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

SITE-SPECIFIC ENVIRONMENTAL ASSESSMENT

OF

EXPLORATION PLAN
NO. N-9577

FOR

ATP OIL & GAS CORPORATION

November 10, 2011

RELATED ENVIRONMENTAL DOCUMENTS

Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas Lease Sales: 2007-2012; Western Planning Area Sales 204, 207, 210, 215, and 218; Central Planning Area Sales 205, 206, 208, 213, 216, and 222 (OCS EIS/EA MMS 2007-018)

Supplemental Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas Lease Sales: 2009-2012; Central Planning Area Sales 208, 213, 216, and 222; Western Planning Area Sales 210, 215, and 218 (OCS EIS/EA MMS 2008-041)

Supplemental Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas Lease Sale: 2011; Western Planning Area Sale 218 (OCS EIS/EA BOEMRE 2011-034)

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

In accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations at 40 C.F.R. §§ 1501.3 and 1508.9, Department of the Interior (DOI) regulations implementing NEPA at 43 C.F.R. Part 46, and Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) policy, BOEMRE prepared a Site-Specific Environmental Assessment (SEA), No. N-9577, which analyzed the potential effects of ATP Exploration Offshore, LLC's (ATP) initial Exploration Plan (EP) for drilling operations on the Outer Continental Shelf (OCS) of the Gulf of Mexico (GOM). The SEA of the proposed action is complete and the BOEMRE has found no information to indicate that the proposed action will significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the NEPA. Therefore, the BOEMRE has determined that an Environmental Impact Statement (EIS) is not required and is issuing a Finding of No Significant Impact (FONSI).

The BOEMRE has determined that the mitigation measure listed below and analyzed in the *Gulf of Mexico OCS Oil and Gas Lease Sales: 2007-2012; Western Planning Area Sales 204, 207, 210, 215, and 218; Central Planning Area Sales 205, 206, 208, 213, 216, and 222; Final Environmental Impact Statement* (USDOI, MMS, 2007); the *Gulf of Mexico OCS Oil and Gas Lease Sales: 2009-2012; Central Planning Area Sales 208, 213, 216, and 222; Western Planning Area Sales 210, 215, and 218; Final Supplemental Environmental Impact Statement* (USDOI, MMS, 2008); the *Gulf of Mexico OCS Oil and Gas Lease Sale: 2011;Western Planning Area Sale 218; Final Supplemental Environmental Impact Statement* (USDOI, BOEMRE, 2011); and in this SEA is necessary to minimize possible adverse effects of this action upon the environment. The mitigation is as follows:

AVOIDANCE OF POTENTIAL HIGH-DENSITY CHEMOSYNTHETIC COMMUNITIES: Our deepwater benthic communities review indicates that the proposed anchoring activities are in the vicinity of areas that could support high-density chemosynthetic communities. The operator will be required to use a state-of-the-art positioning system (e.g., differential global positioning system [DGPS]) on their anchor handling vessel to ensure that any seafloor disturbances resulting from their use of anchors (including that caused by the anchors, anchor chains, and wire ropes) does not occur within 250 ft of the area identified on the map provided to the operator under separate letter. The operator will be required to submit plats for Wells A and B (Mississippi Canyon Block 710) that depict the "as-placed" location of all anchors and any associated anchor chains and wire ropes on the seafloor, at a scale of 1 inch = 1,000 feet with DGPS accuracy, to this office at the same time they submit their End of Operations Report (Form MMS-125) to the appropriate BOEMRE GOMR District Office, to demonstrate that the features were not physically impacted by anchoring activities.

Gregory J. Kozlowski /s/ November 10, 2011
Acting Unit Supervisor, Operations Assessment Section, Unit 2 Date
Office of Environment, GOM OCS Region

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Appendix A: Accidental Oil-Spill Discussion A-1

SITE-SPECIFIC ENVIRONMENTAL ASSESSMENT (SEA) PREPARED FOR ATP EXPLORATION OFFSHORE, LLC'S INITIAL EXPLORATION PLAN; N-9577

1. OVERVIEW

The purpose of this Site-Specific Environmental Assessment (SEA) is to determine whether the proposed drilling activities outlined in the initial Exploration Plan (EP), N-9577, initially submitted by ATP Oil & Gas Corporation (ATP) on February 23, 2011, 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. ATP's EP proposes to explore for hydrocarbons by drilling and temporarily abandoning two exploration wells in Mississippi Canyon Block 710, Lease Number OCS-22896, in the Central Planning Area (CPA). This SEA is tiered from three prior EISs: (1) *Gulf of Mexico OCS Oil and Gas Lease Sales: 2007-2012; Western Planning Area Sales 204, 207, 210, 215, and 218; Central Planning Area Sales 205, 206, 208, 213, 216, and 222; Final Environmental Impact Statement* (Multisale EIS) (USDOI, MMS, 2007); (2) *Gulf of Mexico OCS Oil and Gas Lease Sales: 2009-2012; Central Planning Area Sales 208, 213, 216, and 222; Western Planning Area Sales 210, 215, and 218; Final Supplemental Environmental Impact Statement* (Supplemental EIS) (USDOI, MMS, 2008); and (3) *Gulf of Mexico OCS Oil and Gas Lease Sale: 2011; Western Planning Area Sale 218; Final Supplemental Environmental Impact Statement* (Supplemental Western EIS) (USDOI, BOEMRE, 2011). The EISs evaluated a broad spectrum of potential impacts resulting from drilling activities across the Central and Western Planning Areas of the Gulf of Mexico (GOM) Outer Continental Shelf (OCS).

This "tiering" process is provided for in the NEPA implementing regulations (40 C.F.R. §§ 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 the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) is subject to additional guidance under Department of the Interior (DOI) regulations at 43 C.F.R. § 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 Supplemental EIS 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** – new environmental conditions now exist and 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 –** new environmental conditions now exist since the preparation of the programmatic analyses;
- **Noise/Vessel-Strike Impacts on Sea Turtles –** new environmental conditions now exist since the preparation of the programmatic analyses;
- **Discharge Impacts/Disturbances to Fish and Fisheries –** new environmental conditions now exist 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 Macondo well blowout, spill, and remediation 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 Supplemental EIS are summarized and utilized for this site-specific analyses, and are incorporated by reference into this SEA. Relevant mitigation measures identified in the EISs have been considered in the evaluation of the proposed action.

1.1. BACKGROUND

The BOEMRE is 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. The BOEMRE issues oil and gas leases and regulates exploration, development, production, and decommissioning. Prior to authorizing activities related to these phases, BOEMRE conducts the appropriate NEPA review. The BOEMRE's Field Operations (FO) Plan Program oversees the submittal of EPs and Development Operations Coordination Documents (DOCDs) pursuant to 30 C.F.R. Part 250, Subpart B.

Lessees and operators submit EPs and DOCDs to provide BOEMRE 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 C.F.R. § 250.227 and in DOCDs under 30 C.F.R. § 250.261; 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 mi (80 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 bbl per day (2.23-2.60 million gallons) 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 Macondo Event has resulted in changes in environmental conditions over a large portion of the Northern Gulf of Mexico. Some of the information/impact determinations found in recent EIAs has relied upon out-of-date and inaccurate data. For this reason, BOEMRE 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 ATP's initial EP were fully discussed and analyzed in the EISs, and the specific locations, equipment, methodologies, and the duration of the proposed exploration activities will result in impacts similar to those discussed in the EISs. However, there is new information from the Macondo Event in scientific literature that is peer-reviewed as well as new mitigation methodologies such as oil spill remediation that could alter the baseline for the affected environment. This information was not previously available and could not be considered or analyzed during the preparation of the Multisale EIS or Supplemental EIS. The Supplemental Western EIS does address the Macondo Event and is impacts; however, this SEA was prepared by BOEMRE to evaluate the activity-specific issues related to the applicant's proposed drilling activities in addition to the new information.

1.2. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to approve, approve with modification, or disapprove ATP's initial EP. Authorizing the proposed action as outlined in the EP, N-9577, allows ATP to pursue its rights under the lease and to conduct exploration drilling activities. The need for the proposed action arises from Section 11 of the Outer Continental Shelf Lands Act (OCSLA). Section 11 (43 U.S.C. § 1340) requires oil and gas lessees seeking to conduct exploratory activities to first obtain approval from the Secretary who has delegated the authority to grant such approval to the BOEMRE. In response to the

proposed action in ATP's plan, BOEMRE 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 BOEMRE 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 C.F.R. Part 250, Subpart B).

1.3. DESCRIPTION OF THE PROPOSED ACTION

ATP's initial EP proposes to explore for hydrocarbons by drilling and temporarily abandoning two exploration wells; Well A and B in Mississippi Canyon Block 710, Lease Number OCS-G22896 located in the CPA (ATP, 2011). The proposed drilling locations are located approximately 48 mi(77 km) from the nearest Louisiana shoreline and approximately 85 mi (137 km) from the site of the Macondo Well in Mississippi Canyon Block 252. The water depth at the proposed well sites is 2,810 ft (856 m). The mobile offshore drilling unit (MODU) ATP proposes using is an anchored semisubmersible drilling rig. The anchor radii for the moorings at each of the two well sites is 11,000 ft (3,353 m), which could result in bottom impacts in all or portions of Mississippi Canyon Block 710. The projected duration of rig mobilization/movement, drilling, and temporary abandonment of the 2 exploration wells is a total of 124 days (ATP, 2011). ATP does not expect any shore-based construction or expansion in association with this proposed action. Supply and crewboat facilities to support the proposed action are located in Fourchon, Louisiana, approximately 116 mi (187 km) west of the project location. Fourchon will be used as the debarkation point for equipment, supplies, and crews. Air operations and traffic (helicopter) will also use the existing facility in Fourchon. The types of support vessels and their potential travel frequency during exploratory drilling are included in ATP's plan (ATP, 2011).

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 exploration activities proposed by the operator in this plan include: (1) waste and discharges from vessel operations and drilling activities, (2) air emissions from equipment and vessels; (3) noise from vessel and helicopter transportation and drilling activities, and (4) bottom disturbances from well operations and anchoring (including the anchors and associated wire, chain, and/or wire rope). 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 due to the low probabilities of such events from occurring, existing/recently implemented safety/mitigation measures, and an increased level of operator awareness observed since the Macondo Event. The accidental IPFs are detailed and addressed in each of the site-specific analyses under "Accidental Events."

The Multisale EIS and the Supplemental EIS considered the routine and accidental IPFs described above; however, additional information related to the oil spill/blowout IPF has been collected since the Macondo Event 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 Supplemental Western EIS, "Catastrophic Spill Event Analysis," to address the potential impacts to the environment in the unlikely event that a catastrophic spill similar to the Macondo Event was to occur.

Accidental Spill Concerns

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

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

Potential Spills from Vessels/Transfer Operations

As indicated above, offshore spills from ATP's proposed action are possible if an accident were to damage a storage tank onboard the drilling rig, the crewboat, or supply vessels. Historically, accidents of this nature have resulted from unintentional vessel collisions and transfer incidents during the offloading of diesel fuel to the drilling rig. ATP will use a semisubmersible MODU to drill and temporarily abandon the proposed exploration wells. There are tanks onboard the MODU that store fuel and lubricants necessary for the rig's operation. A worst-case discharge scenario from a rupture and spill from the largest main tank on the drilling rig would be 4,750 bbls of diesel fuel, with the total diesel, lube, and fuel oil capacity on the semisubmersible at 19,000 bbls. Additionally, the supply boat proposed to support the drilling operations has an estimated diesel tank capacity of 500 bbls, and the associated crewboat has a capacity of 500 bbls (ATP, 2011).

Potential Spills from a Loss of Well Control/Blowout

Losses of well control (also known as blowouts) can occur during exploratory drilling, development drilling, completion, production, or workover operations. Blowouts occur when improperly balanced well pressures result in the sudden, uncontrolled releases of fluids from a wellbore or wellhead. Historically, since 1971, most OCS blowouts have resulted in the release of gas; blowouts resulting in the release of oil have been rare. As described in Chapter 1.1 above, the most recent blowout was related to the Macondo Event, which resulted in the release of both gas and oil. Though not proposed or expected, ATP has estimated that a worst-case discharge (WCD) scenario from a blowout of one of the wells under this proposed action could be 143,374 BOPD of 35.4° American Petroleum Institute (API) gravity crude. In accordance enhanced agency oversight, BOEMRE verified the operator's calculations used to determine the WCD volume.

In the unlikely event that a blowout was to occur, one of the primary processes that could stop the uncontrolled flow is a process called "bridging off." Bridging is a phenomenon that occurs when severe pressure differentials are imposed at the well/reservoir interface and the formation around the wellbore collapses and seals the well. ATP indicated within their plan that it is possible that the borehole for these wells could fail if the formation is not supported by a casing or a cemented wellbore; however, the potential for these wells to bridge over is very poor due to the lack of data to support it (ATP, 2011).

Outside of bridging, the main tool for recovery from a blowout event is a blowout preventer (BOP) attached to the well. Most BOP systems allow activation of selected components with the intent sever the drill pipe and seal off the well bore. As per the information provided in their plan, ATP well barrier schematics indicates that the BOP stack is composed of, (1) annular preventer, (2) blind shear ram, (3) casing shear ram, (4) upper pipe ram, and (5) lower pipe ram.

If the BOP fails, there are other options available to control the blowout that include capping/shut-in, capping/diverting, surface stinger, vertical intervention, offset kill, and relief wells. Of these methods, a relief well is often considered most important, and may be required immediately (even if it is not the first choice), since it is typically considered the ultimate solution for well control. The amount of time required to drill a relief well may depend upon the complexity of the intervention, the location of a suitable rig, the operations that may be required to release the rig, and any problems mobilizing personnel/equipment. For this project, ATP estimates that it will take approximately 10 days to contract and mobilize a rig and 33 days for them to drill a relief well to top of reservoir and kill operations for a total of 43 days. Currently, there are approximately 25 to 35 deepwater MODUs available in the GOM that meet the criteria necessary to drill the relief well. Additional details related to the proposed action can be found in ATP's proposed exploration plan (ATP, 2011) and general information on other intervention methodologies and recovery tools can be found in Appendix A.

