UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT
GULF OF MEXICO OCS REGION
NEW ORLEANS, LOUISIANA

SITE-SPECIFIC ENVIRONMENTAL ASSESSMENT

OF

EXPLORATION PLAN NO. S-7829

FOR

LLOG EXPLORATION OFFSHORE, LLC

March 14, 2017

RELATED ENVIRONMENTAL DOCUMENT

Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas Lease Sales: 2012-2017; Western Planning Area Sales 229, 233, 238, 246, and 248; Central Planning Area Sales 227, 231, 235, 241, and 247 (OCS EIS/EA BOEM 2012-019)

Supplemental Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas Lease Sale: 2016 Western Planning Area Lease Sale 248; Final Supplemental Environmental Impact Statement (OCS EIS/EA BOEM 2016-005)

Supplemental Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas Lease Sale: 2017, Central Planning Area Lease Sale 247;
Final Supplemental Environmental Impact Statement
(OCS EIS/EA BOEM 2016-061)

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

The Bureau of Ocean Energy Management (BOEM) has prepared a Site-Specific Environmental Assessment (SEA) (No. S-7829) complying with the National Environmental Policy Act (NEPA). NEPA regulations under the Council on Environmental Quality (CEQ) (40 CFR § 1501.3 and § 1508.9), the United States Department of the Interior (USDOI) NEPA implementing regulations (43 CFR part 46), and BOEM policy require an evaluation of proposed major federal actions, which under BOEM jurisdiction includes approving a plan for oil and gas exploration or development activity on the Outer Continental Shelf (OCS).

NEPA regulation 40 CFR Part 1508.27(b) requires significance to be evaluated in terms of context and intensity. The context and intensity of impacts caused by similar actions to that proposed were examined at a basin-wide scale in the Gulf of Mexico (GOM) in the following NEPA documents:

- *Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas Lease Sales: 2012-2017; Western Planning Area Sales 229, 233, 238, 246, and 248; Central Planning Area Sales 227, 231, 235, 241, and 247* (Multisale EIS) (USDOI, BOEM, 2012);
- *Final Supplemental Environmental Impact Statement for the Gulf of Mexico OCS Oil and Gas Lease Sale: 2016; Western Planning Area Lease Sale 248* (Western SEIS) (USDOI, BOEM, 2016a); and
- *Final Supplemental Environmental Impact Statement for Gulf of Mexico OCS, Oil and Gas Lease Sale: 2017; Central Planning Area Lease Sale 247* (Central SEIS) (USDOI, BOEM, 2016b).

This SEA tiers from these evaluations and considers the impacts of the proposed action.

The Proposed Action: LLOG Exploration Offshore, LLC (LLOG) supplemental Exploration Plan proposes to explore for hydrocarbons by drilling and completing two wells (Wells D and E) in Mississippi Canyon Block 387 (OCS-G 22873) in the Central Planning Area. The proposed drilling locations are located southeast of Venice, Louisiana, approximately 60 miles (96 kilometers) from the nearest shoreline in Plaquemines Parish, Louisiana. The water depths at the proposed well sites range from 6,497 to 6,592 feet (1,980 to 2,009 meters). LLOG plans on using a dynamically positioned (DP) drillship or DP semisubmersible to drill and complete proposed wells and no anchors would be used.

Resources and Impacts Considered: The impact analysis for the proposed activity focused on the exploration activities and the resources that may be potentially impacted. The impact producing factors (IPF) include: (1) air emissions; (2) drilling and overboard discharges; (3) seafloor disturbance from well emplacement; (4) vessel traffic and noise; and (5) marine trash and debris.

In this SEA BOEM has considered two alternatives: (1) no action; and (2) proposed action as submitted. BOEM has assessed the impacts of the proposed action on the following resources:

1) air quality;
2) water quality;
3) deepwater benthic communities;
4) marine mammals;
5) sea turtles;
6) fish resources and essential fish habitat; and
7) archaeological resources.

Potential impacts on these resources are summarized here. Because direct contact is potentially the most disruptive potential impact for resources fixed or lying on the sea bottom, it is weighted most heavily out of all other potentially impacting factors. Pre-activity surveys of the sea bottom required by BOEM may identify potentially sensitive deepwater benthic communities and archaeological resources. At this time no deepwater benthic communities or archaeological resources on the sea bottom are known that could be disturbed by the proposed activity. In the event that either type of resource is encountered the operator is instructed to avoid impacts to these resources and notify BOEM per the regulations. Operator following the regulations and the regulatory guidance found in the NTLs, potential impacts to air quality, water quality, deepwater benthic communities, marine mammals, sea turtles, fish resources and essential fish habitat, and archaeological resources from the proposed activities were determined to be negligible and BOEM therefore will not require additional conditions of approval. Our evaluation in this SEA has selected alternative 2 and serves as the basis for approving the proposed action. We therefore conclude that no significant impacts are expected to occur to any affected resources by allowing the proposed action to proceed.

Conclusion: BOEM has evaluated the potential environmental impacts of the proposed action. Based on SEA No. S-7829, we determine that the proposed action would have no significant impact on the human environment. Therefore an Environmental Impact Statement will not be required.

PERRY BOUDREAUX

Digitally signed by PERRY BOUDREAUX
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Chief, Environmental Operations Section
BOEM Office of Environment, GOM OCS Region

March 14, 2017
Date

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Site-Specific Environmental Assessment (SEA) Prepared for LLOG Exploration Offshore, LLC Supplemental Exploration Plan: S-7829

1. OVERVIEW

The purpose of this Site-Specific Environmental Assessment (SEA) is to determine whether the proposed activities outlined in the supplemental Exploration Plan (EP), S-7829, initially submitted by LLOG Exploration Offshore, LLC (LLOG) on January 13, 2017 will significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act (NEPA) and whether an Environmental Impact Statement (EIS) must be prepared. LLOG's supplemental EP proposes to explore for hydrocarbons by drilling and completing two wells (Wells D and E) in Mississippi Canyon Block 387 (OCS-G 22873) in the Central Planning Area (CPA). This SEA is tiered from the prior NEPA documents:

- Gulf of Mexico OCS Oil and Gas Lease Sales: 2012-2017; Western Planning Area Sales 229, 233, 238, 246, and 248; Central Planning Area Sales 227, 231, 235, 241, and 247: Final Environmental Impact Statement (Multisale EIS) (USDOI, BOEM, 2012);
- Gulf of Mexico OCS Oil and Gas Lease Sale: 2016 Western Planning Area Lease Sale 248; Final Supplemental Environmental Impact Statement (Western SEIS) (USDOI, BOEM, 2016a); and
- Gulf of Mexico OCS, Oil and Gas Lease Sale 2017, Central Planning Area Lease Sale 247, Final Supplemental Environmental Impact Statement (Central SEIS) (USDOI, BOEM, 2016b).

The Multisale EIS and SEISs evaluated a broad spectrum of potential impacts resulting from drilling activities across the Central and Western Planning Areas of the GOM Outer Continental Shelf (OCS).

"Tiering" process is provided for in the NEPA implementing regulations (40 CFR part 1502.20 and 1508.28) and is designed to reduce and simplify the size of subsequent environmental analyses of actions included within the broader program previously examined in NEPA compliance documents by eliminating discussions of impacts that would be repetitive to allow focus on those site-specific concerns and effects related to the specific action proposed. Document tiering in Bureau of Ocean Energy Management (BOEM) is subject to additional guidance under the United States Department of the Interior (DOI) regulations at 43 CFR § 46.140 wherein the site-specific analysis must note which conditions and effects addressed in the programmatic document remain valid and which conditions and effects require additional review.

Although the analyses of drilling-related impacts prepared in the Multisale EIS and SEISs are comprehensive, new information has become available with respect to the following:

- **Emission Impacts on Air Quality** – the EP contains project-specific emissions data not known during the preparation of the programmatic analyses;
- **Discharge Impacts on Offshore Water Quality** – the EP contains project-specific discharge data not known during the preparation of the programmatic analyses;
- **Bottom Impacts on Deepwater Benthic Communities** – the EP contains project-specific information not known during the preparation of the programmatic analyses;
- **Noise/Vessel-Strike Impacts on Marine Mammals –** the environmental baseline since completion of the Multisale EIS and SEISs may have experienced slight changes and new information has become available since the preparation of the programmatic analyses;
- **Noise/Vessel-Strike Impacts on Sea Turtles –** the environmental baseline since completion of the Multisale EIS and SEISs may have experienced slight changes and new information has become available since the preparation of the programmatic analyses;
- **Discharge Impacts/Disturbances to Fish and Fisheries –** the environmental baseline since completion of the Multisale EIS and SEISs may have experienced slight changes and new information has become available since the preparation of the programmatic analyses; and

- **Bottom Impacts on Potential Archaeological Resources** – the EP contains project-specific information not known during the preparation of the programmatic analyses.

Therefore, Chapter 3 of this SEA focuses on how the new information, including a discussion of the known effects of the *Deepwater Horizon* explosion, spill, and response activities on the analyzed resources, relates to the routine, accidental, and cumulative environmental effects of this proposed action. Where applicable, relevant affected environment discussions and impact analyses from the Multisale EIS and SEISs is summarized and utilized for this site-specific analyses, and are incorporated by reference into this SEA. Relevant condition(s) of approval identified in this SEA, Multisale EIS, and SEISs have been considered in the evaluation of the proposed action.

1.1. BACKGROUND

BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are mandated to manage and oversee the exploration and development of OCS oil, gas, and mineral resources while ensuring safe operations and the protection of the human, marine, and coastal environments. BOEM and the BSEE issue oil and gas leases and regulates exploration, development, production, and decommissioning. Prior to authorizing activities related to these phases, BOEM conducts the appropriate NEPA review. BOEM's Office of Leasing and Plans oversees the submittal of EPs and Development Operations Coordination Documents (DOCD) pursuant to 30 CFR part 550, Subpart B.

Lessees and operators submit EPs and DOCDs to provide BOEM with information needed to adequately evaluate the overall potential impacts on OCS resources prior to seeking any individual permit approvals, such as an application for permit to drill (APD). Most of the information in EPs and DOCDs is presented in basic statements, figures, lists, and tables that simply provide the necessary details on the proposed exploration, development, production, and/or transportation operations. One exception is the Environmental Impact Analyses (EIA) required in EPs under 30 CFR § 550.227 and in DOCDs under 30 CFR § 550.261; wherein, the operator provides environmental information and makes impact conclusions regarding their activities.

On April 20, 2010, while working on an exploratory well approximately 50 miles (mi) 80 kilometers (km)) offshore Louisiana, the semisubmersible drilling rig *Deepwater Horizon* experienced an explosion and fire, resulting in an uncontrolled release of oil and natural gas from the Macondo reservoir. Oil was dispersed into the water column, but heavier oil fractions and tarballs washed onto shorelines in varying concentrations. Natural gas dissolved into the water column or vented into the atmosphere. On July 15, 2010, the leaking well was capped and a relief well encountered and plugged the Macondo wellbore on September 19, 2010. Prior to capping/plugging the well, approximately 53,000-62,000 barrels (bbl) of oil per day (BOPD) (2.23-2.60 million gallons per day) were released from the well, with an approximate total release of 4.9 million bbl of oil (206,000,000 gallons) over an 87-day period.

The *Deepwater Horizon* spill has resulted in changes in environmental conditions over a large portion of the northern GOM. Some of the information found in recent EIAs has relied upon out-of-date and inaccurate data. For this reason, BOEM reviewed, but did not rely upon, any environmental information and/or assumptions provided by the operator in the EIA when conducting this analysis.

The scope of the effects on the environment in the GOM from the activities proposed in LLOG's Supplemental EP were fully discussed and analyzed in the Multisale EIS and SEISs, and the specific locations, equipment, methodologies, and the duration of the proposed activities will result in impacts similar to those discussed in the EIS. However, there is new information from the *Deepwater Horizon* explosion, spill, and response in scientific literature that is peer-reviewed as well as new mitigation methodologies such as oil spill remediation that could alter the severity or duration of impacts on the affected environment. This information was not previously available and could not be considered or analyzed during the preparation of the Multisale EIS and SEISs. This SEA was prepared by BOEM to evaluate the activity-specific issues related to the applicant's proposed activities in addition to the new information.

1.2. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

LLOG has submitted a plan to conduct exploration activities on the OCS. The purpose of the proposed action is to drill and complete two exploratory wells so that LLOG can utilize the information to evaluate the potential for, and develop plans for, the development and production of hydrocarbon resources on the OCS, which would help satisfy the Nation's need for energy.

The need for this action is established by BOEM's responsibility under the Outer Continental Shelf Lands Act (OCSLA) to make OCS lands available for expeditious and orderly development, subject to environmental safeguards, in a manner that is consistent with the maintenance of competition and other national needs. Section 11 of OCSLA (43 U.S.C. § 1340) requires oil and gas lessees seeking to conduct exploration activities to first obtain approval from the Secretary who has delegated the authority to grant such approval to BOEM.

In response to the proposed action in LLOG's plan, BOEM is required by OCSLA to approve, approve with modifications, or deny the plan within 30 days (see 43 U.S.C. § 1340(c)(1)). The criteria that BOEM will apply in reaching a decision to approve, approve with modifications, or deny the plan within 30 days and the scope of its discretion are provided by Section 11 of OCSLA and detailed in the implementing regulations (30 CFR part 550, Subpart B). Authorizing the proposed action as outlined in the supplemental EP, S-7829, allows LLOG to pursue its rights under the lease and to conduct exploration drilling activities.

1.3. Description of the Proposed Action

LLOG supplemental EP proposes to explore for hydrocarbons by drilling and completing two wells (Wells D and E) in Mississippi Canyon Block 387 (OCS-G 22873) in the CPA. The proposed drilling locations are located southeast of Venice, Louisiana, approximately 60 mi (96 km) from the nearest shoreline in Plaquemines Parish, Louisiana. The water depths at the proposed well sites range from 6,497 to 6,592 feet (ft) (1,980 to 2,009 meters (m)). LLOG plans on using a dynamically positioned (DP) drillship or DP semisubmersible to drill and complete proposed wells and no anchors would be used.

The projected duration of drilling and completing the exploratory wells is 100 days per well; the drilling is scheduled to start in April 2017 and end in August 2018 (LLOG, 2017). Supply and crewboat facilities to support the proposed activities are located in Port Fourchon, Louisiana, approximately 126 mi (203 km) northwest of the project location. Air support will be based out of Venice, Louisiana which is located approximately 83 mi (134 km) northwest of the project location. LLOG does not expect any shore-based construction or expansion in association with this proposed action. The types of support vessels and their potential travel frequency during exploratory drilling are included in LLOG's plan (LLOG, 2017).

1.4. Impact-Producing Factors

An impact-producing factor (IPF) is any activity or process resulting from an approved operation that causes impacts to the environment, such as an emission, effluent, or physical disturbance. The IPFs from the routine activities proposed by the operator in this plan include: (1) waste and discharges from vessel operations and exploration activities; (2) air emissions from equipment and vessels; (3) noise from vessel and helicopter transportation and drilling activities, and (4) bottom disturbances from well completion activities. The routine IPFs are expected to occur during the operations conducted under the proposed action and are addressed in each of the site-specific analyses in Chapter 3 under "Routine Activities."

The analyses in Chapter 3 also consider IPFs that might result from an accidental event. The primary IPFs from potential accidents related to OCS drilling activities include: (1) vessel collisions with marine mammals and sea turtles; (2) oil spills and blowouts; (3) bottom disturbances from lost/jettisoned debris; and (4) helicopter collisions with coastal and/or marine birds. Unlike the IPFs associated with routine activities, the IPFs from accidental events are not expected because of the low probabilities of such events from occurring, existing/recently implemented safety measures and condition(s) of, approval, and an increased level of operator awareness observed since the *Deepwater Horizon* spill. The accidental IPFs are detailed and addressed in each of the site-specific analyses under "Accidental Events."

The Multisale EIS and SEISs considered the routine and accidental IPFs described above; however, additional information related to the oil spill/blowout IPF has been collected since the *Deepwater Horizon* spill that was not available during the preparation of the programmatic analyses. Appendix A; Accidental Oil-Spill Discussion, introduces the new data and describes the circumstances that might result if an accidental spill were to occur. Additionally, the analyses of the "Accidental Events" incorporate information from Appendix B of the Multisale EIS, "Catastrophic Spill Event Analysis," to address the potential impacts to the environment in the unlikely event that a catastrophic spill similar to the *Deepwater Horizon* spill was to occur.

Accidental Spill Concerns

Since spills are unplanned, unforeseeable events, BOEM is required to rely on past experiences to predict many factors regarding oil-spill risks. Based on experience and the operations proposed in LLOG's plan, the potential sources of hydrocarbon spills from the proposed activity would include the following:

- A storage tank accident on the MODU;
- A transfer operation mishap between the supply vessel and the MODU;
- A leak resulting from damage to the fuel tanks on one of the supply or crew boats; and/or
- A blowout of a proposed well.

