trends in OCS platform decommissioning, State oil and gas activities, overall vessel traffic, tropical storms/hurricanes, economic factors, and Federal and State fisheries management strategies. The incremental impacts of Alternatives A-D on recreational fisheries are expected to be **beneficial** (due to fish attraction at platforms and the potential use of decommissioned platforms as rigs-to-reefs) to **minor** adverse incremental impacts (due to impacts to fish populations, space-use conflicts, and oil spills) on recreational fishing activities because of the limited amount of activity and because the positive and negative impacts would partially offset each other. Alternative E would cause some economic adjustments (refer to **Chapter 4.14.2**), which could cause **negligible** impacts to recreational fishing activities. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of recreational fishing can be found in Chapter 4.11 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

The level of impacts to recreational fishing would range from **beneficial** to **minor** for Alternatives A, B, C, and D. While there are some differences in the amount of activities associated with the alternatives, many of the impacts associated with the alternatives are similar because the types of activities that occur are similar and the differences are not large enough to change the range of impact conclusions. Alternative E would prevent these impacts from occurring, except for **negligible** changes to recreational fishing due to changes in income patterns in the economy.

Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information regarding the extent to which recreational fishing is dependent upon OCS platforms, as well as on the site-specific determinants of this dependency. In lieu of this incomplete or unavailable information, BOEM used existing information and reasonably accepted scientific methodologies. For example, BOEM used data on recreational fishing activity provided by the Texas Parks and Wildlife Department and NMFS to examine trends in recreational fishing in various areas. BOEM has also used information from Heitt and Milon (2002) and Ajemian et al. (2015), which provide some information on the scale and location of platform-dependent recreational fishing. BOEM does not expect the incomplete or unavailable information to significantly change its estimates of the impacts of the OCS Oil and Gas Program on recreational fishing activity because BOEM still has enough baseline data to reasonably estimate impacts. Therefore, BOEM has determined that the incomplete or unavailable information is not essential to a reasoned choice among alternatives.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various sources (including NMFS, the Texas Parks and Wildlife Department, and Internet searches) were examined to assess recent information regarding recreational fishing that may be pertinent to a proposed action. The NMFS recently released its *Fisheries Economics of the United States 2015* report (USDOC, NMFS, 2017). This report provides various data on recreational fishing activities and their associated economic impacts, which improves BOEM's understanding of the basline environment for recreational fishing. There were 19.7 million angler trips in the Gulf of Mexico in 2015, down from 21.1 million in 2014. From 2014 to 2015, landings of kingfish and seatrouts increased, while landings of Spanish mackerel, Atlantic croaker, and striped mullet decreased. However, the information in this report does not change BOEM's impact conclusions from the 2017-2022 GOM Multisale EIS because the changes between 2014 and 2015 were small.

Conclusion

BOEM has reexamined the analysis for recreational fishing presented in the 2017-2022 GOM Multisale EIS. No new information was discovered that would alter the impact conclusion for recreational fishing presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.12 RECREATIONAL RESOURCES

Summary

BOEM has reexamined the analysis for recreational resources presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. Updated data on the number of visitors and the amount of visitor spending supported by parks along the Gulf Coast have become available. However, no new information was discovered that would alter the impact conclusion for recreational resources presented in the 2017-2022 GOM Multisale EIS. The analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of recreational resources, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.12 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Recreational resources are natural or manmade things that are used as part of activities that are primarily for human enjoyment. The GOM is home to various resources that support recreational activities. These include ocean-based resources as well as resources in the counties and parishes along the Gulf of Mexico. Chapter 4.12.1 of the 2017-2022 GOM Multisale EIS provides information regarding the affected environment for recreational resources, including data on the scales of recreation and tourism in onshore areas, as well as information regarding beaches, wildlife viewing, artificial reefs, and marine protected areas in the Gulf of Mexico region.

Analysis

This chapter analyzes the potential impacts of routine activities and accidental events associated with a proposed action on recreational resources, as well as a proposed action's incremental contribution to the cumulative impacts to recreational resources. The approach of the analysis is to focus on the potential impact-producing factors from OCS oil- and gas-related routine activities (i.e., exploration, development, and production), accidental events, and cumulative impacts, and to define the impact levels for each impact-producing factor.

Impact-Level Definitions

In this chapter (and in the analyses of the alternatives) the impact levels are defined in terms of the intensity, duration, and geographical extent of the impacts to the human uses of recreational resources along the Gulf Coast. Long-term impacts are those lasting more than 1 year. Extensive impacts are those for which it is difficult to find substitute recreational activities nearby, while severe impacts mostly or completely diminish the recreational value of a resource. In particular, the impacts of each impact-producing factor are summarized in **Table 4-21** using the impact-level definitions below to help the reader quickly understand the potential impacts of a proposed lease sale on recreational resources. The analyses supporting these conclusions are discussed below.

- **Beneficial** – Impacts would be positive. The level of benefical impacts are specified in the analysis, which could be low, medium, or high.
- **Negligible** – Little or no detectable adverse impact.
- **Minor** – Adverse impacts are detectable but less than severe.
- **Moderate** – Adverse impacts are severe but are short term and/or not extensive.
- **Major** – Adverse impacts are long term, extensive, and severe.

For Alternatives A-D, space-use conflicts (from vessel traffic) and visual impacts (from the visibility of OCS structures) that arise due to the broader OCS Program would be **negligible** to **minor**. Structure emplacements can have **beneficial** impacts on recreational fishing and diving because platforms often act as artificial reefs, but the eventual removal of these structures would lead to **negligible** to **minor** negative impacts. Oil spills can have a **negligible** to **minor** negative effect on beaches and other coastal recreational resources. Alternatives A-D should also be viewed in light of the overall OCS Program, as well as various non-OCS oil- and gas-related factors such as beach/wetlands erosion, beach disruptions, economic factors, and activities that can cause space-use conflicts and aesthetic impacts, such as commercial and military activities.

Table 4-21. Recreational Resources Impact-Producing Factors That Are Reasonably Foreseeable.

Recreational Resources	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Routine Activities					
Space-Use Conflicts	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Structure Emplacement and Removal	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
Visual Impacts	Negligible to Minor	Negligible to Minor	Negligible	Negligible to Minor	Negligible
Indirect Economic Impacts	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible

Recreational Resources	Magnitude of Potential Impact[1]				
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Accidental Events					
Oil Spills	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Marine Debris	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible
Cumulative Impacts					
Incremental Contribution[2]	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Beneficial to Minor	Negligible
OCS Oil and Gas[3]	Beneficial to Moderate				
Non-OCS Oil and Gas[4]	Beneficial to Major				

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.12 of the 2017-2022 GOM Multisale EIS.
[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.
[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.
[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

Comparison of Alternatives

Because of the relatively small contribution of any given lease sale under any of the action alternatives (i.e., Alternatives A-D) to the overall OCS Program, in addition to other non-OCS oil- and gas-related activities, the incremental impacts are expected to be **beneficial** to **minor** adverse effects. However, the visual impacts of production structures arising from Alternative C would be **negligible** because of the distances of these structures from shore. There could be **negligible** impacts to recreational resources due to the small economic adjustments that would occur in light of Alternative E. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of recreational resources can be found in Chapter 4.12 of the 2017-2022 GOM Multisale EIS.

Incomplete or Unavailable Information

There is some incomplete or unavailable information regarding the visual impacts from a proposed action. In particular, the attitudes of people towards the visibility of structures that could arise in certain areas are not fully known. BOEM has determined that such information is not essential to a reasoned choice among alternatives because much of this uncertainty relates to the inherent uncertainty regarding where (and what types) of structures would arise from a proposed action. In addition, existing information allows for sufficient estimates of the overall dependence of visual impacts to factors such as distance, height, brightness, and general location. BOEM used generally accepted scientific principles to estimate the visual impacts of a proposed action, including literature sources, data sources, and photographic evidence. This evidence suggests that the incremental visual impacts of a proposed action would be **negligible** to **minor**. In addition, BOEM has issued an Information to Lessees and Operators to ensure that visual impacts near the Gulf Islands National Seashore are considered at BOEM's site-specific review stage.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various sources (including Internet searches related to the Gulf Islands National Seashore, economic conditions, and oil-spill impacts) were examined to assess recent information regarding recreational resources that may be pertinent to a proposed action. A new report by Cullinane Thomas and Koontz (2017) provides estimates of the number of visitors, amount of spending, number of jobs, and amount of income in 2016 supported by each national park along the Gulf Coast). From 2014 to 2016, the number of visitors and visitor spending levels increased at three of these parks (i.e., the Padre Island National Seashore, Gulf Islands National Seashore, and Dry Tortugas National Park) but decreased in the other four parks. The number of visitors and the amount of visitor spending supported by national parks along the Gulf Coast in 2016 are listed below.

- Padre Island National Seashore (Texas) (634,013 visitors; $27,231,100)
- Jean Lafitte National Historical Park and Preserve (Louisiana) (438,420 visitors; $25,633,800)
- Gulf Islands National Seashore (Mississippi and Florida) (4,771,308 visitors; $206,607,700) (About 25% of these impacts occur in the Mississippi District.)
- De Soto National Memorial (Florida) (232,463 visitors; $13,591,800)
- Big Cypress National Preserve (Florida) (1,102,147 visitors; $88,049,800)
- Everglades National Park (Florida) (930,907 visitors; $91,321,400)
- Dry Tortugas National Park (Florida) (73,661 visitors; $4,410,000)

However, the information in this report does not change BOEM's impact conclusions from published in the 2017-2022 GOM Multisale EIS because the varied changes in park visitation levels between 2014 and 2016 were modest.

Conclusion

BOEM has reexamined the analysis for recreational resources presented in the 2017-2022 GOM Multisale EIS. No new information was discovered that would alter the impact conclusion for recreational resources presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.13 ARCHAEOLOGICAL RESOURCES

Summary

BOEM has reexamined the analysis for archaeological resources presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for archaeological resources presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of archaeological resources, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.13 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Archaeological resources are any material remains of human life or activities that are at least 50 years of age and that are capable of providing scientific or humanistic understanding of past human behavior, cultural adaptation, and related topics through the application of scientific or scholarly techniques, such as controlled observation, contextual measurement, controlled collection, analysis, interpretation, and explanation (30 CFR § 550.105).

Available evidence suggests that sea level in the northern GOM was at least 90 m (295 ft), and possibly as much as 130 m (427 ft), lower than present sea level during the period 20,000-17,000 years Before Present (B.P.) (Nelson and Bray, 1970). Sea level in the northern GOM reached its present stand around 3,500 years B.P. (Pearson et al., 1986). During periods that the continental shelf was exposed above sea level, the area was open to habitation by prehistoric peoples.

Historic archaeological resources on the OCS consist of historic shipwrecks and a single historic lighthouse, the Ship Shoal Light. A historic shipwreck is defined as a submerged or buried vessel or its associated components, at least 50 years old, that has foundered, stranded, or wrecked, and that is currently lying on or embedded in the seafloor. Europeans are known to have traversed the waters of the western Gulf of Mexico as early as Captain Alonso Alvarez de Piñeda’s expedition in 1519. Alvar Nuñez Cabeza de Vaca is likely the first European to be shipwrecked along the Texas coast as early as 1528 (Francaviglia, 1998).

Protective Measures for Archaeological Resources

To mitigate potential adverse impacts to archaeological resources, BOEM requires an archaeological survey of areas impacted by bottom-disturbing activities and avoidance or other actions, up to and including data recovery excavation, of all potential archaeological resources within the identified area of potential effect of the undertaking. Based on shallow hazard survey data and shipwreck discoveries since 2008, an archaeological survey may be required as a result of site-specific NEPA analysis conducted for new bottom-disturbing activity associated with plans (USDOI, BOEM, 2011). Archaeological surveys, where required prior to an operator beginning OCS oil- and gas-related activities, are expected to identify possible archaeological sites so that they may be avoided. BOEM requires operators to submit an archaeological report with their EP, DOCD, DPP, or other permit application for certain OCS lease blocks. These requirements are posted on BOEM's website under NTL 2005-G07 and NTL 2011-JOINT-G01. **Table 4-22** illustrates the results of the surveys and archaeological reviews between 2009 and 2014. The number of shipwrecks and potential archaeological sites, identified each year through archaeological reviews and surveys, are listed in **Table 4-22**.

Table 4-22. Archaeological Surveys and Resources Identified, 2009-2014.

Year	Blocks Surveyed	Identified Shipwreck Sites	Potential Archaeological Sites Mitigated by Avoidance (identified through requisite industry surveys)
2009	118	11	479 magnetic anomalies and 103 sonar targets
2010	74	8	274 magnetic anomalies and 100 sonar targets
2011	120	15	577 magnetic anomalies and 171 sonar targets
2012	115	15	341 magnetic anomalies and 112 sonar targets
2013	166	6	374 magnetic anomalies and 163 sonar targets
2014	144	13	417 magnetic anomalies and 146 sonar targets

As per NTL 2010-G05 ("Decommissioning Guidance for Wells and Platforms") (idle iron initiative), idle and toppled oil and gas industry-related structures embedded in the seafloor, including single-leg caissons, multi-legged jacketed fixed platforms, floating platforms secured by suction pilings, and subsea well-head and manifold systems, must be decommissioned and removed. Depending on water depth, seafloor characteristics, and vessel availability, an anchored barge, moored barge, or liftboat may be used. Additionally, the site must be cleared of debris to a radius of 600 or 1,320 ft (183 or 402 m) depending on the structure type and use. Clearance may be carried out by trawling or by sonar and diving operations. Since 2013, BOEM may require, as a condition of approval for a decommissioning permit, an archaeological survey in advance of structure-removal activities when no preexisting survey of the area of potential effect exists.

Under 30 CFR § 550.194(c) lessees are required to immediately notify BOEM's Regional Director of the discovery of any potential archaeological resources. Under 30 CFR § 250.194(c) and 30 CFR § 250.1010(c), lessees are also required to immediately notify BOEM's and BSEE's Regional Directors of the discovery of any potential archaeological resources.

Analysis

Impacts to archeological sites occur when proposed activities result in complete or partial destruction of the resource and are equivalent to a loss of integrity as defined in the National Historic Preservation Act (54 U.S.C. §§ 300101 *et seq*.). In determining the appropriate impact threshold, both the extent to which the proposed activity results in a loss of integrity and the degree to which losses can be compensated by mitigating activities, including preservation or data recovery, are considered. For the purposes of this analysis, all alternatives may be assumed to have effectively similar potential impacts to archaeological resources. Only those resources determined eligible or potentially eligible for listing in the National Register of Historic Places are considered under the National Historic Preservation Act. Resources are eligible for listing in the National Register of Historic Places if they meet one or more eligibility criteria and if they possess integrity. For purposes of archaeological mitigation, BOEM/BSEE considers all uninspected shipwrecks, sonar targets, and magnetic anomalies to be potentially eligible for the National Register of Historic Places.

For the analysis of impacts to archeological resources, the determination of the intensity of an impact is based on the foreseeable loss of integrity to known or potential resources. The analysis considers only the direct impacts of seafloor disturbance associated with the below-listed, impact-producing factors as there would be no additional impacts upon archeological resources under any of the alternatives under consideration upon completion of said activities. As each archaeological resource is unique and exists at a specific location on the seafloor, there is a high level of variability in how a site may be impacted by any potential impact-producing factor. Therefore, it is impossible to evaluate the potential impact to an archaeological site from a proposed action at the programmatic level. During postlease activities, each permitted action would be assessed for site-specific potential impacts during the permit application process, and avoidance buffers would be placed around identified resources in order to mitigate potential impacts.

The analyses of the potential impacts of routine activities and accidental events associated with a proposed action and a proposed action's incremental contribution to the cumulative impacts are presented below. The approach of the analysis is to focus on the potential impact-producing factors from routine OCS oil- and gas-related activities (i.e., exploration, development, and production), as well as accidental events and cumulative impacts. Archaeological resources are primarily impacted by any activity that directly disturbs or has the potential to disturb the seafloor. For the OCS Program, this includes the placement of drilling rigs and production systems on the seafloor; pile driving associated with platform emplacement; pipeline placement and installation; the use of seismic receiver nodes and cables; the dredging of new channels, as well as maintenance dredging of existing channels; anchoring activities; post-decommissioning activities including trawling clearance; and the masking of archaeological resources from industry-related infrastructure and debris. Visual impacts to coastal archaeological and historic sites are not considered, as offshore oil and gas infrastructure has existed on the OCS since the 1940s and constitutes a seaward historic viewshed in its own right. Additionally, offshore oil and gas infrastructure predates the National Historic Preservation Act, and therefore, any coastal historic property currently on the National Register of Historic Places would not derive its eligibility from an unobstructed view of the GOM.

Impact-Level Definitions

The definition of impact thresholds used in this analysis are listed below.

- **Beneficial** – An archeological site is stabilized in its current condition to maintain its existing level of integrity or an archeological site is preserved in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties.
- **Negligible** – The lowest level of detection that would have neither adverse nor beneficial impacts.
- **Minor** – Disturbance of archaeological resources would result in little, if any, loss of site integrity.
- **Moderate** – Site disturbance would result in a loss of integrity and a partial loss of the character-defining features and information potential that form the basis of the site's National Register of Historic Places' eligibility. Mitigation is accomplished by a combination of archeological data recovery and in-place preservation.
- **Major** – The disturbances result in a loss of site integrity to the extent that the resource is no longer eligible for listing in the National Register of Historic Places. The site's character-defining features and information potential are lost to the extent that archeological data recovery is the primary form of mitigation.

Duration: Short-term impacts last for the duration of construction-related activities while long-term impacts last beyond the proposed construction activities and are permanent. Generally, impacts to archeological sites are considered long-term impacts.

The impact of coastal and marine environmental degradation from OCS oil- and gas-related activities is expected to minimally affect cultural resources in comparison to other sources of coastal erosion and subsidence. Impacts of routine discharges are localized in time and space, are regulated by USEPA permits, and would have minimal impact. Accidental events that could impact archaeological resources include blowouts and oil or chemical spills and the associated cleanup response activities, and also the loss of debris from an MODU, platform, lay barge, etc. during offshore operations. A noncatastrophic oil spill (even one reasonably foreseeable as a result of a proposed lease sale) occurring and contacting a submerged archaeological resource is unlikely, given that oil released tends to rise quickly to the surface and that the average size of a spill is <1 bbl (refer to **Chapter 3.2.2** of this Supplemental EIS and Chapter 3.2.1 of the 2017-2022 GOM Multisale EIS).

Offshore oil and gas activities resulting from a proposed action could adversely impact an archaeological resource because of incomplete knowledge on the location of these sites in the GOM. The risk of contact to archaeological resources is greater in instances where archaeological survey data are unavailable. Such an event could result in the disturbance or destruction of important archaeological information. Archaeological surveys provide the necessary information to develop avoidance strategies that would reduce the potential for adverse impacts on archaeological resources. As part of the environmental reviews conducted for postlease activities, available information would be evaluated regarding the potential presence of archaeological resources within the proposed action area to determine if additional archaeological resource surveys and mitigation is warranted.