Estimated Spill Occurrence Rates

Data from past OCS spills are used to estimate future potential OCS spills. The BOEMRE has estimated spill rates for spills from the following sources: facilities/platforms, pipelines, and drilling activities. Spill rates for facilities and pipelines have been developed for several time periods, and an analysis of trends for spills is presented in *Update of Comparative Occurrence Rates for Offshore Oil Spills* (Anderson and LaBelle, 2000). Spill rates for the most recent period analyzed, 1985-1999, are presented here. Data for this period should reflect more modern spill-prevention requirements than was required prior to 1985. An internal review of recent historical data following the spill events that occurred as a result of hurricanes that occurred in the Gulf of Mexico from 2004 to 2009 indicated that there had been no change in the 1985-1999 spill rates identified in the aforementioned report. The BOEMRE is in the process of updating these spill rates, which will include the recent Macondo Event; however, significant changes to the spill rates for the entire OCS are not anticipated (Anderson, personal communication, 2010).

An estimate of spill risk from ATP'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 about 4,123. Prior to the Macondo Event, two of the largest spills resulting from blowouts on the Gulf of Mexico OCS occurred in 1970, releasing 30,000 and 53,000 bbl of oil, respectively. Since 1970, there has been a total of 13 losses of well-control events that have resulted in >50 bbl of oil being spilled. Most of these losses of well-control events were of short duration, more than one-half lasting less than a day (USDOI, BOEMRE, 2010). Additional details on estimating accidental spill occurrence rates can be found in Appendix A.

In addition to the extremely low probability noted above, there are several new factors that were not taken into consideration in the historical/statistical evaluation. The BOEMRE recently promulgated an interim Drilling Safety Rule that imposes requirements that will help enhance the safety of OCS drilling operations addresses improvement with both well bore integrity and well control equipment and procedures. Two new Notices to Lessees and Operators (NTLs) were developed to provide additional guidance on agency regulations related to spill response efforts and the development/implementation of subsea blowout containment resources. Issued in June 2010, NTL No. 2010-N06, "Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the OCS," outlined how operators must certify that they are prepared to deal with a potential blowout and describe measures they propose to enhance their ability to prevent or reduce the likelihood of a blowout and to conduct early and effective intervention, including measures for drilling a relief well. The BOEMRE also issued NTL No. 2010-N10, "Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources," which informs operators that they must attest that they will conduct all authorized activities in compliance with all applicable regulations and that they have the demonstrated capacity to deploy containment resources that could adequately and promptly respond to a blowout/loss of well control.

Ultimately, when one considers the historical data, the low estimated spill risk (.014percent), the recent response and containment improvements, BOEMRE's enhanced oversight, and industry's heightened safety awareness since the Macondo Event, it is reasonable to conclude that an accidental spill event is not very likely to occur.

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. 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. ATP provided a Regional OSRP on December 15, 2009, which was modified to address issues related to the Macondo Even on August 1, 2011. The review and approval of the revised OSRP is pending; however, in the interim, ATP submitted a certification letter on July 12, 2011 in compliance with 30 C.F.R. §254.2(b), that confirms they have the capability to respond, to the maximum extent practicable, to a worst case discharge or a substantial threat of such a discharge.

Catastrophic Spill Event Analysis

Appendix B of the Supplemental Western 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 Macondo Event 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 analysis utilizes two general analyses approaches. The first approach consists of a bounding analysis for each individual resource category (e.g., marine mammals, sea turtles, etc.), selecting a different set of factors and scenarios for each resource affected by a worst-case analysis. The second approach selects a single set of key circumstances that, in combination, result in catastrophic consequences. By combining the two approaches, relying on a generalized scenario while identifying site-specific severity factors for individual resources, this analysis allows for the scientific investigation of a range of possible, although not necessarily probable, consequences of a catastrophic blowout and oil spill in the Gulf of Mexico.

To analyze a hypothetical catastrophic event in an area such as the Gulf of Mexico, several assumptions and generalizations were made. Additionally, the life cycle of a catastrophic blowout and spill is divided into four geographic areas and/or time periods, some of which may overlap:

- Phase 1: Initial event (Section 2)
- Phase 2: Offshore spill (Section 3)
- Phase 3: Onshore contact (Section 4)
- Phase 4: Post-spill, long-term recovery (Section 5)

All four phases of a catastrophic oil spill is addressed and for each phase, the scenario is described, factors that could produce environmental impacts are listed, and the most likely and most significant impacts are discussed. The conclusions made in the of the Supplemental Western EIS' Catastrophic Spill Event Analysis are addressed in the SEA's impact analyses (Chapters 3.2 to 3.8).

2. ALTERNATIVES CONSIDERED

2.1. NO ACTION ALTERNATIVE

Alternative 1 –*Disapproval of the Proposed Action* – If selected, BOEMRE would not approve the EP and the operator would not be allowed to 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, Supplemental EIS, of the Supplemental Western EIS, and this SEA would not occur.

2.2. APPROVAL OF THE PROPOSED ACTION AS SUBMITTED

Alternative 2 – If selected, the operator would be permitted to undertake the proposed activities as requested in its 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 C.F.R. §250.101(a)), and guidance provided in all appropriate NTLs (as per 30 C.F.R. §250.103). However, no additional, site-specific mitigations would be required by BOEMRE.

2.3. APPROVAL OF THE PROPOSED ACTION WITH EXISTING AND/OR ADDITIONAL MITIGATIONS

Alternative 3 – *Preferred Alternative* – If selected, BOEMRE would approve the operator's proposed activities, as requested and conditioned by stipulations, regulations, and guidance (similar to alternative 2); however, BOEMRE would require the operator to undertake additional mitigations as identified by BOEMRE (listed in Section 2.4 below and described in the effects analyses) in order to fully address the

potential site- and project-specific impacts of the proposed action. Alternative 3 is the preferred alternative.

2.4. SUMMARY AND COMPARISON OF THE ALTERNATIVES

If selected, Alternative 1, the no action alternative (disapproval of the proposed action), would prevent the operator from exercising its rights under the lease and conducting their proposed exploratory drilling activities. Alternative 1 would not result in any impacts to the environmental resources analyzed in Chapter 3; however, it does not allow the lessee to develop the oil and gas resources of its lease for the benefit of the U.S. economy. Alternative 2 allows the lessee to achieve its objectives; however, BOEMRE has determined that additional mitigations (described below) are needed to limit or negate possible environmental impacts. Alternative 2 does not include the additional mitigations.

Alternative 3 is the preferred alternative because it allows the lessee to achieve its development objectives and also provides for additional mitigation requirements to limit or negate potential environmental impacts.

Mitigation Required under the Preferred Alternative

The need for, and utility of, the following mitigation measure discussed in the relevant impact analysis section of this SEA. To ensure adequate environmental protection, the following mitigation is applied:

AVOIDANCE OF POTENTIAL HIGH-DENSITY CHEMOSYNTHETIC COMMUNITIES: Our deepwater benthic communities review indicates that the proposed anchoring activities are in the vicinity of areas that could support high-density chemosynthetic communities. The operator will be required to use a state-of-the-art positioning system (e.g., differential global positioning system [DGPS]) on their anchor handling vessel to ensure that any seafloor disturbances resulting from their use of anchors (including that caused by the anchors, anchor chains, and wire ropes) does not occur within 250 ft of the area identified on the map provided to the operator under separate letter. The operator will be required to submit plats for Wells A and B (Mississippi Canyon Block 710) that depict the "as-placed" location of all anchors and any associated anchor chains and wire ropes on the seafloor, at a scale of 1 inch = 1,000 feet with DGPS accuracy, to this office at the same time they submit their End of Operations Report (Form MMS-125) to the appropriate BOEMRE GOMR District Office, to demonstrate that the features were not physically impacted by anchoring activities.

2.5. 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 of 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 rational 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 Dynamically-Positioned (DP) MODUs Only	The alternative would only allow the proposed drilling activities from DP MODUs (drillships or semisubmersibles) to reduce the possible impacts from anchoring activities.	This alternative does not consider the limited availability of DP MODUs in the GOM or the adequate mitigation and guidance shown to reduce/negate impacts from anchoring.
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 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 exploration activities and their IPFs would have significant impacts to the human environment of the Gulf of Mexico; 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 C.F.R. § 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, Supplemental EIS, and Supplemental Western EIS; and statistics/data pertinent to historic and projected activities. The BOEMRE 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 exploration activities similar to those proposed by ATP are analyzed in the Multisale EIS, Supplemental EIS, and Supplemental Western EIS. The EISs considered the proposed exploration 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 EISs and is incorporated by reference.

The Multisale EIS, Supplemental EIS, and Supplemental Western EIS 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, BOEMRE evaluated the potential impacts resulting from the operator's proposed exploration activities that were not considered in the EISs. For the reasons set forth on page 1, 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 Nonendangered 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 exploration activities, were fully addressed in the Multisale EIS, Supplemental EIS, and Supplemental Western EIS and deemed negligible (40 C.F.R. § 1508.27) and are not discussed in this SEA. Space-use conflicts with any recreational or commercial fishing vessels, as well as recreational and/or commercial diving operations, are minimal, if any, because of the proposed activities, the water depth (> 2,810 ft), and the distance to shore (~ 48 miles). Coastal and marine birds were not further analyzed due to the distance from shore (~ 48 miles) and the temporary nature of the proposed activities. Topographic and pinnacle features were not further analyzed due to the distance from the proposed exploration activities to the nearest topographic and/or pinnacle features (> 24 miles). 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 EISs for similar activities. The potential impacts of a low-probability, Catastrophic Oil-Spill event, such as the Macondo Event (see below) to the environmental resources and socioeconomic conditions listed above are fully addressed in the Catastrophic Spill Event Analysis (Appendix B of the Supplemental Western EIS) and a respective resource summary of that analysis is provided in each impact review below.

Macondo Well Blowout, Spill, and Remediation

On April 20, 2010, while working on an exploratory well approximately 50 mi (80 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 reached and plugged the Macondo wellbore on September 19, 2010. Prior to capping/plugging the well, approximately 53,000-62,000 bbl per day (2.23-2.60 million gallons) were released from the well, with an approximate total release of 4.9 million bbl (206,000,000 gallons) over an 87-day period. The following information was made available by the Deepwater Horizon Unified Command (DHUC) (2010a):

- More than 6,050 response vessels and approximately 47,849 personnel responded to protect the shoreline and wildlife and to cleanup vital coastlines;
- At the surface, approximately 34.7 million gallons (827,251 bbl) of oily water were recovered and an estimated 11.14 million gallons (265,450 bbl) of oil burned;
- Approximately 1.84 million gallons (43,809 bbl) of dispersant were applied (1.07 million gallons [25,476 bbl] on the surface and 771,000 gallons [18,357 bbl] subsea);
- More than 3.33 million feet (1,003 km) of containment boom and 9.7 million feet (2,469 km) of sorbent boom were deployed;
- Approximately 641 mi (1,032 km) of Gulf Coast shoreline was oiled, including approximately 368 mi (592 km) in Louisiana, 112 mi (180 km) in Mississippi, 73 mi (117 km) in Alabama, and 88 mi (142 km) in Florida.

According to the National Marine Fisheries Service (NMFS), approximately 80,228 square miles (mi^2) (207,790 square kilometers [km^2]) of Federal waters were closed to commercial and recreational fishing, approximately 33 percent of the Gulf of Mexico Federal waters (USDOC, NMFS, 2010a).

Macondo Impacts Incorporated into SEA Analyses

The BOEMRE, 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 Macondo well blowout, spill, and remediation efforts. For many resources, the data are still being collected and analyzed through the National Resource Damage Assessment (NRDA) process. The BOEMRE continues to seek data and research results from the NRDA process and the scientific community. Results of this research are forthcoming, and BOEMRE 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 exploration activities. These descriptions present environmental resources as they are now, thus providing new baseline information that is informed by the Macondo Event for analyses of potential impacts from the exploration activities.

3.2. AIR QUALITY

3.2.1. Affected Environment

The complete description of the air quality in the Gulf of Mexico region is set forth in Chapter 3.1.1 of the Multisale EIS, Chapter 4.1.1 of the Supplemental EIS, and Chapter 4.1.1.1.1 of the Supplemental Western EIS. The following information is a summary of the description incorporated from the EISs. Mississippi Canyon Block 710 is located west of 87.5° W. longitude and hence, falls under BOEMRE 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, MMS, 1997). ATP's proposed exploration activities in Mississippi Canyon Block 710 is located approximately 48 mi(77 km) from the nearest Louisiana coastline, an area that is in attainment of the NAAQS for carbon monoxide, nitrogen oxides, sulphur oxides, ozone, and particulate matter and that, for Prevention of Significant Deterioration (PSD) purposes, is classified as a Class II Area.

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 (Florida A&M University, 1988).

3.2.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed exploration activities on air quality can be found in Chapters 4.2.2.1.1 (routine/accidental) and 4.5.1 (cumulative) of the Multisale EIS and Chapters 4.1.1.1.2 (routine), 4.1.1.1.3 (accidental), and 4.1.1.1.4 (cumulative) of the Supplemental Western EIS. The following information is a summary of the impact analyses.

3.2.2.1. Alternative 1

Alternative 1, the no action alternative (disapproval of the proposed action), would result in the operator's not being permitted to drill the proposed exploration wells. Therefore, the impact producing factors 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, approval of the proposed action as proposed, would allow the operator to undertake 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 exploratory operations, service vessels, and aircraft. The impact from emissions for the proposed activities described in this EP will not exceed BOEMRE's exemption levels per 30 C.F.R. § 250.303(d), which would exempt the operator from additional air quality modeling. The drilling 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 (approximately 90 mi (145 km)).

Accidental Events

Should a spill of oil occur, the volatile organic compounds (VOCs), 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. The corresponding onshore area is in attainment for ozone. Due to the distance from shore, the proposed exploration 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 exploration activities are projected 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 Macondo Event, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of drilling and temporary abandonment associated with the proposed action. In the event of a catastrophic spill similar to the Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Supplemental Western 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 in the Supplemental Western EIS concludes, the potential impacts from a catastrophic spill could include air quality impacts that would require extensive recovery times.

Conclusion

The air quality in the immediate vicinity of the proposed activities would be affected by the short-term projected emissions, but the roughly 48-mi 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. Therefore, because of the short duration of the proposed activities and the distance from shore, no substantial long-term impacts on air quality would be expected from the proposed exploration activities. The potential impacts from a catastrophic spill as described and analyzed in Appendix B of the Supplemental Western EIS could include air quality impacts that would require extensive recovery times.

Cumulative Impacts

Cumulative impacts on air quality that result from oil and gas leasing, exploration, development, and production activity were discussed in Chapter 4.5.1 of the Multisale EIS. 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 drilling activities are located over 48 mi (77 km) from shore, and would not affect the overall quality of air over the Louisiana coast because of the temporary nature of the proposed activity and the distance to shore. Most of the Gulf's coastal areas, except for Southeast Texas, are currently designated as "attainment" for all the NAAQS regulated pollutants (USEPA, 2003).