Potential Spills from Vessels/Transfer Operations

As indicated above, offshore spills from LLOG's proposed action are possible if an accident were to damage a storage tank onboard the drilling rig, the crewboat, offshore support vessel, or the fuel supply vessel. Historically, accidents of this nature have resulted from unintentional vessel collisions and transfer incidents during the offloading of diesel fuel to the drilling rig. LLOG plans to use a DP drillship or DP semi-submersible that will include well control, pollution prevention, and blow out prevention equipment to conduct the proposed activities. There are several tanks onboard the MODUs that store fuel and lubricants necessary for the rig's operation. A worst-case discharge scenario from a rupture and spill from the vessels are:

	Largest Main Tank Capacity	Total Diesel Oil Capacity
DP Semi-submersible	4,634 bbl	18,079 bbl
DP Drillship	16,685 bbl	36,956 bbl

Additionally, the crew boat and supply boat proposed to support the drilling operations have estimated fuel tank capacities of 500 bbl each. The diesel oil supply vessel is estimated to have tank capacity of 1,900 bbl. The helicopter proposed to support activities has an estimated fuel tank capacity of 279 gal (6.6 bbl).

Potential Spills from a Loss of Well Control/Blowout

BOEM and BSEE require that all losses of well control (blowouts) be reported. The current definition for "loss of well control" used by BOEM and BSEE is:

- 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);
- flow through a diverter; or
- uncontrolled flow resulting from a failure of surface equipment or procedures.

Losses of well control (also known as blowouts) can occur during exploratory drilling, development drilling, completion, production, or workover operations. A blowout can occur when improperly balanced well pressures result in the sudden, uncontrolled releases of fluids from a wellbore or wellhead (PCCI, 1999; Neal Adams Firefighters, Inc. 1991). Since 1971, most OCS blowouts have resulted in the release of gas; blowouts resulting in the release of oil have been rare. The most recent blowout was related to the *Deepwater Horizon* spill, which resulted in the release of both gas and oil. In the event of a blowout, an operator's first course of action is to activate the BOP to close the well. The BOP may be located on the drilling rig or on the seafloor. There are built-in redundancies in the BOP system to allow activation of selected components with the intent to seal off the well bore. If a subsea BOP cannot be operated from the drill rig, it can be operated at the seafloor using remotely-operated vehicles (ROV).

If the blowout occurs during drilling, pieces of the rock formation below the drill bit may fail and collapse into the wellbore because of the pressure drop. Formation fragments subsequently clog or "bridge" the drill bit or pipe, reducing or stopping flow (PCCI, 1999). Completed wells, or those in production, present more severe consequences in the event of a blowout due to the hole being fully cased down to the producing formation that lowers the probability of bridging (PCCI, 1999).

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If the BOP fails and the well does not bridge, there are other options available to control the blowout that include capping/shut-in, capping/diverting, surface stinger, vertical intervention, offset kill, and drilling relief wells (Neal Adams Firefighters, Inc. 1991). Of these methods, a relief well is the most important remedy and may be required immediately (even if it is not the first choice), since it is typically considered the ultimate solution for well control. A relief well must be drilled from a nearby platform or drillship. It is estimated that drilling a relief well in deep water can take anywhere from 30 to 120 or more. The actual amount of time required to drill the relief well will depend upon the complexity of the intervention, the location of a suitable rig, the type of operation that must be terminated in order to release the rig (e.g., may need to secure the well before releasing the rig), and any problems mobilizing personnel and equipment to the location.

Catastrophic Spill Event Analysis

Appendix B of the Multisale EIS, "Catastrophic Spill Event Analysis," is a region-wide evaluation that identifies the most likely and most significant impacts from a high-volume blowout and oil spill that continues for an extended period of time. The scenario and impacts discussed in Appendix B are similar to that of a spill similar to the *Deepwater Horizon* spill and are not associated with IPFs anticipated to result from routine activities or even more reasonably-feasible, accidental events that could occur during the proposed action. The conclusions made in the Multisale EIS's Catastrophic Spill Event Analysis are addressed in the SEA's impact analyses (Chapters 3.2 to 3.8) and hereby incorporates by reference.

Site-Specific Estimate of Spill Risk

LLOG's plan describes measures for blowout prevention, likelihood for surface intervention to stop blowout, and early intervention in the event of a blowout. LLOG has developed standards for well control, personnel safety, and emergency response plan and these methods are stated in detail in the plan submitted by LLOG (LLOG, 2017). As per the information provided in LLOG's plan, the MODU, LLOG plans to use will deploy a subsea BOP while drilling the well (LLOG, 2017). An estimate of spill risk from LLOG's proposed activities was calculated using the drilling spill rate for the entire OCS and the estimated number of wells to be drilled. The resulting value, 0.00014 or 0.014 percent, is used to address the risk of a spill >1,000 bbl occurring during the proposed action. When examining only wells in deep water (in water depths >500 ft; (152 m)), past data suggest the chance of a major spill from a deepwater well under current regulations and practices is 1 in 4,957 (USDOI, BOEM, 2012).

Though not proposed or expected, LLOG has estimated that a WCD scenario from a blowout of one of the well under this proposed action could be 202,067 BOPD of 28.5° API gravity crude. In accordance with enhanced agency oversight, BOEM verified the operator's calculations used to determine the WCD volume.

Mechanical failure/collapse of the borehole in a blowout scenario is influenced by several factors including in-situ stress, rock strength and fluid velocities at the sand face. Given the substantial fluid velocities inherent in the WCD, and the scenario as defined where the formation is not supported by a cased and cemented wellbore, it is possible that the borehole may fall/collapse/bridge over within a span of a few days, significantly reducing the outflow of the rates. For this blowout scenario, no bridging is considered (LLOG, 2016).

In the event a relief well is required due to blowout, LLOG indicates that it will take 19 days to evaluate, conduct immediate and interim response actions and activities, and mobilize to drill site; 55 days for relief well operations, and 20 days to perform hydraulic kill operations and secure the blown out well, for a total of 94 days. Additional details related to the proposed action can be found in LLOG's proposed supplemental EP (LLOG, 2017).

Spill Response Requirements

Agency regulations require that all owners and operators of oil handling, storage, or transportation facilities located seaward of the coastline submit an Oil-Spill Response Plan (OSRP) before they can use a facility. BSEE has issued BSEE NTL No. 2012-N06 (Guidance to Owners and Operators of Offshore

Facilities Seaward of the Coast Line Concerning Regional Oil Spill Response Plans), which informs operators of OSRP requirements and requires that they have adequate resources available to protect the environment from spills from their facilities. The Environmental Protection and Response Plan within the OSRP outlines the availability of spill containment and cleanup equipment and trained personnel necessary to ensure that a full-response can be deployed during an oil-spill emergency. All the proposed activities and facilities in this plan will be covered by the Regional OSRP filed by LLOG (Operator Number 02058) and approved by BSEE. The biannual OSRP review was found to be in compliance on June 29, 2016 in accordance with 30 CFR 550 and 254. LLOG also certifies it has the capability to respond, to the maximum extent practicable, to WCD, or a substantial threat of such a discharge, resulting from the activities proposed in their supplemental EP (LLOG, 2017).

Spill Response

Potential impacts from an accidental release of oil from a high-volume blowout are a serious concern; however, the historical database indicates that it is rare for such a pollution event to occur. An operator is responsible for ensuring that the response to an oil spill would be in full accordance with the applicable Federal and State laws and regulations. BOEM has requirements for preparedness to respond to a spill in the event of an accidental spill (30 CFR part 254 and 30 CFR 250 Subpart C).

The ability to effectively respond to a spill that might occur in the deepwater areas of the OCS will vary depending upon a number of factors. Among these factors are the chemical and physical characteristics of oil, the volume of oil spilled, the rate of spillage, the weather conditions at the time of the spill, the source of the spill, and the amount of time necessary for response equipment or chemical countermeasures to reach a spill site. The distance from shore for a deepwater drilling project would generally allow more time for cleanup efforts and natural weathering of the oil to take place before oil could reach shore.

Oil-Spill-Response Plan

As required by BOEM and BSEE, operators are required to provide a regional oil-spill-response plan (ROSRP). During the review of an OSRP, the operators can submit a worst case discharge letter in compliance with 30 CFR 254.2(b). This regulatory provision allows an operator to operate their facility for up to two years while BSEE reviews the OSRP if the operator certifies in writing that they have the capacity to respond to maximum extent possible to a worst case discharge of oil. An OSRP contains procedures for alerting, reporting, and cleaning up in the event of an oil spill. The OSRP is designed to help personnel respond quickly and effectively to environmental incidents and is a "guide" to assist in handling spill-response situations. The operator indicates within their OSRP that they have a current contract with an offshore oil-spill response organization.

The information included in the table below is included in an OSRP. In addition, appendices to this plan include: (1) facility information; (2) training information; (3) drill information; (4) contractual agreements; (5) response equipment; (6) support services and supplies; (7) notification and reporting forms; (8) worst-case discharge scenarios; (9) oceanographic and meteorological information; and (10) bibliography. The proposed operations would be required to be conducted under the applicable provisions of OCS regulations and notices and in the interest of safety and pollution control.

Topics Covered by an OSRP			
(1)	OSRP quick guide	(12)	strategic response planning
(2)	preface	(13)	resource protection methods
(3)	introduction	(14)	mobilization and deployment methods
(4)	organization	(15,16)	oil/debris removal/disposal procedures
(5)	spill response operations/communications	(17)	wildlife rehabilitation procedures
(6)	spill detection and source identification	(18)	dispersant use plan
(7,8)	internal and external notifications	(19)	in-situ burn plan
(9)	available technical expertise	(20)	chemical and biological response strategies
(10)	spill assessment	(21)	documentation
(11)	resource identification		

BSEE Spill-Response Program

The BSEE Oil-Spill Program oversees the review of oil-spill response plans, coordinates inspection of oil-spill response equipment, and conducts unannounced oil-spill drills. This program also supports continuing research to foster improvements in spill prevention and response. Studies funded by BSEE address issues such as spill prevention and response, in-situ burning, and dispersant use. In addition, BSEE works with the United States Coast Guard (USCG) and other members of the multiagency National Response System to further improve spill-response capability in the GOM.

Subsurface Response

Most oil-spill response strategies and equipment are based upon the simple principle that oil floats. However, as evident during the *Deepwater Horizon* spill, this is not always true. Sometimes oil suspends within the water column or sinks to the seafloor and sometimes it does all three: floats, suspends, and sinks. Oil suspended in the water column and moving with the currents is difficult to track using standard visual survey methods. Trajectory models traditionally used to predict floating oil movement and fate are not applicable to submerged oil - oil that is suspended in the water column and/or that sinks. There are no proven methods for the containment of submerged oil, and methods for recovery of submerged oil have limited effectiveness (Coastal Response Research Center, 2007).

Efforts to contain and/or recover suspended oil have focused on different types of nets, either the ad hoc use of fishing nets or specially designed trawl nets. There has been research conducted on the design of trawl nets for recovery of emulsified fuels. However, the overall effectiveness for large spills is expected to be very low. Suspended oil can occur as liquid droplets or semisolid masses in sizes ranging from millimeters to meters in diameter. At spills where oil has been suspended in the water column, responders have devised low technology methods for tracking the presence and spread of oil over space and time. For suspended oil, these methods include stationary systems such a snare sentinels, which can consist of any combination of the following: a single length of snare on a rope attached to a float and an anchor; one or more crab traps on the bottom that are stuffed with snare; and minnow or other type of traps that are stuffed with snare and deployed at various water depths. The configuration would depend upon the water depth where the oil is located within the water column. Currently, it is not possible to determine the particle size, number of particles, or percent oil cover in the water column based upon the visual observations of oil on these systems (Coastal Response Research Center, 2007).

Spills involving submerged oil trigger the need for real-time data on current profiles (surface to bottom), wave energy, suspended sediment concentrations, detailed bathymetry, seafloor sediment characteristics, and sediment transport patterns and rates. These data are needed to validate or calibrate models (both computer and conceptual), direct sampling efforts, and predict the behavior and fate of the submerged oil. This information might be obtained through the use of acoustic Doppler current profilers, dye tracer studies, rapid seafloor mapping systems, and underwater camera or video systems that could record episodic events (Coastal Response Research Center, 2007). During the *Deepwater Horizon* spill, fluorometers were used successfully to detect the presence of oil.

Surface Response

Prior to the DeepSpill sea trials, there was some doubt about whether oil released subsea in deep water would reach the sea surface. The surface slick formed after the DeepSpill crude oil releases contained patches of water-in–oil emulsion with film thickness more than adequate for containment with oil booms and also sufficient thickness for efficient treatment with chemical dispersant, similar to what actually happened during the *Deepwater Horizon* spill. However, the DeepSpill sea trials indicated that the potential lifetime of the crude oil slick would be short, which resulted in the report suggesting that the slick could be left to disperse naturally without attempting any mechanical cleanup (Johansen et al., 2001). The fact that the experiment did not involve the quantity of crude that was lost per day and on an ongoing basis for approximately 87 days as occurred during the *Deepwater Horizon* spill may account for the observed differences in slick behavior between the experiments and the GOM spill. As occurred during the Norwegian Sea trials, there was no hydrate formation at the damaged riser during the uncontrolled flow during the MC 252 release.

The MC 252 spill incident indicated that, although released at a water depth of 5,000 ft (1,524 m), once the oil surfaced, a variety of response methods were effective on the oil that surfaced near the source. The options for oil combat in deep water are the same as those used for shallower waters (mechanical recovery, dispersion, in-situ burning). Response to the oil as it emulsified and moved farther from the source proved more difficult. The emulsified oil had to be chased down by the responders, making it more difficult for the skimmers to stay in skimmable oil. The emulsified oil was also less likely to be effectively burned or dispersed.

A variety of standard cleanup protocols were used for removing MC 252 oil from beaches, shorelines, and offshore water (Table A-1). After the *Deepwater Horizon* spill, BSEE (then BOEMRE) issued NTL No. 2010-N10 that became effective on November 8, 2010. This NTL applies only to operators conducting operations using subsea blowout BOPs or surface BOPs on floating facilities. The NTL also informs lessees that BSEE will be evaluating whether each operator has submitted adequate information demonstrating that it has access to and can deploy surface and subsea containment resources that would be adequate to promptly respond to a blowout or other loss of well control. Although the NTL does not require that operators submit revised OSRP that include this containment information at this time, operators were notified of BSEE's intention to evaluate the adequacy of each operator to comply in the operator's current OSRP.

Source Control and Containment

The type of information that BSEE reviews pursuant to this NTL includes, but is not limited to:

- Subsea containment and capture equipment, including containment domes and capping stacks;
- Subsea utility equipment, including hydraulic power, hydrate control, and dispersant injection equipment;
- Riser systems;
- Remotely operated vehicles;
- Capture vessels;
- Support vessels; and
- Storage facilities.

Table A-1
Primary Cleanup Options Used during the *Deepwater Horizon* Spill Response.

Type	Fresh Oil	Sheens	Mousse	Tar Balls	Burn Residue
On-Water Response	Disperse, skim, burn	Light sheens very difficult to recover, heavier sheens picked up with sorbent boom or sorbent pads	Skim	Snare boom	Manual removal
On-Land Response	Sorbent pads, manual recovery, flushing with water, possible use of chemical shoreline cleaning agents	Light sheens very difficult to recover, heavier sheens picked up with sorbent boom or sorbent pads	Sorbent pads, manual recovery	Snare boom, manual removal, beach cleaning machinery	Manual removal

Source: USDOC, NOAA, 2010.

To address the new improved containment systems expectations to rapidly contain a spill as a result of a loss of well control from a subsea well addressed in NTL No. 2010-N10, several oil and gas industry majors initiated the development of a new, rapid response system. This system is designed to fully contain oil flow in the event of a potential future underwater blowout and to address a variety of scenarios. The system would consist of specially designed equipment constructed, tested, and available for rapid response. It is envisioned that this system could be fully operational within days to weeks after a spill event occurs. The system is designed to operate in up to 10,000 ft (3,048 m) water depth and will add containment capability of 100,000 BOPD (4.2 million gallons per day). The companies that originated this system are forming a non-profit organization, the Marine Well Containment Company (MWCC), to operate and maintain the system. MWCC will provide fully trained crews to operate the system, will ensure the equipment is operational and ready for rapid response and will conduct research on new containment technologies. This system will connect by risers to vessels that are designed to safely capture, store and offload the oil. This improves safety and environmental protection by fully securing the well via capping and shut-in or by containing the oil flow until the well is under control. It also enhances safe operations by reducing congestion (i.e., fewer vessels, risers/flowlines). Until this equipment is available, MWCC has built a subsea containment equipment system that is engineered to be used in water depths up to 8,000 ft (2,438 m) and has the capacity to contain 60,000 BOPD. This initial response system includes a capping stack with the ability to shut in oil flow or to flow the oil via flexible pipes and risers to surface vessels.