Regardless of in which planning area a proposed lease sale is held, the greatest potential impact to an archaeological resource as a result of a proposed action under any of the action alternatives is site-specific and would result from direct contact between an offshore activity or accidental event and a site. A proposed action's postlease activities, including the drilling of wells and installation of platforms, installation of pipelines, anchoring, and removal of platforms and other structures installed on the seafloor and site clearance activities, as well as accidental events such as loss of debris, may result in **negligible** to **major** impacts to archaeological sites.

Major impacts could potentially occur if the mitigations described above were not applied to postlease activities. With identification, evaluation, and avoidance or mitigation of archeological resources, the incremental contribution of a proposed action is expected to result in **negligible**, long-term cumulative impacts to archeological resources; however, if an archaeological site were to be impacted, impacts may range from **negligible** to **major**. Under Alternative E, the impact-producing factors mentioned above would not take place for that proposed lease sale; therefore, the impacts would be **none**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. A full analysis of archaeological resources can be found in Chapter 4.13 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

For the purposes of this analysis, all alternatives may be assumed to have effectively similar potential impacts to archaeological resources. Therefore, the level of impacts would be the same for Alternatives A, B, C, and D. Under Alternative E, there would be no new activities associated with a proposed lease sale; however, activities associated with past lease sales and non-OCS oil- and gas-related activities would continue.

Incomplete or Unavailable Information

There is incomplete or unavailable information regarding the long-term impacts of oil, dispersant, and/or dispersed oil contamination on, and the location of, archaeological resources in the GOM. There are currently no published studies on the long-term impacts to archaeological resources exposed to oil, dispersant, or dispersed oil contamination. However, considering the low probability of an accidental oil spill contacting an archaeological site as a result of a proposed action, BOEM has determined that the information is not essential to a reasoned choice among alternatives.

Additionally, the locations of all archaeological resources in the GOM cannot be determined because the overall costs of obtaining that information through survey of the entire GOM are exorbitant. This incomplete information may be relevant to adverse impacts because the locations and integrity of many archaeological resources remain unknown. Nevertheless, this incomplete information is not likely to be available within the timeline contemplated in the NEPA analysis of this Supplemental EIS. It would take several years before data confirming the presence (or lack thereof) of archaeological resources, and the status of each, could be investigated, analyzed, and compiled. Archaeological sites within the GOM have the potential to be buried, embedded in, or laying on the seafloor. The seafloor is comprised of highly variable bathymetric and geophysical regimes, which differentially affect the ease and ability to identify, ground truth, and evaluate archaeological sites. This fact, combined with the scope of the acreage within the GOM, results in the aforementioned exorbitant costs and time factors.

BOEM used existing information and reasonably accepted scientific theories on archaeological site potential in the Gulf of Mexico to extrapolate from available information in completing the relevant analysis. In addition, future site-specific, remote-sensing surveys of the seafloor, where required, will be used to identify potential resources within areas of proposed seafloor impact (NTL 2005-G07, "Archaeological Resource Surveys and Reports"). The results of these surveys are reviewed in tandem with credible scientific evidence from previously identified sites, regional sedimentology, and physical oceanography that is relevant to evaluating the adverse impacts on resources that are a part of the human environment. The survey data are analyzed by industry and BOEM's archaeologists prior to the authorization of any new or significant bottom-disturbing impacts and, if necessary, avoidance of potential archaeological resources is prescribed. Archaeological surveys are expected to be effective in identifying resources to allow for mitigation of impacts and protection of the resource during OCS oil- and gas-related activities. A proposed action is not expected to have a reasonably foreseeable significant impact because BOEM's evaluation of such impacts is based upon pre-disturbance and site-specific surveys, the results of which BOEM uses to require substantial avoidance of any potential resource that could be affected by the proposed activity. Therefore, BOEM has determined that the gaps in information on the presence of or status of archaeological resources is not essential to a reasoned choice among alternatives at the lease sale stage.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including JSTOR, the National Technical Information Service's National Technical Reports Library, and ScienceDirect) were examined to assess recent information regarding archaeological resources that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for archaeological resources presented in the 2017-2022 GOM Multisale EIS based on the information presented above. No new information was discovered that would alter the impact conclusion for archaeological resources presented in the 2017-2022 GOM Multisale EIS, and the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.14 HUMAN RESOURCES AND LAND USE

4.14.1 Land Use and Coastal Infrastructure

Summary

BOEM has reexamined the analysis for land use and coastal infrastructure presented in the 2017-2022 GOM Multisale EIS. No new information was discovered that would alter the impact conclusion for land use and coastal infrastructure presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of land use and coastal infrastructure, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.14.1 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Along the Gulf Coast, from the southern tip of Cameron County, Texas, to the Florida Keys, 23 BOEM-defined Economic Impact Areas (EIAs) are identified for the Gulf of Mexico region. The counties and parishes that form the EIAs are listed and the EIAs are visually illustrated in **Figure 4-11**. The EIAs geographically link together not only counties and parishes immediately adjacent to the GOM but also those tied to coastal counties and parishes as parts of functional economic areas. An analysis that encompasses where people live, as well as where they work, permits a more meaningful assessment of the impact of offshore oil and gas activities. The OCS oil- and gas-related activities draw on existing infrastructural, economic, and labor capacity from across the GOM region. BOEM's analysis considers the potential impacts in all 23 EIAs regardless of where a proposed action may take place.

Analysis

For land use and coastal infrastructure, a proposed action would involve all of the Gulf Coast States: Texas; Louisiana; Mississippi; Alabama; and Florida. Particular emphasis is placed on the 133 counties and parishes that constitute the 23 BOEM-identified EIAs and are located in the coastal areas of all five states. This geographic area is broadly diverse in types of land use and distribution of coastal infrastructure related to OCS oil- and gas-related activities. Some counties and parishes are more closely connected to the offshore oil and gas industry than others, such as Harris County, Texas, and Lafourche Parish, Louisiana. Figures 3-9, 3-11, and 3-12 of the 2017-2022 GOM Multisale EIS illustrate the analysis area's key infrastructure.

Impacts to land use and coastal infrastructure may be positive as well as negative. For example, increased economic demand for services provided by infrastructure facilities would lead to more hiring, and this additional employment would further the positive economic trend as new workers spend their wages in the community. The affected environment and analyses supporting these conclusions are discussed below. BOEM has concluded that the selection of Alternative E would result in negligible impacts. Cumulative impacts of current and past activities, however, would continue to occur under Alternative E.

Impact-Level Definitions

- **Beneficial** – Positive impacts in the form of maintaining current employment levels, creating new employment, indirect and induced positive impacts through increased spending, and stimulating local and regional economies.
- **Negligible** – Little or no measureable adverse impact.
- **Minor** – Small-scale measurable adverse impact, temporary in duration and geographically small area (less than county/parish level).
- **Moderate** – Medium-scale measurable adverse impact and may last from a few weeks to 1 year and geographically may affect multiple counties/parishes.
- **Major** – Large-scale measurable or potentially unmeasurable adverse impact, long-lasting (1 year to many years), and may occur over a geographically large regional area.

The impacts of each impact-producing factor for Alternatives A through D are summarized in **Table 4-23** to help the reader quickly identify the level of potential impacts for each impact-producing factor using the impact-level definitions below.

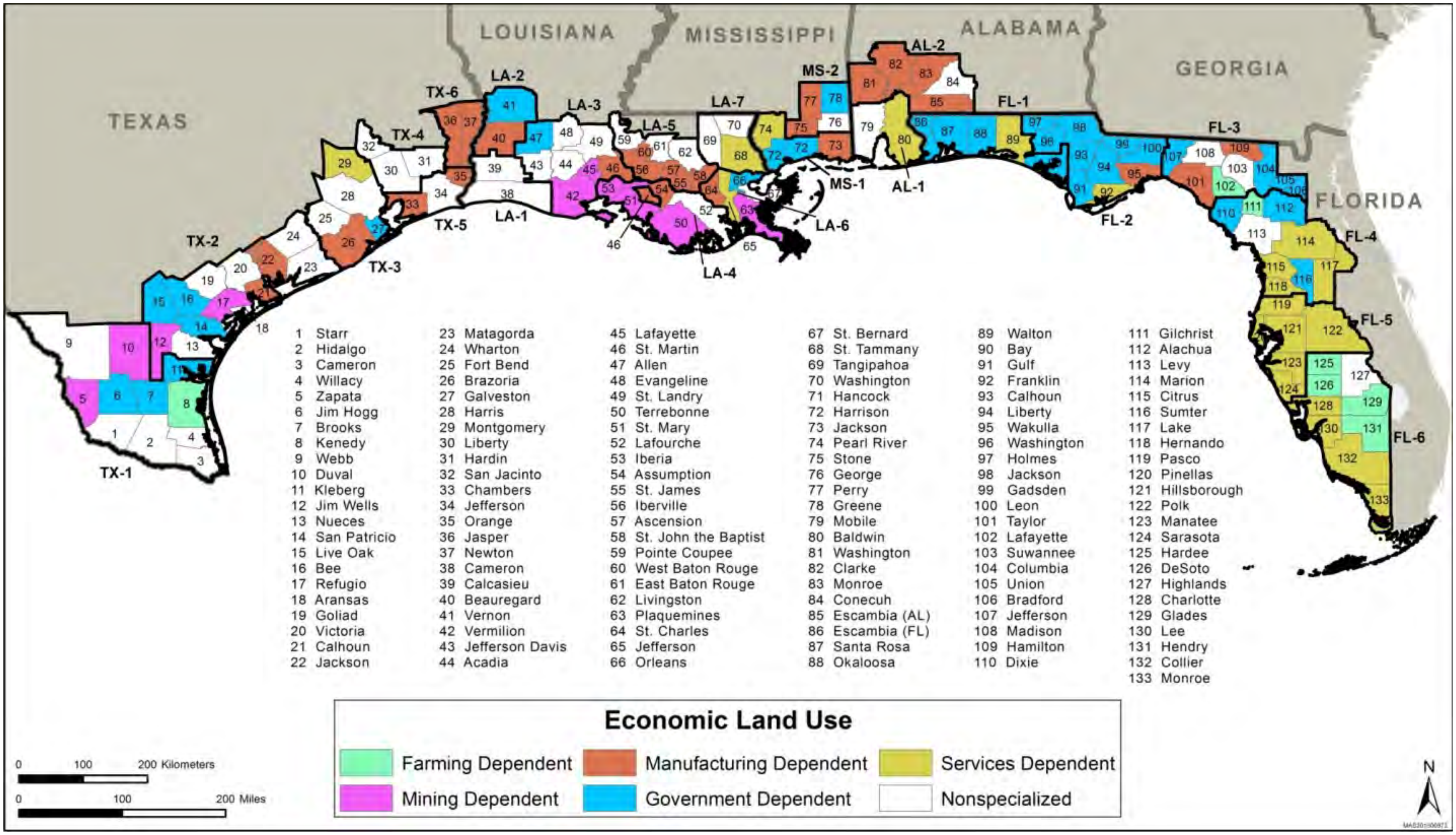


Figure 4-11. Economic Land Use Patterns.

Table 4-23. Land Use and Coastal Infrastructure Impact-Producing Factors That Are Reasonably Foreseeable.

Land Use and Coastal Infrastructure	Magnitude of Potential Impact[1]			
Impact-Producing Factors	Alternative A	Alternative B	Alternative C	Alternative D
Routine Activities				
Changes in the Level of OCS Exploration, Development, and Production Activities	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate
Expansions of Existing Infrastructure	Minor to Moderate	Minor to Moderate	Minor to Moderate	Minor to Moderate
New Infrastructure Facility Construction	Minor to Moderate	Minor to Moderate	Minor to Moderate	Minor to Moderate
Onshore Waste Disposal	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor
Navigation Channel Maintenance Dredging	Negligible to Minor	Negligible to Minor	Negligible to Minor	Negligible to Minor
Accidental Events				
Oil Spills (coastal and offshore)	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate
Chemical/Drilling-Fluid Spills	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate
Spill Response	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate
Vessel Collisions	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate	Negligible to Moderate
Cumulative Impacts				
Incremental Contribution[2]	Minor	Minor	Minor	Minor
OCS Oil and Gas[3]	Beneficial to Moderate			
Non-OCS Oil and Gas[4]	Beneficial to Major			

[1] The analysis supporting these conclusions is discussed in detail in the "Environmental Consequences" section in Chapter 4.14.1 of the 2017-2022 GOM Multisale EIS.

[2] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) as a result of a single proposed lease sale in the 2017-2022 Five-Year Program.

[3] This includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, proposed, and future lease sales.

[4] This includes other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as a proposed action, but they are not related to the OCS Oil and Gas Program.

A current snapshot of land use and coastal infrastructure in the GOM reveals a diverse social and economic landscape, with the oil and gas industry playing a substantially larger role in some states (i.e., Texas and Louisiana) than in the rest of the GOM. The oil and gas industry has developed across the region over many decades and is intimately intertwined with its socioeconomic structure. This complex structure involves both offshore (i.e., Federal OCS and State waters) and onshore (i.e., private land, and State and Federal onshore lands) exploration, development, and production activities, complicating the environmental impact analysis because it is very difficult, if not impossible, to separate the impacts of Federal OCS oil- and gas-related activities from those of oil and gas activities in State waters and onshore, or foreign imports.

Oil and gas exploration, production, and development activities on the OCS are supported by an expansive onshore network of coastal infrastructure that includes large and small companies providing a wealth of services from construction facilities, service bases, and waste disposal facilities to crew, supply, and product transportation, as well as processing facilities. **Chapter 3.1.2.2** summarizes coastal infrastructure scenario projections, and Chapter 3.1.5.3 of the 2017-2022 GOM Multisale EIS describes onshore waste disposal. More detail on coastal infrastructure can be found in Chapter 3.1.7 of the 2017-2022 GOM Multisale EIS. A description of the affected environment covers land use in the area and different infrastructure categories that support thousands of jobs. These jobs represent direct, indirect, and induced economic impacts that ripple through the Gulf Coast economy. As a long-standing part of the regional economy that developed over the past several decades, the coastal infrastructure network is quite mature in the Gulf of Mexico region.

Because OCS oil- and gas-related activities are supported by a long-lived, expansive onshore network of coastal infrastructure that includes hundreds of large and small companies, routine operations associated with a proposed action are not expected to produce any major impacts to land use and coastal infrastructure. Potential impacts from routine operations could range from **negligible** to **moderate**, depending on the location, scale, and type of activity. The impacts of reasonably foreseeable accidental events such as oil spills, chemical and drilling fluid spills, and vessel collisions are not likely to last long enough to adversely affect overall land use or coastal infrastructure in the analysis area and would therefore be **negligible** to **moderate**. For a detailed analysis of a high-impact, low-probability catastrophic oil spill, refer to the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b).

The cumulative analysis includes impacts that could result from a proposed lease sale combined with baseline conditions, all past, present, and future Federal OCS oil- and gas-related lease sales and activities, as well as all past, present, and reasonably foreseeable future actions that are external to Federal OCS oil- and gas-related activities. Activities relating to all past, present, and future OCS oil- and gas-related activities are expected to minimally affect the current land use of the analysis area because most subareas have strong industrial bases and designated industrial parks. Non-OCS oil- and gas-related factors contribute substantially to the cumulative impacts on land use and coastal infrastructure, while only a **minor** incremental contribution is expected for a proposed action.

Comparison of Alternatives

For any of the action alternatives (i.e., Alternatives A, B, C, and D), the cumulative impacts on land use and coastal infrastructure could range from **beneficial** to **moderate** for OCS oil- and gas-related activities and **beneficial** to **major** for non-OCS oil- and gas-related activities, depending on the specifics of each situation, whether the impacts are measurable, how long the impacts would last, and the size of the affected geographic area as defined in Chapter 4.14.1 of the 2017-2022 GOM Multisale EIS. Alternative E would result in no lease sale and, thus, the direct impacts as a result of a proposed lease sale woud be **none**, and there would be no incremental contribution of impacts to land use and coastal infrastructure beyond a temporary negative economic impact for the oil and gas industry and coastal states, such as Louisiana, that are more dependent on oil and gas revenues. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative.

Incomplete or Unavailable Information

BOEM has identified incomplete information regarding the potential impacts of coastal land loss on land use and coastal infrastructure. This incomplete information may be relevant to adverse impacts because it is not completely known how current subsidence and erosion is affecting industry or what plans industry is making to mitigate current or future impacts. Because there are hundreds of large and small property-owning businesses spread across the coastal zone, which directly and indirectly support the offshore petroleum industry, the identity of these properties and the possibilities of losses due to subsidence, sea-level rise, and erosion cannot be quantified at this time.

BOEM has employed reasonably accepted scientific methodologies to extrapolate from existing information on dredged material and other approaches used to mitigate for land loss in completing its analysis and formulating the conclusions presented here. For a more detailed discussion on deltaic land loss, refer to **Chapter 4.3.2** ("Coastal Barrier Beaches and Associated Dunes"). In the case of coastal ports, for example, dredged material from navigation slips are used to fill in property and mitigation habitat areas for wildlife and to act as a barrier to protect ports from storm surges (Volz, 2013). This example shows that, although BOEM does not possess a complete understanding of what industrial infrastructure improvements may occur, such as mitigation for land loss, industry would most likely mitigate as necessary to protect existing and growing infrastructure. With each passing year, the pressure increases to take action and protect critical oil and gas infrastructure (Traywick, 2016). Like any industrial infrastructure improvements, future adaptations would occur on an as-needed basis or as new technologies become available. Given that coastal infrastructure will continue to be subject to the impacts of coastal land loss and routine tropical storm activity, there will also continue to be considerable motivation to protect existing infrastructure. Therefore, BOEM has determined that the information is not essential to a reasoned choice among alternatives. BOEM continues to monitor the industry and its infrastructure footprint over time to document short- and long-term impacts of continued land loss.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including USDHS, Federal Emergency Management Agency; USDOC, Bureau of the Census; USDOC, NOAA; USDOE, Energy Information Administration; USDOT, Maritime Administration; USDOI, FWS; RestoreTheGulf.gov website; USEPA; Louisiana Department of Environmental Quality; Louisiana Recovery Authority; Louisiana Office of Community Development; Mississippi Department of Environmental Quality; Alabama Department of Environmental Management; State of Florida Department of Environmental Protection; recently published journal articles, and trade publications such as The Greater Lafourche Port Commission, LA1 Coalition, The Oil Drum, Rigzone, *Oil and Gas Journal*, *Offshore* Magazine, Reuters, TOLLROADS News, and *The Energy Journal*) were examined to assess recent information regarding land use and coastal infrastructure that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for land use and coastal infrastructure presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on land use and coastal infrastructure has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for land use and coastal infrastructure presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.14.2 Economic Factors

Summary

BOEM has reexamined the analysis for economic factors presented in the 2017-2022 GOM Multisale EIS based on the additional information presented below. No new information was discovered that would alter the impact conclusion for economic factors presented in the 2017-2022 GOM Multisale EIS. The analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of economic factors, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.14.2 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS.