No substantive cumulative impacts on air quality are expected as a result of the proposed exploration 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.

3.2.2.3. Alternative 3

If selected, Alternative 3, approval of the proposed action with additional mitigations, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan; however, the operator would be required to undertake an additional mitigation as identified by BOEMRE. As described in the analyses above for alternatives 1 and 2, impacts to air quality from the proposed action are expected to be short-term, localized and not lead to significant impacts. The mitigation measure outlined in Chapter 2.4 is not expected to increase or decrease the potential for effects to air quality from the proposed action. Alternative 3 does not differ from Alternative 2 because the additional mitigation measures do not address this resource (i.e., all assumptions, estimates, and conclusions are identical), see the analysis provided in Section 3.2.2.2 for this alternative for this resource.

3.3. OFFSHORE WATER QUALITY

3.3.1. Affected Environment

The description of water quality in offshore waters of the Gulf of Mexico is set forth in Chapter 3.1.2.2 of the Multisale EIS, Chapter 4.1.2.2 of the Supplemental EIS, and Chapter 4.1.1.2.2.1 of the Supplemental Western EIS. The following information is a summary of the description incorporated from the EISs.

The water offshore of the Gulf's coasts can be divided into two regions: the continental shelf and slope (<1,000 ft; 305 m) and deep water (>1,000 ft; 305 m). Waters on the continental shelf and slope are heavily influenced by the Mississippi and Atchafalaya Rivers, the primary sources of freshwater, sediment, nutrients, and pollutants from a huge drainage basin encompassing 55 percent of the continental U.S. (Murray, 1998). Lower salinities are characteristic nearshore where freshwater from the rivers mix with Gulf waters. The presence or extent of a nepheloid layer at the sea bottom affects water quality on the shelf and slope. Deep waters east of the Mississippi River are affected by the Loop Current and associated warm-core (anti-cyclonic) eddies that consist of clear, low-nutrient water (Muller-Karger et al., 2001). However, cold-core cyclonic eddies (counter-clockwise rotating) also form at the edge of the Loop Current and are associated with upwelling and nutrient-rich, high-productivity waters.

Compared with the Eastern and Western Gulf, the Central Gulf generally has higher levels of total organic` carbon and hydrocarbons in sediment, particularly those from terrestrial sources (Gallaway and Kennicutt, 1988). Hydrocarbons in sediments have been determined to influence biological communities of the Gulf slope, even when present in trace amounts (Gallaway and Kennicutt, 1988).

Natural hydrocarbon seepage is considered to be the predominant source of petroleum in Gulf waters (NRC, 2003). The National Research Council (NRC) estimated an annual input of oil from seeps to be approximately 980,000 bbl/yr for the entire Gulf (NRC, 2003). In addition to hydrocarbon seeps, other fluids leak from the underlying sediments into the bottom water along the slope. These fluids have been identified to have three origins: (1) seawater trapped during the settling of sediments; (2) brine from dissolution of underlying salt diapirs; and (3) deep-seated formation waters (Fu and Aharon, 1998; Aharon et al., 2001).

Produced water (formation water) is the largest waste stream by volume from the oil and gas industry that enters Gulf waters. Produced water is commonly treated to separate free oil and is either injected back into the reservoir or discharged overboard according to NPDES permit limits. The NRC has estimated the quantity of oil in produced water entering the Gulf per year to be 473,000 bbl (NRC, 2003).

Deepwater sediments, with the exception of barium concentrations in the vicinity of previous drilling, do not appear to contain elevated levels of metal contaminants (USDOI, MMS, 1997 and 2000). Reported total hydrocarbons, including biogenic (e.g., from biological sources) hydrocarbons, in sediments collected from the Gulf slope range from 5 to 86 nanograms/gram (Kennicutt et al., 1987).

Mississippi Canyon Block 710 is entirely in deep water, for which limited information is available on water quality. Despite more limited information on the water quality of deep water, it is clear that the condition of the offshore waters of the Gulf of Mexico is being altered as the Macondo Event evolves. The oil that entered the GOM from the Macondo well is a South Louisiana sweet crude oil (i.e., it is low in sulfur) and is fairly high in alkanes (organic compounds containing only carbon and hydrogen and single bonds; sometimes called paraffin or aliphatic compounds) (USDOC, NOAA, 2010a). Because alkanes are simple hydrocarbons, these oils are likely to undergo biodegradation more easily (USDOC, NOAA, 2010a). Weathering of crude can occur within the first 24-48 hours with up to a 40 percent weight loss within seven days (Restek, 2010). Also, this oil is less toxic than other crude oils in general because this oil is lower in polyaromatic hydrocarbons (PAHs) than many crude oils.

The Macondo Event released natural gas, primarily in the form of methane, into the water column in addition to oil. Although limited research is available for biogeochemistry of hydrocarbon gases in the marine environment, it is thought that methane may stay in the marine environment for long periods of time as the compound is highly soluble in sea water at the high pressures and cold temperatures found in deep water environments (NRC, 2003; Patin, 1999). However, methane diffusing through the water column would likely be oxidized in the aerobic zone and would rarely reach the air-water interface (Mechalas, 1974).

One tool that was used in response to the Macondo spill is dispersants, which can have both positive and negative effects. The purpose of chemical dispersants is to facilitate the movement of oil into the

water column in order to encourage weathering and biological breakdown of the oil (i.e., biodegradation) (NRC, 2005; AMSA, 2010). If the oil moves into the water column and is not on the surface of the water, it is less likely to reach sensitive shore areas (USEPA, 2010). In addition to dispersion being enhanced by artificial processes, oil may also be dispersed from natural processes. For instance, microbial metabolism of crude oil results in the dispersion of oil (Bartha and Atlas, 1983). The positive effect is that the oil, once dispersed, is more available to be degraded. The negative effect is that the oil, once dispersed, is more available to microorganisms, which temporarily increases the toxicity (Bartha and Atlas, 1983). Toxicity of dispersed oil in the environment will depend on many factors, including the effectiveness of the dispersion, temperature, salinity, the degree of weathering, type of dispersant and degree of light penetration in the water column (NRC, 2005). The toxicity of dispersed oil is primarily due to the toxic components of the oil itself (AMSA, 2010).

The dispersants Corexit® 9500 and 9527 were used in the Macondo Event (USEPA, 2010). The components of these dispersants are identical with the exception of the base solvent; Corexit® 9527 has an organic solvent as a base (MacDonald et al., 1984; USEPA, 2010). Dispersants used in the 1960s were quite toxic, but more recently developed dispersants such as Corexit® are considerably less toxic (Doe and Wells, 1978) (Leahy and Colwell, 1990). Lindstrom and Braddock (2002) found that environmental use of Corexit® 9500 could result in either increases or decreases in the toxicity of residual oil through selective microbial mineralization of hydrocarbons. In fact, reviews of studies have found that the general effectiveness of dispersants in enhancing biodegradation of crude oil and individual hydrocarbons is highly variable and depends on several factors including the chemical formulation of the dispersant, its concentration, and the dispersant/oil application ratio (Boehm, 1983). However, there was evidence that the dispersants worked in the case of the Macondo Event (USDOC, NOAA, 2010a; USEPA, 2010). Corexit® 9527 has been shown to greatly increase volatile liquid hydrocarbons incorporation into water as well as to accelerate the process in experiments compared to if no dispersant was used (MacDonald et al. 1984). In fact, dispersant use during the Macondo Event has been noted to reduce the volatile organic compounds which can be a workplace issue for response workers on ships near the site (White House Press Briefing, 2010). Since the amount of dispersants used in the Macondo Event is unprecedented and since this is the first time dispersants have been applied in deep waters, continual monitoring and evaluation of their use is imperative (White House Press Briefing, 2010).

As a result of the use of subsea dispersants, clouds or plumes of dispersed oil may occur near the blowout site in offshore waters. Reports thus far have found such plumes and have shown that the concentrations of these clouds drop to undetectable levels within a few miles (USDOC, NOAA, 2010a). Dissolved oxygen levels are a concern with any release of a carbon source, such as oil and natural gas, and became a particular concern during the Macondo Event since dispersants were used in deep waters for the first time. Thus, the U.S. Environmental Protection Agency (USEPA) required monitoring protocols in order to use subsea dispersants (USDOC, NOAA, 2010b). In areas where plumes of dispersed oil were previously found, dissolved oxygen levels decreased by about 20 percent from long-term average values in the GOM, however, scientists reported that these levels have stabilized and are not low enough to be considered hypoxic (USDOC, NOAA, 2010b). The drop in oxygen, which has not continued over time, has been attributed to microbial degradation of the oil. Initially released studies indicate that bacteria are degrading hydrocarbons from both gas and oil, but the degradation rates reported in the studies varied considerably (Camilli et al., 2010; Hazen et al., 2010; Valentine et al., 2010). Over time, as the oil continues to be degraded and diffuses, hypoxia becomes less of a concern. In fact, the 2010 hypoxic zone could not be linked to the Macondo Event in either a positive or a negative manner (LUMCON, 2010).

3.3.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed exploration activities on offshore water quality can be found in Chapters 4.2.1.1.2.2, 4.4.2.2, and 4.5.2.2 of the Multisale EIS, Chapter 4.1.2.2. of the Supplemental EIS, and Chapters 4.1.1.2.2.2, 4.1.1.2.2.3, and 4.1.1.2.2.4 of the Supplemental Western EIS. The IPFs associated with the proposed exploration activities in Mississippi Canyon Block 710 that could affect marine water quality include: (1) discharges during the drilling of wells; (2) well siting and anchoring activities; and (3) accidental spills of crude oil, diesel fuel, chemicals, or other materials from vessels 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 (disapproval of the proposed action), would result in the operator not being permitted to drill the proposed exploration wells. Therefore, the impact producing factors to offshore water quality would not occur. There would be no discharges during the drilling of wells and no accidental spills of crude oil, diesel fuel, chemicals, or other materials from vessels in marine waters. In addition, there would be no turbidity issues related to anchoring/well siting activities that would result in potential localized degradation of water quality.

3.3.2.2. Alternative 2

If selected, Alternative 2, approval of the proposed action as submitted by the operator, would allow the applicant to drill the proposed exploration wells. As described in the analyses below, impacts to water quality from the proposed action, as submitted by the operator, are expected be short-term, localized and not lead to significant impacts.

Routine Operations

The water depth at the proposed well sites is 2,810 ft (856 m). These deep marine waters and environments would not be directly affected by the proposed activities. Minor localized sediment disturbance and increased turbidity near the sea bottom would occur near the actual wells and anchor and mooring line locations. These disturbances would not adversely affect offshore water quality because the area of potential disturbance is relatively small and the effects would be temporary. Elevated turbidity would be a short-term, localized, and reversible condition once the disturbance ceases.

The USEPA regulates discharges associated with offshore oil and gas exploration, development, and production activities on the outer continental shelf (OCS) under the Clean Water Act's (CWA) National Pollutant Discharge Elimination System (NPDES) program. Regulated wastes include drilling fluids, drill cuttings, deck drainage, produced water, produced sand, well treatment fluids, well completion fluids, well workover fluids, sanitary wastes, domestic wastes, and miscellaneous wastes (USEPA, 2009). The USEPA's NPDES general permit for the Western Gulf of Mexico, Region 6, (GMG290000, which authorizes discharges to surface water during drilling and production) was reissued and went into effect on October 1, 2007 (USEPA, 2007). Overboard discharges and wastes intended from the project are shown in the wastes and discharge tables provided in the plan and the types and rates would be in accordance with NPDES General Permit (ATP, 2011). The wastes destined for onshore disposal or recycling pose no potential significant impacts to affected resources unless spilled. Sanitary and domestic waste would be produced on the MODU as well as the support vessels; however, these discharges would be treated to meet USEPA discharge requirements. Water would be impacted by the introduction of suspended solids and biochemical oxygen demand (BOD) matter.

Accidental Events

The BOEMRE has determined, based on historical trends in the GOM (see Chapter 1.4 and Appendix A) that blowouts are not likely to occur as a result of drilling and temporary abandonment associated with the proposed action. In 2007, BOEMRE (then MMS) looked at the occurrences of blowouts during a 15 year period. From 1992 to 2006, 39 blowouts occurred at a rate of one blowout for every 387 wells drilled. Spills that occur from the proposed drilling activity would be few (if any) and small in size (<1,000 bbls) (see Chapter 1.4, Appendix A, and Anderson and LaBelle, 2000). Spilled oil originating from the project is not expected to be ≥1,000 bbl and is expected to be substantially recovered and/or weathered while still at sea.

A surface slick from a blowout begins to weather as soon as it forms, depending on a number of factors, particularly the characteristics of the released oil and oceanographic conditions. Some of the subsurface oil may disperse within the water column. A variety of physical, chemical, and biological processes act to disperse and degrade the slick once oil enters the ocean. These include spreading, evaporation of the more volatile constituents, dissolution into the water column, emulsification of small droplets, agglomeration sinking, microbial modification, photochemical modification, and biological ingestion and excretion. Some oil from the slick would be mixed into the water and dispersed by wind and waves. The quality of marine waters on the surface or in a rising subsurface plume from a blowout

would be temporarily affected by the solubility of hydrocarbon components and by small, dispersed oil droplets that do not rise to the surface due to current activity or that are mixed downward by surface turbulence. Dispersion by currents and microbial degradation remove the oil from the water column and eventually dilute the constituents to background levels.

In the event of a catastrophic spill similar to the Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Supplemental Western 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 Macondo Event, 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 drilling and temporary abandonment associated with the proposed action.

Conclusion

No significant long-term impacts on offshore water quality would be expected from the proposed action 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 siting and installation anchors and mooring lines/chains. Any effects from the elevated turbidity would be short term, localized, and reversible.

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 cited above, 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 (see Chapter 1.4 and Appendix A). 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.

Cumulative Impacts

Cumulative impacts on offshore water quality that result from oil and gas leasing, exploration, development, and production activity were discussed in Chapter 4.5.2.2 of the Multisale EIS and Chapter 4.1.2.2 of the Supplemental EIS.