Another option for source control and containment is through the use of the equipment stockpiled by Helix Energy Solutions Group, Inc. (Helix). The Helix initiative involves more than 20 smaller energy companies, and supplements the MWCC response effort. Helix has stockpiled the equipment that it found useful in the MC 252 response and is offering it to oil and gas producers for immediate use. The Helix system centers on three ships: the *Helix Producer I*; the *Q4000*: and the *Express* deepwater construction vessel. These vessels played a role in the *Deepwater Horizon* response and continue to work in the Gulf. Together, the Helix ships and related equipment can handle up to 55,000 BOPD, 70,000 bbl of liquid natural gas and 95 million cubic ft of natural gas at depths up to 8,000 ft (2,438 m). The primary difference between the MWCC system and the Helix system is that nothing needs to be built for the Helix system it has been field tested, and is currently available for deployment. Another group, Wild Well Control, is also providing some subsea containment capability and debris removal to offshore operators.

BOEM and BSEE will not allow an operator to begin drilling operations until adequate subsea containment and collection equipment as well as subsea dispersant capability is determined by the agency to be available to the operator and sufficient for use in response to a potential incident form the proposed well(s). However, it would be impossible to predict with any degree of certainty the percentage of oil that could be contained subsea in the event of a spill or when or if complete containment would even be possible. There are some situations where this equipment might not be able to be used to control the well, for example, if the drilling structure were to fall directly on top of the well as debris during a loss of well control event. If a loss of well control event occurred in the future, it is possible that it could be contained in a best case scenario within weeks with the utilization of the rapid subsea containment packages thereby greatly limiting the amount of oil potentially lost to the environment.

Summary

In the event of a spill, particularly a blowout, there is no single method of containing and removing it that would be 100 percent effective. Removal and containment efforts to respond to an ongoing spill would likely require multiple technologies, including mechanical cleanup, burning of the slick, and chemical dispersants. Even with the deployment of all of these technologies, it is likely that, with the operating limitations of today’s spill response technology, not all of the oil could be contained and removed offshore. It is likely that larger spills in deep waters under the right conditions would require the simultaneous use of all available cleanup methods (mechanical cleanup, dispersant application, and in-situ burning. That being said, when one considers the historical/statistical data, the recent subsea containment improvements, BOEM’s and BSEE’s enhanced oversight, and industry’s heightened safety awareness since the *Deepwater Horizon* spill, it is reasonable to conclude that an accidental spill event is not likely to occur

2. ALTERNATIVES CONSIDERED

2.1. No Action Alternative

Alternative 1 – If selected, the operator would not undertake the proposed activities. If the proposed activities are not undertaken, all environmental impacts, including additional routine, accidental, or cumulative impacts to the environmental and cultural resources described in the Multisale EIS and SEISs and this SEA would not occur.

2.2. Proposed Action as Submitted

Alternative 2 – This is BOEM’s *Preferred Alternative* – If selected, the operator would undertake the proposed activities as requested in their plan. This alternative assumes that the operator will conduct their operations in accordance with their lease stipulations, the OCSLA and all applicable regulations (as per

30 CFR § 550.101(a)), and guidance provided in all appropriate NTLs (as per 30 CFR § 550.103). However, no additional, site-specific condition(s) of approval would be required by BOEM.

2.3. Summary and Comparison of the Alternatives

If selected, Alternative 1, the no action alternative, would result in the operator not exercising its rights under the lease and conducting their proposed activities. Alternative 1 would not result in any impacts to the environmental resources analyzed in Chapter 3; however, the lessee would not develop the oil and gas resources of its lease for the benefit of the U.S. economy. Alternative 2 is the preferred alternative because it meets the objectives of the purpose and need and will allow the proposed action to be conducted safely and with the necessary conditions to limit or negate potential environmental impacts.

2.4. Alternatives Considered but Not Analyzed

Several other alternatives were considered and reviewed during the preparation of this SEA and coordination of the resource reviews. Ultimately, a viable alternative is required to be a logical option for carrying out the proposed action, ensure that the purpose and need can be met, and be feasible under the regulatory directives of the OCSLA and all other applicable guidance. The table below lists the alternatives that were considered but dismissed and not analyzed further along with the rationale for the decision:

Alternatives Considered but Not Analyzed

Dismissed Alternative	Alternative Detail	Reason Not Analyzed
Daytime Drilling Only	The alternative would restrict all drilling operations to the hours between legal sunrise and sunset to take advantage of the increased lighting in an effort to improve safety.	This alternative does not consider that adequate lighting is available on vessels and MODUs, existing safety protocol, and that the premature stopping of some drilling/well operations prior to critical junctures could lead to highly-problematic and unsafe situations.
Drilling from an Anchored MODU Only	The alternative would only allow the proposed activities from an anchored semisubmersible to reduce air quality impacts from the increased emissions released from DP MODUs.	This alternative does not consider the limited availability of conventionally-moored MODUs in the GOM or the negligible air quality concerns for temporary operations taking place a great distance from shore.
Incorporation of “Seasonal” Drilling Windows	The alternative would be based upon observed ‘seasonal” migrations or behavioral patterns exhibited by marine protected species (MPS) and would restrict the proposed drilling operations for several weeks/months each year.	This alternative would have to rely upon incomplete seasonal data as most migratory MPS are not found in the Western GOM and it would not be able to account for year-round equipment and personnel contracting.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

3.1. Introduction

The discussion below will: (1) briefly describe/summarize the pertinent affected resources; (2) discuss whether proposed activities and their IPFs would have significant impacts to the human environment of the GOM; and (3) identify significant impacts, if any that would require further NEPA analysis in an EIS. The description of the affected environment and impact analysis are presented together in this section for each resource. For the impact analysis, resource-specific significance criteria were developed for each category of the affected environment. The criteria reflect consideration of both the context and intensity of the impact at issue (see 40 CFR § 1508.27). For the sake of this document, the criteria for impacts to environmental resources are classified into one of the three following levels:

- Significant Impact (including those that could be mitigated to non-significance);
- Adverse but Not Significant Impact; or
- Negligible Impact.

Preliminary screening for this assessment was based on a review of this relevant literature; previous SEAs, the Multisale EIS and SEISs, and statistics/data pertinent to historic and projected activities. BOEM initially considered the following resources for impact analysis:

- marine mammals (including Endangered Species Act (ESA) listed species and strategic stocks);
- sea turtles (all are ESA listed species);
- fishes (including listed species and ichthyoplankton);
- commercial and recreational fisheries;
- coastal and marine birds (including ESA listed species);
- benthic communities (including deepwater benthic communities, live bottoms, and topographic features);
- archaeological resources;
- military uses;
- recreational and commercial diving;
- socioeconomic conditions (including employment, marine transportation, and infrastructure);
- geology/sediments; and
- air and water quality.

The impact analyses focus on a broad group of oil and gas activities and resources with the potential for non-negligible impacts. Routine, accidental, and cumulative impacts from exploratory activities similar to those proposed by LLOG are analyzed in the Multisale EIS and SEISs that considered the proposed activities as well as impacts to resources relevant to the proposal. The level of impacts associated with each interaction was analyzed and described in the EIS and is incorporated by reference.

The Multisale EIS and SEISs provide a comprehensive characterization of biological and socioeconomic resources that may be adversely affected by oil and gas exploration and development activities. For this SEA, BOEM evaluated the potential impacts resulting from the operator's proposed activities that were not considered in the Multisale EIS. This section concentrates on the potential impacts of the proposed action on the following affected resources:

- air quality;
- offshore water quality;
- deepwater benthic biologically sensitive resources;
- marine mammals (including Threatened/Endangered and Non-listed Species);
- sea turtles (all are ESA listed species);
- fisheries and essential fish habitat (EFH); and
- archaeological resources.

Other environmental and socioeconomic conditions, identified in the initial list of resources considered for impact analysis above, such as military uses, were considered and the potential impacts that could occur from activities, such as the proposed activities, were fully addressed in the Multisale EIS and SEISs and deemed negligible (40 CFR § 1508.27) and are not discussed in this SEA. Space-use conflicts with recreational and commercial fishing vessels will be negligible compared to the area available for these activities, and there is a potential for an increase in some types of fishing activity due to development. There are no known recreational and/or commercial diving operations regularly occurring in the area. Although development could necessitate a negligible increase in commercial dive activity, potential impact levels do not warrant further analysis. Coastal and marine birds were not further analyzed due to the distance from shore and the temporary nature of the proposed activities. Topographic and pinnacle features were not further analyzed due to the distance from the proposed activities to the nearest topographic and/or pinnacle features (approximately 77 and 39 mi (124 and 63 km) respectively). No socioeconomic effects were further analyzed due to the type, the temporary nature, and employment size, of the proposed activity. There is no expansion or modification of support bases proposed as a result of this activity. Additionally, support vessel operations are comparable to that described and analyzed in the Multisale EIS for similar activities. The potential impacts of a low-probability, Catastrophic Oil-Spill event, such as the *Deepwater Horizon* spill to the environmental resources and socioeconomic conditions listed above are fully addressed in the Catastrophic Spill Event Analysis (Appendix B of the Multisale EIS) and a respective resource summary of that analysis is provided in each impact review below.

Deepwater Horizon Impacts Incorporated into SEA Analyses

BOEM, in conjunction with the well operator and other Federal and State agencies, continues to monitor and evaluate both the short-term and long-term impacts of the accidental spill. There is ongoing research to assess the impacts to resources from the *Deepwater Horizon* blowout, spill, and response efforts. For many resources, the data are still being collected and analyzed through the National Resource Damage Assessment (NRDA) process. BOEM continues to seek data and research results from the NRDA process and the scientific community. Results of this research are forthcoming, and BOEM subject matter experts (SMEs) are continuing to update their analyses as this information becomes available.

Chapter 3 of this document describes the environmental and archaeological resources and the potential routine, accidental, and cumulative impacts of the proposed action on the resources that could be affected by the proposed activities. These descriptions present environmental resources as they are now, thus providing new baseline information that is informed by the *Deepwater Horizon* spill for analyses of potential impacts from the proposed activities.

3.2. AIR QUALITY

3.2.1. Affected Environment

The complete description of the air quality in the GOM region is set forth in Chapters 4.1.1.1 and 4.2.1.1 of the Multisale EIS and is incorporated by reference. The following information is a summary of the description incorporated from the Multisale EIS. Mississippi Canyon Block 387 is located west of 87.5° W. longitude and hence, falls under BOEM jurisdiction for enforcement of the Clean Air Act (CAA). The air over the OCS water is not classified, but it is presumed to be better than the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants (USDOI, BOEM, 2012). The proposed exploration activities are located approximately 60 mi (96 km) from the nearest coastline of Plaquemines Parish, Louisiana. The Baton Rouge, Louisiana area and Houston/Galveston, Texas areas are in nonattainment for the 2008 and 1997 ozone standards, respectively. As of October 1, 2015 the United States Environmental Protection Agency (USEPA) strengthened NAAQS for ozone and will release new designated areas in late 2017. The St. Bernard Parish, Louisiana is in nonattainment for 2010, 1-hr sulfur dioxide (SO_2) standard. Other than these areas, the coastal areas are in attainment of the NAAQS for carbon monoxide, nitrogen oxides, sulphur oxides, and particulate matter that, for Prevention of Significant Deterioration (PSD) purposes, are classified as a Class II Areas.

Influences to onshore air quality are dependent upon meteorological conditions and air pollution emitted from operational activities. The pertinent meteorological conditions regarding air quality are the wind speed and direction, the atmospheric stability, and the mixing height (which govern the dispersion and transport of emissions). The typical, large-scale wind flow for the GOM area is driven by the clockwise circulation around the Bermuda High, resulting in a prevailing southeasterly to southerly wind flow, which is conducive to transporting air pollution emissions toward shore. However, superimposed upon this large-scale circulation are smaller scale wind-flow patterns, such as the land/sea breeze phenomenon. In addition, there are other large-scale weather features that occur periodically, namely tropical cyclones, and mid-latitude frontal systems. Because of the routine occurrence of these various conditions, the winds blow from all directions in the area of concern (MacDonald et al., 2004).

3.2.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed activities on air quality can be found in Chapters 4.1.1.1.2 and 4.2.1.1.2 (routine), 4.1.1.1.3 and 4.2.1.1.3 (accidental) and 4.1.1.1.4 and 4.2.1.1.4 (cumulative) of the Multisale EIS and is incorporated by reference. The following information is a summary of the impact analyses.

3.2.2.1. Alternative 1

If selected, Alternative 1, the no action alternative, would result in the operator not undertaking the proposed activities as described in the plan. Therefore, the IPFs to air quality would not occur. For example, there would be no VOC emissions that would result in potential localized degradation of air quality.

3.2.2.2. Alternative 2

If selected, Alternative 2, the proposed action, would result in the operator undertaking the proposed activities, as requested and conditioned in the plan. As described in the analyses below, impacts to air quality from the proposed action are expected to be short-term, localized, and not lead to significant impacts.

Routine Activities

Air quality would be affected in the immediate vicinity of the proposed operations, service vessels, and aircraft. The impact from emissions for the proposed activities described in this supplemental EP will not exceed BOEM's exemption levels per 30 CFR § 550.303(d), which would exempt the operator from additional air quality modeling. The proposed activities are not expected to significantly affect onshore air quality, due to the distance from shore and the distance from the area of the proposed action to any PSD Class I air quality area, such as the Breton National Wildlife Refuge.

Accidental Events

Should a spill of oil occur, the volatile organic compounds (VOC), which would escape to the atmosphere from a surface slick, are precursors to photochemically produced ozone. A spike in VOCs could contribute to a corresponding spike in ozone, especially if the release were to occur on a hot sunny day in a NO_2-rich environment. Should an accidental or emergency flaring or venting of gas occur, VOCs, methane and carbon monoxide would also escape to the atmosphere. VOCs, methane and carbon monoxide can contribute to ozone formation with methane and carbon monoxide forming after a long period of time. Additionally, flared and vented gas can contain hydrogen sulfide which could result in emitted SO_2. With the exception of the Baton Rouge, Louisiana and Houston/Galveston, Texas areas, the corresponding onshore area is in attainment for ozone. With the exception of the St. Bernard Parish, Louisiana, the corresponding onshore area is in attainment for SO_2. Due to the distance from shore, the proposed activities are not expected to have any impacts to onshore air quality, including nonattainment areas. If a fire occurs, prior to containment, particulate and combustible emissions will be released in addition to the VOCs. Emissions of pollutants into the atmosphere from routine activities associated with the proposed activities are expected to have minimal impacts to onshore air quality because of the prevailing atmospheric conditions, emission heights, emission rates, and the distance of these emissions from onshore.

Despite the recent *Deepwater Horizon* spill, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of the activities associated with the proposed action. In the event of a catastrophic spill similar to the *Deepwater Horizon* spill, the Catastrophic Spill Analysis in Appendix B of the Multisale EIS discusses the most likely and most significant impacts to air quality as it relates to the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.1.1.; Page B-4);
2) **Offshore Spill** (Section 3.2.1.1; Page B-15);
3) **Onshore Contact** (Section 4.2.1.1; Page B-30); and
4) **Post-Spill, Long-Term Recovery** (Section 5.2.1.1.; Page B-40).

As the Catastrophic Spill Analysis concludes, the potential impacts from a catastrophic spill could include air quality impacts that would require extensive recovery times.

Cumulative Impacts

Cumulative impacts on air quality within the offshore area would come primarily from non-OCS oil/gas activities in the Gulf as well as sources on land such as generated outside the OCS and include emissions from industrial plants, power generation, and urban transportation. The location of the proposed action is far removed from coastal populations or industrial activity. The proposed activities are located over 60 mi (96 km) from the nearest shoreline, and would not affect the overall quality of air over the coast because of the distance to shore. Figure 4-1 of the Multisale EIS, shows the Texas and Louisiana ozone attainment status (USEPA, 2016). Most of the Gulf's coastal areas, except for Southeast Texas (Houston-Galveston-Brazoria), and Baton Rouge, Louisiana areas, which are nonattainment for ozone, are currently designated as "attainment" for all the NAAQS regulated pollutants. Also St. Bernard Parish, Louisiana is in non-attainment for SO_2. Two new 1-hour NAAQS standards went into effect in 2010. They are the 1-hour NO2 standard of 100 ppb and the 1-hour SO2 standard of 75 ppb. No substantive cumulative impacts on air quality are expected as a result of the proposed activities when added to the impacts of past, present, or reasonably foreseeable oil and gas development in the area, as well as other activities in the area.

Conclusion

The air quality in the immediate vicinity of the proposed activities would be affected by the projected emissions, but the 60 mi (96 km) distance between the area of the proposed action and the nearest shoreline results in substantial dilution factors for point-source emissions from the proposed action so that onshore air quality impacts would be well below levels considered to be significant.