Introduction

Economic factors are factors that explain and quantify the human behaviors that determine the positive and negative impacts from the alternatives. Chapter 4.14.2.1 of the 2012-2022 GOM

Multisale EIS provides detailed economic and demographic data for Gulf of Mexico EIAs, provides background research regarding the offshore oil and gas industry, and presents data from the Office of Natural Resources' revenue regarding sales volumes, sales values, and revenues received from offshore oil and gas activities.

Analysis

This chapter discusses the routine activities, accidental events, and cumulative impacts to economic factors that would arise from the alternatives. Many of the economic impacts of the alternatives would be beneficial, and these impacts are stated in terms of standard measures of economic activity. The negative impacts are measured in terms of the severity, duration, and geographical extent of impacts. Long-term impacts are those lasting more than 1 year. Extensive impacts are those that affect numerous economic impact areas. Severe impacts cause sizeable impacts to economic activity in levels or relative to the size of an economic impact area.

Impact-Level Definitions

In this chapter the impact levels are defined in terms of the intensity, duration, and geographical extent of the impacts to the human uses of economic factors along the Gulf Coast.

- **Beneficial** – Positive impacts stated in levels and percentages of employment (number of jobs), labor income (wages, benefits, and sole-proprietor income), and/or value-added (contribution to gross regional product).
- **Negligible** – Little or no detectable adverse impact.
- **Minor** – Adverse impacts are detectable but less than severe.
- **Moderate** – Adverse impacts are severe but are short-term and/or not extensive.
- **Major** – Adverse impacts are long-term (more than 1 year), extensive, and severe.

A proposed action would lead to **beneficial** impacts arising from industry expenditures, government revenues, corporate profits, and other market impacts. Some of these impacts would be concentrated along the Gulf Coast, while others would be widely distributed. A proposed action could also lead to negative economic impacts (**negligible** to **minor**) arising from accidental events and disruptions to other industries. There would be some differences in economic impacts among the alternatives, corresponding to the differences in the scales and distributions of likely activities. Chapter 4.14.2 of the 2017-2022 GOM Multisale EIS presents detailed estimates of the economic impacts of the alternatives. A full analysis of economic factors can be found in Chapter 4.14.2 of the 2017-2022 GOM Multisale EIS.

Comparison of Alternatives

The alternatives should be viewed in light of the OCS Program, as well the numerous forces that can affect energy markets and the overall economy. Most of the incremental economic impacts of a proposed action are forecast to be **beneficial**, although there would be some **minor** adverse impacts that may occur as a result of accidental events. The exact impacts will be roughly proportional to the amount of resulting oil and gas industry activity that occurs as a result of a proposed action. While there are some differences in the amount of activities associated with the alternatives, many of the impacts associated with the alternatives are similar because the types of activities that occur are similar and the differences are not large enough to change the range of impact conclusions. Alternative E, the cancellation of a proposed lease sale, would negatively impact firms and employees that depend on recurring leases; therefore, the impacts of Alternative E would be **negligible** to **minor**, with some partially offsetting **beneficial** impacts. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative.

Incomplete or Unavailable Information

Even after evaluating the information above, there is still incomplete or unavailable information. This information primarily relates to the onshore geographic distributions of economic impacts arising from the OCS Program, which would allow BOEM to better estimate the impacts from routine activities, accidental events, and cumulative impacts. This information is difficult to obtain since most data sources do not adequately differentiate between onshore and offshore oil and gas activities. In addition, standard data sources do not trace revenue and corporate profit streams to ultimate expenditures. BOEM used reasonably accepted scientific methodologies to extrapolate from existing information in completing the relevant analysis and formulating the conclusions presented here. For example, BOEM used the model MAG-PLAN (MMS Alaska-GOM Model Using IMPLAN) to estimate the impacts of the alternatives and OCS Program. In addition, the economic impacts arising from the OCS Program are generally positive, not adverse. Therefore, BOEM has determined that the incomplete or unavailable information, while relevant, is not essential to a reasoned choice among alternatives.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various sources (including Internet searches regarding economic developments) were examined to assess recent information regarding economic factors that may be pertinent to a proposed action. Woods and Poole Economics, Inc. (2017) is an annual update of forecasts of various economic and demographic variables through 2050. This source provides information regarding the affected environment for economic factors, as well as information regarding cumulative impacts. **Table 4-24** presents Woods and Poole’s forecasted growth rates of population, employment, gross regional product, and labor income from 2015 through 2050 in BOEM’s Economic Impact Areas, which are defined in Figure 4-29 of the 2017-2022 GOM Multisale EIS. The fastest employment growth is forecasted (in descending order) in TX-1, TX-3, FL-6, and FL-4; the slowest employment growth is forecast (in ascending order of growth rates) in AL-2, LA-6, TX-5, and MS-1. Woods and Poole, Inc. (2017) does not change the impact conclusions presented in the 2017-2022 GOM Multisale EIS because the forecasted growth rates have not substantially changed since the prior version of the data.

Table 4-24. Forecasted Average Annual Growth in Population, Employment, Gross Regional Product from 2015 through 2050.

Economic Impact Area	Population	Employment	Gross Regional Product	Labor Income
AL-1	0.97%	1.25%	1.92%	1.89%
AL-2	-0.03%	0.50%	1.33%	1.24%
FL-1	1.06%	1.33%	1.87%	2.01%
FL-2	0.86%	1.13%	1.35%	1.77%
FL-3	0.87%	1.04%	1.53%	1.59%
FL-4	1.62%	1.64%	2.29%	2.38%
FL-5	1.19%	1.36%	2.14%	2.24%
FL-6	1.58%	1.70%	2.36%	2.54%
LA-1	0.48%	0.91%	1.57%	1.49%
LA-2	0.56%	0.97%	1.08%	1.74%
LA-3	0.73%	1.24%	2.05%	2.16%
LA-4	0.50%	1.03%	1.65%	1.93%
LA-5	1.16%	1.34%	2.02%	1.96%
LA-6	0.03%	0.65%	1.43%	1.43%
LA-7	1.10%	1.29%	2.03%	1.80%
MS-1	0.46%	0.84%	1.30%	1.50%
MS-2	0.75%	0.92%	1.57%	1.61%
TX-1	2.06%	2.23%	3.01%	3.07%
TX-2	0.49%	0.94%	1.65%	1.75%
TX-3	1.69%	1.78%	2.66%	2.68%
TX-4	1.04%	1.18%	1.64%	1.99%
TX-5	0.29%	0.77%	1.43%	1.44%
TX-6	0.57%	1.00%	1.37%	1.56%

Source: Woods & Poole Economics, Inc., 2017.

Some new reports regarding future energy activities have also been released. The Energy Information Administration (USDOE, Energy Information Administration, 2017) has released its *Annual Energy Outlook 2017*. This report provides modeled scenarios of overall energy markets and describes various drivers of future energy production and consumption. In addition, this source now provides forecasts through 2050, 10 years longer than the prior report. The Louisiana State University's Center for Energy Studies (2017) provides additional information regarding issues facing the Gulf of Mexico region's energy economy. This report provides forecasts regarding energy prices, capital expenditures, and overall energy employment. However, these two reports do not change BOEM's impact conclusions from the 2017-2022 GOM Multisale EIS because the forecasts were roughly consistent with BOEM's expectations. Finally, Kaplan et al. (2016) describes the calculations within MAG-PLAN GOM 2016, which was used in the 2017-2022 GOM Multisale EIS. However, this report does not change the economic estimates presented in the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for economic factors presented in the 2017-2022 GOM Multisale EIS. No new information was discovered that would alter the impact conclusion for economic factors presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.14.3 Social Factors (Including Environmental Justice)

Summary

BOEM has reexamined the analysis for social factors presented in the 2017-2022 GOM Multisale EIS. No new information was discovered that would alter the impact conclusion for social factors presented in the 2017-2022 GOM Multisale EIS. Further, the analysis and potential impacts detailed in that document still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

A detailed description of social factors, along with the full analyses of the potential impacts of routine activities, accidental events, and cumulative impacts associated with a proposed action are presented in Chapter 4.14.3 of the 2017-2022 GOM Multisale EIS. The following information is a summary of the resource description and impact analysis incorporated from the 2017-2022 GOM Multisale EIS. An environmental justice determination follows in **Chapter 4.14.3.1**.

Introduction

The affected environment that comprises the baseline for the social factors' environmental impact analysis is geographically distributed across 23 BOEM-identified EIAs in all five Gulf Coast States. **Figure 4-12** shows the aggregation of 133 counties and parishes that comprise the EIAs. **Chapter 4.14.2** ("Economic Factors") discusses the methodology behind the development of the EIAs and employment in the analysis area.

Analysis

The petroleum industry as a whole in the Gulf of Mexico region has matured over several decades and is well-developed, expansive, extensive, and deeply intertwined in the regional communities and economies of the five coastal states, i.e., Texas, Louisiana, Mississippi, Alabama, and Florida. An inherent complication in conducting an impact analysis of OCS oil- and gas-related activities lies in the fact that the industry involves exploration, development, and production located on private and public lands onshore, State waters offshore, and on the Federal OCS. This long-lived, well-developed, and extensive industry functions within a much larger context, a socioeconomic framework that weaves through the region in a complex, inter-connected grid-like manner. Nothing occurs as an isolated event, but rather results from and simultaneously triggers other events, all of which are experienced at varying degrees of negative or positive impact. For example, when oil prices drop and then gasoline prices drop, this positively impacts individuals and businesses who buy fuel. When oil prices remain low for many months, negative impacts begin to appear. Oil and gas companies start reducing the number of employees to cut operational costs. Laid-off employees no longer have income to make purchases and the businesses where workers would normally spend their money began to suffer and, when necessary, people began moving out of the area to find other work, leading to a negative impact on the housing market, depressing real estate prices as the number of units available for rent or sale outgrows the demand. A negative impact for some (i.e., sellers and landlords) becomes a positive impact for others (i.e., buyers and renters). This is just one example of an event leading to dual ripple impacts (negative and positive) through communities and illustrates the complexity of the socioeconomic framework.

Within this context, and in the cumulative analysis, a single proposed lease sale is one piece of a vastly complex social and economic structure. A single proposed lease sale's main impact on communities would be to contribute to the maintenance of current employment levels; not to cause a notable increase of people to move into the region; not to cause new roads, schools, or hospitals to be built; and not to cause large public works improvements. A single proposed lease sale would help to maintain what decades of economic development have built, the complex Gulf of Mexico region that exists today.

While this chapter is titled "social factors," the resource discussed here is essentially human beings. The list of potential impact-producing factors is, in a sense, nearly limitless because the industry involves people at all levels; it simultaneously affects and is affected by people, their communities, and their daily lives. Most of the impacts to people are positive, e.g., in the form of direct employment in the industry, indirect employment in the extensive support sectors, and employees' spent wages and tax revenues that support community businesses and local governments.

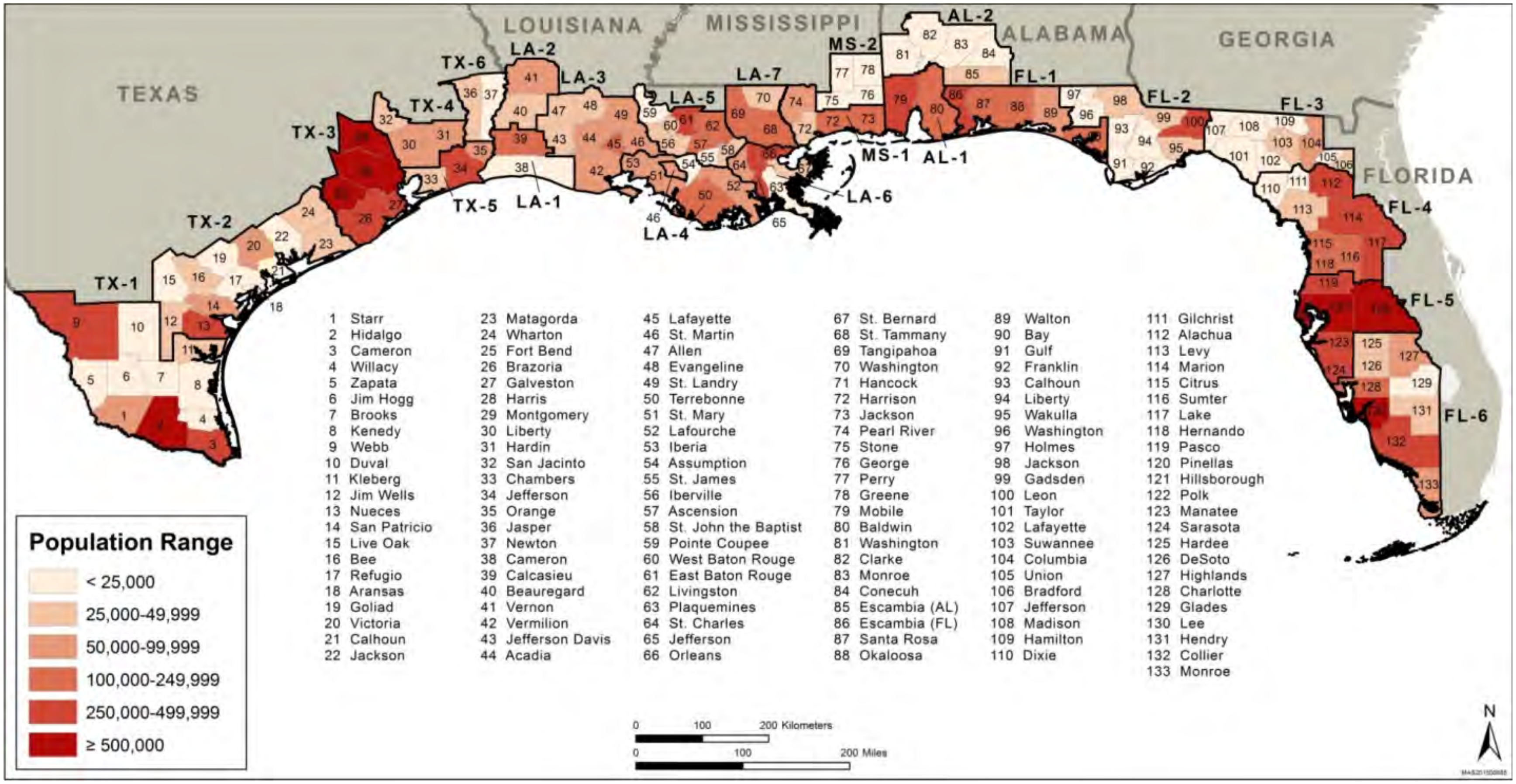


Figure 4-12. Population of BOEM's Economic Impact Areas in the Gulf of Mexico.

Impact-Level Definitions

Impacts to people and communities may be positive as well as negative. For example, increased economic demand would lead to more hiring, and this additional employment would further the positive economic trend as new workers spend their wages in the community. The definitions below define the impact levels for this analysis.

- **Beneficial** – Positive impacts such as any of the following: measurable beneficial effects such as maintaining current employment levels; creating new employment; and indirect and induced positive impacts through increased spending that stimules local and regional economies.
- **Negligible** – Little or no measureable adverse impact.
- **Minor** – Small-scale measurable adverse impact, temporary in duration, and geographically small area (less than county/parish level).
- **Moderate** – Medium-scale measurable adverse impact, may last from a few weeks to 1 year, and geographically may affect multiple counties/parishes.
- **Major** – Large-scale measurable or potentially unmeasurable adverse impact, long lasting (1 year to many years), and may occur over a geographically large regional area.

A regionwide proposed lease sale is the preferred alternative and, just like planning area specific lease sales, involves all of the Gulf Coast States, i.e., Texas, Louisiana, Mississippi, Alabama, and Florida because the onshore effects operate independently of the boundaries of offshore planning areas. Particular emphasis is placed on the 133 counties and parishes that constitute the 23 BOEM-identified EIAs and that are located in the coastal areas of all five states. **Figure 4-11** shows the aggregation of counties and parishes into the EIAs used for BOEM's socioeconomic analysis. This geographic area possesses a culturally and racially diverse population. Some counties and parishes are more closely connected to the offshore oil and gas industry than others, particularly Harris County, Texas, and Lafourche Parish, Louisiana.

Analysis of the various alternatives considers impact-producing factors within a distinct framework that includes frequency, duration, and geographic extent. Frequency (i.e., rare, intermittent, and continuous) refers to how often the impact-producing factor occurs over the entire analysis period of 50 years for routine activities and accidental events and for an analysis period of 70 years for cumulative impacts. Duration (i.e., low, medium, and high) refers to how long the impact-producing factor lasts (i.e., from less than a year to many years). Geographic extent refers to which areas are affected and, depending on the impact-producing factor, the size of an affected area.

Potential social impacts resulting from a proposed action would occur within the larger socioeconomic context of the GOM region. The affected environment of the analysis area is quite large geographically and in terms of population (133 counties and parishes with over 22.7 million residents). The impacts from routine activities related to a proposed action are expected to be **negligible** to **moderate**, widely distributed, and to have little impact because of the existing extensive and widespread support system for the petroleum industry and its associated labor force. Outside of a low-probability catastrophic oil spill, which is not reasonably foreseeable and not part of a proposed action, any potential accidental events are not likely to be of sufficient scale or duration to have adverse and disproportionate long-term impacts for people and communities in the analysis area and would therefore range from **negligible** to **moderate**. In the cumulative analysis, impacts from OCS oil- and gas-related activities would range from **beneficial** to **moderate**. Non-OCS oil- and gas-related factors, which include all human activities, natural events, and processes, actually contribute more to cumulative impacts than do factors related to OCS oil- and gas-related activities alone and result in **beneficial** to **major** impacts. The incremental contribution of a proposed action to cumulative impacts would be **minor**. Alternative E would result in no lease sale and, thus, the overall incremental impacts as a result of Alternative E would be **none**. Cumulative impacts of current and past activities (i.e., OCS oil- and gas-related and non-OCS oil- and gas-related), however, would continue to occur under this alternative. For a detailed analysis of a high-impact, low-probability catastrophic oil spill, refer to the *Catastrophic Spill Event Analysis* white paper (USDOI, BOEM, 2017b).

Coastal populations experience cumulative impacts that include all human activities and natural processes and events. The cumulative analysis includes impacts that could result from a proposed lease sale combined with baseline conditions, all past, present, and future Federal OCS oil- and gas-related lease sales and activities, as well as all past, present, and reasonably foreseeable future actions that are external to Federal OCS oil- and gas-related activities. Within this divided analytical framework of OCS oil- and gas-related and non-OCS oil- and gas-related impacts, the largest quantity of impact-producing factors for coastal populations occur as non-OCS oil- and gas-related impacts because OCS oil- and gas-related activities form a very small part of the greater, complex socioeconomic structure in the GOM. The incremental contribution to cumulative impacts of a proposed action, i.e., a single regionwide lease sale, would be **minor** for communities and people in the Gulf Coast region.