Exploration, development, and production activity contribute to cumulative water quality degradation in offshore waters. 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. Well blowouts can disturb the bottom, increase turbidity, and put oil into the sea. Should a blowout occur, involving an oil spill ≥1,000 bbl, localized, short-term changes in water quality would be expected and cumulative impacts would be negligible. Activities that would contribute to cumulative impacts, for example bottom area disturbances resulting from other, like dredging, are not expected due to water depths in the area of the proposed action. Bottom disturbances from anchoring of the proposed MODU would produce short-lived effects on water quality related to each anchor site.

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

3.3.2.3. Alternative 3

If selected, Alternative 3, approval of the proposed action with additional mitigations, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan; however, the

operator would be required to undertake additional mitigation as identified by BOEMRE. As described in the analyses above, impacts to offshore water quality from the proposed action are expected to be short-term, localized and not lead to significant impacts. The mitigation measure outlined in Chapter 2 and discussed in the other resource sections is not expected to increase or decrease the potential for effects to offshore water quality from the proposed action. Alternative 3 does not differ from Alternative 2 because the additional mitigation measures do not address this resource (i.e., all assumptions, estimates, and conclusions are identical), see the analysis provided in Section 3.2.2.2 for this alternative for this resource.

3.4. DEEPWATER BENTHIC COMMUNITIES

3.4.1. Chemosynthetic Deepwater Benthic Communities

A remarkable assemblage of invertebrates are found in association with hydrocarbon seeps, including chemosynthetic organisms that use a carbon source independent of photosynthesis and the sun-dependent photosynthetic food chain that supports most all other life on the planet. Chemosynthetic communities begin with bacterial mats that consume methanes and sulfides; their respiration results in the precipitation of carbonate, forming a hard substrate. Other chemosynthetic organisms can then become established on the carbonate substrate. These other chemosynthetic organisms form additional structure upon the seafloor, increasing the complexity of the habitat and supporting a variety of nonchemosynthetic invertebrates and fishes.

3.4.1.1. Affected Environment

The description of the chemosynthetic deepwater benthic communities in the Gulf of Mexico region can be found in Chapter 3.2.2.2.1 of the Multisale EIS, Chapter 4.1.5 of the Supplemental EIS, and Chapter 4.1.1.8.1 of the Supplemental Western EIS. The following information is a summary of the description in the EISs and it is incorporated by reference into this SEA.

The continental slope in the Gulf of Mexico 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, MMS, 2007b). The vast majority of the Gulf of Mexico has a soft, muddy bottom in which burrowing infauna are the most abundant invertebrates. Mississippi Canyon Block 710 fall into this category and the water depth at the proposed well sites is 2, 810 ft (856 m).

Chemosynthetic communities are defined as persistent, largely sessile assemblages of marine organisms dependent upon symbiotic chemosynthetic bacteria as their primary food source (MacDonald, 1992). Bacteria live within specialized cells in these invertebrate organisms and are supplied with oxygen and chemosynthetic compounds by the host via specialized blood chemistry (Fisher, 1990). The host, in turn, lives off the organic products subsequently released by the chemosynthetic bacteria and may even feed on the bacteria themselves. Additional information on the biology, life history, and distribution of chemosynthetic deepwater benthic communities can be found in Chapter 3.2.2.2 of the Multisale EIS and Chapter 4.1.4 of the Supplemental EIS.

Hydrocarbon seep communities in the GOM have been reported to occur at water depths greater than 984 ft (300 m) (USDOI, MMS, 2007). The total number of chemosynthetic communities in the Gulf is now known to exceed 60. A recent MMS study, *Investigations of Chemosynthetic Communities on the Lower Continental Slope of the Gulf of Mexico*, performed exploration surveys specifically targeting water depths below 3,280 ft (1,000 m) (Brooks et al., 2009). This study confirmed the presence of 12 additional chemosynthetic communities not previously know in these water depths. What was initially thought to be relatively rare occurrences of chemosynthetic communities is now known to be far more common and regularly associated with primary geophysical signatures of the seabed, including faulting with conduits for hydrocarbons to the surface from deeper depths and precipitation of carbonate deposits on the seafloor. Acoustic amplitude anomalies on the seabed are major features related to almost all known chemosynthetic communities in the CPA and WPA, and these kinds of features are now relatively well mapped throughout the entire northern Gulf of Mexico. The total number of features on the northern Gulf slope that have probable associated communities now number over 15,000.

The Macondo Event released an estimated 53,000-62,000 bbl of oil per day for almost 3 months. Much of the oil was treated with dispersant at the sea surface and at the source in a water depth of 1,500

m (5,000 ft). The dispersed oil mixed with the water; its movement was dictated by water currents and the physical processes of degradation. It is assumed that most of the dispersed oil eventually went to the ground on some portion of the seafloor; the longer it remained suspended, the more it dispersed and degraded. Depending on how long it remained in the water column, it may have been thoroughly degraded by biological action before contact or it may have contacted the seafloor more quickly. Oil may reach the seafloor through consumption by plankton, with excretion distributed over the seafloor. Water currents could have carried a plume to contact the seafloor directly but a likely scenario would be for the oil to adhere to other particles and precipitate to the seafloor, much like rainfall. This would result in a wide distribution of small amounts of oil.

Oil from the Macondo Event would be subject to biodegradation from bacterial action that would continue on the seafloor, resulting in scattered microhabitats with an enriched carbon environment. Chemosynthetic communities are adapted to gas seeps, which in some cases release oil also. For example, in a 2002 study, it is stated that "three of our [chemosynthetic community] sites are clearly anomalous in terms of [high] oil concentration" (MacDonald, 2002). These sites that may have received low quantities of well-dispersed oil undergoing biodegradation are likely to have experienced little negative effect. Exposure may be similar to normal conditions for these communities or toxic oil may have caused some fluctuation in health, resulting in slower growth or delayed spawning. Since these organisms grow slowly, the effects of a small amount of oil exposure could eliminate a year or more of normal growth. Chemosynthetic communities exposed to more concentrated oil may experience detrimental toxic effects of oil including death of affected organisms, tissue damage, lack of growth, interruption of reproductive cycles, and loss of gamete viability (USDOI, BOEMRE, 2010; Peters et al., 1981; Reimer, 1975; Loya and Rinkevich, 1979; Rinkevich and Loya, 1977; Cohen et al., 1977; Guzmán and Holst, 1993). Other invertebrates associated with chemosynthetic communities, particularly the crustaceans, would likely be more susceptible to damage from oil exposure because they are not obligatory residents of gas seep habitats that may include oil seepage (Dean and Jewett, 2001; Gómez Gesteria and Dauvin, 2000). Recolonization of severely damaged or destroyed communities could take years to decades because chemosynthetic communities have low reproductive effort and are long-lived (ecologically k-selected) (MEC, 1995; Rinkevich and Loya, 1977; CSA and GERG, 2001; MRRI, 1984; Montagna and Holmberg, 2000). Data on the short and long term impacts of toxic oil on chemosynthetic communities or their recovery from disturbance are lacking.

3.4.1.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed exploration activities on chemosynthetic communities can be found in Chapters 4.2.1.1.4.2.1, 4.2.2.1.4.2.1, 4.4.4.2.1, and 4.5.4.1 of the Multisale EIS, Chapter 4.1.4.1 of the Supplemental EIS, and Chapters 4.1.1.8.2, 4.1.1.8.3, and 4.1.1.8.4. The following information is a summary of the impact analyses in the EISs and it is incorporated by reference into this SEA.

The IPFs associated with the exploration activities in Mississippi Canyon Block 710 that could affect deepwater benthic communities include physical impacts from: (1) well siting and anchoring activities, including related chains and cables; (2) drilling discharges, including primarily cuttings with associated drilling muds; and (3) possible seafloor blowouts during well drilling.

3.4.1.2.1. Alternative 1

If selected, Alternative 1, the no action alternative (disapproval of the proposed action), would result in the operator not being permitted to drill the proposed exploration wells. Therefore, the impact-producing factors to chemosynthetic deepwater benthic communities would not occur. For example, there would be no well or anchor placement activities that could result in physical damage to the chemosynthetic communities or their substrates, no drilling discharges that could result in burial of the organisms, or no damage from contact with oil from blowouts/spills.

3.4.1.2.2. Alternative 2

If selected, Alternative 2, approval of the proposed action as submitted by the operator, would allow the operator to drill the proposed exploration wells according to the operator's plan. Examples of potential impacts to possible chemosynthetic deepwater communities without implementation of the

mitigation noted in Chapter 2.4 include, but are not limited to, damage to potential resources from anchoring operations. (More details on the potential for impacts absent these mitigation measures are described further in the sections below.) Without mitigation, this Alternative would not limit or negate potential impacts to chemosynthetic deepwater benthic communities beyond what is proposed in the EP itself or under applicable law.

Routine Operations

The NTL No. 2009-G40, "Deepwater Benthic Communities," provides guidance related to BOEMRE's regulations implementing a policy of avoidance of dense chemosynthetic communities (such as Bush Hill-type communities) or areas that have a high potential for supporting these community types, as interpreted from geophysical records. 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 communities. ATP's survey data was incorporated into this analysis.

Physical disturbances from anchors, anchor chains/cables, and mooring lines as they are deployed, set, and configured on the seabed could cause considerable mechanical damage to any deepwater benthic communities near the anchor sites and/or sweep of the moorings. The area affected by anchoring operations depends on the water depth, length of the chain, size of the anchor, and water currents and while such an area of disturbance may be small in absolute terms, it may be large in relation to the area inhabited by dense chemosynthetic communities. For this plan, ATP proposes to conduct their anchoring/mooring activities within a 11,000 ft radius of both well sites and did not submit associated anchor patterns/configurations. Therefore, this analysis considers the areal extent of the potential impacts to be the entire scope of the radii since anchoring could take place at any location within its limits. The site-specific deepwater benthic communities review conducted for the proposed action determined that there are possible, high-density chemosynthetic communities or sites that could support such communities within the mooring radii of Wells A and B (Mississippi Canyon Block 710). If the proposed anchoring activities were to contact one of the sites, it has the potential to destroy any sessile organisms that may be present or cause destruction of underlying carbonate structures on which organisms rely for substrate as well as dispersion of hydrocarbon sources. Should this occur, these impacts could be quite severe to the immediate area affected, with recovery times as long as 200 years for mature tube-worm communities, with the possibility of the community never recovering.

Routine surface discharges of drilling cuttings have been documented to reach the seafloor in water depths greater than 1,310 ft (400 m); however, significant accumulation thickness will be limited to a relatively close distance from the surface discharge point. A study looked at both development and production facility drilling discharges in water depths of 3,280 ft (1,000 m) and reported detectable accumulations at distances as far as 0.6 mi (1 km) (CSA, 2006). Realistically, splays of discharges only move in limited directions depending on prevailing currents; a good estimate would be 1/3 of the circumference of a circle with a radius of 3,280 ft (1,000 m) or 260 acres (105 hectares). Routine surface discharges of drilling cuttings would not result in a significant impact on the benthic communities because the duration and areal extent of the proposed activities, i.e., exploratory drilling, would be limited and recolonization of benthic communities would be facilitated from nearby surrounding areas because numerous widespread pelagic larvae can settle on sediment where mortality to chemosynthetic organisms may reduce crowding and open up space for colonization.

The deepwater benthic communities review conducted for this proposal did identify possible, high-density chemosynthetic communities or sites that could support such communities within the mooring radius of the well sites (as noted above); however, it did not detect any potential, high-density chemosynthetic communities within 2,000 ft of any of the proposed wells. As such, impacts from discharges related to the proposed drilling operations are not expected.

Accidental Events

A blowout at the seafloor occurs when excess pressure in the well exceeds the capacity (both the operator's and the drilling apparatus' capacity) to contain the well. A blowout could create a crater on the sea bottom and resuspend and disperse large quantities of bottom sediments within a 985 ft (300 m) radius of the blowout site, burying both infaunal (living in the sediment) and epifaunal (living on

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). Burial by thinner 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 the duration and areal extent [within a radius of 985 ft (300 m)] and recolonization of communities would be facilitated from nearby surrounding areas because numerous widespread pelagic larvae can settle on sediment where mortality to chemosynthetic organisms may reduce crowding and will open up space for colonization. ATP's proposed activities are not to be placed near sensitive high-density chemosynthetic communities because BOEMRE is prohibited under its regulations, from approving the placement of any wells near these communities. Consequently, sensitive high-density chemosynthetic communities would not be affected by sediments.

Oil released by a seafloor blowout could have potential negative effects on chemosynthetic communities. However, there are two reasons why substantive impacts are very unlikely: (1) the surface areas of possible communities is very small compared with the surrounding soft bottoms so they present relatively small, widely dispersed targets for contact by an oil spill; and (2) the likelihood of any size blowout is very small. Impacts from a potential blowout similar to the Macondo Event are examined in the Catastrophic Spill Analysis located in Appendix B. Oil treated with dispersant on the sea surface or at depth could contact chemosynthetic communities beyond the immediate area of the drilling activity. Currently there is limited information on toxicity of oil to chemosynthetic organisms. Data on the general toxicity of oil to organisms suggests that if oil contacted chemosynthetic communities, potential toxic effects would range from no discernable effect (for well-dispersed oil undergoing biodegradation) to lack of growth, to interruption of reproductive cycles, to loss of gamete viability, to tissue damage, and to death of affected organisms, depending on the amount and duration of contamination. Chemosynthetic organisms are adapted to exposure to gas seeps that may include oil discharge. For example, a USDOI, MMS (2002) study stated that "three of our [chemosynthetic community] sites are clearly anomalous in terms of [high] oil concentration". Such organisms may be more tolerant to exposure to oil than other invertebrates associated with chemosynthetic communities, particularly the crustaceans, and would likely be less susceptible to damage from oil exposure. Recolonization of severely damaged or destroyed communities could take years to decades because the organisms are long-lived with relatively low reproductive rates (i.e., they are ecologically k-selected). However, as noted above, the deepwater benthic communities review conducted for this proposal did not identify any potential, high-density chemosynthetic communities within 2,000 ft of any of the proposed wells. Therefore, impacts from accidental blowouts and spills that may be related to the proposed drilling operations are not expected

Despite the recent Macondo Event, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of drilling and temporary abandonment associated with the proposed action. In the event of a catastrophic spill similar to the Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Supplemental Western EIS discusses the most likely and most significant impacts to deepwater benthic habitats as it relates to three of the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.2.5.; Page B-7);
2) **Offshore Spill** (Section 3.2.2.7; Page B-23);
3) **Onshore Contact** (deepwater benthic communities not included in this discussion); and
4) **Post-Spill, Long-Term Recovery** (Section 5.2.2.8; Page B-44).