3.3. OFFSHORE WATER QUALITY

3.3.1. Affected Environment

The description of water quality in offshore waters of the GOM is set forth in Chapters 4.1.1.2 and 4.2.1.2 of the Multisale EIS and is incorporated by reference. The following information is a summary of the description incorporated from the EIS.

The GOM is the ninth largest waterbody in the world. The Mississippi River Basin drains 41 percent of the contiguous United States. The basin covers more than 1,245,000 square miles, and includes all or parts of 31 states and two Canadian provinces (USACE, 2015).

The physical oceanography of the deep Gulf can be approximated as a two-layer system with an upper layer about 800- to 1,000-m (2,625- to 3,281-ft) deep that is dominated by the Loop Current and associated clockwise (anticyclonic) eddies (Welsh et al., 2009; Inoue et al., 2008); and the lower layer below ~1,000 m (3,281 ft) that has near uniform currents (Welsh et al., 2009; Inoue et al., 2008).

Deep waters east of the Mississippi River are affected by the Loop Current and associated warm-core anticyclonic eddies, which consist of clear, low-nutrient water (Muller-Karger et al., 2001). Cold-core cyclonic eddies also form at the edge of the Loop Current and are associated with upwelling and nutrient-rich, high-productivity waters. More details on the physical oceanography of the GOM are available in Chapter 3.3.5.1 and Appendix A.2 of the Multisale EIS.

Typical water quality parameters that are considered important to the health of coastal and marine environments include temperature, salinity, dissolved oxygen, nutrients, pH, turbidity, and pollutants.

Surface water temperatures in the GOM vary seasonally from about 29 ºC (84 ºF) in the summer to about 19 ºC (65 ºF) in the winter (Gore, 1992). In the summer, warm water may be found from the surface down to a thermocline at depths to about 160 ft (50 m) deep. Minimum water temperatures at the deep seafloor approach 4º C (39 ºF).

The salinity at the sea surface in the offshore central GOM is generally 36 parts per thousand (ppt) (Gore, 1992). Lower salinities are characteristic nearshore where fresh water from the rivers mix with shallow Gulf waters. For example, salinity in open water near the coast may vary between 29 and 32 ppt during fall and winter, but it may decline to 20 ppt during spring and summer due to increased runoff (USDOI, MMS, 2000).

Dissolved oxygen (DO) concentrations in seawater vary as a function of temperature and barometric pressure. In general, cold water supports higher DO concentrations than warm water. DO concentrations between 5 and 10 milligrams per liter (mg/L) are considered beneficial to aquatic life. The GOM hypoxic zone is a band of oxygen-stratified water that stretches along the Texas-Louisiana shelf each summer where the DO concentrations are less than 2 mg/L. It is the largest hypoxic area in the entire western Atlantic Ocean (Turner et al., 2005). The hypoxic zone is the result of excess nutrients, primarily nitrogen, carried downstream by rivers to discharge to coastal waters. Density stratification results where the less dense, nutrient-rich fresh water spreads on top of the denser seawater and prevents oxygen from replenishing the bottom waters. The excess nutrients cause phytoplankton blooms which eventually die and sink to the bottom, where bacterial decomposition consumes DO.

Seawater generally averages pH 8 at the surface due to marine systems being buffered by carbonates and bicarbonates. However, in the open waters of the GOM, pH ranges from approximately 8.1 to 8.3 at the surface (Gore, 1992). The pH decreases to approximately 7.9 at a depth of 700 m (2,297 ft), and in deeper waters, it increases again to approximately 8.0 (Gore, 1992).

Gulf of Mexico coastal waters offshore of Texas, Louisiana, Mississippi, and Alabama exhibit high turbidity due to suspended sediment in river discharge, especially during seasonal periods of heavy precipitation. High turbidity may extend up to 50 miles offshore the Mississippi River and lesser distances to the east and west along the coast. Storms may also resuspend soft bottom sediments on the continental shelf, causing an increase in turbidity near the seafloor. Stratified water normally restricts this turbid water to within 20 m (66 ft) from the seafloor up into the water column (Bright et al., 1976; Bright and Rezak, 1978). Warm-core eddies can entrain and transport high turbidity shelf waters to farther offshore over deep Gulf waters. Outside of these areas, water clarity in the GOM is good to excellent, with low levels of suspended sediment.

River runoff may include any number of pollutants such as nutrients, pesticides and other organic chemicals, and metals. The Mississippi River introduces approximately 3,680,938 bbl of oil and grease per year from land-based sources (NRC, 2003) into the waters of the GOM. Offshore waters, especially deeper waters, are more directly affected by natural seeps. Hydrocarbons enter the GOM through natural seeps at a rate of approximately 980,392 bbl per year (a range of approximately 560,224-1,400,560 bbl per year) (NRC, 2003).

The National Research Council estimated that, on average, approximately 26,324 bbl of oil per year entered Gulf waters from petrochemical and oil refinery industries in Louisiana and Texas. Spills to coastal waters include pipeline releases (annual estimate of 6,230 bbl), tank vessel incidents (5,390 bbl), and coastal facility releases (5,180 bbl); while spills to offshore waters include pipeline releases (annual estimate of 420 bbl) and tank vessel incidents (10,500 bbl) (NRC, 2003).

The April 2010 *Deepwater Horizon* oil spill resulted from failures of a cement well seal and subsea blowout preventer. The Government estimated that approximately 4.9 million barrels of oil were released during the event (Oil Spill Commission, 2011a), and that 1.84 million gallons of dispersant were used subsea at the wellhead and on the surface (Oil Spill Commission, 2011b). Additionally, the corresponding emission of methane from the wellhead during the event was estimated between 9.14×10^{9} and 1.25×10^{10} moles (Kessler et al., 2011). Short-term and long-term effects from the *Deepwater Horizon* oil spill are discussed in Section 4.1.1.2. of the 2012-2017 Multisale EIS.

3.3.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed activities on offshore water quality can be found in Chapters 4.1.1.2.2.2 and 4.2.1.2.2.2 (routine), 4.1.1.2.2.3 and 4.2.1.2.2.3 (accidental), and 4.1.1.2.2.4 and 4.2.1.2.2.4 (cumulative) of the Multisale EIS, and is incorporated by reference. The IPFs associated with the proposed activities in Mississippi Canyon Block 387 that could affect marine water quality include: (1) turbidity from bottom disturbances from well emplacement activities; (2) drilling discharges, including cuttings with associated drilling muds; and (3) accidental spills of crude oil, diesel fuel, chemicals, or other materials from vessels/blowouts in marine waters. As explained below, due to the type and the temporary nature of the proposed activities, no substantive impacts would be expected.

3.3.2.1. Alternative 1

If selected, Alternative 1, the no action alternative, would result in the operator not undertaking the proposed activities as described in the plan. Therefore, the IPFs to offshore water quality would not occur. There would be no turbidity issues related to well emplacement activities that would result in potential localized degradation of water quality, no discharges during the drilling of the well and no accidental spills of crude oil, diesel fuel, chemicals, or other materials from vessels/blowouts in marine waters.

3.3.2.2. Alternative 2

If selected, Alternative 2, the proposed action, would result in the operator undertaking the proposed activities as requested and conditioned in the plan. As described in the analyses below, impacts to water quality from the proposed action, as submitted by the operator, are expected to be short-term, localized and not lead to significant impacts.

Routine Operations

Impacts to water quality from routine activities associated with drilling or production may include overboard discharges of fluids and cuttings during drilling, development and workovers of exploration and production wells; and service-vessel discharges.

The primary operational waste streams generated during offshore oil and gas exploration, development and production are drilling fluids, drill cuttings, various waters (e.g., bilge, ballast, fire, and cooling), deck drainage, sanitary wastes, domestic wastes, produced water, produced sand, and well treatment, workover, and completion fluids. Minor additional waste streams include desalination unit discharges, blowout preventer fluids, boiler blowdown discharges, excess cement slurry, several fluids used in subsea production, and uncontaminated freshwater and saltwater.

USEPA (Regions 4 and 6) regulates all waste streams generated from offshore oil and gas 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. Water Quality Standards consist of the waterbody's designated uses, water quality criteria to protect those uses and to 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. In general, waste streams that can be discharged overboard include water-based drilling fluids and drill cuttings, synthetic-based fluid-wetted drill cuttings, cement slurries, various treated waters and sanitary wastes, and uncontaminated freshwater and saltwater provided they meet the criteria of the applicable NPDES permit.

Discharged water may not cause a sheen on the water surface, and the oil/grease concentration may not exceed 42 mg/L daily maximum, or 29 mg/L monthly average. The discharge must also be characterized for toxicity. 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.

Impacts to offshore waters from routine activities associated with the subject plan should be minimal. A detailed impact analysis of the routine impacts to offshore waters due to OCS activities can be found in Chapter 4.1.1.2.2.2 of the 2012-2017 WPA/CPA Multisale EIS (USDOI, BOEM, 2012).

Accidental Events

Accidental events associated with the subject plan that could impact offshore water quality include spills of oil and refined hydrocarbons, releases of natural gas and condensate, spills of chemicals or drilling fluids, loss of well control, pipeline failures, collisions, or other malfunctions that would result in such spills. Spills from collisions are not expected to be significant. Overall, since major losses of well control and blowouts are rare events, potential impacts to offshore water quality are not expected to be significant except in the rare case of a catastrophic event. Although response efforts may decrease the amount of oil in the environment, the response efforts may also impact the environment through, for example, increased vessel traffic and the application of dispersants. Natural degradation processes will also decrease the amount of residual oil over time. Chemicals used in the oil and gas industry are not a significant risk for a spill because they are either nontoxic, are used in minor quantities, or are only used on a noncontinuous basis. A detailed impact analysis of the accidental impacts that may be associated with the proposed action on offshore waters can be found in Chapter 4.1.1.2.2.3 and 4.2.1.2.2.3 of the Multisale EIS. Accidental spills as a result of a catastrophic event are discussed in Appendix B of the Multisale EIS.

In the event of a catastrophic spill similar to the *Deepwater Horizon* spill, the Catastrophic Spill Analysis in Appendix B of the Multisale EIS discusses the most likely and most significant impacts to offshore water quality as it relates to three of the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.1.2.; Page B-5);
2) **Offshore Spill** (Section 3.2.1.2; Page B-16);
3) **Onshore Contact** (offshore water quality not included in this discussion); and

4) **Post-Spill, Long-Term Recovery** (Section 5.2.1.2.; Page B-40).

The potential impacts from a catastrophic spill could result in both temporary and long term offshore water quality degradation that would require extensive recovery times. However, despite the recent *Deepwater Horizon* spill, historical trends in the GOM (see Chapter 1.4 and Appendix A) indicate that catastrophic spill events are not likely to occur as a result of the proposed action.

Cumulative Impacts

Exploration, development, and production activities contribute to cumulative water quality degradation in offshore waters. Surface spills of oil, diesel fuel, and other materials may occur from vessels transporting crude oil and petroleum products; from vessels involved in commercial fishing, freight or passenger transport; and from OCS operations. Such spills are low quantity and are readily dispersed on the water surface. Well blowouts can disturb the bottom, increase turbidity, and put hydrocarbons into the sea. Should a blowout occur involving an oil spill ≥1,000 bbl (but not catastrophic), localized, short-term changes in water quality would be expected, however, cumulative impacts on water quality over the long term would be negligible.

Therefore, no significant cumulative impacts on offshore water quality would be expected as a result of the proposed activities when added to the impacts of past, present, or reasonably foreseeable oil and gas development; as well as other activities in the area.

Conclusion

Impacts on offshore water quality from the operational discharges that would be expected to result from the proposed action are negligible because of: 1) existing USEPA regulations; 2) water depth; 3) distance of the project from the coast; 4) weathering; and 5) dilution factors. Spilled oil originating from the project is not expected to be ≥1,000 bbl and is expected to be substantially recovered/weathered while still at sea. Operator-initiated activities to contain and clean up an oil spill would begin as soon as possible after an event. Small quantities of unrecovered oil would weather and largely biodegrade within two weeks.

No significant long-term impacts on offshore water quality would be expected from the subject plan because of the type of and temporary nature of the proposed activity. Near-bottom water quality would be affected by increased turbidity and disturbed substrates during the period of well emplacement. Any effects from the elevated turbidity would be short term, localized, and reversible.

3.4. DEEPWATER BENTHIC COMMUNITIES

For purposes of OCS activity impact analyses, BOEM defines "deepwater benthic communities," to include chemosynthetic and nonchemosynthetic communities (e.g., deepwater corals), in the GOM as those typically found in water depths of 984 ft (300 m) and greater (USDOI, BOEM, 2012). Chemosynthetic communities are formed around natural seepages where bacteria consume methanes and sulfides and chemosynthetically derive amino acids and sugars for respiration. Bacteria then excrete carbon dioxide that may result in calcium carbonate precipitating from the water column. Eventually, enough precipitate can form a hard substrate where higher order chemosynthetic organisms can colonize the surfaces to create a complex, three-dimensional matrix that can be further colonized. Nonchemosynthetic communities can co-occur on hard substrates near hydrocarbon seeps with chemosynthetic organisms; however, they also routinely colonize natural or artificial hard substrates without any hydrocarbon seepage. In addition to deepwater corals, other associated deepwater fauna include sponges, anemones, echinoderms, crustaceans, and fishes.

3.4.1. Affected Environment

A description of chemosynthetic deepwater benthic communities in the GOM region can be found in Chapter 4.1.1.8.1 and 4.2.1.9.1 of the Multisale EIS and a description of the nonchemosynthetic deepwater benthic communities (e.g., deepwater corals) can be found in Chapters 4.1.1.9.1 and 4.2.1.10.1. The following information is a summary of the descriptions in the EIS, and it is incorporated by reference into this EA.

The continental slope in the GOM extends from the edge of the continental shelf at a depth of about 656 ft (200 m) to a water depth of approximately 9,840 ft (3,000 m) (USDOI, BOEM, 2012). The vast majority of the GOM has a soft, muddy bottom in which burrowing infauna are the most abundant invertebrates. Mississippi Canyon Block 387 falls into this category and the water depth of the proposed activity is greater than or equal to 6,497 ft (~1,980 m).

A remarkable assemblage of invertebrates is found in association with hydrocarbon seeps in the GOM. Chemosynthetic communities can occur at or near hydrocarbon seeps and are defined as persistent, largely sessile assemblages of marine organisms dependent upon symbiotic chemosynthetic bacteria as their primary food source (MacDonald, 1992). Invertebrate taxa in these communities include tube worms and bivalves, among others. Symbiotic chemosynthetic bacteria live within specialized cells in the invertebrate organisms and are supplied with oxygen and chemosynthetic compounds (methane and sulfides) by the host via specialized blood chemistry (Fisher, 1990). Chemosynthetic bacteria, which live on mats, in sediment, and in symbiosis with chemosynthetic invertebrates, use a carbon source independent of photosynthesis to make sugars and amino acids. The host, in turn, lives off the organic products subsequently released by the chemosynthetic bacteria and may even feed on the bacteria themselves. Chemosynthetic communities can become established when a hard substrate is available for colonization at or near a seep. Depending on the situation, chemosynthetic organisms or nonchemosynthetic invertebrates can settle and colonize carbonate substrate. These organisms form additional structure upon the seafloor, increasing the complexity of the habitat that may provide support to a variety of deepwater corals, invertebrates and fishes.

Some nonchemosynthetic deepwater corals form communities occurring at or near hydrocarbon seeps, or on exposed outcrops, and may be found in association with chemosynthetic communities. Deepwater coral communities are also found on shipwrecks, and deepwater oil and gas infrastructure. These coral communities are distinctive and provide three-dimensional habitat for a range of fishes and invertebrates. Hard-bottom habitats in deepwater include communities dominated by *Lophelia pertusa*, with other corals such as the bamboo coral (*Keratoisis flexibilis*) and zigzag coral (*Madrepora oculata*). Numerous other invertebrates are also associated with these benthic habitats (Sulak et al., 2008; Cordes et al., 2008; Fisher et al., 2007; Schroeder et al., 2005).

Hydrocarbon seep communities in the GOM have been reported to occur at water depths greater than 300 m (984 ft) (USDOI, BOEM, 2012). To date, there are approximately 285 documented deepwater benthic communities comprised of chemosynthetic organisms and/or deepwater corals. Once thought rare, research suggests that deepwater faunal communities are regularly associated with seafloor features commonly found in the vicinity of the primary geophysical signatures of the seabed for hydrocarbon migration to the seafloor. These areas include those where hydrocarbons percolate through sediments or where hydrocarbons move along faults that reach the seafloor. More than 23,000 positive anomalies have been identified from seismic survey data and each may represent a habitat where a hard substrate and a deepwater community may be found. However, until an anomaly has been visited and confirmed, it is unknown if hard substrates are exposed and capable of supporting deepwater benthic communities.