Comparison of Alternatives

The impacts for social factors would be similar for Alternatives A, B, C, and D; however, the level of impacts would be directly related to the level of OCS oil- and gas-related activity in the Gulf of Mexico. Alternative B would produce proportionately smaller OCS oil- and gas-related activity than Alternative A, and Alternative C would result in less OCS oil- and gas-related activity than Alternative A or B. The impacts of Alternative D could be less than Alternative A, B, or C, but this difference would likely be indiscernible. Under Alternative E, there would be no new activities associated with a proposed lease sale; however, activities associated with past lease sales and non-OCS oil- and gas-related activities would continue.

Incomplete or Unavailable Information

BOEM has identified unavailable information that is relevant to people and communities regarding the impacts of the *Deepwater Horizon* explosion, oil spill, and response. This information cannot be obtained because long-term health impact studies, subsistence studies, and the NRDA restoration process are ongoing, and data from these efforts would be unavailable and unobtainable for some time. In order to fill this data gap, BOEM has used existing information and reasonably accepted scientific methodologies to extrapolate from available information in completing the relevant analysis, including information that has been released after the *Deepwater Horizon* explosion, oil spill, and response and studies of past oil spills, which indicate that a low-probability, catastrophic oil spill, which is not part of a proposed lease sale and not likely expected to occur, may have adverse impacts on residents in GOM coastal communities. Research into possible long-term health impacts of the *Deepwater Horizon* explosion, oil spill, and response continues (National Institute of Environmental Health Science, 2014; National Center for Disease Preparedness, 2013 and 2014; Substance Abuse and Mental Health Services Administration and Centers for Disease Control and Prevention, 2013). Because long-term health impacts to coastal populations are unknown, this information may be relevant to the evaluation of impacts from the *Deepwater Horizon* explosion, oil spill, and response; therefore, BOEM would continue to seek additional information as it becomes available and bases the previous analysis on the best information currently available. Although long-term health impacts to people and communities may be relevant to this analysis, BOEM has determined that the unavailable information is not essential to a reasoned choice among alternatives based on the information discussed above.

New Information Available Since Publication of the 2017-2022 GOM Multisale EIS

Various printed and Internet sources (including peer-reviewed research publications, U.S. Department of Health and Human Services, National Institutes of Health; USEPA; USDOC, Bureau of the Census and Bureau of Labor Statistics; USDHS, Federal Emergency Management Agency; USDOE, Energy Information Administration; RestoreTheGulf.gov website; *Deepwater Horizon* Oil Spill Portal; Louisiana Department of Environmental Quality; Mississippi Department of Environmental Quality; Alabama Department of Environmental Management; State of Florida Department of Environmental Protection; Louisiana Recovery Authority; Louisiana Office of Community Development; The Greater Lafourche Port Commission; LA1 Coalition; Reuters; Rigzone; and *Oil and Gas Journal*) were examined to assess recent information regarding social factors that may be pertinent to a proposed action. No new information that would add to the analyses or change the conclusions was discovered since publication of the 2017-2022 GOM Multisale EIS.

Conclusion

BOEM has reexamined the analysis for social factors presented in the 2017-2022 GOM Multisale EIS, with the understanding that no new information on social factors has been published since the publication of the 2017-2022 GOM Multisale EIS. Therefore, no new information was discovered that would alter the impact conclusion for social factors presented in that document, and the analysis and potential impacts detailed in the 2017-2022 GOM Multisale EIS still apply for the remaining proposed GOM lease sales in the 2017-2022 Five-Year Program.

4.14.3.1 Environmental Justice Determination

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs Federal agencies to make a determination as to whether their actions have disproportionate environmental impacts on minority or low-income people. These environmental impacts encompass human health, and social and economic consequences. In 1997, President Clinton issued Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," directing Federal agencies to identify and assess environmental health risks and safety risks of its policies, programs, and activities that may disproportionately affect children. In accordance with NEPA and the Executive Orders, BOEM provides opportunities for community input during the NEPA process.

One example of BOEM's efforts to foster an inclusive and transparent public process are the meetings that BOEM has held with the Vietnamese fisherfolk community in Mississippi at the Vietnamese fisherfolk community's request. BOEM provided Vietnamese translations of relevant portions of the 2017-2022 GOM Multisale EIS to maximize participation. Additional avenues of public outreach employed by BOEM include specific types of notices that are (1) mailed to public libraries; interest groups; industry; ports and docks; local, State, and Federal agencies; and federally recognized Indian Tribes; (2) published in local newspapers; (3) posted on the Internet; and (4) published in the *Federal Register*. The formal scoping process is initiated by the publication of a Notice of Intent, and public scoping meetings are held in several geographically separate cities to allow the public to submit comments and to identify all stakeholders' concerns. All public comments and responses to comments are published in the Draft and Final Supplemental EISs. A detailed discussion of the complete scoping process can be found in **Chapter 5.6.2.1**. A summary of the scoping comments for this Supplemental EIS can be found in **Chapter 5.6.2.2**.

In accordance with 40 CFR §§ 1508.7 and 1508.8, BOEM has considered potential cumulative, direct, and indirect impacts to minority and low-income populations in the analysis area. Furthermore, in reaching this considered environmental justice determination, BOEM utilized guidance from the Council on Environmental Quality (CEQ, 1997), the U.S. Environmental Protection Agency (USEPA, 1998) and the Federal Interagency Working Group on Environmental Justice & NEPA Committee (2016). The OCS lease sales occur in Federal waters 3 nmi (3.5 mi; 5.6 km) or 9 nmi (10.4 mi; 16.7 km) from shore. Thus, the permitted activities of petroleum exploration, extraction, and production that occur on these leaseholds are distant from human habitation, and these activities would not have any direct impacts on low-income and minority populations. State offshore oil and gas leasing occurs in waters closer to land where petroleum-related activities are generally viewed as having a greater potential for directly impacting coastal communities. Indirect impacts to minority and low-income populations could occur onshore, and would result from the operations of the extensive infrastructure system that supports all onshore and offshore oil and gas activities. This downstream infrastructure moves hydrocarbon product to market and includes gas processing facilities, petrochemical plants, transportation corridors, petroleum bulk storage facilities, and gas and petroleum pipelines. These facilities comprise a mature, widespread and concentrated infrastructure system (refer to **Chapter 4.14.1**). Much infrastructure is located in coastal Louisiana and Texas, and to a lesser extent in Mississippi's Jackson County and Alabama's Mobile County. While many fabrication and supply facilities are concentrated around coastal ports, downstream processing is concentrated in industrial corridors farther inland (Dismukes, 2011b; Kaplan et al., 2011). The onshore downstream infrastructure exists to support all oil- and gas-related activities (i.e., onshore, offshore, and imported product), and the proportion of Federal OCS contribution to downstream infrastructure use has not yet and, most likely, may never be possible to determine as it is dependent on highly unpredictable market demands and prices.

Potential environmental justice impacts that may arise from downstream support activities cannot be influenced by BOEM's decisionmaking because BOEM has no regulatory authority over any onshore activities, including their location. Many other Federal and State agencies regulate onshore oil and gas infrastructure. Therefore, BOEM has determined that a proposed lease sale would not adversely affect minority and low-income populations.

4.15 UNAVOIDABLE ADVERSE IMPACTS OF A PROPOSED ACTION

Unavoidable adverse impacts associated with a proposed action are expected to be primarily short term and localized in nature and are summarized below. Adverse impacts from low-probability catastrophic events, which are not part of a proposed action and not likely expected to occur, could be of longer duration and extend beyond the local area. All OCS oil- and gas-related activities involve temporary and exclusive use of relatively small areas of the OCS over the lifetimes of specific projects. Lifetimes for these activities can be days, as in the case of seismic surveys, or decades, as in the case of a production structure or platform. No activities in the OCS Program involve the permanent or temporary use or "taking" of large areas of the OCS. Cumulatively, however, a multitude of individual projects results in a major use of OCS space.

Air Quality: Unavoidable short-term impacts on air quality could occur after large oil spills because of evaporation and volatilization of the lighter components of crude oil, combustion from surface burning, and aerial spraying of dispersant chemicals. Mitigation of long-term impacts from offshore engine combustion during routine operations would be accomplished through existing regulations and the development of new control emission technology. Short-term impacts from spill events could occur and are likely to be aggravated or mitigated by the time of year the spills take place.

Water Quality: Routine offshore operations would cause some unavoidable adverse impacts to varying degrees on the quality of the surrounding water. Drilling, construction, overboard discharges of drilling mud and cuttings, and pipelaying activities would cause an increase in the turbidity of the affected waters for the duration of the activity periods. This, however, would only affect water in the immediate vicinity of the construction activity or in the vicinity of offshore structures, rigs, and platforms. Impacts from these activities would be reduced through existing NPDES regulations. Accidental spills from platforms and the discharge of produced waters could result in increases of hydrocarbon levels and trace metal concentrations in the water column in the vicinity of the platforms. Spilled oil from a tanker collision would affect the water surface in combination with dispersant chemicals used during spill response. A subsurface spill would subject the surface, water column, and near-bottom environment to spilled oil and gas released from solution, dispersant chemicals, or emulsions of dispersed oil droplets and dispersant chemicals.

Unavoidable impacts to onshore water quality would occur as a result of chronic point- and nonpoint-source discharges such as runoff and effluent discharges from existing onshore infrastructure used in support of lease sale activities. Vessel traffic contributes to the degradation of water quality by chronic low-quantity oil leakage, treated sanitary and domestic waste, bilge water, and contaminants known to exist in ship paints. Regulatory requirements of the State and Federal water authorities and some local jurisdictions would be applicable to point-source discharges from support facilities such as refineries and marine terminals.

Coastal Habitats: If an oil spill contacts beaches or barrier islands, the removal of beach sand during cleanup activities could result in adverse impacts if the sand is not replaced, and a beach could experience several years of small surface residue balls (also called tarballs) washing ashore over time, causing an aesthetic impact. Sand borrowing on the OCS for coastal restorations involves the taking of a quantity of sand from the OCS and depositing it onshore, essentially moving small products of the deltaic system to another location. If sand is left where it is, it would eventually be lost to the deltaic system by redeposition or burial by younger sediments; if transported onshore, it would be lost to burial and submergence caused by subsidence and sea-level rise.

If an oil spill contacts coastal wetlands, adverse impacts could be high in localized areas. In more heavily oiled areas, wetland vegetation could experience suppressed productivity for several years; in more lightly oiled areas, wetland vegetation could experience die-back for one season. Epibionts (organisms growing) on wetland vegetation and grasses in the tidal zone could be killed, and the productivity of tidal marshes for the vertebrates and invertebrates that use them to spawn and develop could be impaired. Much of the wetland vegetation would recover over time, but some wetland areas could be converted to open water. Some unavoidable impacts could occur during pipeline and other related coastal construction, but regulations are in place to avoid and minimize these impacts to the maximum extent practicable. Unavoidable impacts resulting from dredging, wake erosion, and other secondary impacts related to channel use and maintenance would occur as a result of a proposed action.

Offshore Biological Habitats: Unavoidable adverse impacts would take place if an oil spill occurred and contacted offshore biological habitats, such as *Sargassum* at the surface; fish, turtles, and marine mammals in the water column; or benthic habitats on the bottom. There could be some adverse impacts on organisms contacted by oil, dispersant chemicals, or emulsions of dispersed oil droplets and dispersant chemicals that, at this time, are not completely understood, particularly in subsurface environments.

Fish and Invertebrate Resources: Unavoidable adverse impacts from routine operations would take place from discharges from vessels and platforms. These would be minor given the available area for fish habitat. If a large oil spill occurs, the oil, dispersant chemicals, or emulsions of oil droplets and dispersant chemicals could temporarily displace mobile fish species on a population or local scale. There could also be impacts on prey and sublethal impacts on fish.

Birds: Unavoidable adverse impacts from routine operations on birds could result from noise, helicopter and OCS service-vessel traffic, coastal facility and platform lighting, and floating trash and debris. Trans-Gulf migrating species could be affected by lighted platforms, helicopter and vessel traffic, and floating trash and debris. If a large oil spill occurs and contacts bird habitats, some birds could experience lethal and sublethal impacts from oiling, and birds feeding or resting in the water could be oiled and die. Birds coming into contact with oil may migrate more deeply into marsh habitats, out of reach from spill responders seeking to count them or collect them for rehabilitation. Oil spills and oil-spill cleanup activities could also affect the food species for bird species. Depending on the time of year, large oil spills could decrease the nesting success of species that concentrate nests in coastal environments due to direct impacts of the spill and also disruption from oil-spill cleanup activities.

Threatened and Endangered Species: Because a proposed lease sale does not in and of itself make any irreversible or irretrievable commitment of resources that would foreclose the development or implementation of any reasonable and prudent measures to comply with the Endangered Species Act, BOEM may proceed with publication of this Supplemental EIS and finalize a decision among these alternatives even if consultation is not complete, as described in Section 7(d) of the ESA (also refer to **Chapter 5.2**). Irreversible loss of individuals that are ESA-listed species may occur after a large oil spill from the acute impact of being oiled or the chronic impact of oil having eliminated, reduced, or rendered suboptimal the food species upon which they were dependent.

Marine Mammals: Unavoidable adverse impacts to marine mammals would be those that also affect endangered and threatened marine mammal species. Routine operation impacts (such as seismic surveys, water quality and habitat degradation, helicopter disturbance, vessel collision, and discarded trash and debris) would be negligible or minor to a population, but they could be lethal to individuals as in the case of a vessel collision. A large oil spill would temporarily degrade habitat if spilled oil, dispersant chemicals, or emulsions of dispersed oil droplets and dispersant chemicals contact free-ranging pods or calving grounds.

Commercial Fisheries and Recreational Fishing: Unavoidable adverse impacts from routine operations are loss of open ocean or bottom areas desired for fishing by the presence or construction of OCS oil- and gas-related facilities and pipelines. Loss of gear could occur from bottom obstructions around platforms and subsea production systems. If a large oil spill occurs, it is unlikely that fishermen would want, or be permitted, to harvest fish in the area of an oil spill, as spilled oil could coat or contaminate commercial fish species, rendering them unmarketable.

Recreational Resources: Unavoidable adverse impacts from routine operations may result in the accidental loss overboard of some floatable debris that may eventually come ashore on frequented recreational beaches. A large oil spill could make landfall on recreational resources, leading to local or regional economic losses and stigma effects, causing potential users to avoid the area after acute impacts have been removed. Some recreational resources become temporarily soiled by weathered crude oil, and small surface residue balls (also called tarballs) may come ashore long after stranded oil has been cleaned from shoreline areas. Impacts on recreational resources from a large oil spill may, at the time, seem irreversible, but the impacts are generally temporary. Beaches fouled by a large oil spill would be temporarily unavailable to the people who would otherwise frequent them, but only during the period between landfall and cleanup of the oil, followed by an indefinite lag period during which stigma effects recede from public consciousness.

Archaeological Resources: Unavoidable adverse impacts from routine operations could lead to the loss of unique or significant archaeological information if unrecognized at the time an area is disturbed. It is BOEM's policy to not approve any EP or DOCD plan with known or potential archaeological resources within 500 ft (152 m) of the planned activity or a pipeline application with known or potential archaeological resources within the pipeline corridor or right-of-way (the 200-ft [61-m] corridor in which the pipeline is to be constructed). For decommissioning activities, all known or potential (i.e., side-scan sonar targets, magnetic anomalies, or sub-bottom profiler targets) archaeological resources must be investigated before site clearance activities take place and, if the presence of archaeological resources is confirmed, exceptions to the site clearance requirements at that location would be granted. Complete archaeological data recovery (excavation) would be required if BOEM decided that a permitted activity must take place that would cause an adverse impact to an archaeological resource.

Economic and Social Factors: Net economic, political, and social benefits to the U.S. accrue from the production of hydrocarbon resources. Once these benefits become routine, unavoidable adverse impacts from routine operations follow trends in supply and demand based on the commodity prices for oil, gas, and refined hydrocarbon products. Declines in oil and gas prices can lead to activity ramp downs by operators until prices rise. A large oil spill would cause temporary increases in economic activity associated with spill-response activity. An increase in economic activity from the response to a large spill could be offset by temporary work stoppages that are associated with spill-cause investigations and would involve a transfer or displacement of demand to different skill sets. Routine operations affected by new regulations that are incremental would not have much effect on the baseline of economic activity; however, temporary work stoppages or the introduction of several new requirements at one time, which are costly to implement, could cause a drop-off of activity as operators adjust to new expectations or use the opportunity to move resources to other basins where they have interests.

4.16 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible or irretrievable commitment of resources refers to impacts or losses to resources that cannot be reversed or recovered. Examples are when a species becomes extinct or when wetlands are permanently converted to open water. In either case, the loss is permanent.

4.16.1 Coastal Habitats

An irreversible or irretrievable loss of wetlands and associated biological resources could occur if wetlands are permanently lost because of impacts caused by dredging and construction activities that displace existing wetlands or from oil spills severe enough to cause permanent die-back of vegetation and conversion to open water. Construction and emplacement of onshore pipelines in coastal wetlands displace coastal wetlands in disturbed areas that are then subject to indirect impacts like saltwater intrusion or erosion of the marsh soils along navigation channels and canals. Regulatory requirements of the State and Federal water authorities and some local jurisdictions would be applicable to these activities to mitigate these impacts. Ongoing natural and anthropogenic processes in the coastal zone, only one of which is an OCS oil- and gas-related activity, can result in direct and indirect loss of wetlands. Natural losses as a consequence of the coastal area becoming hydrologically isolated from the Mississippi River that built it, sea-level rise, and subsidence of the delta platform in the absence of new sediment added to the delta plain appear to be much more dominant processes impacting coastal wetlands.

4.16.2 Biological Resources

An irreversible loss or degradation of ecological habitat caused by cumulative activity tends to be incremental over the short term. Irretrievable loss may not occur unless or until a critical threshold is reached. It can be difficult or impossible to identify when that threshold is, or would be, reached. Oil spills and chronic low-level pollution can injure and kill organisms at virtually all trophic levels. Mortality of individual organisms can be expected to occur, and possibly a reduction or even elimination of a few small or isolated populations. The proposed biological stipulations, however, are expected to eliminate most of these risks.

4.16.2.1 Threatened and Endangered Species

Irreversible loss of individuals that are protected species may occur after a large oil spill from the acute impact of being oiled or the chronic impact of oil having eliminated, reduced, or rendered suboptimal the food species upon which they were dependent.

4.16.2.2 Fish and Invertebrate Resources, Deepwater Benthic Communities, Commercial Fisheries, and Recreational Fishing

Irreversible loss of fish and invertebrate resources, including commercial and recreational species, may be caused by structure removals using explosives. Fish in proximity to an underwater explosion can be killed. Without the structure to serve as habitat area, sessile, attached invertebrates and the fish that live among them are absent. Removing structures eliminates these special and local habitats and the organisms living there, including such valuable species as red snapper. Continued structure removal, regardless of the technique used, would reduce the net benefits to commercial fishing due to the presence of these structures. However, the Rigs-to-Reef Program would help offset these impacts.