The potential impacts from a catastrophic spill to chemosynthetic communities would be similar to aforementioned routine and accidental issues, and any substantive impact to chemosynthetic communities is very unlikely, due to the low probability of oil contacting the widely scattered, small targets represented by the communities.

Conclusion

As discussed above, the site-specific deepwater benthic communities review conducted for the proposed action determined that there are possible, high-density chemosynthetic communities or sites that could support such communities within the mooring radii of proposed Wells A and B (Mississippi

Canyon Block 710). If the proposed anchoring activities were to contact one of the sites, it has the potential to destroy any sessile organisms that may be present or cause destruction of underlying carbonate structures on which organisms rely for substrate as well as dispersion of hydrocarbon sources. These impacts could be quite severe to the immediate area affected, with recovery times as long as 200 years for mature tube-worm communities, with the possibility of the community never recovering. The review also determined that there were no known or potential high-density chemosynthetic communities or support sites within 2,000 ft of the wells sites; therefore impacts from drilling discharges are not expected. Significant impacts to chemosynthetic communities are not expected from accidental blowouts due to their low probability and the low probability of oil contacting such communities (representing very small, widely dispersed targets). The potential impacts from a catastrophic spill to chemosynthetic communities would be similar to aforementioned spill issues, and any substantive impact to chemosynthetic communities is very unlikely, due to the low probability of oil contacting the widely scattered, small targets represented by the communities.

Since review of the ATP's plan and associated survey data determined that high-density chemosynthetic communities or sites that could support such communities are present within the mooring radii of Wells A and B (Mississippi Canyon Block 710), without proper avoidance requirements/mitigation, selecting Alternative 2 could result in significant impacts to these resources.

Cumulative Impacts

Impacts of any disturbance from routine activities would be local and short-term and unlikely to occur more than once to any area. Severe impacts resulting from a major blowout event could severely damage localized areas supporting chemosynthetic communities. However, the chance of such a blowout is very low and would only damage a chemosynthetic community that happens to be directly in the path of a subsea plume at the seafloor. Effects to the overall ecosystem of chemosynthetic communities in the GOM would be minimal. For the same reasons described above, even the most severe impacts, from a blowout, are not expected to significantly impact a chemosynthetic community.

Considering the potential cumulative impacts from all other GOM activities, the operator's proposed drilling/anchoring activities would constitute the primary effect on the resources that may exist in the area of the proposed action.

3.4.1.2.3. Alternative 3.

If selected, Alternative 3, approval of the proposed action with additional mitigation, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan. However, approval of the proposed plan would be conditioned on the operator conducting their anchoring operations under the mitigation identified in Section 2.4 and discussed below. These conditions of approval would limit/negate potential impacts and ensure that the resources identified in the site-specific deepwater benthic communities review will be protected.

Routine Activities

The analysis of the possible impacts from routine activities for Alternative 3 remains the same as that discussed for Alternative 2, above. As previously noted, review of the ATP's plan and associated survey data determined that high-density chemosynthetic communities or sites that could support such communities are present within the mooring radii of Wells A and B (Mississippi Canyon Block 710). As such, unconditioned anchoring operations could result in significant impacts to these resources. Impacts to a chemosynthetic community could result from direct physical contact with anchors and/or associated chains, cables, and mooring lines that has the potential to destroy any sessile organisms that may be present or cause destruction of underlying carbonate structures on which organisms rely for substrate as well as dispersion of hydrocarbon sources. These impacts could be quite severe to the immediate area affected, with recovery times as long as 200 years for mature tube-worm communities, with the possibility of the community never recovering. The review also determined that there were no known or potential high-density chemosynthetic communities or support sites within 2,000 ft of the wells sites; therefore impacts from drilling discharges are not expected.

Compliance with the conditional employment of DGPS during anchor placement and the establishment of 250 ft no-activity buffer area around the potential community sites will allow the

anchoring operations to be conducted and the potential impacts to be avoided to the maximum extent practicable. Ultimately, the implementation of the mitigation reduces the potential for impacts from routine events of the proposed action by locating the associated activities away from resources.

Accidental Events

The analysis of the possible impacts from accidental events for Alternative 3 remains the same as that discussed for Alternative 2, above. Significant impacts to chemosynthetic communities are not expected from accidental blowouts due to their low probability and the low probability of oil contacting such communities (representing very small, widely dispersed targets). The potential impacts from a catastrophic spill to chemosynthetic communities would be similar to aforementioned spill issues, and any substantive impact to chemosynthetic communities is very unlikely, due to the low probability of oil contacting the widely scattered, small targets represented by the communities. The potential for accidental events associated with the proposed action would also be limited or negated under Alternative 3 by distancing the anchoring activities away from the identified resource.

Conclusion

The site-specific deepwater benthic communities review conducted for the proposed action determined that there were no known or potential high-density chemosynthetic communities or support sites within 2,000 ft of the wells sites; therefore impacts from drilling discharges are not expected. Significant impacts are also not expected from accidental blowouts due to their low probability and the low probability of oil contacting such communities (representing very small, widely dispersed targets). The potential impacts from a catastrophic spill to chemosynthetic communities would be similar to aforementioned spill issues, and any substantive impact to chemosynthetic communities is very unlikely, due to the low probability of oil contacting the widely scattered, small targets represented by the communities. However, the site-specific review did identify possible, high-density chemosynthetic communities or sites that could support such communities within the mooring radii of Wells A and B (Mississippi Canyon Block 710). If the proposed anchoring activities were to contact one of the sites, it has the potential to destroy any sessile organisms that may be present or cause destruction of underlying carbonate structures on which organisms rely for substrate as well as dispersion of hydrocarbon sources. These impacts could be quite severe to the immediate area affected, with recovery times as long as 200 years for mature tube-worm communities, with the possibility of the community never recovering.

For this reason, Alternative 3 would require the lessee to comply with the mitigation outlined in Chapter 2.4 during their anchoring activities. These conditions are designed to provide for appropriate distancing between the anchoring operations and the identified resources to reduce or eliminate adverse impacts. Therefore, under Alternative 3, the proposed action is not expected to result in significant impacts to high-density chemosynthetic communities or sites that could support such communities.

Cumulative Analysis

The cumulative analysis for Alternative 3 remains the same as that discussed for Alternative 2, above. However, the imposition of the mitigation outlined in Chapter 2.4 will further ensure that the potential impacts of the proposed action on chemosynthetic communities and/or site that could support them within the area of the proposed action will be low or non-existent, because activities will be sited away from the identified resource. Therefore, no significant cumulative impacts on chemosynthetic communities and/or site that could support them would be expected as a result of the proposed exploration 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.

3.4.2. Nonchemosynthetic Deepwater Benthic Communities

Hard-bottom habitats in deep water include invertebrate communities dominated by the thicket-forming hard coral, *Lophelia pertusa*, with other corals such as the bamboo coral (*Keratoisis flexibilis*) and hidden white coral (*Madrepora oculata*). Numerous other invertebrates are also associated with these benthic habitats (Sulak et al., 2008a; Cordes et al., 2008; Fisher et al., 2007; Schroeder et al., 2005). The hard substrate underlying deep coral habitats in the deep Gulf of Mexico is formed by the processes of

chemosynthetic organisms consuming hydrocarbons. Bacteria consume methanes and sulfides; their respiration results in the precipitation of carbonate, forming a hard substrate. The deep coral communities can form on the hard substrate after the hydrocarbon seep subsides or on the periphery away from the immediate effects of the seep. The coral community forms additional structure upon the seafloor, increasing the complexity of the habitat and supporting a variety of invertebrates and fishes.

3.4.2.1. Affected Environment

The description of the nonchemosynthetic deepwater benthic communities in the Gulf of Mexico region can be found in Chapter 3.2.2.2.2 of the Multisale EIS, Chapter 4.1.5 of the Supplemental EIS, and Chapter 4.1.1.9.1 of the Supplemental Western EIS. The following information is a summary of the description in the EISs, and it is incorporated by reference into this SEA.

The continental slope in the Gulf of Mexico 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, MMS, 2007b). The vast majority of the Gulf of Mexico has a soft, muddy bottom in which burrowing infauna are the most abundant invertebrates. Mississippi Canyon Block 710 falls into this category and the water depth at the proposed well sites is 2, 810 ft (856 m).

Deepwater coral habitats and other potential hard-bottom communities are often associated with chemosynthetic communities. Chemosynthetic bacteria at hydrocarbon and sulfide seep sites produce chemical reactions that result in the precipitation of hard carbonate substrate. While these hard substrates support complex chemosynthetic communities they also harbor deep coral communities. Corals are able to thrive on the periphery of chemosynthetic habitat and even replace them after the hydrocarbon seep subsides. These unique communities are distinctive and similar in nature to protected pinnacles and topographic features on the continental shelf.

Any hard substrate communities located in deep water would be particularly sensitive to impacts from OCS activities, such as bottom disturbances and increased turbidity. Such impacts to these sensitive habitats could permanently prevent recolonization with similar organisms requiring hard substrate.

The Macondo Event resulted in the release of an estimated 53,000-62,000 bbl of oil per day for almost 3 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 (1,500 m). The dispersed oil mixed with the water; its movement was dictated by water currents and the physical processes of degradation. It is assumed that most of the dispersed oil eventually went to the ground on some portion of the seafloor; the longer the oil remained suspended, the more it dispersed and degraded. Depending on how long the oil remained in the water column, it may have been thoroughly degraded by biological action before contact with the seafloor or the dispersed oil may have quickly dropped to the seafloor. Oil may have also reached the seafloor indirectly through consumption by plankton, with excretion distributed over the seafloor. It is possible that water currents could have carried a plume directly to the seafloor directly but a more likely scenario would have been for the oil to adhere to other particles and precipitate to the seafloor, much like rainfall. This scenario would have resulted in a wide distribution of small amounts of oil. Oil distributed in this way would be subject to the process of biodegradation from bacterial action that would continue on the seafloor, resulting in scattered microhabitats with an enriched carbon environment.

There have been no experiments and thus, no information regarding the response of deepwater corals to oil exposure. Experiments with shallow water tropical corals indicate that corals have a high tolerance to oil exposure (Shigenaka, 2001). Though deepwater corals live in a different environment, their general physiology is similar to shallow water tropical corals and, therefore, similar response to oiling can be expected. The mucus layers on coral resist penetration of oil and slough off the contaminant. Longer exposure times and areas of tissue where oil adheres to the coral in shallow waters are more likely to result in tissue damage and death of polyps. Corals with branching growth forms appear to be more susceptible to damage from oil exposure (Shigenaka, 2001). The most common deepwater coral, *Lophelia pertusa*, is a branching species. Tests with shallow tropical gorgonians indicate relatively low toxic effects to the coral, suggesting deepwater gorgonians may have a similar response. Deepwater coral response to exposure to oil would vary, depending on the level of exposure. Exposure to widely dispersed oil adhering to organic detritus and partially degraded by bacteria may be expected to result in little effect; such oil was undetectable on the seafloor following the Ixtoc spill (ERCO, 1982). Direct contact with plumes of relatively fresh dispersed oil in the vicinity of the incident could cause death of affected coral polyps because concentrated oil has the ability to penetrate their exoskeletons and impair

photosynthesis carried out in symbiotic algae that the polyps rely upon for oxygen and food (Cook and Knap, 1983). Median levels of exposure to dispersed oil in a partly degraded condition may result in effects similar to those of shallow tropical corals, with often no discernable effects other than temporary contraction and some sloughing. The health of corals may be degraded by the necessary expenditure of energy as the corals respond to oiling. Communities exposed to more concentrated oil may experience detrimental effects including death of affected organisms, tissue damage, lack of growth, interruption of reproductive cycles, and loss of gametes (Peters et al., 1981; Reimer, 1975; Loya and Rinkevich, 1979; Rinkevich and Loya, 1977; Cohen et al., 1977; Guzmán and Holst, 1993). Many invertebrates associated with deepwater coral communities, particularly the crustaceans, would likely be more susceptible to damage from oil exposure (Dean and Jewett, 2001; Gómez Gesteria and Dauvin, 2000). Recolonization of severely damaged or destroyed communities could take years to decades.

3.4.2.2. Impact Analysis

A detailed impact analysis of the routine, accidental, and cumulative impacts of the proposed exploration activities on nonchemosynthetic benthic communities can be found in Chapters 4.2.1.1.4.2.2, 4.2.2.1.4.2.2, 4.4.4.2.2, and 4.5.4.2 of the Multisale EIS, Chapter 4.1.5 of the Supplemental EIS, and Chapters 4.1.1.9.2, 4.1.1.9.3, and 4.1.1.9.4 in the Supplemental Western EIS. The following information is a summary of the impact analyses in the EISs, and it is incorporated by reference into this SEA. The potential impacts to nonchemosynthetic deepwater benthic communities expected to inhabit the area of the proposed action are discussed in this section.

Similar to the previously discussed chemosynthetic communities, the IPFs associated with the proposed action that could affect nonchemosynthetic deepwater benthic communities include physical impacts from: (1) anchoring, including related chains and cables; (2) drilling discharges, including primarily cuttings with associated drilling muds; and (3) possible seafloor blowouts during well drilling.

3.4.2.2.1. Alternative 1

If selected, Alternative 1, the no action alternative (disapproval of the proposed action), would result in the operator not being permitted to drill the proposed exploration wells. Therefore, the impact producing factors to nonchemosynthetic deepwater benthic communities would not occur. For example, there would be no drilling discharges that could result in burial of the organisms, or no damage from contact with oil from blowouts/spills.

3.4.2.2.2. Alternative 2

If selected, Alternative 2, approval of the proposed action as submitted by the operator, would allow the operator to drill the proposed exploration wells according to the operator's plan as submitted. Examples of potential impacts to possible nonchemosynthetic deepwater communities without implementation of the mitigation noted in Chapter 2.4 include, but are not limited to, damage to potential resources from anchoring operations. (More details on the potential for impacts absent these mitigation measures are described further in the sections below.) Without mitigation, this Alternative would not limit or negate potential impacts to nonchemosynthetic deepwater benthic communities beyond what is proposed in the EP itself or under applicable law.