To map areas of probable habitat for deepwater benthic communities, scientists at BOEM analyzed decades of three-dimensional seismic data to classify seafloor returns exhibiting anomalously high or low reflectivity. The areas of high reflectivity represent patches of anomalous seafloor returns that likely indicate patches of hard seafloor that would provide substrate for deepwater benthic communities. Most confirmed hard bottoms in the deepwater GOM were created by the precipitation of calcium carbonate substrate by chemosynthetic bacterial activity and are capable of supporting deepwater benthic communities. However, non-biogenic hard bottoms are also found at escarpments, seafloor-reaching faults, or where salt formations reach the surface. Investigations of the seafloor at patches of high reflectivity indicate that chemosynthetic and coral communities are much more common in the deepwater GOM than previously known (USDOI, BOEM, 2012). Also, areas of low reflectivity (negative anomalies) can be indicative of gassy sediments and mud volcanoes with a high flux of hydrocarbons from the seafloor. Although uncommon, chemosynthetic bivalves may be found in areas with a high flux of hydrocarbons.

3.4.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed activities on chemosynthetic communities can be found in Chapters 4.1.1.8.2 and 4.2.1.9.2 (routine), 4.1.1.8.3 and 4.2.1.9.3 (accidental), and 4.1.1.8.4 and 4.2.1.9.4 (cumulative) of the Multisale EIS, and for nonchemosynthetic (deepwater benthic) communities in Chapters 4.1.1.9.2 and 4.2.1.10.2 (routine), 4.1.1.9.3 and 4.2.1.10.3 (accidental), and 4.1.1.9.4 and 4.2.1.10.4 (cumulative) of the same document.

The following information is a summary of the impact analyses in the EIS and it is incorporated by reference into this EA.

Any hard substrate communities located in deep water would be particularly sensitive to impacts from OCS activities restulting in bottom disturbances and increased turbidity. Such impacts to these habitats could permanently prevent recolonization by similar organisms requiring hard substrate. The IPFs associated with the proposed activities in Mississippi Canyon Block 387 that could affect deepwater benthic communities include physical impacts from: (1) well emplacement activities; (2) drilling discharges, including cuttings and drilling muds; (3) seafloor blowouts without an oil spill during well drilling or emplacement of subsea infrastructure.

3.4.2.1. Alternative 1

If selected, Alternative 1, the no action alternative, would result in the operator not undertaking the proposed activities as described in the plan. Therefore, the IPFs to deepwater benthic communities would not occur. For example, there would be no well emplacement activities that could result in physical damage to the deepwater benthic communities or their substrates, no drilling discharges that could result in burial of the organisms, or no burial due to a blowout.

3.4.2.2. Alternative 2

If selected, Alternative 2, the proposed action, would result in the operator undertaking the proposed activities as requested and conditioned in the plan. Examples of potential impacts to possible deepwater benthic communities include, but are not limited to, damage from well emplacement activities, smothering from drilling discharges, possible sedimentation and/or oil contamination from a blowout, and crushing or burial from emplacement of subsea infrastructure. Because the operator is required to follow all existing lease stipulations as well as the applicable regulations as clarified by NTLs (the operator reaffirmed compliance in its plan as cited above), conditions outlined in the following analyses related to NTL No. 2009-G40 will result in reducing the probability of impacts to deepwater benthic communities.

Routine Operations

The NTL No. 2009-G40, (Deepwater Benthic Communities) provides guidance related to BOEM's regulations implementing a policy of avoidance of sensitive deepwater benthic communities or areas that have a high potential for supporting these community types, as interpreted from geophysical records. According to NTL No. 2009-G40 all plans submitted for deepwater (984 ft, 300 m or greater) will be reviewed for the presence of deepwater benthic communities that may be affected by the proposed activity. Wells must be located a distance of at least 2,000 ft (610 m) from possible and known deepwater benthic communities to prevent cuttings from smothering the communities and any seafloor disturbance (anchors, anchor chains, cables) must be at least 250 ft (76 m) from a possible or known deepwater benthic community. Lessees intending to explore or develop in water depths >984 ft (300 m) are required to provide information about geophysical surveys of the area of proposed activities and to evaluate the data for indications of conditions that may support chemosynthetic and nonchemosynthetic deepwater benthic communities.

Well Emplacement Activities: Emplacement of the wells and associated subsea infrastructure can cause disturbances with lethal and sub-lethal effects such as (1) crushing; (2) burial; and (3) decreased fitness if substantial quantities of sediments are suspended in the water column during operations. For this plan LLOG proposes to use a DP semisubmersible or DP drillship to conduct their drilling activities; therefore, anchors will not be associated with the proposed operations. Also, the site-specific deepwater benthic communities review conducted for the proposed activities determined that there were no potential high-density deepwater benthic communities or habitat that could support such communities within 2,000 ft (610 m) of the proposed well sites.

Drilling Discharges: Routine surface discharges from development drilling and production facility operations in water depths of 1,000 m (3,280 ft) can reach detectable accumulations at distances of at least 1 km (0.6 mi) (CSA, 2006); however, substantial sediment accumulations will be limited in distance from the surface discharge point. For discharges on the seafloor during initial well jetting, sediment accumulation may reach distances of approximately 100 m (328 ft) and could result in mounding in the immediate area around the well site (CSA, 2006). In both situations, splays of discharges tend to deposit in the direction of prevailing currents. Any discharges landing on any deepwater communities in substantial quantities during these activities could result in impacts directly due to mortality or indirectly due to sub-lethal impacts.

Distancing bottom disturbing activities from features that could support deepwater benthic communities, as described in NTL No. 2009-G40, minimizes potential impacts to deepwater benthic communities due to drilling discharges. Because of this distancing, any drill cuttings from deepwater operations would not come in contact with a deepwater community or would be diluted to such an extent to not result in negative impacts to a deepwater community. Because many deepwater organisms are long-lived with low reproductive rates, if a chemosynthetic community was impacted, it could take decades or centuries to recover depending on the size of the community. The deepwater benthic communities review conducted for this proposed action did not detect any potential, high-density deepwater benthic communities or habitat that could support such communities within 2,000 ft (610 m) of the proposed well sites. As such, impacts from discharges related to the proposed activities are not expected.

Accidental Events

A blowout, as used here, is from expulsion of gas and/or water and/or suspended sediment and/or insubstantial oil out of a well. A blowout at the seafloor without the presence of substantial quantities of oil could occur when excess pressure in the well exceeds the capacity (both the operator's and the drilling apparatus' capacity) to contain the well. A blowout at the seafloor could create a crater on the sea bottom and/or suspend and disperse large quantities of bottom sediments, burying both infaunal (living in the sediment) and epifaunal (living on the sediment) organisms and interfering with sessile invertebrates that rely on filter-feeding organs. Rapid burial by accumulations of sediment >1 ft (>30 cm) in thickness is likely to be lethal for all benthic organisms based on analysis of escape trace fossils from the geologic record (Frey, 1975; Basan et al., 1978; Eckdale et al., 1984). Lesser accumulations of sediment (or cuttings) may be lethal to some sessile (attached or immotile) invertebrates and survivable by motile organisms. Similar to impacts from drill cuttings, impacts from a blowout would be limited because of the duration and areal extent of the accident. Distancing the well at least 610 m (2,000 ft) from any feature that could support deepwater benthic communities also reduces that possibility of organisms being smothered by disturbed sediment. Any oil, sediments, or fluids released by a seafloor blowout of this nature could have potentially adverse effects on sensitive deepwater benthic communities. However, there are several reasons why substantive impacts from these are very unlikely for this IPF: First, the likelihood of any size blowout is very small. Since reporting requirements changed in 2006, there have been no reported blowouts of this nature (USDOI, BSEE, 2015). Second, any sediments or fluids in this type of blowout would be limited in quantity, and the blowout would be limited in duration. As such, the sediments or fluids would either rise to the surface or be rapidly diluted in the water column and not impact any deepwater communities given the proper distancing requirements. This type of blowout is not considered a catastrophic event similar to the *Deepwater Horizon* explosion and spill. For information on this type of event see the Catastrophic Spill Analysis located in Appendix B of the Multisale EIS.

Impacts of any disturbance from routine activities would be local and short-term. Given distancing requirements, severe impacts resulting from a blowout event without substantial oil are negligible at the community or the population level. The deepwater benthic communities review conducted for this proposal did not identify any potential, high-density deepwater benthic communities or habitat that could support such communities within 2,000 ft (610 m) of the proposed well sites. Therefore, impacts to deepwater benthic communities from accidental blowouts are not expected.

Cumulative Impacts

Considering the remote location of these habitats, the operator's proposed activities would constitute the primary effect on the resources that may exist in the area of the proposed action. As such, the potential cumulative impacts from all other GOM activities would be identical to a combination of the Routine and Accidental Events described above. Given the negligible impacts on deepwater benthic communities because of the application of BOEM avoidance criteria as described in NTL No. 2009-G40, the cumulative Impacts are also negligible.

Conclusion

Although deepwater benthic community components could potentially occur in the vicinity of the proposed activities in Mississippi Canyon Block 387 the deepwater benthic communities review conducted for the proposed activities did not identify any potential, high-density deepwater benthic communities or habitat that could support such communities within 2,000 ft (610 m) of the proposed well sites. Since a DP semisubmersible or DP drillship will be used, then the potential for bottom-disturbing activities would be reduced during routine activities.

The proposed activities are expected to have negligible impacts on the ecological function, abundance, productivity, and/or distribution of deepwater benthic communities given adherence to distancing requirements found in NTL No. 2009-G40. The operator in its plan proposes compliance with the regulations as clarified by NTL No. 2009-G40. Bottom disturbances from emplacement activities, drilling discharges, or blowouts without substantial oil would be distanced from any sensitive deepwater communities. Any sediments or fluids that could come in contact with the organisms would be diluted to a concentration where the impact to the deepwater benthic community would be negligible.

3.5. MARINE MAMMALS

3.5.1. Affected Environment

The U.S. Gulf of Mexico marine mammal community is diverse and distributed throughout the northern Gulf waters. Twenty-one species of cetaceans regularly occur in the Gulf of Mexico and are identified in the NMFS Gulf of Mexico Stock Assessment Reports (Waring et al., 2016), in addition to one species of Sirenian. The GOM's marine mammals are represented by members of the taxonomic order Cetacea, which is divided into the suborders Mysticeti (i.e., baleen whales) and Odontoceti (i.e., toothed whales), as well as the order Sirenia, which includes the manatee.

Threatened or Endangered Marine Mammal Species

There is only one cetacean, the sperm whale (*Physeter macrocephalus*), and one sirenian, the West Indian manatee (*Trichechus manatus latirostris*), that regularly occur in the GOM and that are listed as endangered under the Endangered Species Act (ESA). The sperm whale is common in oceanic waters of the northern GOM and appears to be a resident species. The West Indian manatee typically inhabits only coastal marine, brackish, and freshwater areas. The life history, population dynamics, status, distribution, behavior, and habitat use of baleen and toothed whales can be found in Chapters 4.1.1.11 and 4.2.1.12 of the Multisale EIS, and is incorporated by reference, and also in the NMFS 2015 SAR (Waring et al., 2016). The distribution, feeding habits, habitat use, and population estimates of manatees can be found in Chapter 4.2.1.12.1 of the Multisale EIS. On December 8, 2016 (81 FR 88639), NMFS issued a proposed rule to list the Bryde's whale (*Balaenoptera edeni*) as endangered (Federal Register, 2016a). On January 8, 2016 (81 FR 999), the United States Fish and Wildlife Service (FWS) issued a proposed rule and notice to reclassify the West Indian manatee from endangered to threatened (*Federal Register*, 2016b).

Non-ESA-Listed Marine Mammal Species

One baleen cetacean (Bryde's whale) and 19 toothed cetaceans (including beaked whales and dolphins) occur in the GOM. Of these species, only the sperm whale is protected under the ESA; however all marine mammals are protected under the Marine Mammal Protection Act (1972). The only commonly occurring baleen whale in the northern GOM is the Bryde's whale (*Balaenoptera edeni*). The other baleen whales that have been sighted in the GOM are either considered rare or extralimital by Waring *et al*. (2016). Most sightings have been made in the De Soto Canyon region and off western Florida, although there have been some in the west-central portion of the northeastern GOM. The best estimate of abundance for Bryde's whales in the northern GOM is 33 individuals (Waring *et al*., 2016).

Non-ESA-listed toothed cetaceans include all of the dolphin and small whale species in the GOM and comprise 19 species. The *Kogia* species (pygmy and dwarf sperm whales) are small and cryptic whales that inhabit offshore waters. Very little is known of their life history. The beaked whales have been highly publicized in the last several years due to strandings and deaths attributed to military sonar. Beaked whales are not as small as *Kogia*, but they are just as difficult to survey. As with *Kogia*, very little is known about beaked whales (Waring *et al*., 2016).

Additional information on non-ESA-listed marine mammal species of the GOM is provided in Chapter 4.2.1.12.1 of the Multisale EIS, and in the NMFS 2015 SAR (Waring *et al*., 2016) and is incorporated by reference into this SEA.

3.5.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed activities on marine mammals can be found in Chapters 4.1.1.11.2 and 4.2.1.12.2 (routine), 4.1.1.11.3 and 4.2.1.12.3 (accidental), and 4.1.1.11.4 and 4.2.1.12.4 (cumulative) of the Multisale EIS, and is incorporated by reference. The IPFs with the proposed activities in Mississippi Canyon Block 387 that could affect marine mammals include: (1) vessel noise and collisions; (2) marine debris; (3) water-quality degradation from drilling rig effluents; (4) oil spills and spill-response activities; and (5) drilling noise. These IPFs are the same for non-threatened and non-endangered marine mammal species as well as those listed under the Endangered Species Act of 1973 (ESA).

3.5.2.1. Alternative 1

If selected, Alternative 1, the no action alternative, would result in the operator not undertaking the proposed activities as described in the plan. Therefore, the IPFs to marine mammals would not occur. These factors include vessel/drilling noise that would result in behavioral change, masking, or non-auditory effects to marine mammals, no long-term or permanent displacement of the animals from preferred habitats, and no destruction or adverse modification of any habitats. Because there would be no support vessel traffic related to the drilling operation, there would be no risk of collisions with marine mammals, and there would be no water degradation as a result of the proposed activities.

3.5.2.2. Alternative 2

If selected, Alternative 2, the proposed action, would result in the operator undertaking the proposed activities as requested and conditioned in the plan. The operator has proposed adherence with the guidance provided under BSEE NTL No. 2015-G03 (*Marine Trash and Debris Awareness and Elimination*) and BOEM NTL No. 2016-G01 (*Vessel Strike Avoidance and Injured/Dead Protected Species Reporting*) (LLOG, 2017). Compliance with the regulations as clarified in these NTLs should negate or lessen the chance of significant impacts to marine mammals under this alternative.

Routine Operations

Vessel Noise and Collisions

The proposed activities are expected to require several roundtrip supply-vessel and crew-vessel trips per week. Deep-diving whales may be more vulnerable to vessel strikes given the longer surface period required to recover from extended deep dives. Given NMFS has determined vessel strikes to be a discountable concern for sperm whales (USDOC, NMFS, 2007) , a deep-diving species, the faster diving marine mammal species with less surface recovery time would be expected to have even less risk of vessel strikes.

In 1995, an oil crew workboat struck and killed a manatee in a canal near coastal Louisiana (Fertl et al., 2005). Manatees are infrequently found in water depths where the activities are proposed, though some recent deepwater sightings have occurred. As of April 2014, five manatee sightings have been reported in the deep water of the GOM. These include three sightings from Protected Species Observers (PSO) on seismic vessels and two visual observations from a drilling rig and ship at depths ranging from 465 to 6,000 ft (142 to 1,829 m). Sightings at these depths are uncommon. Seismic survey operations should pose little, if any, risk to them. The dominant source of noise from vessels is from the propeller operation, and the intensity of this noise is largely related to ship size and speed. Vessel noise from the proposed action will produce low levels of noise, generally in the 150 to 170 dB re 1 µPa-m at frequencies below 1,000 Hz. Vessel noise is transitory and generally does not propagate at great distances from the vessel. As a result, the NMFS 2007 ESA Biological Opinion concluded that the effects to sperm whales from vessel noise are discountable (USDOC, NMFS, 2007).

The noise and the shadow from helicopter overflights, take-offs, and landings can cause a startle response and can interrupt whales and dolphins while resting, feeding, breeding, or migrating (Richardson et al., 1995). The Federal Aviation Administration’s Advisory Circular 91-36D (September 17, 2004) encourages pilots to maintain higher than minimum altitudes over noise-sensitive areas. Guidelines and regulations put in place by NOAA Fisheries under the authority of the Marine Mammal Protection Act include provisions specifying that helicopter pilots maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals. The proposed action is expected to have helicopter support with multiple transits between the MODU and airbase. Since these occurrences would be temporary and pass within seconds, marine mammals are not expected to be adversely affected by routine helicopter traffic operating at prescribed altitudes.