4.16.3 Archaeological Resources

Any loss of undiscovered archaeological resources on or below the seafloor of the OCS in developed areas would be an irreversible and irretrievable commitment of resources. A resource can be completely destroyed, severely damaged, or the scientific context badly impaired by well drilling, subsea completions, and platform and pipeline installation, or sand borrowing. An archaeological survey, avoidance through development design, documentation, and/or other mitigation would be accomplished prior to development, so as to minimize impacts.

4.16.4 Oil and Gas Development

Leasing and subsequent development and extraction of hydrocarbons as a result of a proposed action represents an irreversible and irretrievable commitment by the removal and consumption of nonrenewable oil and gas resources. The estimated amount of resources to be recovered as a result of a proposed action is presented in **Chapter 3.1.2**.

4.16.5 Loss of Human and Animal Life

The OCS oil and gas exploration, development, production, and transportation are carried out under comprehensive, state-of-the-art, enforced regulatory procedures designed to ensure public and work place safety and environmental protection. Nevertheless, some loss of human and animal life may be inevitable from unpredictable and unexpected acts of man and nature (i.e., unavoidable accidents, accidents caused by human negligence or misinterpretation, human error, and adverse weather conditions). Some normal and required operations, such as structure removal, can kill sea life in proximity to explosive charges or by removal of the structure that served as the framework for invertebrates living on it and the fish that lived with it.

4.17 Relationship Between the Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The short-term impacts on various components of the environment in the vicinity of the proposed action are related to long-term impacts and the maintenance and enhancement of long-term productivity.

4.17.1 Short-Term Use

Short-term refers to the total duration of oil and gas exploration and production activities. Extraction and consumption of offshore oil and natural gas is a short-term benefit. Discovering and producing domestic oil and gas now reduces the Nation's dependency on foreign imports. Depleting a nonrenewable resource now removes these domestic resources from being available for future use. The production of offshore oil and natural gas as a result of a proposed action would provide short-term energy, and as it delays the increase in the Nation's dependency on foreign imports, it can also allow additional time for ramp-up and development of long-term renewable energy sources or substitutes for nonrenewable oil and gas. Economic, political, and social benefits would accrue from the availability of these natural resources.

The principle short-term use of the leased areas in the Gulf of Mexico would be for the production of up to 0.211-1.118 BBO and 0.547-4.424 Tcf of gas from a proposed action. The impact scenario in this Supplemental EIS extends approximately from 2017 to 2066. The 50-year time period is used because it is the approximate longest life span of activities conducted on an individual lease. The 50 years following a proposed lease sale is the period of time during which the activities and impacting factors that follow as a consequence of a proposed lease sale would be influencing the environment.

The cumulative impact scenario in this Supplemental EIS extends from approximately 2017 to 2086. The 70-year timeframe includes projected activity from (1) past lease sales for which exploration or development has either not yet begun or is continuing, (2) lease sales that would be held in the 2017-2022 Five-Year Program, and (3) future lease sales that would be held as a result of future Five-Year Programs (four additional programs are included in this cumulative analysis). Activities that take place as a result of Five-Year Programs beyond the next four programs are not included in this analysis. The 70-year time period following a proposed lease sale is the period of time during which the activities and impacting factors that follow as a consequence of the cumulative impact scenario would be influencing the environment.

The specific impacts of a proposed action vary in kind, intensity, and duration according to the activities occurring at any given time (**Chapter 3**). Initial activities, such as seismic surveying and exploration drilling, result in short-term, localized impacts. Development drilling and well workovers occur sporadically throughout the life of a proposed action but also result in short-term, localized impacts. Activities during the production life of a platform may result in chronic impacts over a longer period of time (over 25 years), potentially punctuated by more severe impacts as a result of accidental events or a spill. Platform removal is also a short-term activity with localized impacts, including removal of the habitat for encrusting invertebrates and fish living among them. Many of the impacts on physical, biological, and socioeconomic resources discussed in **Chapter 4** are considered to be short term (being greatest during the construction, exploration, and early production phases). These impacts would be further reduced by the mitigating measures discussed in **Chapter 2.2.4**.

The OCS development off Texas and Louisiana has enhanced recreational and commercial fishing activities, which in turn has stimulated the manufacture and sale of larger private fishing vessels and specialized recreational fishing equipment. Commercial enterprises such as charter boats have become heavily dependent on offshore structures for satisfying recreational customers. A proposed action could increase these incidental benefits of offshore development. Offshore fishing and diving have gradually increased in the past three decades, with offshore structures and platforms becoming the focus of much of that activity. As mineral resources become depleted, platform removals would occur and may result in a decline in these activities, but this could be offset by the Rigs-to-Reef program.

The short-term exploitation of hydrocarbons for the OCS Program in the Gulf of Mexico may lead to long-term impacts on biologically sensitive resources and areas if a large oil spill occurs. A spill and spill-response activity could temporarily interfere with commercial and recreational fishing, beach use, and tourism in the area where the spill makes landfall and in a wider area based on stigma effects. The proposed leasing may also result in onshore development and population increases that could cause very short-term adverse impacts to local community infrastructure, particularly in areas of low population and minimal existing industrial infrastructure (refer to **Chapter 4.14**).

4.17.2 Relationship to Long-Term Productivity

Long-term refers to an indefinite period beyond the termination of oil and gas production. Over a period of time after peak oil production has occurred in the Gulf of Mexico, a gradual easing of the specific impacts caused by oil and gas exploration and production would occur as the productive reservoirs in the Gulf have been discovered and produced, and have become depleted. The BSEE estimates that oil production in the GOM peaked at 1.6 MMbbl/day in 2002, declined for a few years and then peaked again in 2009 and 2010 at 1.6 MMbbl/day before declining again. Production rates in 2015 indicate it was another high year (1.5 MMbbl/day), and gas production in the GOM peaked at 14.4 billion cubic feet (Bcf)/day in 1997 and has declined since then to 3.6 Bcf/day in 2015 (USDOI, BSEE, 2016b). Production has shifted from many smaller reserves on the continental shelf to fewer larger reserves in deep water. Large deepwater oil discoveries have the potential to alter the oil production rate, but the exact effect any one discovery would have or when that discovery would be made is difficult to project due to the difficulties that may be encountered producing these prospects because of their geologic age; burial depth and high-temperature, high-pressure *in-situ* conditions; lateral continuity of reservoirs; and the challenges of producing from ultra-deepwater water depths.

The Gulf of Mexico's large marine ecosystem is considered a Class II, moderately productive ecosystem (mean phytoplankton primary production 150-300 gChlorophyll a/m^2-yr [The Encyclopedia of Earth, 2008]) based on Sea-viewing Wide Field-of-view Sensor (SeaWiFS) global primary productivity estimates (USDOC, NASA, 2003). After the completion of oil and gas production, a gradual ramp-down to economic conditions without OCS oil- and gas-related activity would be experienced, while the marine environment is generally expected to remain at or return to its normal long-term productivity levels that, in recent years, has been described as stressed (The Encyclopedia of Earth, 2008). The Gulf of Mexico's large marine ecosystem shows signs of ecosystem stress in bays, estuaries, and coastal regions (Birkett and Rapport, 1999). There is shoreline alteration, pollutant discharge, oil and gas development, and nutrient loading. The overall condition for the U.S. section of this large marine ecosystem, according to the USEPA's seven primary indicators (Jackson et al., 2000), is good dissolved oxygen, fair water quality, poor coastal wetlands, poor eutrophic condition, and poor sediment, benthos, and fish tissue (The Encyclopedia of Earth, 2008).

To help sustain the long-term productivity of the Gulf of Mexico ecosystem, the OCS Program provides structures to be used as site-specific artificial reefs and fish-attracting devices for the benefit of commercial and recreational fishermen and for sport divers and spear fishers. Approximately 10 percent of the oil and gas structures removed from the OCS are eventually used for State artificial reef programs. Additionally, the OCS Program continues to improve the knowledge and mitigation practices used in offshore development to enhance the safe and environmentally responsible development of OCS oil and gas resources.

CHAPTER 5

CONSULTATION AND COORDINATION

What's in This Chapter?

- BOEM is conducting consultation and other activities to comply with laws and Executive Orders.
- BOEM coordinated the prelease process with key agencies and organizations.
- The prelease and NEPA process has included publication of the Notice of Intent to Prepare an EIS (NOI).
- BOEM conducted internal and public scoping to determine the content of this Supplemental EIS.
- The National Park Service is a cooperating agency on this Supplemental EIS.
- BOEM solicited comments on the Draft Supplemental EIS from March 31 through May 15, 2017.
- Several changes were made between the Draft and Final Supplemental EISs. These changes were the result of new information becoming available, editorial suggestions, and comments received on the Draft Supplemental EIS.

5 CONSULTATION AND COORDINATION

5.0 INTRODUCTION

BOEM is conducting consultation and other activities to comply with the following laws, including but not limited to, the following: the development of consistency determinations (CDs) under CZMA; consultation under the Endangered Species Act (ESA) for potential impacts to listed species or designated critical habitat; completion of an Essential Fish Habitat assessment pursuant to the Magnuson-Stevens Fishery Conservation and Management Act; and a request for comments and consultation with federally recognized Indian Tribes pursuant to the National Historic Preservation Act and Executive Order 13175. Pursuant to NEPA, BOEM has conducted public involvement activities during scoping for and review of the Draft Supplemental EIS. This chapter describes the processes with which BOEM worked with other Federal and State agencies, Tribal governments, and the public during the development of this Supplemental EIS.

5.1 COASTAL ZONE MANAGEMENT ACT

The Federal agency performs a consistency review pursuant to the CZMA, and CDs are prepared for each coastal State along the Gulf of Mexico with a federally approved Coastal Management Program (CMP) prior to each of the proposed lease sales. To prepare the CDs, BOEM reviews each State's approved Coastal Management Plan and analyzes the potential impacts as outlined in the 2017-2022 GOM Multisale EIS and this Supplemental EIS, new information, and applicable studies as they pertain to the enforceable policies of each CMP. The CZMA requires that Federal actions that have reasonably foreseeable coastal effects (i.e., effects to any coastal use or resource of the coastal zone) be "consistent to the maximum extent practicable" with relevant enforceable policies or guidelines of the State's federally approved coastal management program (15 CFR part 930 subpart C).

Based on these and other analyses, BOEM's Gulf of Mexico OCS Region's Regional Director makes an assessment of consistency, which is then sent to the States of Texas, Louisiana, Mississippi, Alabama, and Florida for proposed regionwide lease sales; to Texas and Louisiana for proposed WPA lease sales; or Louisiana, Mississippi, Alabama, and Florida for proposed CPA and/or EPA lease sales. If the State concurs, BOEM proceeds with the proposed lease sale. A State's concurrence may be presumed when a State does not provide a response within the 60-day review period. A State may request an extension of time to review the CD within the 60-day period, which the Federal agency shall approve for an extension of 15 days or less. If a State objects, it must do the following under the CZMA:

(1) indicate how BOEM's prelease proposal is inconsistent with the State's federally approved CMP and suggest alternative measures to bring BOEM's proposal into consistency with the State's CMP; or

(2) describe the need for additional information that would allow a determination of consistency. In the event of an objection, the Federal and State agencies should use the remaining portion of the 90-day review period to attempt to resolve their differences (15 CFR § 930.43(b)).

At the end of the 90-day review period, the Federal agency shall not proceed with the activity over a State agency's objection unless the Federal agency concludes that, under the "consistent to the maximum extent practicable" standard described in 15 CFR § 930.32, consistency with the enforceable policies of the CMP is prohibited by existing law applicable to the Federal agency and the Federal agency has clearly described, in writing, to the CZMA State agency the legal impediments to full consistency; or, the Federal agency has concluded that its proposed action is fully consistent with the enforceable policies of the CMP, though the State agency objects. Unlike the consistency process for specific OCS plans and permits, there is no procedure for administrative appeal to the Secretary of Commerce for a Federal CD for prelease activities. In the event that there is a serious disagreement between BOEM and a State, either agency may request mediation. Mediation is voluntary, and the Secretary of Commerce would serve as the mediator. Whether there is mediation or not, the final CD is made by DOI, and it is the final administrative action for the prelease consistency process. Each Gulf State's CMP is described in Appendix J of the 2017-2022 GOM Multisale EIS.

5.2 ENDANGERED SPECIES ACT

The Endangered Species Act of 1973 (16 U.S.C. §§ 1531 *et seq.*) establishes a national policy designed to protect and conserve threatened and endangered species and the ecosystems upon which they depend. BOEM and BSEE are currently in consultation with NMFS and FWS regarding the OCS Oil and Gas Program in the Gulf of Mexico. BOEM is acting as the lead agency in the ongoing consultation, with BSEE's assistance and involvement. The programmatic consultation, which was reinitiated in 2010, was expanded in scope after the reinitiation of consultation by BOEM following the *Deepwater Horizon* explosion and oil spill, and it will include both existing and future OCS oil and gas leases in the Gulf of Mexico over a 10-year period. This consultation also considers any changes in baseline environmental conditions following the *Deepwater Horizon* explosion, oil spill, and response. The programmatic consultation will also include postlease activities associated with OCS oil- and gas-related activities in the Gulf of Mexico, including G&G and decommissioning activities. While the programmatic Biological Opinion is in development, BOEM and NMFS have agreed to interim consultation.

With consultation ongoing, BOEM and BSEE will continue to comply with all reasonable and prudent measures and the terms and conditions under the existing consultations, along with implementing the current BOEM- and BSEE-required mitigation, monitoring, and reporting requirements. Based on the most recent and best available information at the time, BOEM and BSEE will also continue to closely evaluate and assess risks to listed species and designated critical habitat in upcoming environmental compliance documentation under NEPA and other statutes. Refer to Appendix K of the 2017-2011 GOM Multisale EIS for copies of the consultation letters.

5.3 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act, Federal agencies are required to consult with NMFS on any action that may result in adverse effects to essential fish habitat (EFH). The NMFS published the final rule implementing the EFH provisions of the Magnuson-Stevens Fisheries Conservation and Management Act (50 CFR part 600) on January 17, 2002. Certain OCS oil- and gas-related activities authorized by BOEM may result in adverse effects to EFH and therefore require EFH consultation.

BOEM prepared an EFH Assessment white paper that describes the OCS proposed activities, analyzes the effects of the proposed activities on EFH, and identifies proposed mitigating measures (USDOI, BOEM, 2016c). The EFH Assessment was sent to NMFS on June 8, 2016, with a letter requesting formal consultation. This regional programmatic EFH consultation will cover proposed GOM lease sales analyzed in the 2017-2022 Five-Year Program and related activities (i.e., decommissioning and geological and geophysical). The EFH Assessment, the formalized conservation recommendations put forth by NMFS and accepted by BOEM/BSEE or NMFS' concurrence will complete the EFH consultation. However, all agencies will continue to communicate for the duration of the EFH consultation (2017-2022).

5.4 NATIONAL HISTORIC PRESERVATION ACT

In accordance with the National Historic Preservation Act (54 U.S.C. §§ 300101 *et seq.*), Federal agencies are required to consider the effects of their undertakings on historic properties. The implementing regulations for Section 106 of the National Historic Preservation Act, issued by the Advisory Council on Historic Preservation (36 CFR part 800), specify the required review process. In accordance with 36 CFR § 800.8(c), BOEM intends to use the NEPA substitution process and documentation for preparing a prelease EIS and Record of Decision or a postlease environmental assessment and Finding of No Significant Impact to comply with Section 106 of the National Historic Preservation Act in lieu of 36 CFR §§ 800.3-800.6. Because of the extensive geographic area analyzed in this Supplemental EIS and because identification of historic properties will take place after leases are issued, BOEM will complete its Section 106 review process once BOEM has performed the necessary site-specific analysis of postlease activities prior to issuing a permit or approving these activities. Additional consultations with the Advisory Council on Historic Places, State Historic Preservation Offices, federally recognized Indian Tribes, and other consulting parties may take place at that time, if appropriate. Refer to **Chapter 4.13** for more information on this review process and Appendix K of the 2017-2022 GOM Multisale EIS for copies of the State Historic Preservation Offices' concurrence letters.

As an early planning effort, BOEM initiated a request for comment on the NOI for the 2017-2022 GOM Multisale EIS via a formal letter to each of the affected Gulf Coast States on April 3, 2015. A 30-day comment period was provided. The State Historic Preservation Officers for Alabama, Florida, and Louisiana responded via formal letters, all concurring that no historic properties will be affected. The Florida State Historic Preservation Officer further requested to be notified and given the opportunity to comment should any cultural resources be identified off the Florida coast. No additional responses were received.

BOEM also solicited Tribal comment on the *2017-2022 Outer Continental Shelf Oil and Gas Leasing: Draft Proposed Program* via a formal letter on March 4, 2015, and on the *Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Draft Environmental Impact Statement* via a formal letter on May 19, 2016. The Final 2017-2022 GOM Multisale EIS and the Draft 2018 Supplemental EIS were sent to each Tribe in April 2017, again requesting Tribal comment or additional consultation.

Those letters were addressed to each of the Gulf Coast State-affiliated federally recognized Indian Tribes, including the Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Miccosukee Tribe of Indians of Florida, Mississippi Band of Choctaw Indians, Muscogee (Creek) Nation, Poarch Band of Creek Indians, Seminole Tribe of Florida, Seminole Nation of Oklahoma, and Tunica-Biloxi Indian Tribe of Louisiana.

The Choctaw Nation of Oklahoma has indicated that the 2017-2022 GOM Multisale EIS activities will affect the Tribe's area of historic interest. They requested to be updated on archaeological surveys and that any work be stopped and their Historic Preservation Department be notified immediately in the event that Native American artifacts of human remains are encountered (Bilyeu, official communication, 2017). The Poarch Band of Creek Indians has indicated that they do not have any specific concerns with BOEM's activities on the OCS, but they would like to continue to receive notifications concerning BOEM's activities (McCullers, official communication, 2015). Additionally, the Jena Band of Choctaw has indicated a general concern over adverse effects to documented or undocumented prehistoric and historic sites in the CPA and has requested to be notified should BOEM be unable to avoid a potential resource or have a post-review discovery, as well as to continue being notified concerning BOEM's activities (Shively, official communication, 2015a and 2015b).

No additional responses have been received in response to the above-referenced outreach efforts; however, informal discussions with designated Tribal representatives are ongoing to determine if any of the individual Tribes desire continued consultation on these issues.