Routine Operations

As noted in the previous impact analysis, the site-specific deepwater benthic communities review conducted for the proposed drilling determined that there were potential deepwater benthic communities (either chemosynthetic or nonchemosynthetic) or sites that could support such communities within the scope of the proposed anchor radii of Wells A and B (Mississippi Canyon Block 710). Since nonchemosynthetic communities are often associated with chemosynthetic community sites, similar impacts could occur from direct contact with the anchors and/or their associated mooring components. Similarly, anchors and mooring lines from the MODU can cause disturbances with lethal affects such as (1) crushing by anchors or mooring lines; (2) burial or disruption the organisms from scraping, plowing, or redistribution of bottom sediment by mooring lines that pivot on their anchors; and (3) increased turbidity from sediment that is resuspended as a result of anchor emplacement or mooring line motion that

fouls or interferes with filter-feeding organs. Although a recent study looked at both exploration and production facility drilling discharges in water depths of 3,280 ft (1,000 m) and reported detectable accumulations at distances as far as 0.6 mi (1 km), significant accumulation of sediments from drilling discharges (cuttings and muds) will be limited to a close distance from the well (CSA, 2006) because splays of discharges only move in limited directions depending on prevailing currents; a good estimate would be 1/3 of the circumference of a circle with a radius of 3,280 ft (1,000 m) or 260 acres (105 hectares). However, since the site-specific review did not identify any nonchemosynthetic benthic communities within 2,000 ft of the proposed well sites, no significant impacts from discharges are expected.

Accidental Events

A blowout at the seafloor occurs when excess pressure in the well exceeds the capacity (both the operator's and the drilling apparatus' capacity) to contain the well. A blowout could create a crater on the sea bottom and resuspend and disperse large quantities of bottom sediments within a 985 ft (300 m) radius of the blowout site, burying both infaunal (living in the sediment) and epifaunal (living on 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). Burial by thinner 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 the duration and areal extent would be limited and recolonization of communities would be facilitated from nearby surrounding areas. Oil treated with dispersant on the sea surface or at depth could contact sensitive benthic communities beyond the immediate area of the activity. Potential blowouts similar to the Deepwater Horizon incident are described in the Catastrophic Spill Analysis located in Appendix B of the Supplemental Western EIS.

There have been no experiments and thus, no information regarding the response of deepwater corals to oil exposure. Experiments with shallow water tropical corals indicate that corals have a high tolerance to oil exposure (Shigenaka, 2001). Though deepwater corals live in a different environment, their general physiology is similar to shallow water tropical corals and, therefore, similar response to oiling can be expected. The mucus layers on coral resist penetration of oil and slough off the contaminant. Longer exposure times and areas of tissue where oil adheres to the coral in shallow waters are more likely to result in tissue damage and death of polyps. Corals with branching growth forms appear to be more susceptible to damage from oil exposure (Shigenaka, 2001). The most common deepwater coral, Lophelia pertusa, is a branching species. Tests with shallow tropical gorgonians indicate relatively low toxic effects to the coral, suggesting deepwater gorgonians may have a similar response. Deepwater coral response to exposure to oil would vary, depending on the level of exposure. Exposure to widely dispersed oil adhering to organic detritus and partially degraded by bacteria may be expected to result in little effect; such oil was undetectable on the seafloor following the Ixtoc spill (ERCO, 1982). Direct contact with plumes of relatively fresh dispersed oil in the vicinity of the incident could cause death of affected coral polyps, because concentrated oil has the ability to penetrate their exoskeletons and impair photosynthesis carried out in symbiotic algae that the polyps rely upon for oxygen and food (Cook and Knap, 1983). Median levels of exposure to dispersed oil in a partly degraded condition may result in effects similar to those of shallow tropical corals, with often no discernable effects other than temporary contraction and some sloughing. The health of corals may be degraded by the necessary expenditure of energy as the corals respond to oiling. Communities exposed to more concentrated oil may experience detrimental effects including death of affected organisms, tissue damage, lack of growth, interruption of reproductive cycles, and loss of gametes (Peters et al., 1981; Reimer, 1975; Loya and Rinkevich, 1979; Rinkevich and Loya, 1977; Cohen et al., 1977; Guzman and Holst, 1993). Many invertebrates associated with deepwater coral communities, particularly the crustaceans, would likely be more susceptible to damage from oil exposure (Dean and Jewett, 2001; Gómez, Gesteria, and Dauvin, 2000). Recolonization of severely damaged or destroyed communities could take years to decades (MEC, 1995; Rinkevich and Loya, 1977; CSA and GERG, 2001; MRRI, 1984; Montagna and Holmberg, 2000).

Other invertebrates associated with deepwater coral communities, particularly the crustaceans, would likely be more susceptible to damage from oil exposure. Recolonization of severely damaged or destroyed communities could take years to decades. Additionally, even though the site-specific

deepwater communities review detected features within the anchor radii of Wells A and B (Mississippi Canyon Block 710), none of the wells are proposed within 2,000 ft of potential nonchemosynthetic communities and impacts from spills and blowouts are not expected..

In the event of a catastrophic spill similar to the Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Supplemental Western EIS discusses the most likely and most significant impacts to deepwater benthic habitats as it relates to three of the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.2.5.; Page B-7);
2) **Offshore Spill** (Section 3.2.2.7; Page B-23);
3) **Onshore Contact** (deepwater benthic communities not included in this discussion); and
4) **Post-Spill, Long-Term Recovery** (Section 5.2.2.8; Page B-44).

In the event of a catastrophic spill similar to the Macondo Event, any substantive impact to deepwater benthic communities is very unlikely because the potential impacts from a catastrophic spill would be similar to aforementioned routine and accidental issues. However, despite the recent Macondo Event, 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.

Conclusion

The same geophysical conditions associated with the potential presence of chemosynthetic communities also result in hard carbonate substrate. The proposed exploration activities may impact the ecological function, biological productivity, or distribution of hard-bottom non-chemosynthetic communities. The recruitment of new organisms would take place from nearby areas, and organisms from undisturbed areas are free to migrate into disrupted areas after the disturbance ceases. However, the site-specific deepwater benthic communities review conducted for the proposed drilling determined that there were potential deepwater benthic communities (either chemosynthetic or nonchemosynthetic) or sites that could support such communities within the scope of the proposed anchor radii of Wells A and B (Mississippi Canyon Block 710). Since nonchemosynthetic communities are often associated with chemosynthetic community sites, similar impacts could occur from direct contact with the anchors and/or their associated mooring components. Similarly, anchors and mooring lines from the MODU can cause disturbances with lethal affects such as (1) crushing by anchors or mooring lines; (2) burial or disruption the organisms from scraping, plowing, or redistribution of bottom sediment by mooring lines that pivot on their anchors; and (3) increased turbidity from sediment that is resuspended as a result of anchor emplacement or mooring line motion that fouls or interferes with filter-feeding organs. Without the mitigation (described below) potential impacts to hard-bottom communities may also occur.

The proposed exploration activities are expected to have negligible impacts on the ecological function, biological productivity, or distribution of hard-bottom non-chemosynthetic communities. Bottom disturbances from the discharge of drilling cuttings and associated drilling muds would not be of a sufficient size or duration to adversely affect these benthic community types to any significant or permanent degree. Minor and temporary impacts, such as interference with filter-feeding structures, could occur over areas inside an envelope estimated to be no more than about 260 acres (105 hectares). Routine discharges at the sea surface are not expected to adversely impact these community types because of the water depth in the area of the proposed action. Bottom disturbance from a blowout during the drilling of wells is not likely, based on the historical record of blowout events in the Gulf. The recruitment of new organisms would take place from nearby areas, and organisms from undisturbed areas are free to migrate into disrupted areas after the disturbance ceases.

Cumulative Impacts

The proposed action may result in slight increases in turbidity in the vicinity of possible nearby hard-bottom communities; such effects would be temporary and negligible. No direct physical impacts are expected. The remote possibility of a catastrophic blowout would add to cumulative impacts if it did occur, but it is very unlikely and would produce localized effects wherever concentrated oil directly contacts sensitive communities. Therefore, no significant cumulative impacts to nonchemosynthetic deepwater benthic communities would be expected as a result of the proposed exploration 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.

Considering the potential cumulative impacts from all other GOM activities, the operator's proposed drilling/anchoring activities would constitute the primary effect on the resources that may exist in the area of the proposed action.

3.4.2.2.3. Alternative 3

If selected, Alternative 3, approval of the proposed action with additional mitigation, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan. However, approval of the proposed plan would be conditioned on the operator conducting their anchoring operations under the mitigation identified in Section 2.4 and discussed below. These conditions of approval would limit/negate potential impacts and ensure that the possible nonchemosynthetic resources identified in the site-specific deepwater benthic communities review will be protected.

Routine Activities

The analysis of the possible impacts from routine activities for Alternative 3 remains the same as that discussed for Alternative 2, above. As previously noted, review of the ATP's plan and associated survey data determined that nonchemosynthetic communities or sites that could support such communities are present within the mooring radii of Wells A and B (Mississippi Canyon Block 710). As such, unconditioned anchoring operations could result in significant impacts to these resources. Impacts to a nonchemosynthetic community could result from direct physical contact with anchors and/or associated chains, cables, and mooring lines that has the potential to destroy any sessile organisms that may be present or cause destruction of underlying carbonate structures on which organisms rely for substrate. These impacts could be quite severe to the immediate area affected, with the possibility of the community never recovering. The review also determined that there were no known or potential high-density nonchemosynthetic communities or support sites within 2,000 ft of the wells sites; therefore impacts from drilling discharges are not expected.

Compliance with the conditional employment of DGPS during anchor placement and the establishment of 250 ft no-activity buffer area around the potential community sites will allow the anchoring operations to be conducted and the potential impacts to be avoided to the maximum extent practicable. Ultimately, the implementation of the mitigation reduces the potential for impacts from routine events of the proposed action by locating the associated activities away from resources.

Accidental Events

The analysis of the possible impacts from accidental events for Alternative 3 remains the same as that discussed for Alternative 2, above. Significant impacts to nonchemosynthetic communities are not expected from accidental blowouts due to their low probability and the low probability of oil contacting such communities (representing very small, widely dispersed targets). The potential impacts from a catastrophic spill to nonchemosynthetic communities would be similar to aforementioned spill issues, and any substantive impact to nonchemosynthetic communities is very unlikely, due to the low probability of oil contacting the widely scattered, small targets represented by the communities. The potential for accidental events associated with the proposed action would also be limited or negated under Alternative 3 by distancing the anchoring activities away from the identified resource.

Conclusion

The site-specific deepwater benthic communities review conducted for the proposed action determined that there were no known or potential nonchemosynthetic communities or support sites within 2,000 ft of the wells sites; therefore impacts from drilling discharges are not expected. Significant impacts are also not expected from accidental blowouts due to their low probability and the low probability of oil contacting such communities (representing very small, widely dispersed targets). The potential impacts from a catastrophic spill to chemosynthetic communities would be similar to aforementioned spill issues, and any substantive impact to chemosynthetic communities is very unlikely, due to the low probability of oil contacting the widely scattered, small targets represented by the

communities. However, the site-specific review did identify possible, nonchemosynthetic communities or sites that could support such communities within the mooring radius of Well C (Mississippi Canyon Block 300). If the proposed anchoring activities were to contact one of the sites, it has the potential to destroy any sessile organisms that may be present or cause destruction of underlying carbonate structures on which organisms rely for substrate.

For this reason, Alternative 3 would require the lessee to comply with the mitigation outlined in Chapter 2.4 during their anchoring activities. These conditions are designed to provide for appropriate distancing between the anchoring operations and the identified resources to reduce or eliminate adverse impacts. Therefore, under Alternative 3, the proposed action is not expected to result in significant impacts to nonchemosynthetic communities or sites that could support such communities.

Cumulative Analysis

The cumulative analysis for Alternative 3 remains the same as that discussed for Alternative 2, above. However, the imposition of the mitigation outlined in Chapter 2.4 will further ensure that the potential impacts of the proposed action on nonchemosynthetic communities and/or site that could support them within the area of the proposed action will be low or non-existent, because activities will be sited away from the identified resource. Therefore, no significant cumulative impacts on nonchemosynthetic communities and/or site that could support them would be expected as a result of the proposed exploration 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.

3.5. MARINE MAMMALS

3.5.1. Affected Environment

Twenty-nine species of marine mammals occur in the GOM (Davis et al., 2000). 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 and dugong. Within the GOM, there are 28 species of cetaceans (7 mysticete and 21 odontocete species) and 1 sirenian species (the manatee).

Threatened or Endangered Marine Mammal Species

Five baleen cetaceans (the North Atlantic right, blue, fin, sei, and humpback whales), one toothed cetacean (the sperm whale), and one sirenian (the West Indian manatee) occur in the GOM and 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, while the baleen whales are considered rare or extralimital in the GOM (Würsig et al., 2000). The National Marine Fisheries Service's (NMFS) annual Stock Assessment Report (SAR) for the GOM indicates that the northern right, blue, fin, sei, and humpback whales are rare in the GOM (Waring et al., 2009). The life history, population dynamics, status, distribution, behavior, and habitat use of baleen and toothed whales can be found in Chapter 3.2.3.1 of the Multisale EIS, Chapter 4.1.6.1 of the Supplemental EIS, Chapter 4.1.1.10.1 of the Supplemental Western EIS, and in the NMFS 2009 SAR (Waring et al., 2009). The West Indian manatee (*Trichechus manatus*) typically inhabits only coastal marine, brackish, and freshwater areas. The distribution, feeding habits, habitat use, and population estimates of manatees can be found in Chapter 3.2.3.1.3 of the Multisale EIS.

Non-ESA-Listed Marine Mammal Species

The remaining 22 marine mammal species that occur in the GOM are not protected under the ESA. However, all marine mammals are protected by the Marine Mammal Protection Act (MMPA). There are two species of non-ESA-listed baleen whales that may occur in the GOM – the minke whale and the Bryde's whale. The minke whale is considered rare and is not included in the NMFS SAR for the GOM (Wursig et al., 2000; Waring et al., 2009). The Bryde's whale is considered uncommon but is the most frequently sighted baleen whale in the GOM (Wursig et al., 2000).

Non-ESA-listed toothed whales include all of the dolphin and small whale/"blackfish" species in the GOM and comprise 20 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 cryptic and difficult to survey. As with *Kogia*, very little is known about beaked whales (Waring et al., 2009).

Additional information on non-ESA-listed marine mammal species of the GOM is provided in Chapter 3.2.3.2 of the Multisale EIS, Chapter 4.1.6.1 of the Supplemental EIS, Chapter 4.1.1.10.1 of the Supplemental Western EIS, and in the NMFS 2009 SAR (Waring et al., 2009) and is incorporated by reference into this SEA.