Atmospheric noise inputs, however, are negligible relative to other sources of noise that are propagated in water (e.g., vessel traffic and platform and drill rig operations). Noise from service-vessel traffic may elicit a startle and/or avoidance reaction from whales and dolphins or mask their sound reception. There is the possibility of short-term disruption of movement patterns and behavior, but such disruptions are unlikely to affect survival or productivity. The behavioral disruptions potentially caused by noise and the presence of service-vessel traffic will have negligible effects on cetacean populations in the northern GOM.

Drilling activities would produce sounds transmitted into the water at intensities and frequencies that could be heard by cetaceans. Noise from drilling could be intermittent, sudden, and at times high intensity as operations take place. Sound from a fixed, ongoing source like an operating drillship is continuous. However, the distinction between transient and continuous sounds is not absolute on a drillship as generators and pumps operate essentially continuously, but there are occasional transient bangs and clangs from various impacts during operations (Richardson et al., 1995). Drilling from semi-submersible vessels estimated frequencies are broadband from 80-4000 Hz with an estimated source level (SL) of 154 dB re 1µPa at 1 m. Tones of 60 Hz was SLs of 149 dB, 181 Hz was 137 dB, and 301 Hz was 136 dB (Greene, 1986). The potential effects that water-transmitted noise has on marine mammals include disturbance (subtle changes in behavior, interruption of previous activities, or short- or long-term displacement), masking of sounds (calls from conspecifics, reverberations from own calls, and other natural sounds such as surf or predators), physiological stress, and hearing impairment. Individual marine mammals exposed to recurring disturbance could be negatively affected. Malme et al. (1986) observed the behavior of feeding gray whales in the Bering sea during four experimental playbacks of drilling sounds (50 to 315 Hz; 21- min overall duration and 10% duty cycle; source levels 156 to 162 dB re: 1 µPa-m). In two cases for received levels (RL) 100 to 110 dB re: 1 µPa, there was no observed behavioral reaction. Avoidance behavior was observed in two cases where RLs were 110 to 120 dB re: 1 µPa. These source levels are all below NMFS' current 160 dB level B harassment threshold under the MMPA.

The source levels from drilling are relatively low (154 dB and below, as cited by Greene, 1986 in Richardson et al., 1995), below the level B (behavioral) harassment threshold of 160 dB (set by NMFS). According to Southall et al. (2007), for behavioral responses to nonpulses (such as drill noise), data indicate considerable variability in received levels associated with behavioral responses. Contextual variables (such as novelty of the sound to the marine mammal and operation features of the sound source) appear to have been at least as important as exposure level in predicting response type and magnitude. While there are some data from the Arctic on baleen whales, there is little information on the behavioral responses by marine mammals to drilling noise in the GOM. Southall et al. (2007) summarized the existing research, stating that the probability of avoidance and other behavioral affects increases when received levels increase from 120 to 160 dB. Marine mammals may exhibit some avoidance behaviors, but their behavioral or physiological responses to noise associated with the proposed project are unlikely to have population-level impacts in the northern GOM.

Marine Debris

Many types of plastic materials end up as solid waste during drilling and production operations. Some of this material is accidentally lost overboard where cetaceans could consume it or become entangled in it. The incidental ingestion of marine debris and entanglement could adversely affect marine mammals. The operator has proposed adherence with the guidance provided under BSEE NTL No. 2015-G03 (*Marine Trash and Debris Awareness and Elimination*) which appreciably reduces the likelihood of marine mammals encountering marine debris from the proposed activity (LLOG, 2017).

Water Degradation

Most operational discharges are diluted and dispersed when released in offshore areas and are considered to have sublethal effects (NRC, 1983; API, 1989; Kennicutt, 1995; Kennicutt et al., 1996). Any potential impacts from drilling fluids would be indirect, either as a result of impacts to prey species or possibly through ingestion via the food chain (Neff et al., 1989). Marine mammals generally are thought to be inefficient assimilators of petroleum compounds within prey (Neff, 1990).

Accidental Events

Oil Spills and Response Activities

The oil from an oil spill can adversely affect cetaceans by causing soft tissue irritation, fouling of baleen plates, respiratory stress from inhalation of toxic fumes, food reduction or contamination, direct ingestion of oil and/or tar, and temporary displacement from preferred habitats. The long-term impacts to marine mammal populations are poorly understood but could include decreased survival and lowered reproductive success. The range of toxicity and degree of sensitivity to oil hydrocarbons and the effects of cleanup activities on cetaceans are unknown. One assumption concerning the use of dispersants is that chemical dispersion of oil will considerably reduce the impacts to seabirds and aquatic mammals, primarily by reducing their exposure to petroleum hydrocarbons (French-McCay 2004; NRC, 2005). Chemical dispersant application during an oil spill may lower the amount of oil to which a bird or aquatic mammal is exposed while increasing the potential loss of the insulative properties of feathers or fur through the reduction of surface tension at the feather/fur-water interface (NRC, 2005).

Impacts from the dispersants are unknown but dispersants may contain ingredients that are known to irritate sensitive tissues of seabirds and marine mammals (NRC, 2005). There have been no experimental studies and only a handful of observations suggesting that oil has harmed any manatees (St. Aubin and Lounsbury, 1990). Types of impacts to manatees and dugongs from contact with oil include: (1) asphyxiation due to inhalation of hydrocarbons; (2) acute poisoning due to contact with fresh oil; (3) lowering of tolerance to other stress due to the incorporation of sublethal amounts of petroleum components into body tissues; (4) nutritional stress through damage to food sources; and (5) inflammation or infection and difficulty eating due to oil sticking to the sensory hairs around their mouths (Preen, 1989, in Sadiq and McCain, 1993, AMSA, 2003). For a population whose environment is already under great pressure, even a localized incident could be significant (St. Aubin and Lounsbury, 1990). Spilled oil might affect the quality or availability of aquatic vegetation, including seagrasses, upon which manatees feed.

In the event of catastrophic spill similar to the *Deepwater Horizon* spill, the Catastrophic Spill Analysis in Appendix B of the Multisale EIS discusses the most likely and most significant impacts to marine mammals as it relates to the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.2.3.; Page B-6);
2) **Offshore Spill** (Section 3.2.2.3; Page B-18);
3) **Onshore Contact** (Section 4.2.2.3; Page B-32); and
4) **Post-Spill, Long-Term Recovery** (Section 5.2.2.3; Page B-41).

In the event of a catastrophic spill similar to the *Deepwater Horizon* spill, any substantive impact to marine mammals is very unlikely because the potential impacts from a catastrophic spill would be similar to aforementioned routine and accidental issues. However, despite the recent *Deepwater Horizon* spill, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of the proposed action.

Cumulative Impact Analysis

The proposed action may cumulatively affect protected cetaceans when viewed in light of the *Deepwater Horizon* explosion, spill, and response. Marine mammals could be impacted by oil and gas leasing, exploration, development and production activities including the degradation of water quality resulting from operational discharges; vessel traffic; noise generated by platforms, drilling rigs, helicopters, and vessels; seismic surveys; explosive structure removals; oil spills; oil-spill-response activities; and loss of debris from service vessels and OCS structures. The cumulative impact on marine mammals is expected to result in a number of chronic and sporadic sublethal effects (i.e., behavioral effects and nonfatal exposure to or intake of OCS-related contaminants or discarded debris) that may stress and/or weaken individuals of a local group or population and predispose them to infection from natural or anthropogenic sources (Harvey and Dahlheim, 1994).

Few deaths are expected from chance vessel collisions and ingestion of plastic material. Disturbance (noise from vessel traffic and drilling operations, etc.) and/or exposure to sublethal levels of toxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them more vulnerable to parasites and diseases that normally would not be fatal (Harvey and Dahlheim, 1994). The net result of any disturbance will depend upon the size and percentage of the population likely to be affected, the ecological importance of the disturbed area, the environmental and biological parameters that influence an animal's sensitivity to disturbance and stress, and the accommodation time in response to prolonged disturbance (Geraci and St. Aubin, 1980).

The effects of the proposed action, when viewed in light of the effects associated with other relevant activities, may impact marine mammals in the GOM. However, the operator is required to follow all existing lease stipulations and regulations as clarified by NTLs. Because of the operator's reaffirmed compliance with BOEM NTL No. 2016-G01 (*Vessel-Strike Avoidance and Injured/Dead Protected Species Reporting*) and BSEE NTL No. 2015-G03 (*Marine Trash and Debris Awareness and Elimination*), as well as the limited scope, timing, and geographic location of the proposed action, effects from the proposed activities on marine mammals will be negligible. Therefore, no significant cumulative impacts to marine mammals would be expected as a result of the proposed activities when added to the impacts of past, present, or reasonably foreseeable oil and gas development in the area as well as other activities in the area

Conclusion

The sections above discuss the potential range of effects to marine mammals from the proposed activity and any of these effects has the potential individually or cumulatively to result in impacts to marine mammal species commonly found in the GOM and proposed action area. However, BOEM finds that the potential for such effects from the proposed action are unlikely to rise to significant levels for the following reasons:

- Mysticetes, as low-frequency hearing specialists, are the species groups most likely to be susceptible to impacts from nonpulse sound (intermittent or continuous) given that their hearing ranges overlap most closely with the noise frequencies produced from drilling (Southall et al., 2007). However, most mysticete species that may occur in the GOM (i.e., North Atlantic right, blue, fin, sei, humpback, and minke) are considered either "extralimital," "rare," or "uncommon" within the GOM (Wursig et al., 2000; Waring et al., 2016). The only commonly occurring baleen whale in the northern GOM is the Bryde's whale which is limited in its range. Given the small geographic scope of the proposed action, the presence of these species within the action area is unlikely.
- The remaining marine mammal species in the GOM are considered mid-frequency hearing specialists (e.g., sperm whales, beaked whales, and dolphins) with hearing ranges that slightly overlap with sound frequencies produced from drilling noise (Southall et al., 2007), or high-frequency specialist (pygmy and dwarf sperm whales). It is expected that there will be some overlap in the frequencies of the drill source and the hearing thresholds of the marine mammals present in the GOM. Greene (1986) estimated the broadband frequencies of semi-submersible drill vessels to be from 80-4000 Hz with an estimated SL of 154 dB re 1µPa at 1 m. A tone of 60 Hz had a source level of 149 dB, 181 Hz was 137 dB, and 301 Hz was 136 dB. Wartzok and Ketten (1999) stated that bottlenose dolphins have hearing thresholds ranging from less than 5 kHz to over 100 kHz, Ridgway and Carder (2001) found, through auditory brainstem analysis, that pygmy sperm whales have thresholds from 90 to 150 kHz. Gordon et al. (1996) found that a stranded sperm whale had lower hearing limits at around 100 Hz while Ridgway and Carder (2001) found that a sperm whale calf had best hearing sensitivity between 5 and 20 kHz. Since there is some overlap in drilling and vessel sound levels produced and hearing thresholds of marine mammals, there is potential for the drilling noise produced to cause auditory and non-auditory effects, permanent threshold shift (PTS), temporary threshold shift (TTS), behavioral changes, or masking but it is expected to be limited.
- The NMFS sets the 180-dB root-mean-squared (rms) isopleth where on-set of auditory injury or mortality (level A harassment) to cetaceans may occur. Southall et al. (2007) suggests this level should rather be at 230 dB rms for a nonpulsed sound, such as drilling noise. Richardson et al. (1995) cited Greene (1986) and stated drilling from semi-submersible vessels have estimated broadband frequencies from 80-4000 Hz with an estimated source level of 154 dB re 1microPa at 1 m. Tones of 60 Hz have source levels of 149 dB, while 181 Hz have source levels of 137 dB,

and 301 Hz have source levels of 136 dB. These source levels all fall below the 180 dB level A harassment isopleths.

- The operator proposes adherence with the guidance provided under BSEE NTL No. 2015-G03, (*Marine Trash and Debris Awareness and Elimination*), which appreciably reduces the likelihood of marine mammals encountering marine debris from the proposed activity (LLOG, 2017).

The geographic scope of the proposed action is small in relation to the ranges of marine mammals in the GOM. The proposed activities are not expected to cause long-term or permanent displacement of the animals from preferred habitats, nor will they result in the destruction or adverse modification of any habitats. In conclusion, because of the scope, timing, and transitory nature of the proposed action and the condition(s) of approval and monitoring requirements in place, the noise related to the proposed drilling operation is not expected to result in PTS, TTS, behavioral change, masking, or non-auditory effects to marine mammals in the GOM that would rise to the level of significance.

3.6. SEA TURTLES

3.6.1. Affected Environment

The life history, population dynamics, status, distribution, behavior, and habitat use of sea turtles can be found in Chapters 4.1.1.12 and 4.2.1.13 of the Multisale EIS, and is incorporated by reference. Of the extant species of sea turtles, five are known to inhabit the waters of the GOM (Pritchard, 1997): the leatherback, green, hawksbill, Kemp’s ridley, and loggerhead. These five species are all highly migratory, and individual animals will migrate into nearshore waters as well as other areas of the North Atlantic Ocean, GOM, and Caribbean Sea. All five species of sea turtles found in the GOM have been federally listed as endangered or threatened since the 1970’s. Critical habitat has been designated for the Northwest Atlantic Ocean Loggerhead sea turtle population segment (DPS) in the GOM (*Federal Register* 2014).

In 2007, FWS and NMFS published 5-year status reviews for all federally listed sea turtles in the GOM (USDOC, NMFS and USDOI, FWS, 2007a-e). A 5-year review is an ESA-mandated process that is conducted to ensure that the listing classification of a species as either threatened or endangered is still accurate. As of 2013, two 5-year reviews have been updated for the Leatherback and Hawksbill sea turtles (USDOC, NMFS and USDOI, FWS, 2013a and b). Both agencies share jurisdiction for federally listed sea turtles and jointly conducted the reviews. After reviewing the best scientific and commercially available information and data, agencies determined that the current listing classification for the five sea turtle species remain unchanged.

3.6.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed exploration activities on sea turtles can be found in Chapters 4.1.1.12.2 and 4.2.1.13.2 (routine), 4.1.1.12.3 and 4.2.1.13.3 (accidental) and 4.1.1.12.4 and 4.2.1.13.4 (cumulative) of the Multisale EIS, and is incorporated by reference. The diversity of a sea turtle’s life history leaves it susceptible to many natural and human impacts, including impacts while it is on land, in the benthic environment, and in the pelagic environment. The IPFs associated with the proposed activities in Mississippi Canyon Block 387 that could affect sea turtles include: (1) vessel noise and collisions; (2) marine debris; (3) water-quality degradation from drilling rig effluents; (4) oil spills and spill-response activities; and (5) drilling noise.

3.6.2.1. Alternative 1

If selected, Alternative 1, the no action alternative, would result in the operator not undertaking the proposed activities as described in the plan. Therefore, the IPFs to sea turtles would not occur. For example, there would be no vessel noise or drilling noise that would result in behavioral change, masking, or non-auditory effects to sea turtles, no long-term or permanent displacement of the animals from preferred habitats, and no destruction or adverse modification of any habitats. Since there would be no vessel traffic related to the drilling operation, there would be no risk of collisions with sea turtles.

3.6.2.2. Alternative 2

If selected, Alternative 2, the proposed action, would result in the operator undertaking the proposed activities as requested and conditioned in the plan. The operator has proposed adherence with the guidance provided under BSEE NTL No. 2015-G03 (*Marine Trash and Debris Awareness and Elimination)* and BOEM NTL No. 2016-G01 (*Vessel Strike Avoidance and Injured/Dead Protected Species Reporting*) (LLOG, 2017). Compliance with the regulations as clarified in these NTLs should negate or lessen the chance of significant impacts to sea turtles under this alternative.

Routine Operations

Vessel Noise and Collisions

The first IPF associated with the proposed action that could affect ESA-listed sea turtles is impacts from vessel noise and vessel collisions. The dominant source of noise from vessels is propeller operation, and the intensity of this noise is largely related to ship size and speed. Vessel noise from the proposed action would produce low levels of noise, generally in the 150 to 170 dB re 1 µPa-m at frequencies below 1,000 Hz. Vessel noise is transitory and generally does not propagate at great distances from the vessel. Also, available information indicates that sea turtles do not greatly utilize environmental sound. As a result, the NMFS 2007 Biological Opinion concluded that effects to sea turtles from vessel noise are discountable (USDOC, NMFS, 2007).

Drilling activities would produce sounds transmitted into the water that could be intermittent, sudden, and at times could be high intensity as operations take place. However, sea turtles are not expected to be impacted by this disturbance because the NMFS in their 2007 Biological Opinion determined that "drilling is not expected to produce amplitudes sufficient to cause hearing or behavioral effects to sea turtles or sperm whales; therefore, these effects are insignificant."

Popper et al. (2014) published sound exposure guidelines for fishes and sea turtles. The guidelines were broad-ranging and provided non-quantified, generalized guidelines for shipping noise as a low risk of impairment, unless the turtle is in the near field range (within tens of meters), which would pose a moderate risk of temporary threshold shift (TTS) that can recover over time. Risk for noise to cause masking and behavior effects range from low to high depending on the location of the turtle relative to the noise (Popper et al., 2014).