5.5 GOVERNMENT-TO-GOVERNMENT TRIBAL CONSULTATION

In accordance with Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," Federal agencies are required to establish regular and meaningful consultation and collaboration with Tribal officials in the development of Federal policies that have Tribal implications to strengthen the United States' government-to-government relationships with Indian Tribes, and to reduce the imposition of unfunded mandates upon Indian Tribes. On March 4, 2015, BOEM sent a formal letter to federally recognized Indian Tribes notifying them of the development of the *2017-2022 Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program* and the *Gulf of Mexico Proposed Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas—Programmatic Environmental Impact Statement*. That letter was addressed to each of the Gulf Coast State-affiliated Indian Tribes, including the Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Miccosukee Tribe of Indians of Florida, Mississippi Band of Choctaw Indians, Poarch Band of Creek Indians, Seminole Tribe of Florida, Seminole Nation of Oklahoma, and Tunica-Biloxi Indian Tribe of Louisiana. The letter was intended to be the first step of a long-term and broad consultation effort between BOEM and the Gulf-area Tribes, inclusive of all BOEM activities that may occur under the Draft Proposed Program, as well as ongoing activities. On May 19, 2016, another formal letter was sent announcing and soliciting consultation on the release of the 2017-2022 Proposed Program, Draft Five-Year Program EIS, and Draft 2017-2022 GOM Multisale EIS. That letter was sent to each of the above-listed Tribes, as well as to the Muscogee (Creek) Nation. The Final 2017-2022 GOM Multisale EIS and the Draft 2018 Supplemental EIS were sent to each Tribe in April 2017, again requesting Tribal comment or additional consultation.

BOEM has received response to its letters from the Choctaw Nation of Oklahoma, the Poarch Band of Creek Indians, and the Jena Band of Choctaw. The Choctaw Nation of Oklahoma has requested to be updated on archaeological surveys and that any work be stopped and their Historic Preservation Department be notified immediately in the event that Native American artifacts of human remains are encountered because activities could be occurring in the Tribe's area of historic interest (Bilyeu, official communication, 2017). Both the Poarch Band of Creek Indians and the Jena Band of Choctaw have indicated that they would like to continue to receive notifications concerning BOEM's activities (McCullers, official communication, 2015; Shively, official communication, 2015a and 2015b). The Jena Band of Choctaw has indicated a general concern over adverse effects to documented or undocumented prehistoric and historic sites in the CPA and requests to be notified should such effects occur, while the Poarch Band of Creek Indians does not have any specific concerns with BOEM's activities on the OCS.

BOEM has also analyzed environmental justice issues for minority and low-income populations, which is broadly applicable to federally recognized Indian Tribes. Further information on that analysis can be found in **Chapter 4.14.3.1**.

5.6 NATIONAL ENVIRONMENTAL POLICY ACT

5.6.1 Development of the Proposed Action

This Supplemental EIS addresses a proposed regionwide Federal OCS oil and gas lease sale, as tentatively scheduled in the 2017-2022 Five-Year Program. This Supplemental EIS is expected to be used to inform decisions for each of the two proposed lease sales scheduled in 2018 and to be used and supplemented as necessary for decisions for each of the remaining proposed regionwide lease sales scheduled in the 2017-2022 Five-Year Program. BOEM conducted early coordination with appropriate Federal and State agencies and other concerned parties to discuss and coordinate the prelease process for the proposed lease sales and this Supplemental EIS. Key agencies and organizations included FWS, NOAA, NOAA's National Marine Fisheries Service, National Park Service, U.S. Coast Guard, U.S. Department of Defense, USEPA, State governors' offices, federally recognized Indian Tribes, industry, and nongovernmental organizations.

5.6.1.1 Call for Information and Area ID Memorandum

Pursuant to the Outer Continental Shelf Lands Act of 1953, as amended (OCSLA), BOEM published a Call for Information (Call) to request and gather information to determine the Area ID for each proposed lease sale. The Call was published in the *Federal Register* (2015) on September 4, 2015. The comment period for the Call closed on October 5, 2015. BOEM received one comment letter in response to the Call from the Louisiana Department of Natural Resources, which is summarized below:

- the Louisiana Office of Coastal Management requests that BOEM consider secondary and cumulative impacts of OCS lease sales on coastal environments;
- BOEM should identify, quantify, and mitigate (e.g., compensatory mitigation) secondary and cumulative harm that occurs to Louisiana's coastal wetlands;
- BOEM should implement plans for validating predictions of social and environmental effects on coastal resources; and
- offshore exploration and development of hydrocarbon resources has been and continues to be of significant value to Louisiana and coastal communities.

Using information provided in response to the Call and from scoping comments received for the 2017-2022 GOM Multisale EIS, BOEM developed an Area ID recommendation memorandum. The Area ID is an administrative prelease step that describes the geographic area for environmental analysis and consideration for leasing. All of this information was used to develop a proposed action and a reasonable range of alternatives for the 2017-2022 GOM Multisale EIS, and subsequently, this Supplemental EIS. On November 20, 2015, the Area ID decision was made. One Area ID was prepared for all proposed lease sales. The Area ID memo recommended keeping the entire regionwide area of the GOM included in the 2017-2022 Proposed Final Program for consideration in the 2017-2022 GOM Multisale EIS. The area identified for lease includes all of the available unleased blocks in the GOM not subject to Congressional moratorium pursuant to the Gulf of Mexico Energy Security Act of 2006.

5.6.1.2 Notice of Intent to Prepare a Supplemental EIS

On August 19, 2016, the NOI to prepare a Supplemental EIS for the proposed regionwide lease sales was published in the *Federal Register* (2016c). Additional public notices, including individual consultation invitations to federally recognized Indian Tribes, were distributed via the U.S. Postal Service, local newspapers, and the Internet. A 30-day comment period was provided; it closed on September 19, 2016. Federal, State, and local governments, federally recognized Indian Tribes, nongovernmental organizations, other interested parties, and the public at large were invited to send written comments on the scope of this Supplement EIS. BOEM received 433 comments in response to the NOI. These comments are summarized in **Chapter 5.6.2.2**.

5.6.2 Development of the Draft Supplemental EIS

5.6.2.1 Scoping

Scoping for the Draft Supplemental EIS was conducted in accordance with CEQ regulations for implementing NEPA. Public scoping provides those with an interest in the OCS Program an opportunity to provide comments on the proposed action. Public scoping meetings were held in Mississippi, Alabama, Texas, and Louisiana on the following dates and at the times and locations indicated below:

Tuesday, September 6, 2016
4:00 p.m. until 7:00 p.m. CDT
Courtyard by Marriott
Gulfport Beachfront MS Hotel
1600 East Beach Boulevard
Gulfport, Mississippi 39501
1 registered attendee
0 verbal comments received
1 written comment received

Wednesday September 7, 2016
4:00 p.m. until 7:00 p.m. CDT
Renaissance Mobile Riverview
Plaza Hotel
64 South Water Street
Mobile, Alabama 36602
6 registered attendees
2 verbal comments received
1 written comment received

Tuesday, September 13, 2016
4:00 p.m. until 7:00 p.m. CDT
Houston Marriott North
255 North Sam Houston Pkwy East
Houston, Texas 77060
4 registered attendees
2 verbal comments received
0 written comments received

Thursday, September 15, 2016
4:00 p.m. until 7 p.m. CDT
Wyndham Garden New Orleans Airport
6401 Veterans Memorial Blvd.
Metairie, Louisiana 70003
14 registered attendees
0 verbal comments received
2 written comments received

5.6.2.2 Summary of Scoping Comments

In addition to accepting oral and written comments at each public meeting, BOEM accepted written comments by mail and through the regulations.gov web portal (http://www.regulations.gov). BOEM received 433 comments in response to the NOI and 8 comments from the scoping meetings, totaling 441 comments. Of the comments received, 1 was a mailed letter; 3 were emails; 73 were received through the regulations.gov web portal; and 356 were form letters received in a bulk package. Comments came from Federal and State agencies, interest groups, industry, and the general public on the scope of this Supplemental EIS, significant issues that should be addressed, alternatives that should be considered, and mitigating measures. Each comment was read and categorized according to its source and the nature of the information included. All scoping comments received that were relevant for a lease sale NEPA document were considered in the preparation of the Draft Supplemental EIS. The scope and content of this Supplemental EIS was formulated to ensure that the relevant issues and concerns expressed by stakeholders during the scoping process were fully addressed. Summaries of comments received follow.

Louisiana Department of Natural Resources, Office of Coastal Management

- The Louisiana Office of Coastal Management continues to support the expansion of exploration and development of energy resources throughout the OCS waters and views these efforts as crucial to our Nation's economic and energy security.
- The State of Louisiana expressed that indirect and cumulative impacts to Louisiana's coastal resources are not adequately addressed in previous EISs.
- The State of Louisiana is also concerned that Louisiana's coastal wetlands are disproportionately bearing the impacts from OCS oil- and gas-related activities and requests compensatory mitigation.
- The Louisiana Office of Coastal Management acknowledges the progress that BOEM has continued to make in improving the procedures and techniques used in the environmental review process. However, BOEM must better revisit the predictions made for previous lease sales and compare these predictions with existing environmental conditions and adjust its impact evaluation process accordingly.

Consumer Energy Alliance

- In recent years, the domestic energy revolution has provided a major boost to the American economy and consumer pocketbooks, while fundamentally transforming the global geopolitical landscape to the benefit of U.S. national security. At the same time, thanks to continuing improvements in technology, practices, and oversight, the United States has demonstrated that offshore energy development and environmental stewardship can and do exist.

- The Consumer Energy Alliance understands that, to meet our long-term energy needs, we will need to access all of our resources, including oil and natural gas, nuclear, solar, wind, and beyond. We also understand that oil and natural gas will continue to be a critical and dominant part of that mix for decades to come.
- Industry and regulators alike have taken a number of actions in recent years that have further strengthened the safety of offshore operations in U.S. waters.
- An “all of the above” approach to energy policy is the only sensible solution, and that must include the Gulf of Mexico.
- The Consumer Energy Alliance urges the Department of the Interior to include valuable offshore opportunities in the Gulf of Mexico and to reject any demands to take actions that would in any way delay, restrict, or prohibit proposed Lease Sales 250 and 251.

Louisiana Mid-Continent Oil and Gas Association

- The Louisiana Mid-Continent Oil and Gas Association fully supports a continued robust OCS leasing program in the Gulf of Mexico.
- Louisiana’s offshore oil and gas industry has a $44 billion economic impact on the State of Louisiana. Combining the offshore sector with related pipeline and refining activities, the oil and gas industry has $70 billion total annual impact to Louisiana. Federal revenue from offshore energy production in the past 10 years totaled $80 billion in lease sales and royalties – a major source of revenue for our country.
- Louisiana has demonstrated how to balance the development of our Nation’s oil and gas resources off its coast and still maintain a robust hunting, fishing, and wildlife industry. In Louisiana, commercial fishing provides one-fourth of the fisheries catch in the lower 48 states, and our wetlands provide habitat for about 1.8 million migratory waterfowl. Wildlife recreation has amounted to a $2.2 billion industry.
- Since 2010, the oil and gas industry has demonstrated its commitment to ensure that people and the environment are protected during all phases of energy exploration, development, and production. A robust collaborative effort among industry has resulted in the development of new technology and standards for prevention, intervention, and response. Industry has formed the Marine Well Containment Company and has developed cutting-edge technology to minimize the risk of a catastrophic oil spill. They have also formed the Center for Offshore Safety to continuously improve the safety performance of offshore operations.
- As a result of Gulf of Mexico Energy Security Act of 2006, Louisiana, Texas, Mississippi, and Alabama will receive 37.5 percent of royalties received from new oil and gas developments in Federal waters, and in 2017 that will expand to

include a portion of all lease sale receipts since December 2006. Beginning in 2017, Louisiana will receive nearly $200 million per year through OCS revenue sharing that is dedicated to the Louisiana coast and projects designed to protect it.

Senator Sharon Hewitt, 2016 Regular Session, Louisiana Senate Resolution No. 116

- The Louisiana oil and gas industry and its workers, suppliers, and the entire business community have expressed their strong support for offshore energy exploration.
- The American economy is truly dependent on and stimulated by the oil and gas production of the Gulf of Mexico.
- The Gulf of Mexico provides nearly 20 percent of the Nation's crude oil supply.
- In Fiscal Year 2014 alone, the Gulf of Mexico energy development supported over 650,000 jobs, contributed over $64 billion in gross domestic product, and provided over $7 billion in revenue to the Federal Government.
- Offshore energy development and production in the Gulf of Mexico is vital to the economic well-being of the Gulf Coast States, coastal communities, and the entire Nation.
- Louisiana has been consistently ranked number two in the Nation in natural gas production, ranked in the top five in oil production, and our refining capability is second only to Texas.
- Our Nation's energy policy is dependent on a thriving oil and natural gas industry in the Gulf of Mexico and requires continued and expanded access to all areas of the Gulf of Mexico to increase and improve the economic well-being of residents, workers, and businesses in the Gulf Coast States' regions.
- Our Nation's energy policy directly affects our trade policy with other countries, our workforce, our economy, and our position as a global super-power to protect our interests at home.

American Petroleum Institute

- The American Petroleum Institute recommends that the Supplemental EIS focus on new information that is readily available and limit the Supplemental EIS to an analysis of this new information and not speculate on future results from ongoing studies.
- BOEM should consider the extensive safety improvements implemented by industry and the new requirements imposed on offshore operations since the *Deepwater Horizon* explosion, oil spill, and response, particularly the formation of

many well containment companies and their ability to assist in any potential future incidents.

- This Supplemental EIS should be designed to serve as a document for future environmental reviews.
- Data from the best available peer-reviewed scientific literature, and not speculation, should be used.

Center for Biological Diversity; 350 Louisiana; Bold Louisiana; Earth Action, Inc.; Friends of the Earth; Greenpeace, USA; Gulf Restoration Network; and Louisiana Bucket Brigade

- BOEM's proposal will deepen the climate crisis and reverse course on President Obama's commitment to combat climate change. The proposal also threatens frontline communities and GOM wildlife with more toxic air and water pollution, coastal erosion, extreme weather events, and oil spills. We urge BOEM to halt all new oil and gas leases.
- BOEM's proposal fails to comply with the clear requirements of the OCSLA and NEPA to precisely define areas available for leasing and to conduct an analysis on a finer geographic scale. BOEM must remedy the numerous faults with its Draft Multisale EIS from which this document will tier to; consider new information regarding climate impact of offshore oil and gas; and harmful impacts of offshore fracking in the Gulf. It is entirely improper for BOEM to be moving forward with these 2018 lease sales before the 2017-2022 OCS Oil and Gas Leasing Program ("Program") is finalized. BOEM's proposal implements an inappropriate change to its NEPA procedures that will lead to less environmental analysis. BOEM is abandoning its prior approach of conducting a supplemental NEPA analysis for each lease sale held in the Gulf of Mexico. Such an approach also violates BOEM's duties under OCSLA to comply with NEPA at every stage of the offshore oil and gas authorization process; and ensure offshore development is balanced with environmental safeguards and protection of the human, marine, and coastal environments. BOEM would offer the entire Gulf of Mexico OCS planning area not under moratorium to oil companies. But Section 18(a) expressly requires BOEM to prepare a leasing program that consists "of a schedule of proposed lease sales indicating, as precisely as possible, the size, timing, and location of leasing activity." Instead of "precisely" defining the location of lease sales, BOEM's proposal takes an areawide approach that designates the entire Gulf of Mexico as the area eligible for lease sales. This areawide lease sale approach is incompatible with the OCSLA. Indeed, under this approach, BOEM is allowing the oil industry to determine which areas are explored and developed, thereby abdicating the agency's responsibility under the OCSLA to direct oil activities and assure that they do not cause environmental harm. The designation lacks the precision required by law and is therefore unlawful.

- BOEM's Supplemental Analysis Must Remedy Numerous Deficiencies and Address New Information. In addition, NEPA regulations recognize that "tiering" from one environmental analysis to another may sometimes be appropriate where a broad environmental analysis has been conducted and the agency wishes to refer back to that assessment at a subsequent stage to avoid repetition. BOEM cannot continue to use tiering to avoid the requisite in-depth analysis required by NEPA.

- Finally, the Supplemental EIS must address new information revealed since the close of the public comment period on the Draft Multisale EIS. This new information includes unprecedented flooding in Louisiana; a report indicating the potential greenhouse gas emissions from offshore oil and gas drilling in the GOM; guidance from the Council on Environmental Quality ("CEQ") on analyzing the lifecycle greenhouse gas emissions from proposed projects; and the scope of offshore fracking being permitted in the Gulf of Mexico.

- BOEM's analysis must consider the final CEQ Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA issued on August 5, 2016. BOEM's Supplemental EIS must properly account for the downstream and lifecycle greenhouse gas emissions as the result of proposed Lease Sales 250 and 251.

- BOEM must also consider new information revealing the scope of inherently dangerous offshore fracking permitted in the Gulf of Mexico. New information reveals that the Obama administration permitted oil companies to frack offshore wells in the Gulf and Mexico more than 1,200 times between 2010 and 2014 alone. The fracks occurred in at least 630 different wells off the coasts of Texas, Louisiana, Mississippi, and Alabama; and many took place in critical habitat for imperiled loggerhead sea turtles. New information also reveals that at least one of the wells, which was connected to the flow line involved in a nearly 90,000-gallon oil spill in the Gulf of Mexico discovered on May 12, 2016, was fracked.

- Offshore fracking has several significant harmful impacts beyond that of conventional offshore oil and gas development. For example, oil companies are allowed to dump their wastewater — including fracking chemicals — into the Gulf of Mexico, which may harm the Gulf of Mexico's sensitive wildlife. Many fracking chemicals are known to be toxic to people and marine animals. Forty percent of the chemicals added to fracking fluids have ecological effects, meaning they can harm aquatic and other wildlife. An analysis of the chemicals used during offshore fracking events in California found that many of the chemicals could kill or harm a broad variety of marine organisms, including sea otters, fish, and invertebrates. Indeed, scientists list some of the chemicals frequently used in offshore fracking as among the most toxic in the world with respect to aquatic life. Numerous scientists and reports have also linked fracking to water contamination, air contamination, spills, earthquakes and birth defects. BOEM's Supplemental EIS must properly account for the added harms and risks caused by offshore fracking in the Gulf of Mexico.

Terrebonne Port Commission

- Ending energy exploration in the Gulf of Mexico would start the elimination of billions of dollars in royalties to the Federal and State governments, and eliminate thousands of direct oil field jobs and several thousand spin off jobs. The State of Louisiana's economy would eventually be cut in half. It would force the U.S. to depend on importing more oil and gas, where this county needs energy independence.

Grow the Gulf

- Grow the Gulf supports the proposed action and continued safe energy exploration in the Gulf of Mexico.

Jean Public

- Jean Public opposes the proposed action due to the lack of safety changes since the *Deepwater Horizon* explosion, oil spill, and response.

Public Comments Supporting the Proposed Action

Almost 380 individual comments were received that were in support of the proposed lease sales, 356 of which were form letters. Commenters stated that future leases are vital to the national economy and security, and integral to the State of Louisiana and local economies and jobs. Several noted that oil and gas companies and employees must be good stewards of the environment and continue to provide more emphasis on safety. Several commenters stated that the recent downturn in oil and gas prices is hurting small towns and southern states in general.