3.5.2. Impact Analysis

The impact-producing factors associated with the proposed drilling activities in Mississippi Canyon Block 710 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 impact-producing factors are the same for nonthreatened and nonendangered 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 (disapproval of the proposed action), would result in the operator's not being permitted to drill the proposed exploration wells. Therefore, the impact producing factors 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 exploration activities.

3.5.2.2. Alternative 2

If selected, Alternative 2, the approval of the proposed action as submitted by the operator, would allow the operator to drill the proposed exploration wells as specified in its plan. The operator has proposed adherence with the guidance provided under NTL No. 2007-G03, "Marine Trash and Debris Awareness and Elimination" and NTL No. 2007-G04, "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting" (ATP, 2011). 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 exploration drilling 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 (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. Although manatees have been killed by vessel strikes (e.g., Schiro et al., 1998), they are rare in the deepwater GOM, and consequently, the proposed activity 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 affects on cetacean populations in the northern Gulf of Mexico.

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 could be 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 has SLs of 149 dB, 181 Hz was 137 dB, and 301 Hz was 136 dB (Greene 1986). The potential effects that water-transmitted noise have 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 (RLs) 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 is some data from the Arctic on baleen whales, there is little data on the behavioral responses of marine mammals in the Gulf of Mexico from the sound of drilling. 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, however, are unlikely to have population-level impacts to marine mammals in the northern Gulf of Mexico.

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 NTL No. 2007-G03,

"Marine Trash and Debris Awareness and Elimination," which appreciably reduces the likelihood of marine mammals encountering marine debris from the proposed activity (ATP, 2011).

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 may have similar irritants to tissues and sensitive membranes as they are known to have had on 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 Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Supplemental Western 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 Macondo Event, 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 Macondo Event, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of drilling and temporary abandonment associated with the proposed action.

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, BOEMRE 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, all mysticete species that may occur in the GOM (i.e., North Atlantic right, blue, fin, sei, humpback, minke and Bryde's whales) are considered either "extralimital," "rare," or "uncommon" within the GOM (Wursig et al., 2000; Waring et al., 2009). 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 (e.g., sperm whales, dwarf or pygmy sperm whales, and dolphins) are considered mid-frequency hearing specialists with hearing ranges that slightly overlap with sound frequencies produced from drilling noise (Southall et al., 2007). 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. Tones of 60 Hz had source levels 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 the sound levels produced and hearing thresholds of marine mammals, there is potential for the drilling noise produced to cause auditory and non-auditory effects, PTS, 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 NTL No. 2007-G03, "Marine Trash and Debris Awareness and Elimination," which appreciably reduces the likelihood of marine mammals encountering marine debris from the proposed activity (ATP, 2011).

The geographic scope of the proposed action is small in relation to the ranges of marine mammals in the GOM. The proposed drilling 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, the scope, timing, and transitory nature of the proposed action and the mitigation 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.

Cumulative Impact Analysis

Chapter 4.5.5 of the Multisale EIS, Chapter 4.1.6.4 of the Supplemental EIS, and Chapter 4.1.1.10.4 of the Supplemental Western EIS address the cumulative impacts on marine mammals as a result of oil and gas leasing, exploration, development and production activities, including the proposed drilling activities. Additionally, Chapter 4.4.5 of the Multisale EIS (USDOI, MMS, 2007) contains a discussion of additional impacts from accidental events (e.g., oil spills) that are particularly relevant in light of the Macondo Event. This information is summarized below and is incorporated by reference into this SEA.

The proposed action may cumulatively affect protected cetaceans when viewed in light of the Macondo Event and associated cleanup activities. 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, drillships, 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 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, 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 (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, or 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. The operator's reaffirmed compliance with NTL No. 2007-G04 (Vessel-Strike Avoidance) and NTL 2007-G03 (Marine Trash and Debris), as well as the limited scope, timing, and geographic location of the proposed action, effects from the proposed drilling activities on marine mammals will be negligible. Therefore, no significant cumulative impacts to marine mammals would be expected as a result of the proposed exploration 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.

3.5.2.3. Alternative 3

If selected, Alternative 3, approval of the proposed action with additional mitigations, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan; however, the operator would be required to undertake additional mitigations as identified by BOEMRE. Because the operator is required to follow all existing lease stipulations and regulations as clarified by NTLs, conditions outlined in the previous analyses related to NTL No. 2007-G04 should negate or lessen the chance of a significant impact to marine mammals. The mitigation measures outlined in Chapter 2.4 is not expected to increase or decrease the potential for effects to marine mammals from the proposed action. Alternative 3 does not differ from Alternative 2 because the additional mitigation measures does not address this resource (i.e., all assumptions, estimates, and conclusions are identical), see the analysis provided in Section 3.5.2.2 for this alternative for this resource.

3.6. SEA TURTLES

3.6.1. Affected Environment

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 Gulf of Mexico have been federally listed as endangered or threatened since the 1970's. There is currently no critical habitat designated in the GOM.

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. 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.

Additional information on sea turtle species of the GOM is provided in Chapter 3.2.4 of the Multisale EIS, Chapter 4.1.7.1 of the Supplemental EIS, and Chapter 4.1.1.11.1 of the Supplemental Western EIS, and is incorporated by reference into this SEA.

3.6.2. Impact Analysis

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 impact-producing factors associated with the proposed drilling activities in Mississippi Canyon Block 710 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 (disapproval of the proposed action), would result in the operator not being permitted to drill the proposed exploration wells. Therefore, the impact producing factors 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, approval of the proposed action as submitted by the operator, would allow the operator to drill the proposed exploration wells. The operator has proposed adherence with the guidance provided under NTL No. 2007-G03, "Marine Trash and Debris Awareness and Elimination" and NTL No. 2007-G04, "Vessel Strike Avoidance and Injured/Dead Protected Species Reporting" (ATP, 2011). 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 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."

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 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). To further minimize the potential for vessel strikes, BOEMRE issued NTL 2007-G04, which clarifies 30 CFR § 250.282 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. The BOEMRE 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 § 250.282 and NTL 2007-G04).

To date, there have been no reported strikes of sea turtles by drilling vessels. Given the scope, timing, and transitory nature of the proposed action and with this established mitigations, 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 NTL 2007-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. 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 Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Supplemental Western 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 Macondo Event, 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 recent Macondo Event, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of drilling and temporary abandonment associated with the proposed action.

Conclusion

The sections above discusses 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; and (4) oil spills and spill-response activities. 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 NTL 2007-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 § 250.282 clarified by NTL 2007-G04, BOEMRE 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's) with implementing terms and conditions to help minimize take. As the operator has indicated that the vessel strike avoidance guidance (NTL 2007-G04) will be followed, there should be an appreciably reduced the 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 BOEMRE for sea turtle mortalities by vessel strikes. The BOEMRE 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.

Cumulative Impact Analysis

Chapter 4.5.6 of the Multisale EIS (USDOI, MMS, 2007), and Chapter 4.1.7.4 of the Supplemental EIS (USDOI, MMS, 2008) address the cumulative impacts of oil and gas leasing, exploration, development and production activities on sea turtles. Additionally, Chapter 4.4.6 of the Multisale EIS (USDOI, MMS, 2007) contains a discussion of additional impacts to sea turtles related to accidental

events (e.g., oil spills) that are relevant in light of the recent Macondo Event. This information is summarized below and is incorporated by reference into this SEA.

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, drillships, 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) because 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 drilling 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 exploratory drilling activities or as the result of past, present, or reasonably foreseeable oil and gas leasing, exploration, development and production in the GOM.

3.6.2.3. Alternative 3

If selected, Alternative 3, approval of the proposed action with additional mitigations, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan; however, the operator would be required to undertake additional mitigations as identified by BOEMRE. As with Alternative 2, the operator is required to follow all existing lease stipulations and regulations that would result in negating or lessening the chance of impacts to sea turtles. The mitigation measures outlined in Chapter 2.4 is not expected to increase or decrease the potential for effects to sea turtles from the proposed action. Alternative 3 does not differ from Alternative 2 because the additional mitigation measures does not address this resource (i.e., all assumptions, estimates, and conclusions are identical). See the analysis provided in Section 3.6.2.2 for this alternative for this resource.

3.7. FISH RESOURCES AND ESSENTIAL FISH HABITAT

3.7.1. Affected Environment

Healthy fish resources and fishery stocks depend on essential fish habitat (EFH) waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity. Due to the wide variation of habitat requirements for all life history stages for managed species, NOAA initially identified EFH throughout the Gulf of Mexico 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).

Fish resources are described on a Gulfwide basis in Chapter 3.2.8 of the Multisale EIS. The Gulf of Mexico supports a wide variety of finfish, and most of the commercial finfish resources are linked either directly or indirectly to the estuaries that ring the Gulf of Mexico. 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. Movement of the adult estuarine-dependent species is essentially onshore-offshore with no extensive east-west migration. Darnell et al. (1983) observed that the density distribution of fish resources in the Gulf was highest nearshore off the central Gulf Coast. For all seasons, the greatest abundance occurred between Galveston Bay and the mouth of the Mississippi River. Recent monthly ichthyoplankton collections over the years 2004-2006 offshore of Alabama have confirmed that peak seasons for ichthyoplankton concentrations on the shelf are spring and summer (Hernandez et al., 2010).

The Macondo Event spill on April 20, 2010, introduced large quantities of oil into the water column between the spill site and the marshes of the central Gulf Coast. Oil from this incident has made contact with shorelines from Galveston, Texas, to Apalachicola, Florida, with the primary areas of oiling occurring from Grande Isle, Louisiana, west of the mouth of the Mississippi River to Santa Rosa Island, Florida. The oil has penetrated estuaries at least along the Louisiana and Mississippi coasts and has been driven farther inshore by the passage of Hurricane Alex, which made landfall near the Texas/Mexico border.

All of these estuaries are extremely important nursery areas (EFH) for fish and aquatic life. Impacts related to oiling of these areas, depending on the severity, can include destruction of nutrient-rich marshes, which can lead to the erosion of coastlines (when the grass dies, the coastline is moved back and eroded. Anything, whether it is salt water or oil that kills grass, erodes coastline). Marshes and coastlines in the central Gulf Coast have already been significantly damaged in recent years, first in 2005 by Hurricanes Katrina and Rita as described in Chapter 4.5.10 of the Multisale EIS and then in September 2008 when Hurricanes Gustav and Ike made landfall on the Gulf Coast. The Louisiana Dept. of Wildlife and Fisheries (2008a and b) released preliminary non-quantitative reports of the effects of Hurricane Gustav on Louisiana fisheries. In the reports, they noted the extensive marsh erosion and vegetative debris present in the canals of southeastern Louisiana as well as localized fish kills, the loss of marsh through erosion and displacement, and the encroachment of saltwater into freshwater areas, which is a contributor to loss of EFH.

Early life stages of animals are usually more sensitive to environmental stress than adults (Moore and Dwyer, 1974). Weathered crude oil has been shown in laboratory experiments to cause malformation, genetic damage, and even mortality at low levels in fish embryos of Pacific herring (Carls et al., 1999). There is a high probability of mortality in the larval stages of fishes of the Gulf that have come into contact with the spilled oil.

Corexit® 9500, the dispersant used during the Macondo Event, is believed to be the least toxic of all of its counterparts to small fish. Its toxicity, mixed with oil, to specific species is currently being studied by NOAA and USEPA, who have proposed a monitoring program that will assess the toxicity of 20:1 oil/dispersant to Atlantic silversides. Corexit® 9500 works, as do all dispersants, by breaking the oil into smaller droplets. The addition of Corexit® 9500 at the seafloor of the spill site and at the surface resulted in the dispersion of plumes of oil particles in the water column. Thus far, these underwater plumes of oil have had relatively low concentrations of oil above background, but they do pose the potential for low dissolved oxygen pockets to form as a result of microbial action utilizing available oxygen to break down the oil. The first Joint Analysis Group sampling cruise in May 2010 discovered that total petroleum hydrocarbon concentrations were at or below 2 parts per million and that there were no indications of large-scale hypoxia areas devoid of oxygen that do not support marine life. (Joint Analysis Group, 2010). The full extent of the ichthyplankton mortality due to all factors related to the oil and dispersants is unknown and may not be known unless a significant portion of a year class is absent from next year's fishery.

Methane gas (CH4) is commonly found in the Gulf of Mexico in concentrations ranging from 6 x10 -5 ml/l to 125 x 10-5 ml/l (Frank et al, 1970). Recent reports resulting from the Macondo Event spill have indicated elevated methane levels as a result of this spill, although no specific methane levels have as yet been reported. At their baseline levels, methane levels are controlled by methanotrophs (methane degrading bacteria) (Patin, 1999). Very little is really known about the effects of methane on fish. Patin, (1999), reported that elevated concentrations of methane resulting from gas blowouts from drilling platforms in the Sea of Asov, resulted in significant species specific pathological changes including

damages to cell membranes, organs and tissues, modifications of protein synthesis and other anomalies typical for acute poisoning of fish. These impacts, however, were observed at levels of 1-10 ml/l.

Adult fish tend to avoid contact with oil in the water column. Specific effects of oil on fish can include direct lethal toxicity, sublethal disruption of physiological processes (internal lesions), effects of direct coating by oil (suffocation by coating gills), incorporations of hydrocarbons, causing tainting or accumulation in the food chain and changes in biological habitat (Moore and Dwyer, 1974). In the case of biological habitat, changes include the potential for contact with waters low in dissolved oxygen, as described above. Direct lethality of the dispersant used and the dispersant mixed with oil is unknown for individual fish species.

Thus far, only anecdotal (observational) evidence is available concerning fish kills. Offshore, a few small fish kills very near the spill site have been reported. On the shelf and off the coast of Louisiana, a few small fish kills have been reported that included common inshore species such as menhaden and saltwater catfish (Bourgeois, personal communication, 2010). Similar kills with similar species composition have been reported in off the coasts of Mississippi and Alabama (Denson, personal communication, 2010).

Recently, whale sharks were sited swimming in heavy oil 4 mi (6.4 km) from the spill site. These large, migratory sharks have been traced by satellite tags to come to the Gulf in the summer from as far away as Belize and Honduras. They are surface feeders, filtering plankton and tiny fish through their mouths. Oil poses a threat to them not only by direct ingestion but also by coating their gills (Raines, 2010).