Sea turtles spend at least 3-6 percent of their time at the surface for respiration and perhaps as much as 26 percent of time at the surface for basking, feeding, orientation, and mating (Lutcavage et al., 1997). Data show that collisions with all types of commercial and recreational vessels are a cause of sea turtle mortality in the GOM (Lutcavage et al., 1997). Stranding data for the U.S. Gulf and Atlantic Coasts, Puerto Rico, and the U.S. Virgin Islands show that between 1986 and 1993 about 9 percent of living and dead stranded sea turtles had boat strike injuries (Lutcavage et al., 1997). Vessel-related injuries were noted in 13 percent of stranded turtles examined from the GOM and the Atlantic during 1993 (Teas, 1994), but this figure includes those that may have been struck by boats post-mortem. Large numbers of loggerheads and 5-50 Kemp's ridley turtles are estimated to be killed by vessel traffic per year in the U.S. (NRC, 1990; Lutcavage et al., 1997).

There have been no known documented sea turtle collisions 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 less than 200 m (USDOC, NMFS, 2007). Additionally, recent satellite tracking studies have provided data to support that larger turtles often remain closer to shore to feed, nest and/or migrate; for loggerheads (Hart et al., 2013 and 2014) and Kemp's ridleys (Shaver et al., 2014). To further minimize the potential for vessel strikes, BOEM issued NTL No. 2016-G01, which clarifies 30 CFR § 550.282 and provides NMFS guidelines for monitoring procedures related to vessel strike avoidance measures for sea turtles and other protected species. With implementation of these measures and the avoidance of potential strikes from OCS vessels, the NMFS 2007 Biological Opinion concluded that the risk of collisions between oil/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 monitors for any takes that have occurred as a result of vessel strikes and also requires that any operator immediately report the striking of any animal (see 30 CFR § 550.282 and BOEM NTL No. 2016-G01).

To date, there have been no known reported strikes of sea turtles by drilling vessels. Given the scope, timing, and transitory nature of the proposed action and with this established condition(s) of approval, effects to sea turtles from drilling vessel collisions is expected to be negligible.

Marine Debris

Many types of plastic materials end up as solid waste during drilling and production operations. Some of this material is accidentally lost overboard where sea turtles could consume it or become entangled in it. The incidental ingestion of marine debris and entanglement could adversely affect sea turtles. As proposed in their plan, the operator proposes compliance with the guidelines provided in BSEE NTL No. 2015-G03 (*Marine Trash and Debris Awareness and Elimination*), which appreciably reduces the likelihood of sea turtles encountering marine debris from the proposed activity.

Water Degradation

Most operational discharges are diluted and dispersed when released in offshore areas and are considered to have sublethal effects (NRC, 1983; API, 1989; Kennicutt, 1995; Kennicutt et al., 1996). Any potential impacts from drilling fluids would be indirect, either as a result of impacts to prey species or possibly through ingestion via the food chain (Neff et al., 1989). Impacts from water degradation are expected to be negligible due to the localized nature of the proposed activity and the wide-ranging habits of sea turtle species in the GOM.

Accidental Events

Oil Spills and Response Activities

The oil from an oil spill can adversely affect sea turtles by causing soft tissue irritation, respiratory stress from inhalation of toxic fumes, food reduction or contamination, direct ingestion of oil and/or tar, and temporary displacement from preferred habitats (Lutz and Lutcavage, 1989). The long-term impacts to sea turtle populations are poorly understood but could include decreased survival and lowered reproductive success. The range of toxicity and degree of sensitivity to oil hydrocarbons and the effects of cleanup activities on sea turtles are unknown. Impacts from the dispersants are unknown, but may have similar irritants to tissues and sensitive membranes as they are known to have had on seabirds and marine mammals (NRC, 2005).

In the event of a catastrophic spill similar to the *Deepwater Horizon* spill, the Catastrophic Spill Analysis in Appendix B of the Multisale EIS discusses the most likely and most significant impacts to sea turtles as it relates to the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.2.4.; Page B-7);
2) **Offshore Spill** (Section 3.2.2.4; Page B-19);
3) **Onshore Contact** (Section 4.2.2.4; Page B-33); and
4) **Post-Spill, Long-Term Recovery** (Section 5.2.2.4; Page B-41).

In the event of a catastrophic spill similar to the *Deepwater Horizon* spill, any substantive impact to sea turtles is very unlikely because the potential impacts from a catastrophic spill would be similar to aforementioned routine and accidental issues. However, despite the *Deepwater Horizon* spill, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of the activities associated with the proposed action.

Cumulative Impact Analysis

Activities considered under the cumulative scenario, including the proposed action, may affect sea turtles. Sea turtles may be impacted by oil and gas leasing, exploration, development and production activities including the degradation of water quality resulting from operational discharges, vessel traffic, noise generated by platforms, drilling rigs, helicopters and vessels, seismic surveys, explosive structure removals, oil spills, oil-spill-response activities, loss of debris from service vessels and OCS structures, commercial fishing, capture and removal, and pathogens. The cumulative impact of these ongoing OCS activities on sea turtles is expected to result in a number of chronic and sporadic sublethal effects (i.e., behavioral effects and nonfatal exposure to or intake of OCS-related contaminants or discarded debris) and that may stress and/or weaken individuals of a local group or population and that may predispose them to infection from natural or anthropogenic sources.

Few deaths are expected from chance collisions with OCS service vessels, ingestion of plastic material, commercial fishing, and pathogens. Disturbance (noise from vessel traffic and drilling operations, etc.) and/or exposure to sublethal levels of toxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them more vulnerable to parasites and diseases that normally would not be fatal during their life cycle. The net result of any disturbance depends upon the size and percentage of the population likely to be affected, the ecological importance of the disturbed area, the environmental and biological parameters that influence an animal's sensitivity to disturbance and stress, or the accommodation time in response to prolonged disturbance (Geraci and St. Aubin, 1980). As discussed above, lease stipulations and regulations are in place to reduce vessel strike mortalities.

Incremental injury effects from the proposed action on sea turtles are expected to be negligible for drilling and vessel noise and minor for vessel collisions, but will not rise to the level of significance because of the limited scope, duration, and geographic area of the proposed drilling and vessel activities and the relevant regulatory requirements.

The effects of the proposed action, when viewed in light of the effects associated with other relevant activities, may affect sea turtles occurring in the GOM. With the enforcement of regulatory requirements for drilling and vessel operations and the scope of the proposed action, incremental effects from the proposed activities on sea turtles will be negligible (drilling and vessel noise) to minor (vessel strikes). The best available scientific information indicates that sea turtles do not greatly use sound in the environment for survival; therefore, disruptions in environmental sound would have little effect. Consequently, no significant cumulative impacts would be expected from the proposed activities or as the result of past, present or reasonably foreseeable oil and gas leasing, exploration, development and production in the GOM.

Conclusion

The sections above discuss the potential range of effects to sea turtles from the proposed action, including: (1) vessel noise and collisions; (2) marine debris; (3) water-quality degradation from drilling rig effluents; (4) oil spills and spill-response activities; and (5) drilling noise. The potential effects of the proposed activity on sea turtles will not rise to the level of significance for the following reasons:

- The best available scientific information indicates that sea turtles do not greatly use sound in the environment for survival; therefore, disruptions in environmental sound would have little effect.
- The scope, timing, and transitory nature of the proposed action will produce limited amounts of drilling noise in the environment. As described, effects of vessel noise on sea turtles are considered "discountable" (USDOC, NMFS, 2007).
- Implementation of the regulations as clarified in BSEE NTL No. 2015-G03 (*Marine Trash and Debris Awareness and Elimination*), appreciably reduces the likelihood of sea turtles encountering marine debris from the proposed activity.

The risk of collisions between sea turtles and vessels associated with the proposed action exists but would not rise to the level of significance given:

- Under 30 CFR § 550.282 clarified by BOEM NTL No. 2016-G01, BOEM provides guidelines for the monitoring programs designed to minimize the risk of vessel strikes to sea turtles and other protected species and the reporting of any observations of injured or dead protected species.
- The NMFS 2007 Biological Opinion determined that monitoring measures should appreciably reduce the potential for vessel strikes. The NMFS issued an Incidental Take Statement on sea turtle species; the Statement contains reasonable and prudent measures (RPM) with implementing terms and conditions to help minimize take. As the operator has indicated that the vessel strike avoidance guidance (BOEM NTL No. 2016-G01) will be followed, there should be appreciably reduced numbers of sea turtles that may be incidentally taken from routine offshore vessel operations; however, the available information on the relationship between these species and OCS oil and gas activities indicates that sea turtles may be killed or injured by vessel strikes. Therefore, pursuant to Section 7(b)(4) of the ESA, NMFS anticipates incidental take and granted a limited number of Incidental Take Authorizations to BOEM for sea turtle mortalities by vessel strikes. BOEM continues to monitor for any strikes to ensure this authority is not exceeded and to date, none have been reported.
- The scope, timing, and transitory nature of the proposed action will result in limited opportunity for vessel strikes to sea turtles.

3.7. FISH RESOURCES AND ESSENTIAL FISH HABITAT

3.7.1. Affected Environment

A detailed description of the Fish Resources and Essential Fish Habitat (EFH) of the GOM may be found in Chapters 4.1.1.15 and 4.2.1.18 of the 2012-2017 WPA/CPA Multisale EIS and is incorporated by reference into this EA. The following section provides a summary of the information found in the Multisale EIS.

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity" [16 U.S.C. § 1801(10)]. These habitats are crucial for maintaining healthy fish resources and fishery stocks. Due to the wide variation of habitat requirements for all life history stages of managed species, NOAA and the Gulf of Mexico Fishery Management Council initially identified EFH throughout the GOM to include all coastal and marine waters and substrates from the shoreline to the seaward limit of the Exclusive Economic Zone (200 mi [322 km] from shore). The EFH final rule summarizing EFH regulation (50 CFR part 600) outlines additional interpretation of the EFH definition. Waters, as defined previously, include "aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate." Substrate includes "sediment, hard bottom, structures underlying the waters, and associated biological communities." Necessary is defined as "the habitat required to supporting a sustainable fishery and the managed species' contribution to a healthy ecosystem." "Fish" includes "finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds," whereas "spawning, breeding, feeding or growth to maturity" covers the complete life cycle of those species of interest.

The GOM supports a great diversity of fish species, including a wide variety of commercially and recreationally valuable fishes, most of which are linked either directly or indirectly to the estuaries ringing the Gulf. The life history of estuarine-dependent species involves spawning on the continental shelf; the transportation of eggs, larvae, or juveniles back to the estuary nursery grounds; and the migration of the adults back to the sea for spawning. Monthly ichthyoplankton collections over the years 2004-2006 offshore of Alabama confirmed that peak seasons for ichthyoplankton concentrations on the shelf are spring and summer (Hernandez et al., 2010). Additionally, the waters of the northern GOM support many coastal pelagic fishes and highly migratory species, some of which spawn exclusively in this region. The distribution of fish species is related to ecological factors (e.g., salinity, temperature, bottom type, primary production and availability of prey) which vary, sometimes widely, across the Gulf and between inshore and offshore waters. Characteristic fish resources are associated with various environments and are not randomly distributed.

Although a generalized analysis suggests, for locations off the continental shelf, species richness and abundance decrease with depth, Rowe and Kennicutt (2009) found food resources are a dominant factor controlling distribution of deepwater benthos in the GOM. Inputs such as the Mississippi River and hydrocarbon seep communities influence local densities of fauna associated with a given depth zone. Descriptions of ecological groups of fishes that occur in the region, including oceanic pelagics and mesopelagics, can be found in Chapters 4.1.1.15 and 4.2.1.18 of the Multisale EIS.

3.7.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed exploration activities on fish and essential fish habitat can be found in Chapters 4.1.1.15.2 and 4.2.1.18.2 (routine), 4.1.1.15.3 and 4.2.1.18.3 (accidental) and 4.1.1.15.4 and 4.2.1.18.4 (cumulative) of the Multisale EIS, and is incorporated by reference. The IPFs associated with exploratory activities proposed in Mississippi Canyon Block 387 that could affect EFH and fish resources include: (1) coastal and marine environmental degradation; (2) presence of a MODU; (3) temporary discharge of drilling cuttings and associated drilling fluids; and (4) blowouts and oil spills.

3.7.2.1. Alternative 1

If selected, Alternative 1, no action alternative, would result in the operator not undertaking the proposed activities as described in the plan. Therefore, the IPFs to fish and EFH would not occur. For example, there would be no drilling noise that would result in behavioral change, masking, or non-auditory effects to the fish resources, no long-term or permanent displacement of fish resources from preferred habitats, and no destruction or adverse modification of any habitats.

3.7.2.2. Alternative 2

If selected, Alternative 2, the proposed action, would result in the operator undertaking the proposed activities as requested and conditioned in the plan. As described in the analyses below, impacts to fish and EFH from the proposed action are expected to be short-term, localized and not lead to significant impacts.

Routine Activities

Routine activities, such as the discharge of drilling fluids and cuttings offshore would contribute to localized temporary marine environmental degradation. Drilling operations are restricted in time, and pelagic species in the area could easily avoid discharge plumes. Routine discharges from the MODU would be highly diluted in the open marine environment. The presence of the MODU will act as a fish-attracting device for the short period of time the rig is on site; however, routine discharges on fish resources will be very limited in duration.

Accidental Events

Accidental blowouts and spills with limited quantities hydrocarbons also have the potential to affect fish resources and EFH, but there is no evidence to date that fish or EFH in the Gulf have been adversely affected at a population level by spills or chronic contamination. At the scale of this EA, any accidental impact would be limited in scope and affected fishes would likely be replaced by organisms from beyond the area of impact or would be colonized during the next recruitment event. Early life stages of fishes may be more sensitive than adults to potentially adverse impacts resulting from exposure to hydrocarbons. For this reason, BOEM considers eggs and larval fishes to be at greater risk than adults in the event of exposure to contamination resulting from a spill or blowout. The specific effects of oil on fish can include direct lethal toxicity, sublethal disruption of physiological processes (internal lesions), suffocation due to oil coating gills, incorporation of hydrocarbons causing tainting or accumulation in the food chain, and changes in biological habitat (Moore and Dwyer, 1974; Incardona et al., 2014; Murawski et al., 2014). However, due to typically high fecundity and relatively wide distribution of eggs and larvae, it is unlikely spilled contaminants would overlap spatially and temporally with a fraction of eggs and larvae large enough to significantly impact populations. Furthermore, most adult fishes are expected to avoid adverse environmental conditions, minimizing the potential for impacts resulting from oil and dispersants. Estuaries are important nursery areas (EFH) for fish and aquatic life. Impacts related to oiling of these areas could result in the destruction of marsh habitat, facilitate in the erosion of coastlines, and increase the potential for adversely impacting juvenile fishes. A discussion of the impacts of oil on adult fish, fish eggs, and larvae can be found in Chapters 4.1.1.15.3 and 4.2.1.18.3 of the Multisale EIS. Given that the potential for a blowout or a spill is small, there is a limited possibility for large amounts of oil released from a blowout or spill reaching shore. Additional sensitive habitat features and potential impacts to these habitats are discussed in sections 3.4 (Deepwater Benthic Communities) of this document.

Cumulative Impacts

Cumulative activities that could impact fish and EFH in the area of the proposed action include State oil and gas activity, coastal development, crude oil imports by tanker, commercial and recreational fishing, hypoxia (i.e., red or brown tides), removal of OCS structures, and offshore discharges of drilling muds and produced waters. It is expected that environmental degradation from the proposed action and non-OCS activities would affect fish populations and EFH; however, the incremental contribution of the proposed action to these cumulative impacts would be small and almost undetectable. Therefore, no significant cumulative impacts on EFH and fish resources would be expected as a result of the proposed activities when added to the impacts of past, present, or reasonably foreseeable oil and gas development in the area as well as other activities in the area.

Conclusion

The proposed action is expected to have little impact on any fish or EFH endemic to the northern GOM. Specific effects from any one oil spill would depend on several factors, including timing, location, volume and type of oil, environmental conditions, and countermeasures used. If a blowout occurred, ichthyoplankton, fish eggs, or larvae would suffer mortality in areas where their numbers are concentrated and where oil concentrations are high. However, impacts are still expected to be minimal to nonexistent based on the low probability of a spill occurring (see Chapter 1.4).

3.8. ARCHAEOLOGICAL RESOURCES

3.8.1. Affected Environment

Archaeological resources are defined in 30 CFR § 550.105 as "any material remains of human life or activity that are at least 50 years of age and that are of archaeological interest." Archaeological resources on the OCS can be divided into two types: prehistoric and historic. Detailed descriptions of these resource types are provided in Chapters 4.1.1.19 and 4.2.1.22 of the Multisale EIS. The following information is a summary of these descriptions, which are hereby incorporated by reference into this SEA.