Public Comments Supporting Alternative E, the No Action Alternative

Twenty-three individual comments were received that opposed future lease sales. Commenters stated that renewable energy should be pursued instead of oil and gas, fossil fuels should be left in the ground, and new lease sales are not compatible with the Paris Treaty. Issues of concern included the impacts of oil and gas on greenhouse gas emission and global climate change, the impacts of climate change on the GOM's environmental resources, warmer oceans, increased storms and flooding events, and land loss. Several were also concerned about continuing oil and chemical spill risks, continuing effects of past oil and chemical spills, leaking wells and pipelines, and a lack of reasonable alternatives. Environmental resources of concern included protected species (i.e., marine mammals, sea turtles, beach mice, protected birds, and corals), wetlands, fish nurseries, coral reefs, safety of seafood, and environmental justice. There were also comments on environmental justice concerns related to those living nearby petrochemical processing facilities.

5.6.2.3 Additional Public Input Opportunities

Although the scoping process is formally initiated by the publication of the NOI, scoping efforts and other coordination meetings have proceeded and will continue to proceed throughout the NEPA processes for the 2017-2022 Five-Year Program. Scoping and coordination opportunities were also available during BOEM's requests for information, comments, input, and review of its other NEPA documents, including the following:

- request for information and comments on the 2017-2022 Five-Year Program,
- scoping and comments on the 2017-2022 Five-Year Program EIS, and
- scoping and comments on the 2017-2022 GOM Multisale EIS.

5.6.2.4 Cooperating Agencies

According to Part 516 of the DOI Departmental Manual, BOEM must invite eligible government entities to participate as cooperating agencies when developing an EIS in accordance with the requirements of NEPA and CEQ regulations. BOEM must also consider any requests by eligible government entities to participate as a cooperating agency with respect to a particular EIS, and must either accept or deny such requests.

The NOI, which was published on August 19, 2016, included an invitation to other Federal agencies and State, Tribal, and local governments to consider becoming cooperating agencies in the preparation of this Supplemental EIS. In a letter dated October 28, 2016, the National Park Service requested cooperating agency status for this Supplemental EIS. On December 29, 2016, a Memorandum of Agreement between BOEM and the National Park Service was initiated, which defines the roles and responsibilities for each agency (**Appendix A**).

5.6.2.5 Distribution of the Draft Supplemental EIS for Review and Comment

BOEM sent copies of the Draft Supplemental EIS to the government, public, and private agencies and groups listed below. Local libraries along the Gulf Coast were provided copies of the Draft Supplemental EIS; a list of these libraries is available on BOEM's website at http://www.boem.gov/nepaprocess/.

Federal Agencies

Congress
- Congressional Budget Office
- House Resources Subcommittee on Energy and Mineral Resources
- Senate Committee on Energy and Natural Resources

Department of Commerce
- National Oceanic and Atmospheric Administration
  - National Marine Fisheries Service

Department of Defense
- Department of the Air Force
- Department of the Army
  - Corps of Engineers
- Department of the Navy
  - Naval Mine and Anti-Submarine Warfare Command

Department of Energy
- Strategic Petroleum Reserve PMD

Department of Homeland Security
- U.S. Coast Guard

Department of State
- Bureau of Oceans and International Environmental and Scientific Affairs

Department of the Interior
- Bureau of Ocean Energy Management
- Bureau of Safety and Environmental Enforcement
- Fish and Wildlife Service
- Geological Survey
- National Park Service
- Office of Environmental Policy and Compliance
- Office of the Solicitor

Department of Transportation
- Pipeline and Hazardous Materials Safety Administration
  - Office of Pipeline Safety

Environmental Protection Agency
- Region 4
- Region 6

Marine Mammal Commission

State and Local Agencies

Alabama
- Governor's Office
- Alabama Highway Department
- Alabama Historical Commission and State Historic Preservation Officer
- Alabama Public Library Service
- Alabama Public Service Commission
- City of Mobile
- City of Montgomery
- Department of Conservation and Natural Resources
- Department of Environmental Management
- Geological Survey of Alabama
- South Alabama Regional Planning Commission
- State Legislature Natural Resources Committee
- Town of Dauphin Island

Florida
- Governor's Office
- Bay County
- Citrus County
- City of Destin
- City of Fort Walton Beach
- City of Gulf Breeze
- City of Panama City
- City of Pensacola
- Department of Agriculture and Consumer Services
- Department of Environmental Protection
- Department of State Archives, History and Records Management
- Escambia County
- Florida Emergency Response Commission
- Florida Fish and Wildlife Conservation Commission
- Franklin County
- Gulf County
- Hernando County
- Hillsborough City-County Planning Commission
- Lee County
- Monroe County
- North Central Florida Regional Planning Council
- Okaloosa County
- Pasco County
- Santa Rosa County
- Sarasota County
- Southwest Florida Regional Planning Council
- State Legislature Agriculture and Natural Resources Committee
- Tampa Bay Regional Planning Council
- Walton County
- West Florida Regional Planning Council
- Withlacoochee Regional Planning Council

Louisiana
- Governor's Office
- Calcasieu Parish
- Cameron Parish
- City of Grand Isle
- City of Lake Charles
- City of Morgan City
- City of New Orleans
- Department of Culture, Recreation, and Tourism
- Department of Economic Development
- Department of Environmental Quality
- Department of Natural Resources
- Department of Transportation and Development
- Department of Wildlife and Fisheries
- Houma-Terrebonne Chamber of Commerce
- Jefferson Parish Director
- Jefferson Parish President

Lafourche Parish Coastal Zone Management
Lafourche Parish Water District #1
Louisiana Geological Survey
South Lafourche Levee District
St. Bernard Planning Commission
State House of Representatives, Natural Resources Committee
State Legislature, Natural Resources Committee
State of Louisiana Library
Terrebonne Parish

Mississippi

Governor's Office
City of Bay St. Louis
City of Gulfport
City of Pascagoula
Department of Archives and History
Department of Environmental Quality
Department of Marine Resources
Department of Wildlife, Fisheries, and Parks
Jackson-George Regional Library System
Mississippi Development Authority
State Legislature Oil, Gas, and Other Minerals Committee

Texas

Governor's Office
Aransas Pass Public Library
Attorney General of Texas
Chambers County Library System
City of Lake Jackson
General Land Office
Southeast Texas Regional Planning Commission
State Legislature Natural Resources Committee
State Senate Natural Resources Committee
Texas Historical Commission
Texas Legislation Council
Texas Parks and Wildlife Department
Texas Sea Grant
Texas State Library and Archives
Texas Water Development Board

Federally Recognized Indian Tribes

Alabama-Coushatta Tribe of Texas
Caddo Nation of Oklahoma
Chitimacha Tribe of Louisiana
Choctaw Nation of Oklahoma
Coushatta Tribe of Louisiana
Jena Band of Choctaw Indians
Miccosukee Tribe of Indians of Florida
Mississippi Band of Choctaw Indians
Muscogee (Creek) Nation
Poarch Band of Creek Indians
Seminole Tribe of Florida
Seminole Nation of Oklahoma
Tunica-Biloxi Indian Tribe of Louisiana

Industry

Adams and Reese, LLP
Alabama Petroleum Council
American Petroleum Institute
Applied Technology Research Corporation
Area Energy LLC
Associated Gas Distributors of Florida
Baker Atlas
Baker Energy
Bepco, Inc.
C.H. Fenstermaker & Associates, Inc.
Century Exploration N.O., Inc.
Chet Morrison Contractors
Chevron U.S.A. Inc.
C-K Associates, LLC
Coastal Conservation Association
Coastal Environments, Inc.
Columbia Gulf Transmission
Continental Shelf Associates, Inc.
De Leon & Associates
Ecological Associates, Inc.
Ecology and Environment
Ecosystem Management, Inc.
Energy Partners, Ltd.
EOG Resources, Inc.
Exxon Mobil Production Company
Florida Natural Gas Association
Florida Petroleum Council
Florida Power and Light
Florida Propane Gas Association
Freeport-McMoRan, Inc.
General Insulation, Inc.
Global Industries, Ltd.
Gulf of Mexico Newsletter
Halliburton Corporation
Han & Associates, Inc.
Horizon Marine, Inc.
Industrial Vehicles International, Inc.
J. Connor Consultants

John Chance Land Surveys, Inc.
L&M Botruc Rental, Inc.
Lampl Herbert Consultants
Larose Intercoastal Lands, Inc.
Linder Oil Company
Louisiana Oil and Gas Association
Magnum Steel Services Corp.
Marine Safety Office
Mid-Continent Oil and Gas Association
Nature's Way Marine, LLC
Newfield Exploration Company
Offshore Process Services, Inc.
Oil and Gas Property Management, Inc.
Phoenix International Holdings, Inc.
Project Consulting Services
R.B. Falcon Drilling
Raintree Resources, Inc.
Science Applications International Corporation
Seneca Resources Corporation
SEOT, Inc.
Shell Exploration & Production Company
Shell Offshore, Inc.
Stone Energy Corporation
Strategic Management Services-USA
T. Baker Smith, Inc.
Texas Geophysical Company, Inc.
The SJI, LLC
The Times-Picayune
The Washington Post
URS Corporation
W & T Offshore, Inc.
Waring & Associates
WEAR-TV

Special Interest Groups

1000 Friends of Florida
Alabama Oil & Gas Board
Alabama Nature Conservancy
Alabama Wildlife Federation
American Cetacean Society
Apalachee Regional Planning Council
Apalachicola Riverkeeper
Audubon Louisiana Nature Center
Audubon of Florida
Barataria-Terrebonne National Estuary Program
Bay County Chamber of Commerce
Bay Defense Alliance
Capital Region Planning Commission
Center for Marine Conservation
Citizens Association of Bonita Beach
Clean Gulf Associates
Coalition to Restore Coastal Louisiana
Coastal Conservation Association
Concerned Shrimpers of America
Conservancy of Southwest Florida
Earthjustice
Florida Chamber of Commerce
Florida Natural Area Inventory
Florida Wildlife Federation
Gulf and South Atlantic Fisheries Foundation, Inc.
Gulf Coast Environmental Defense
Gulf Coast Fisherman's Coalition
Gulf Restoration Network
Houma-Terrebonne Chamber of Commerce
LA 1 Coalition, Inc.
League of Women Voters of the Pensacola Bay Area
Louisiana Wildlife Federation
Manasota-88
Marine Mammal Commission
Mobile Bay National Estuary Program
Natural Resources Defense Council
Nature Conservancy
Offshore Operators Committee
Organized Fishermen of Florida
Panama City Beach Convention and Visitors Bureau
Pensacola Archaeological Society
Perdido Key Association
Perdido Key Chamber of Commerce
Perdido Watershed Alliance
Restore or Retreat
Roffers Ocean Fishing Forecast Service
Save the Manatee Club
Sierra Club
South Central Industrial Association
Surfrider Foundation
The Nature Conservancy
The Ocean Conservancy

Ports/Docks

Alabama
Alabama State Port Authority
Port of Mobile

Florida
Manatee County Port Authority
Panama City Port Authority

Port of Pensacola
Port St. Joe Port Authority
Tampa Port Authority

Louisiana
- Abbeville Harbor and Terminal District
- Grand Isle Port Commission
- Greater Baton Rouge Port Commission
- Greater Lafourche Port Commission
- Lake Charles Harbor and Terminal District
- Plaquemines Port, Harbor and Terminal District
- Port of Baton Rouge
- Port of Iberia District
- Port of New Orleans
- Twin Parish Port Commission
- St. Bernard Port, Harbor and Terminal District
- West Cameron Port Commission

Mississippi
- Mississippi State Port Authority

Texas
- Brownsville Navigation District—Port of Brownsville
- Port Freeport
- Port Mansfield/Willacy County Navigation District
- Port of Beaumont
- Port of Corpus Christi Authority
- Port of Galveston
- Port of Houston Authority
- Port of Isabel—San Benito Navigation District
- Port of Port Arthur Navigation District

Educational Institutions/Research Laboratories

- Abilene Christian University
- Dauphin Island Sea Laboratory
- Florida A&M University
- Florida Institute of Oceanography
- Florida Institute of Technology
- Florida Sea Grant College
- Florida State University
- Foley Elementary School
- Gulf Coast Research Laboratory
- Gulf Coast State College
- Harbor Branch Oceanography
- Louisiana Sea Grant College Program
- Louisiana State University
- Louisiana Tech University
- Louisiana Universities Marine Consortium
- Loyola University
- McNeese State University
- Mississippi State University
- Mississippi-Alabama Sea Grant Consortium
- Mote Marine Laboratory
- Nicholls State University
- Pensacola Junior College
- Tulane University
- University of Alabama
- University of Florida
- University of Louisiana at Lafayette
- University of Miami
- University of Mississippi
- University of New Orleans
- University of South Alabama
- University of South Florida
- University of Southern Mississippi
- University of Texas at Arlington
- University of Texas at Austin
- University of Texas Law School
- University of Texas Libraries
- University of West Florida

5.6.3 Development of the Final Supplemental EIS

5.6.3.1 Major Differences Between the Draft and Final Supplemental EISs

Several changes were made between the Draft and Final Supplemental EISs. These changes were the result of new information becoming available, editorial suggestions, and comments received on the Draft Supplemental EIS. Most notably, portions of the air quality impact analysis in **Chapter 4.1** have been updated in response to public comments received on the analysis. However, as noted in **Chapter 4.1**, BOEM is in the process of updating the air quality modeling based on public comments; the results of the final air quality modeling will be included in a future NEPA analysis that will be available for public review and comment. The revised air quality model run will not be completed before the publication of this Final Supplemental EIS. The results of the initial air quality model are therefore the best available information we have, and they are included in this Supplemental EIS as an overly conservative reference for NEPA analysis. The conservative air quality modeling results currently available allow consideration of anticipated air quality impacts without those impacts being underestimated.

No activities beyond certain ancillary activities are actually authorized by the lease; therefore, there are few environmental impacts, including on air quality, reasonably expected from a proposed lease sale itself (refer to **Chapter 1.3.1**). Should there be any air quality impacts suggested from the updated air quality modeling, regulations governing postlease plan approvals allow for mitigations to address these impacts. During its review of any plan submitted postlease, BOEM conducts an air quality review to determine if additional controls are necessary. At this postlease stage, BOEM has the authority to disapprove or require additional mitigation to reduce impacts from site-specific activities as additional information related to the revised air quality modeling becomes available. It is anticipated that new air quality modeling results will be available for consideration before any plan is submitted on a block leased as a result of proposed Lease Sale 250. Therefore, while additional air quality data would be useful in consideration of this proposed lease sale, it is not necessary for a decision on this proposed lease sale. Any concerns raised by the modeling study will be further refined by the time plans are submitted, and/or additional plan-specific modeling may be required consistent with BOEM's regulations when the plan is submitted for approval.

Comments on the Draft Supplemental EIS were received via verbal, written, and electronic submission. As a result of these comments, changes have been made between the Draft and Final Supplemental EISs. Where appropriate, the text in this Final Supplemental EIS has been verified or expanded to provide clarification on specific issues, as well as to provide updated information. The revisions made between the Draft and Final Supplemental EISs, however, did not change the impact conclusion for the any of the resources analyzed. For more information, refer to **Chapter 4**.

5.6.3.2 Public Meetings

In accordance with 30 CFR § 556.26, BOEM scheduled public meetings soliciting comments on the Draft Supplemental EIS. The meetings were conducted to solicit information from interested parties in order to provide the Secretary of the Interior with information to help in the evaluation of the potential effects of the proposed lease sales. An announcement of the dates, times, and locations of the public meetings was included in the Notice of Availability of the Draft Supplemental EIS. A copy of the public meetings' notice was included with the Draft Supplemental EIS that was mailed to the parties indicated above, was published in local newspapers, and was posted on BOEM's website at http://www.boem.gov/nepaprocess/.

Public meetings were held in Texas, Louisiana, Florida, Alabama, and Mississippi on the dates and at the times and locations indicated below:

Tuesday, April 25, 2017
4:00 p.m.-7:00 p.m. CDT
Wyndham Garden New Orleans Airport
6401 Veterans Memorial Blvd.
Metairie, LA 70003
18 registered attendees
0 oral comments received
4 written comment received

Thursday, April 27, 2017
4:00 p.m.-7:00 p.m. CDT
Houston Marriott North
North Sam Houston Parkway East
Houston, TX 77060
3 registered attendees
0 oral comments received
1 written comments received

Monday, May 1, 2017
4:00 p.m.-7:00 p.m. CDT
Hilton Garden Inn Pensacola Airport
1144 Airport Blvd.
Pensacola, FL 32504
15 registered attendees
2 oral comments received
5 written comment received

Tuesday, May 2, 2017
4:00 p.m.-7:00 p.m. CDT
The Admiral Hotel Mobile,
Curio Collection by Hilton
251 Government St.
Mobile, AL 36602
0 written comment received
7 registered attendees
3 oral comments received

Wednesday, May 3, 2017
4:00 p.m.-7:00 p.m. CDT
Courtyard by Marriott,
Gulfport Beachfront MS Hotel
1600 East Beach Blvd
Gulfport, MS 39501
14 registered attendees
0 oral comments received
1 written comments received

5.6.3.3 Comments Received on the Draft Supplemental EIS and BOEM's Responses

The Notice of Availability and the announcement of public meetings were published in the *Federal Register* on March 31, 2017; were posted on BOEM's website; and were mailed to interested parties. The comment period ended on May 15, 2017; however, the Joint Trades and a private citizen requested an additional 30 days to comment on the air quality modeling and analysis. They were given a 30-day extension, which closed on June 14, 2017, to provide comments on air quality only; however, no additional air quality comments were received during the 30 day extension. BOEM received 335 substantive comments in response to the Draft Supplemental EIS via letter, email, written and verbal comments at public meetings, and the regulations.gov website. BOEM also received 3,677 signatures on a form letter, and a petition signed by over 89,000 individuals requesting an end to offshore drilling. All comments (i.e., letters, court reporter transcripts, electronic submissions, etc.) were analyzed to identify all substantive issues raised by the public. Each issue within an individual's comment was assigned a unique identifier and then grouped into nine major categories. Within these nine categories, responses are provided for each issue. When similar issues were raised by several commenters, a single response has been provided for multiple comments. The comments and responses are presented in a matrix in **Appendix E** and are organized by the following nine topics:

Topic 1 – “NEPA Process and Public Involvement” contains those issues related to the process of preparing this Supplemental EIS and the public’s engagement.

Topic 2 – “NEPA Analysis” includes comments about how BOEM carried out its analysis under NEPA.

Topic 3 – “Alternatives” includes all of the comments related to the alternatives considered in the preparation of this Supplemental EIS. A majority of these comments included a statement of the commenter’s preference for a particular alternative, with some including a reason why. A “Stated Preference” subtopic was included to group those comments.

Topic 4 – “Environmental Issues and Concerns” contains 15 subcategories that include the following:

- Climate Change
- Greenhouse Gas
- Well Stimulation
- Renewable Energy and Alternative Uses of the OCS
- Natural Stressors
- Air Quality
- Water Quality
- Coastal Habitats
- Deepwater Benthic Communities
- *Sargassum* and Associated Communities
- Marine Mammals
- Commercial Fisheries
- Land Use and Coastal Infrastructure
- Economic Factors
- Social Factors (Including Environmental Justice)

Topic 5 – “Cumulative Analysis” includes the comments that BOEM received regarding the analysis of past, present, and reasonably foreseeable activities in this Supplemental EIS.

Topic 6 – “Oil Spills” includes comments related to concerns over oil spills and their impact on the environment.

Topic 7 – “Mitigation” includes all of the comments that relate to how BOEM plans to minimize environmental impacts.

Topic 8 – "Regulations and Safety" includes comments on how BOEM and BSEE regulate offshore energy production and safety.

Topic 9 – "Other" includes a wide range of comments that did not fall into one of the above categories (e.g., halting all future activities, questions about leasing procedures, oil and gas resources and demand, BOEM's mission, shoreline debris, and concern for industry practices).

CHAPTER 6

REFERENCES CITED

6 REFERENCES CITED

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CHAPTER 7

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CHAPTER 8

GLOSSARY

8 GLOSSARY

Acute—Sudden, short term, severe, critical, crucial, intense, but usually of short duration, as opposed to chronic. Effects associated with acute can vary depending on the context of its use (e.g., acute [short-term] exposure could be more or less problematic than chronic [long-term] exposure).

Anaerobic—Capable of growing in the absence of molecular oxygen.

Annular preventer—A component of the pressure control system in the BOP that forms a seal in the annular space around any object in the wellbore or upon itself, enabling well control operations to commence.

Anthropogenic—Coming from human sources, relating to the effect of humankind on nature.

Antipatharian Transitional Zone—The area located between 50 and 90 m (164 and 295 ft), where available light is reduced and there is a gradual ecosystem change from tropical shallow-water corals that are dependent on light to deeper water species, such as antipatharian black corals that are not.

API gravity—A standard adopted by the American Petroleum Institute for expressing the specific weight of oil.

Aromatic—Class of organic compounds containing benzene rings or benzenoid structures.

Attainment area—An area that is shown by monitored data or by air-quality modeling calculations to be in compliance with primary and secondary ambient air quality standards established by USEPA.

Barrel (bbl)—A volumetric unit used in the petroleum industry; equivalent to 42 U.S. gallons or 158.99 liters.

Benthic—On or in the bottom of the sea.

Biological Opinion—The FWS or NMFS evaluation of the impact of a proposed action on endangered and threatened species, in response to formal consultation under Section 7 of the Endangered Species Act.

Block—A geographical area portrayed on official BOEM protraction diagrams or leasing maps that contains approximately 5,760 ac (2,331 ha; 9 mi^2).

Blowout—An uncontrolled flow of fluids below the mudline from appurtenances on a wellhead or from a wellbore.

Blowout preventer (BOP)—One of several valves installed at the wellhead to prevent the escape of pressure either in the annular space between the casing and drill pipe or in open hole (i.e., hole with no drill pipe) during drilling completion operations. Blowout preventers on jackup or platform rigs are located at the water's surface; on floating offshore rigs, BOPs are located on the seafloor.

Cetacean—Aquatic mammal of the order Cetacea, such as whales, dolphins, and porpoises.

Chemosynthetic—Organisms that obtain their energy from the oxidation of various inorganic compounds rather than from light (photosynthetic).

Coastal waters—Waters within the geographical areas defined by each State's Coastal Zone Management Program.

Coastal wetlands—forested and nonforested habitats, mangroves, and marsh islands exposed to tidal activity. These areas directly contribute to the high biological productivity of coastal waters by input of detritus and nutrients, by providing nursery and feeding areas for shellfish and finfish, and by serving as habitat for birds and other animals.

Coastal zone—The coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder) strongly influenced by each other and in proximity to the shorelines of several coastal states; the zone includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches, and it extends seaward to the outer limit of the United States territorial sea. The zone extends inland from the shorelines only to the extent necessary to control shorelands, the uses of which have a direct and significant impact on the coastal waters. Excluded from the coastal zone are lands the use of which is by law subject to the discretion of or which is held in trust by the Federal Government, its officers, or agents (also refer to State coastal zone boundaries).

Completion—Conversion of a development well or an exploration well into a production well.

Condensate—Liquid hydrocarbons produced with natural gas; they are separated from the gas by cooling and various other means. Condensates generally have an API gravity of 50°-120°.

Continental margin—The ocean floor that lies between the shoreline and the abyssal ocean floor, includes the continental shelf, continental slope, and continental rise.

Continental shelf—General term used by geologists to refer to the continental margin province that lies between the shoreline and the abrupt change in slope called the shelf edge, which generally occurs in the Gulf of Mexico at about the 200-m (656-ft) water depth. The continental shelf is characterized by a gentle slope (about 0.1°). This is different from the juridical term used in Article 76 of the United Nations Convention on the Law of the Sea Royalty Payment (refer to the definition of Outer Continental Shelf).

Continental slope—The continental margin province that lies between the continental shelf and continental rise, characterized by a steep slope (about 3°-6°).

Critical habitat—Specific areas essential to the conservation of a protected species and that may require special management considerations or protection.

Crude oil—Petroleum in its natural state as it emerges from a well or after it passes through a gas-oil separator, but before refining or distillation. An oily, flammable, bituminous liquid that is essentially a complex mixture of hydrocarbons of different types with small amounts of other substances.

Delineation well—A well that is drilled for the purpose of determining the size and/or volume of an oil or gas reservoir.

Demersal—Living at or near the bottom of the sea.

Development—Activities that take place following discovery of economically recoverable mineral resources, including geophysical surveying, drilling, platform construction, operation of onshore support facilities, and other activities that are for the purpose of ultimately producing the resources.

Development and Production Plan (DPP)—A document that must be prepared by the operator and submitted to BOEM for approval before any development and production activities are conducted on a lease or unit in any OCS area other than the western Gulf of Mexico.

Development Operations Coordination Document (DOCD)—A document that must be prepared by the operator and submitted to BOEM for approval before any development or production activities are conducted on a lease in the western Gulf of Mexico.

Development well—A well drilled to a known producing formation to extract oil or gas; a production well; distinguished from a wildcat or exploration well and from an offset well.

Direct employment—Consists of those workers involved in the primary industries of oil and gas exploration, development, and production operations (Standard Industrial Classification Code 13—Oil and Gas Extraction).

Discharge—Something that is emitted; flow rate of a fluid at a given instant expressed as volume per unit of time.

Dispersant—A suite of chemicals and solvents used to break up an oil slick into small droplets, which increases the surface area of the oil and hastens the processes of weathering and microbial degradation.

Dispersion—A suspension of finely divided particles in a medium.

Drilling mud—A mixture of clay, water or refined oil, and chemical additives pumped continuously downhole through the drill pipe and drill bit, and back up the annulus between the pipe and the walls of the borehole to a surface pit or tank. The mud lubricates and cools the drill bit, lubricates the drill pipe as it turns in the wellbore, carries rock cuttings to the surface, serves to keep the hole from crumbling or collapsing, and provides the weight or hydrostatic head to prevent extraneous fluids from entering the well bore and to downhole pressures; also called drilling fluid.

Economically recoverable resources—An assessment of hydrocarbon potential that takes into account the physical and technological constraints on production and the influence of costs of exploration and development and market price on industry investment in OCS exploration and production.

Effluent—The liquid waste of sewage and industrial processing.

Effluent limitations—Any restriction established by a State or USEPA on quantities, rates, and concentrations of chemical, physical, biological, and other constituents discharged from point sources into U.S. waters, including schedules of compliance.

Epifaunal—Animals living on the surface of hard substrate.

Essential habitat—Specific areas crucial to the conservation of a species and that may necessitate special considerations.

Estuary—Coastal semienclosed body of water that has a free connection with the open sea and where freshwater meets and mixes with seawater.

Eutrophication—Enrichment of nutrients in the water column by natural or artificial methods accompanied by an increase of respiration, which may create an oxygen deficiency.

Exclusive Economic Zone (EEZ)—The maritime region extending 200 nmi (230 mi; 370 km) from the baseline of the territorial sea, in which the United States has exclusive rights and jurisdiction over living and nonliving natural resources.

Exploration Plan (EP)—A plan that must be prepared by the operator and submitted to BOEM for approval before any exploration or delineation drilling is conducted on a lease.

Exploration well—A well drilled in unproven or semi-proven territory to determining whether economic quantities of oil or natural gas deposit are present.

False crawls—Refers to when a female sea turtle crawls up on the beach to nest (perhaps) but does not and returns to the sea without laying eggs.

Field—An accumulation, pool, or group of pools of hydrocarbons in the subsurface. A hydrocarbon field consists of a reservoir in a shape that will trap hydrocarbons and that is covered by an impermeable, sealing rock.

Floating production, storage, and offloading (FPSO) system—A tank vessel used as a production and storage base; produced oil is stored in the hull and periodically offloaded to a shuttle tanker for transport to shore.

Gathering lines—A pipeline system used to bring oil or gas production from a number of separate wells or production facilities to a central trunk pipeline, storage facility, or processing terminal.

Geochemical—Of or relating to the science dealing with the chemical composition of and the actual or possible chemical changes in the crust of the earth.

Geophysical survey—A method of exploration in which geophysical properties and relationships are measured remotely by one or more geophysical methods.

Habitat—A specific type of environment that is occupied by an organism, a population, or a community.

Hermatypic coral—Reef-building corals that produce hard, calcium carbonate skeletons and that possess symbiotic, unicellular algae within their tissues.

Harassment—An intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, feeding or sheltering.

Hermatypic—Corals in the order Scleractinia that build reefs by depositing hard calcareous material for their skeletons, forming the stony framework of the reef. Corals that do not contribute to coral reef development are referred to as ahermatypic (non-reef-building) species.

Hydrocarbons—Any of a large class of organic compounds containing primarily carbon and hydrogen. Hydrocarbon compounds are divided into two broad classes: aromatic and aliphatics. They occur primarily in petroleum, natural gas, coal, and bitumens.

Hypoxia—Depressed levels of dissolved oxygen in water, usually resulting in decreased metabolism.

Incidental take—Takings that result from, but are not the purpose of, carrying out an otherwise lawful activity (e.g., fishing) conducted by a Federal agency or applicant (refer to Taking).

Infrastructure—The facilities associated with oil and gas development, e.g., refineries, gas processing plants, etc.

Jack-up rig—A barge-like, floating platform with legs at each corner that can be lowered to the sea bottom to raise the platform above the water.

Kick—A deviation or imbalance, typically sudden or unexpected, between the downward pressure exerted by the drilling fluid and the upward pressure of *in-situ* formation fluids or gases.

Landfall—The site where a marine pipeline comes to shore.

Lease—Authorization that is issued under Section 8 or maintained under Section 6 of the Outer Continental Shelf Lands Act and that authorizes exploration for, and development and production of, minerals.

Lease sale—The competitive auction of leases granting companies or individuals the right to explore for and develop certain minerals under specified conditions and periods of time.

Lease term—The initial period for oil and gas leases, usually a period of 5, 8, or 10 years depending on water depth or potentially adverse conditions.

Lessee—A party authorized by a lease, or an approved assignment thereof, to explore for and develop and produce the leased deposits in accordance with regulations at 30 CFR part 250 and 30 CFR part 550.

Littoral zone—Marine ecological realm that experiences the effects of tidal and longshore currents and breaking waves to a depth of 5-10 m (16-33 ft) below the low-tide level, depending on the intensity of storm waves.

Longshore sediment transport—The cumulative movement of beach sediment along the shore (and nearshore) by waves arriving at an angle to the coastline and by currents generated by such waves.

Macondo—Prospect name given by BP to the Mississippi Canyon Block 252 exploration well that the *Deepwater Horizon* rig was drilling when a blowout occurred on April 20, 2010.

***Macondo* spill**—The name given to the oil spill that resulted from the explosion and sinking of the *Deepwater Horizon* rig from the period between April 24, 2010, when search and recovery vessels on site reported oil at the sea surface, and September 19, 2010, when the uncontrolled flow from the *Macondo* well was capped.

Marshes—Persistent, emergent, nonforested wetlands characterized by predominantly cordgrasses, rushes, and cattails.

Military warning area—An area established by the U.S. Department of Defense within which military activities take place.

Minerals—As used in this document, minerals include oil, gas, sulphur, and associated resources, and all other minerals authorized by an Act of Congress to be produced from public lands as defined in Section 103 of the Federal Land Policy and Management Act of 1976.

Naturally occurring radioactive materials (NORM)—naturally occurring material that emits low levels of radioactivity, originating from processes not associated with the recovery of radioactive material. The radionuclides of concern in NORM are Radium-226, Radium-228, and other isotopes in the radioactive decay chains of uranium and thorium.

Nepheloid—A layer of water near the bottom that contains significant amounts of suspended sediment.

Nonattainment area—An area that is shown by monitoring data or by air-quality modeling calculations to exceed primary or secondary ambient air quality standards established by USEPA.

Nonhazardous oil-field wastes (NOW)—Wastes generated by exploration, development, or production of crude oil or natural gas that are exempt from hazardous waste regulation under the Resource Conservation and Recovery Act (*Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes,* dated June 29, 1988, 53 FR 25446; July 6, 1988). These wastes may contain hazardous substances.

Oceanic zone—Offshore water >200 m (656 ft) deep. It is the region of open sea beyond the edge of the continental shelf and includes 65 percent of the ocean's completely open water.

Offloading—Unloading liquid cargo, crude oil, or refined petroleum products.

Operational discharge—Any incidental pumping, pouring, emitting, emptying, or dumping of wastes generated during routine offshore drilling and production activities.

Operator—An individual, partnership, firm, or corporation having control or management of operations on a leased area or portion thereof. The operator may be a lessee, designated agent of the lessee, or holder of operating rights under an approved operating agreement.

Organic matter—Material derived from living plants or animals.

Outer Continental Shelf (OCS)—All submerged lands that comprise the continental margin adjacent to the United States and seaward of State offshore lands.

Passerines—Perching birds (members of the Order Passeriformes) and songbirds.

Potential Biological Removal (PBR)—Of or pertaining to the open sea; associated with open water beyond the direct influence of coastal systems.

Pelagic—Of or pertaining to the open sea; associated with open water beyond the direct influence of coastal systems.

Plankton—Passively floating or weakly motile aquatic plants (phytoplankton) and animals (zooplankton).

Platform—A steel or concrete structure from which offshore development wells are drilled.

Play—A prospective subsurface area for hydrocarbon accumulation that is characterized by a particular structural style or depositional relationship.

Primary production—Organic material produced by photosynthetic or chemosynthetic organisms.

Produced water—Total water discharged from the oil and gas extraction process; production water or production brine.

Production—Activities that take place after the successful completion of any means for the extraction of resources, including bringing the resource to the surface, transferring the produced resource to shore, monitoring operations, and drilling additional wells or workovers.

Province—A spatial entity with common geologic attributes. A province may include a single dominant structural element such as a basin or a fold belt, or a number of contiguous related elements.

Ram—The main component of a blowout preventer designed to shear casing and tools in a wellbore or to seal an empty wellbore. A blind shear ram accomplishes the former and a blind ram the latter.

Recoverable reserves—The portion of the identified hydrocarbon or mineral resource that can be economically extracted under current technological constraints.

Recoverable resource estimate—An assessment of hydrocarbon or mineral resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources can be brought to the surface.

Recreational beaches—Frequently visited, sandy areas along the Gulf of Mexico shorefront that support multiple recreational activities at the land-water interface. Included are National Seashores, State Park and Recreational Areas, county and local parks, urban beachfronts, and private resorts.

Refining—Fractional distillation of petroleum, usually followed by other processing (e.g., cracking).

Relief—The difference in elevation between the high and low points of a surface.

Reserves—Proved oil or gas resources.

Rig—A structure used for drilling an oil or gas well.

Riser insertion tube tool—A “straw” and gasket assembly improvised during the *Macondo* spill response that was designed to siphon oil and gas from the broken riser of the *Deepwater Horizon* rig lying on the sea bottom (an early recovery strategy for the *Macondo* spill in May 2010).

Royalty—A share of the minerals produced from a lease paid in either money or “in-kind” to the landowner by the lessee.

Saltwater intrusion—Saltwater invading a body of freshwater.

Sciaenids—Fishes belonging to the croaker family (Sciaenidae).

Seagrass beds—More or less continuous mats of submerged, rooted, marine, flowering vascular plants occurring in shallow tropical and temperate waters. Seagrass beds provide habitat, including breeding and feeding grounds, for adults and/or juveniles of many of the economically important shellfish and finfish.

Sediment—Material that has been transported and deposited by water, wind, glacier, precipitation, or gravity; a mass of deposited material.

Seeps (hydrocarbon)—Gas or oil that reaches the surface along bedding planes, fractures, unconformities, or fault planes.

Sensitive area—An area containing species, populations, communities, or assemblages of living resources, that is susceptible to damage from normal OCS oil- and gas-related activities. Damage includes interference with established ecological relationships.

Shear ram—The component in a BOP that cuts, or shears, through the drill pipe and forms a seal against well pressure. Shear rams are used in floating offshore drilling operations to provide a quick method of moving the rig away from the hole when there is no time to trip the drill stem out of the hole.

Site fidelity or philopatry—The tendency to return to a previously occupied location.

Spill of National Significance—Designation by the USEPA Administrator under 40 CFR § 300.323 for discharges occurring in the inland zone and the Commandant of the U.S. Coast Guard for discharges occurring in the coastal zone, authorizing the appointment of a National Incident Commander for spill-response activity.

State coastal zone boundary—The State coastal zone boundaries for each CZMA-affected State are defined at https://coast.noaa.gov/czm/media/StateCZBoundaries.pdf.

Structure—Any OCS facility that extends from the seafloor to above the waterline; in petroleum geology, any arrangement of rocks that may hold an accumulation of oil or gas.

Subarea—A discrete analysis area.

Subsea isolation device—An emergency disconnection and reconnection assembly for the riser at the seafloor.

Supply vessel—A boat that ferries food, water, fuel, and drilling supplies and equipment to an offshore rig or platform and returns to land with refuse that cannot be disposed of at sea.

Taking—To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any endangered or threatened species, or to attempt to engage in any such conduct (including actions that induce stress, adversely impact critical habitat, or result in adverse secondary or cumulative impacts). Harassments are the most common form of taking associated with OCS Program activities.

Tension-leg platform (TLP)—A production structure that consists of a buoyant platform tethered to concrete pilings on the seafloor with flexible cable.

Tidal prism—The volume of water in an estuary or inlet between mean high tide and mean low tide, or the volume of water leaving an estuary at ebb tide.

Trunkline—A large-diameter pipeline receiving oil or gas from many smaller tributary gathering lines that serve a large area; common-carrier line; main line.

Turbidity—Reduced water clarity due to the presence of suspended matter.

Volatile organic compound (VOC)—Any organic compound that is emitted to the atmosphere as a vapor.

Water test areas—Areas within the eastern Gulf where U.S. Department of Defense research, development, and testing of military planes, ships, and weaponry take place.

Weathering (of oil)—The aging of oil due to its exposure to the atmosphere, causing marked alterations in its physical and chemical makeup.

KEYWORD INDEX

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The Department of the Interior Mission

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The Bureau of Ocean Energy Management Mission

The Bureau of Ocean Energy Management (BOEM) is responsible for managing development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.