Prehistoric

Geologic features that have a high probability for associated prehistoric sites in the northwestern and north central Gulf (from Texas to Alabama) include barrier islands and back barrier embayments, river channels and associated floodplains and terraces, and salt dome features. Also, a high probability for prehistoric resources may exist landward of a line that roughly follows the 60-m bathymetric contour, which represents the Pleistocene shoreline during the last glaciation some 12,000 years ago when the coastal area of Texas and Louisiana is generally considered to have been populated. BOEM is currently reviewing evidence to determine if a change in the currently accepted area of prehistoric site probability is warranted. The water depth in the area of the proposed action precludes the potential for prehistoric sites or artifacts.

Historic

Historic archaeological resources on the federal OCS include shipwrecks and a single light house (Ship Shoal Light). Historic research has identified over 4,000 potential shipwreck locations in the Gulf, with nearly 1,500 of these potential shipwreck locations on the OCS (Garrison et al., 1989). The historic record, however, is by no means complete, and the current ability to predict potential sites has proven inaccurate. As demonstrated by several studies (Pearson et. al., 2003; Lugo-Fernandez et al., 2007; Krivor et al., 2011; Rawls and Bowker-Lee, 2011), many more shipwrecks are likely to exist on the seafloor than have been accounted for in available historic literature. Currently a high-resolution remote sensing survey is the most reliable method for identifying and avoiding historic archaeological resources.

A 2003 study recommended including some deepwater areas, primarily on the approach to the Mississippi River, among those lease areas requiring archaeological investigation. With this in mind, BOEM revised its guidelines for conducting archaeological surveys in 2005 and added about 1,200 lease blocks to the list of blocks requiring an archaeological survey and assessment. Archaeological survey blocks were further expanded in 2011 and current requirements are posted on BOEM's website under NTL No. 2005-G07 and Joint NTL No. 2011-G01. At present, high-resolution geophysical, ROV, and/or diver survey is required for all new bottom disturbing activities.

Historic shipwrecks have, with the exception of three significant vessels found by treasure salvers, been primarily discovered through oil industry sonar surveys in water depths up to 9,000 ft (2,743 m). In fact, in the last five years, nearly five dozen potential shipwrecks have been located and several of these ships have been confirmed visually as historic vessels. Many of these wrecks were not previously suspected to exist in these areas, based on the historic record. The preservation of historic wrecks found in deep water has been outstanding because of a combination of environmental conditions and limited human access.

The *Deepwater Horizon* spill released an estimated 53,000-62,000 bbl of oil per day for almost three months. Much of the oil was treated with dispersant at the sea surface and at the source in a water depth of 5,000 ft (1,524 m). In Chapter 4.1.1.19.1.3 and 4.2.1.22.1.3 of the Multisale EIS, it was concluded that "impacts [from an oil spill] to historic resources would be limited to visual impacts and, possibly, physical impacts associated with spill cleanup operations." This analysis did not anticipate the use of dispersants at the wellhead that could result in currently unknown effects from dispersed oil droplets settling to the seafloor and that could possibly contaminate exposed artifacts and wood or steel hulls such as those observed on many deepwater sites (Atauz et al., 2006; Church et al., 2007; Church and Warren, 2008; Ford et al., 2008). BOEM recognizes the need to better understand the effects of deepwater oil spills and dispersants on submerged archaeological resources, has initiated a study on their effects on deepwater shipwrecks, and is developing new study proposals that target oiling and dispersant effects on specific archaeological materials in order to assist in collection and interpretation of this data; however, even if a study was initiated immediately, the resulting information would not be available in time to inform the analysis for this proposed action.

The best available information does not provide a complete understanding of the effects, if any, of the spilled oil from the *Deepwater Horizon* spill and potential response/cleanup activities on archaeological resources that may be located in deep water. Though information on the actual impacts to submerged archaeological resources is non-existent at this time, oil settling to the seafloor due to dispersant use at the wellhead could come into contact with archaeological resources. At present, there is no evidence of this having occurred. An experimental study has suggested that while the degradation of wood in terrestrial environments is initially retarded by contamination with crude oil; at later stages, the biodeterioration of wood is accelerated (Ejechi, 2003). While there are different environmental constraints that affect the degradation of wood in terrestrial and waterlogged environments, soft-rot fungal activity, one of the primary wood degrading organisms in submerged environments, was shown to be increased in the presence of crude oil.

3.8.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed exploration activities on historic archeological resources can be found in Chapters 4.1.1.19.1.2 and 4.2.1.22.1.2 (routine), 4.1.1.19.1.3 and 4.2.1.22.1.3 (accidental) and 4.1.1.19.1.4 and 4.2.1.22.1.4 (cumulative) of the Multisale EIS, and hereby incorporated by reference into this SEA. The IPF associated with the proposed action that could affect submerged archaeological resources is seafloor disturbances. These discussions are summarized below and hereby incorporated by reference into this SEA.

The routine IPFs associated with LLOG's proposed activities in Mississippi Canyon Block 387 that could affect archaeological resources is limited to direct contact or disturbance during well emplacement activities or equipment used for the drilling operations.

The historically-available literature is not sufficient to identify historic shipwreck losses in the area of the proposed action as historic records of losses occurring this far offshore are not location-specific (Pearson et. al., 2003; Lugo-Fernandez et al., 2007; Krivor et al., 2011; Rawls and Bowker-Lee, 2011). However, if a historic resource exists in the area of drilling, direct physical contact with a shipwreck site could destroy fragile materials, such as the hull remains or artifacts, and could disturb the site context (Atauz et al., 2006; Church and Warren, 2008). To date, two historically-significant shipwrecks were found to have suffered damage from drilling activities because of a lack of knowledge of their presence.

The IPFs that could be associated with accidental events include seafloor disturbances from jettisoned/lost debris and, as discussed above, deterioration from potential oil spills. Similar to routine impacts, discarded/lost material that falls to the seabed has the potential to damage and/or disturb any archaeological resources. Oil spills and their remediation efforts could also accelerate deterioration of archaeological resources. A detailed discussion of all potential impacts is found below.

3.8.2.1. Alternative 1

If selected, Alternative 1, the no action alternative, would result in the operator not undertaking the proposed activities as described in the plan. Therefore, the IPFs mentioned above (i.e., bottom disturbance associated with well emplacement and the use of equipment associated with drilling operations) would not take place, and any impact that these actions could cause would not occur. Likewise, under the no action alternative, there would be no possibility of a spill. As a result, whatever archaeological resources may be present in the area of potential effect (APE) would not be affected in any way if the no-action alternative were selected.

3.8.2.2. Alternative 2

If selected, Alternative 2, the proposed action, would result in the operator undertaking the proposed activities as requested and conditioned in the plan. Examples of potential impacts to archaeological resources would include, but are not limited to, damage to potential resources from well emplacement activities, lost/discarded material, and potential impacts from an accidental oil spill. As described in the proposed plan and discussed below, the proposed activities are not expected to have significant impacts on known or unknown historical archaeological resources.

Routine Activities

Historic modeling assumes that shipwrecks would be found closest to shore along the Federal/State boundary or within ten mi (16 km) of their reported loss location. However high-resolution geophysical data acquired by oil and gas industry remote sensing surveys now indicate that this model is too limited. For example, several vessel casualties from World War II with historically reported coordinates were later discovered well over ten mi (16 km) outside the 9-mi^2 area assumed to be their location by the model (Irion, 2002). An early nineteenth century steamship lost off the Texas coast was found by treasure salvers over 120 mi (193 km) from the area of its presumed loss in the MMS model (Irion, Official Communication, 2011). These situations, coupled with the fact that no confirmed historic shipwreck sites had been found in any of the designated historic high probability area in 20 years, led to a new study (Pearson et al., 2003) to reassess the high-probability model. Some of the recommendations of this study were implemented in July 2005 with the revision of NTL No. 2005-G07, (*Archaeological Resource Surveys and Reports*), which added 1,802 lease blocks, mostly in deepwater areas in Mississippi Canyon (MC), Green Canyon (GC), and Viosca Knoll (VK) areas, to the "high-probability" block list requiring archaeological surveys. Table 3.8.1 notes the results of the requisite surveys and archaeological reviews between 2010 and 2014.

Table 3.8.1.
Archaeological Surveys and Resources Identified Since 2010

Year	Blocks Surveyed	Identified Shipwreck Sites	Potential Archaeological Sites Mitigated by Avoidance (identified through requisite industry surveys)
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

The addition of the new blocks, the current requirement that all new bottom disturbing activity be cleared by high-resolution geophysical, ROV, and/or diver survey, industry's resultant survey data, and the subsequent increase in the number of shipwrecks discovered further suggest that the potential distribution of significant historic resources is wider than originally thought.

Recent research on historic shipping routes from the 16th through the 19th centuries concluded that in areas greater than 200 m deep bottom-disturbing OCS activities may coincide with the colonial French and Spanish trade routes between Veracruz, New Orleans, and Havana, increasing the likelihood that historic shipwrecks could be located in this area of the GOM (Lugo-Fernandez et al., 2007; Krivor et al., 2011). A wide variability within the general route may be expected as a result of several factors that affected navigation during this period including: the limited capabilities of the navigational technology available to sailors of the time, shifting currents, and prevailing wind patterns and storms.

The western and central Gulf was traversed extensively by shipping throughout the 19th and 20th centuries as new ports developed along the Texas coast, such as Galveston (est. 1825) and Brazos Santiago (1848). With the advent of steam, oil screw, and gasoline or diesel-propelled vessels and improved navigational instruments, sailors' options to set a course irrespective of prevailing winds and currents greatly increased expanding even further the potential for a shipwreck to have occurred in the APE.

Impacts to a historic site could result from direct physical contact causing irreversible damage. The undisturbed provenience of archaeological data (i.e., the 3-dimensional location of archaeological artifacts) allows archaeologists to accumulate a record of where every item is found, and to develop a snapshot as to how artifacts relate to other items or the site as a whole. The analysis of artifacts and their provenience is one critical element used to make a determination of eligibility to the National Register of Historic Places and is essential in understanding past human behavior and ways of life. Impacts from the proposed operations could alter the provenience and destroy fragile remains, such as the hull, wood, glass, ceramic artifacts and possibly even human remains, or information related to the operation or purpose of the vessel. The destruction and loss of this data eliminates the ability of the archaeologist to fully and accurately detail activity areas found at the site, variation and technological advances lost to history, the age, function, and cultural affiliation of the vessel, and its overall contribution to understanding and documenting the maritime heritage and culture of the region.

BOEM's regulation at 30 CFR § 550.194 requires that an archaeological survey be conducted prior to development of leases within the high-probability zones for historic and prehistoric archaeological resources. Currently Mississippi Canyon Block 387 is designated as high-probability block. At present, some form of survey is required for new bottom disturbing activities. LLOG provided an archaeological resource assessment of the wells and surrounding areas (LLOG, 2017) as part of BOEM's pre seabed disturbance guidance which was implemented in 2011.

Accidental Events

Although unlikely, accidental blowouts and spills from the proposed action could lead to oil contact with submerged archaeological resources. While there is no information on the actual impacts of the *Deepwater Horizon* spill on submerged archaeological resources, should an accidental blowout and spill occur during the operator's proposed action, oil may settle on the seafloor due to dispersant use at the wellhead and could come into contact with archaeological resources. Although there is uncertainty and limited data on the effects of an oil spill at depth on submerged archaeological resources, an experimental study has suggested that while the degradation of wood in terrestrial environments is initially retarded by contamination with crude oil; at later stages, the biodeterioration of wood is accelerated (Ejechi, 2003). While there are different environmental constraints that affect the degradation of wood in terrestrial and waterlogged environments, soft-rot fungal activity, one of the primary wood degrading organisms in submerged environments, was shown to be increased in the presence of crude oil. No impacts are expected from marine remediation efforts because bottom-disturbing activities are not anticipated due to the waterdepth.

Another IPF that could result from an accidental event is from the loss of debris from the MODU during drilling operations. Debris such as structural components (i.e., grating, wire, tubing, etc.), boxes, pallets, and other loose items can become dislodged during heavy seas or storm events and fall to the seabed. Similarly, thousands of joints of drill pipe are used during drilling operations; requiring regular transport out to the MODU via workboats. There is the potential to lose pieces of drill pipe during transfer operations or when "tripping pipe" in and out of the wellbore. Similar to the impacts noted under Routine Activities, if lost drill pipe or debris were to fall onto an unknown archaeological resource near the well site, damage could destroy fragile materials, such as hull remains and artifacts, and could disturb the site's context and associated artifact assemblage. Additionally, lost material could result in the masking of actual archaeological resources or the introduction of false targets that could be mistaken in the remote sensing record as historic resources.

In the event of a catastrophic spill similar to the *Deepwater Horizon* spill, the Catastrophic Spill Analysis in Appendix B of the Multisale EIS discusses the most likely and most significant impacts to archaeological resources as it relates to the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.3.1.; Page B-10);
2) **Offshore Spill** (Section 3.2.3.1; Page B-25);
3) **Onshore Contact** (Section 4.2.3.1; Page B-37); and
4) **Post-Spill, Long-Term Recovery** (Section 5.2.3.1; Page B-44).

In the event of a catastrophic spill, with oil entrained in the water column and/or the use of dispersants, oil may travel far enough to have the potential to impact archaeological resources present. However, despite the recent *Deepwater Horizon* spill, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of the proposed action.

Cumulative Analysis

Cumulative impacts on unknown archaeological resources that may be present in the area of the proposed action could result from other GOM activities. Since the water depth at the proposed well sites ranges from 6,497 to 6,592 ft (1,980 to 2,009 m) and the area of the proposed action is approximately 60 mi (96 km) from shore, those activities would be limited to commercial fishing, marine transportation, and adjacent oil and gas exploration, development, and production operations.

During adjacent oil and gas operations, commercial fishing, and maritime transportation activities, there is associated the loss or discard of debris that could result in the masking of archaeological resources or the introduction of false targets that could be mistaken in the remote sensing record as historic resources. The area of the proposed action is also located near active areas of active OCS exploration and production fields. Future exploration, development, and production operations and/or any related infrastructure support could lead to bottom disturbances in the area of the proposed action; however, no additional activities have been proposed or are under review at this time. Similarly, geological and geophysical (G&G) surveys have been permitted near the area of the proposed action. These surveys sometimes involve the seabed deployment of receivers and associated anchors that have the potential to damage unknown archaeological resources that may exist in the area of the proposed action; however, their small size and relatively light weight (~65 lbs [34 kg]) is not expected to cause significant impacts.

Any known or unknown archaeological resources that may be present in Mississippi Canyon Block 387 could be impacted by contact with oil from a blowout or spill from adjacent oil and gas operations. Similarly, cumulative impacts from accidental oil spills and remediation efforts for adjacent oil and gas operations are not expected because of the water depth at the proposed well sites and the historically low probability of a loss of well control/blowout.

Considering the potential cumulative impacts from all other GOM activities, the operator's proposed activities would constitute the primary effect if any, on any known or unknown archaeological resource that may exist in the area of the proposed action. However, based on the archaeological assessment conclusions, there is no reason to believe that the proposed action would result in the disturbance of archaeological resources. Therefore, no significant cumulative impacts are expected as a result of the proposed action when added to the impacts of past, present, or reasonably foreseeable oil and gas development in the area as well as other proximal activities.

Conclusion

Based on the previous information and the survey conclusions, there is no reason to believe that archaeological resources could be present in the area of the proposed action. If an unknown archaeological resource were to exist where bottom-disturbing operations are proposed to occur, and the operator were unaware of its existence prior to disturbing the bottom, the operator's activities might have a significant impact on that resource. Such impact would be damage and/or disturbance to the resource from drilling the well and from the associated equipment. Impacts from accidental events related to the proposed action such as accidental oil spills and their remediation efforts are not expected because of the water depth at the well sites and the historically low probability of a loss of well control/blowout. However, debris resulting from accidental events could lead to impacts similar to those expected from routine impacts such as contact with the well and/or well equipment.

4. CONSULTATION AND COORDINATION

The Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1531 *et seq.*), as amended, 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 GOM. BOEM is acting as the lead agency in the ongoing consultation, with BSEE's assistance and involvement. The programmatic consultation 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 GOM over a ten 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 post lease activities associated with OCS oil and gas activities in the GOM, including G&G and decommissioning activities. While the programmatic Biological Opinion is in development, BOEM and NMFS have agreed to interim consultations on post lease approvals.

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.

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 an EIS/ROD or an EA/FONSI to comply with Section 106 of the National Historic Preservation Act in lieu of 36 CFR §§ 800.3-800.6.

5. PUBLIC COMMENT

Once the operator's plan was deemed submitted (as per 30 CFR §550.231) on February 24, 2017 it was placed on http://www.regulations.gov for a 10-day public review ending on March 6, 2017. No public comments were received.

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8. APPENDIX

Appendix A—Accidental Oil-Spill Discussion
Available: http://www.boem.gov/Appendix-A-Deepwater-SEA-Oil-Spill-Discusssion/