Of particular importance is the bluefin tuna that spawn in the northwestern and northeastern Gulf in January through June, with peak spawning in April and May (Teo et al., 2007a and b). The bluefin tuna forage from the surface down as far as 3,000 ft (914 m) (Horst and Lane, 2007). Eggs, which are produced in large numbers and fertilized externally at depth, quickly become buoyant and float to the surface (Teo et al., 2007a and b). The bluefin tuna is a prized commercial and sport fish that could potentially occur in the area of the proposed action. The western Atlantic stock of bluefin tuna has suffered a significant decline in spawning stock biomass since 1950, and a 20-year rebuilding plan has failed to revive the population or the North American fishery. The failure of the Gulf of Mexico spawning population to rebuild, as well as the scope of illegal and under-reported catches - particularly in the Mediterranean Sea - are of such major concern that the species was recently considered by the Convention of International Trade in Endangered Species (CITES) for endangered species listing in March 2010. Because of their decline in stock, the timing of their spawn in the Gulf, their buoyant eggs, and the timing of the Macondo Event spill, there is concern about further decline in the Gulf stock of blue fin tuna. The effects at this time are, however, unknown.

How assemblages of fish have changed or will change as a result of the Macondo Event is unknown at this time. Adult fish tend to avoid contact with oil in the water column. Specific effects of oil on fish can include direct lethal toxicity, sublethal disruption of physiological processes (internal lesions), effects of direct coating by oil (suffocation by coating gills), incorporations of hydrocarbons in organisms causing tainting or accumulation in the food chain and changes in biologic habitat (Moore and Dwyer, 1974).

The benthic fish populations in the area of the proposed action are expected to be very low in density. Rowe and Kennicutt (2001) found that species richness and abundance decreased with depth in the Gulf of Mexico. In the 2,000- to 3,000-m depth zone, only 71 species representing 33 families were collected, although nearly one-third of the species were epipelagic or mesopelagic and were probably captured in the water column.

Descriptions of other ecological groups of fishes that would occur in the area, including oceanic pelagics and mesopelagics, can be found in Chapter 3.2.8.1 of the Multisale EIS.

3.7.2. Impact Analysis

The impact-producing factors associated with exploration activities proposed in Mississippi Canyon Block 710 that could affect EFH and fish resources include: (1) coastal and marine environmental degradation; (2) presence of a semisubmersible drill rig; (3) temporary discharge of drilling cuttings and associated drilling fluids; and (4) blowouts and oil spills. Chapters 4.2.1.1.8, 4.2.2.1.10, and 4.4.10 of the Multisale EIS and Chapters 4.1.1.13.2 and 4.1.1.13.3 of the Supplemental Western EIS contain discussions of routine and accidental impacts to fish resources and EFH from OCS activity and are hereby incorporated by reference into this SEA.

3.7.2.1. Alternative 1

If selected, Alternative 1, no action alternative (disapproval of the proposed action), would result in the operator not being permitted to drill the proposed exploration wells. Therefore, the impact producing factors 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, approval of the proposed action as submitted by the operator, would allow the operator to drill the proposed exploration wells. 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 semisubmersible drilling rig would be highly diluted in the open marine environment.

The projected drilling period for each well is 62 days. The presence of the semisubmersible drilling rig will therefore act as a fish-attracting device for the short period of time the semisubmersible drilling rig is on each site, and consequently, routine discharges on fish resources will be very limited in duration.

Accidental Events

Accidental blowouts and spills with associated 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 on a regional population level by spills or chronic contamination. The effects of the Deepwater Horizon Spill on ichthyoplankton, juvenile and adult fish in the Gulf of Mexico and the extent of those effects are, at this time, unknown and will be unknown for some time.

A discussion of the impacts of oil on adult fish, fish eggs, and larvae can be found in Chapter 4.2.2.1.10 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.

In the event of a catastrophic spill similar to the Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Supplemental Western EIS discusses the most likely and most significant impacts to fish as it relates to the four phases of a major spill/blowout:

1) **Initial Event** (Section 2.2.2.2.; Page B-6);
2) **Offshore Spill** (Section 3.2.2.2; Page B-17);
3) **Onshore Contact** (Section 4.2.2.2; Page B-32); and
4) **Post-Spill, Long-Term Recovery** (Section 5.2.2.2; Page B-41).

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

Conclusion

The proposed action is expected to have little impact on any fish or EFH endemic to the northern Gulf of Mexico. 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)

Cumulative Impacts

Cumulative impacts on fish and EFH that result from oil and gas leasing, exploration, development, and production activity are discussed in Chapter 4.5.10 of the Multisale EIS. Cumulative activities that could impact fish and EFH 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 exploration 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.

3.7.2.3. Alternative 3

If selected, Alternative 3, approval of the proposed action with additional mitigations, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan; however, the operator would be required to undertake additional mitigations as identified by BOEMRE. As described in the analyses above, impacts to fish and EFH from the proposed action are expected to be short-term, localized and not lead to significant impacts. The mitigation measures outlined in Chapter 2.4 is not expected to increase or decrease the potential for effects to fish and EFH from the proposed action. Alternative 3 does not differ from Alternative 2 because the additional mitigation measures does not address this resource (i.e., all assumptions, estimates, and conclusions are identical), see the analysis provided in Section 3.7.2.2 for this alternative for this resource.

3.8. ARCHAEOLOGICAL RESOURCES

3.8.1. Affected Environment

Archaeological resources are defined in 30 C.F.R. § 250.105 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 Chapter 3.3.4 of the Multisale EIS, Chapter 4.1.15.1 of the Supplemental EIS, and Chapters 4.1.1.17.1.1 and 4.1.1.17.2.1 of the Supplemental Western 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. 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 predictions of potential sites may be inaccurate. As demonstrated by several studies (e.g., Pearson et. al. 2003; Lugo-Fernandez et al., 2007; Krivor et al.,

2011; and Rawls and Bowker-Lee, in press) many more shipwrecks are likely to exist on the seafloor than have been accounted for in available historic literature, indicating a high-resolution remote sensing survey may be the most reliable method for identifying and avoiding historic archaeological resources.

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 7,400 ft. In fact, in the last 5 years, over a dozen shipwrecks have been located in deep water and nine 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 Macondo Event released an estimated 53,000-62,000 bbl of oil per day for almost 3 months. Much of the oil was treated with dispersant at the sea surface and at the source in a water depth of 1,500 m (5,000 ft). In Chapter 4.1.15.3 of the Supplemental 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). BOEMRE recognizes the need to better understand the effects of deep water oil spills and dispersants on submerged archaeological resources and is pursuing options for developing studies 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 Macondo Well 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. A recent 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 was 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

The impact-producing factor (IPF) associated with the proposed action that could affect submerged archaeological resources is seafloor disturbances. Chapters 4.2.1.1.12 and 4.2.2.1.14 of the Multisale EIS, Chapter 4.1.15.2 of the Supplemental EIS, and Chapters 4.1.1.17.1.2, 4.1.1.17.1.3, and 4.1.1.17.1.4 contain discussions of the likely impacts (routine, accidental, and cumulative) that OCS activities could have on archaeological resources. These discussions are summarized below and hereby incorporated by reference into this SEA.

The routine IPF associated with ATP's proposed exploration activities in the area of the proposed action that could affect archaeological resources is limited to direct contact or disturbance during well and anchor 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; and Rawls and Bowker-Lee, in press). However, if a historic resource exists in the area of drilling, direct physical contact with a shipwreck site could destroy fragile remains, such as the hull and wooden or ceramic artifacts, and could disturb the site context (Atauz et al., 2006; Church and Warren, 2008).

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* (disapproval of the proposed action), would result in the operator not being permitted to drill the proposed exploration wells. Therefore, the IPFs mentioned above (i.e., bottom disturbance associated with well emplacement, the use of equipment associated with drilling operations, and anchoring) 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

3.8.2.2. Alternative 2

Alternative 2, approval of the proposed action as submitted by the operator, would allow the operator to drill the proposed exploration wells. As described in the proposed plan and discussed below, the proposed exploration 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 10 miles of their reported loss location. However high-resolution data acquired by oil and gas industry remote sensing surveys now indicates that this model may be too limited. For example, several vessel casualties from World War II with historically reported coordinates were later discovered well over ten miles 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 from the area of its presumed loss in the MMS model (Irion, personal 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 released in 2003 (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. The table below notes the results of the requisite surveys implemented since 2003.

Table 3.8.1.
Archaeological Surveys and Resources Identified since 2003

Year	Blocks Surveyed	Confirmed Shipwreck Sites	Potential Shipwreck Sites Mitigated by Avoidance (identified through requisite industry surveys)
2003	233	1	514 magnetic anomalies and 43 sonar targets
2004	139	3	342 magnetic anomalies and 57 sonar targets
2005	902	16	768 magnetic anomalies and 116 sonar targets
2006	237	37	799 magnetic anomalies and 254 sonar targets
2007	319	18	652 magnetic anomalies and 189 sonar targets
2008	166	17	705 magnetic anomalies and 212 sonar targets
2009	117	9	479 magnetic anomalies and 103 sonar targets
2010[1]	74	8	275 magnetic anomalies and 101 sonar targets

Prior to NTL No. 2005-G07, there were only 48, 9-mi^2 lease blocks in the MC area that required archaeology surveys/assessments; in which, 9 potential shipwrecks were previously located. Since implementation of the NTL and addition of 794 blocks in the MC area, an additional 25 confirmed

[1] BOEMRE GOMR received a substantially lower number of surveys following the Macondo Event.

shipwrecks have been discovered to date as a result of the surveys conducted on only 306 of those new MC blocks. During that same time period, BOEMRE also conducted 2,250 archaeological reviews of proposed oil and gas operations in the MC area and identified 537 previously-unreported sonar targets that may or may not represent historic sites. The addition of the new blocks, industry's resultant survey data, and the subsequent increase in the number of shipwrecks discovered further suggests that the potential distribution of significant historic resources is wider than originally thought.

To date, two historically-significant shipwrecks (see Table 3.8.2.) were found to have suffered damage from drilling activities because of a lack of knowledge of their presence.

Table 3.8.2.
Archaeological Sites Identified since 2001 that Have Suffered Damage

Shipwreck ID Number	Protraction	Survey Available Prior to Permitting (to assist in mitigation)	Damage
15321	VK	No	Anchor chain from a MODU bisected shipwreck causing major damage to site. The site and the damage from the MODU anchoring array were identified during a pipeline survey.
521	GC	No	Site was impacted during anchoring of a MODU. Anchor and chain was hung up on the site during recovery. The site and damage were identified during a pipeline survey and though the damage appears to be major, a complete impact assessment has yet to be conducted.

Recent research on historic shipping routes from the 16th through the 19th centuries concluded that the area of the proposed action is located along 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; see Figure 3-1).

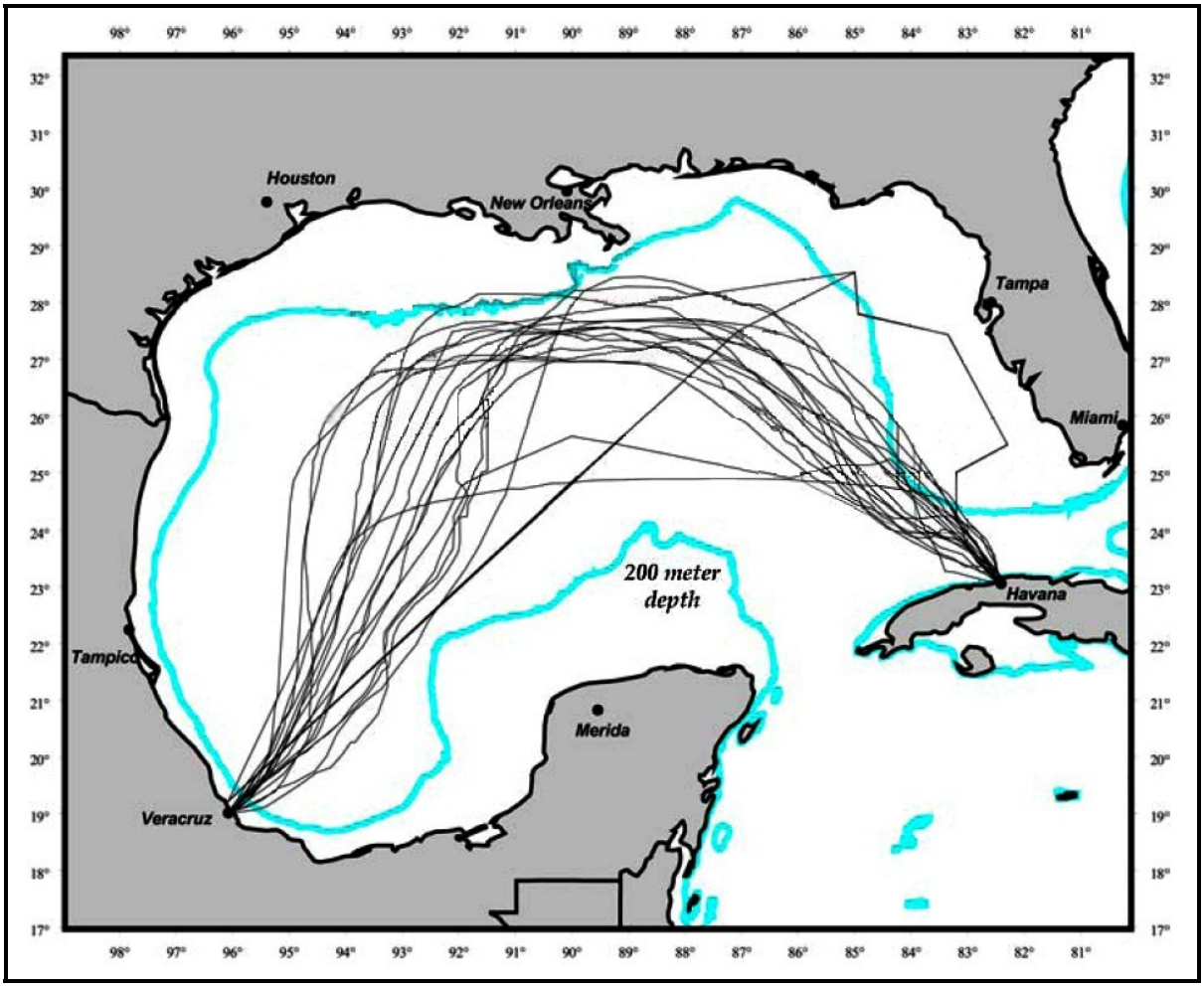

Figure 3-1. Sailing routes across the Northern GOM as depicted on 16th through mid-19th century maps (*from* Lugo-Fernandez et al., 2007).

The study, entitled *Archival Investigations for Potential Colonial-Era Shipwrecks in Ultra-Deep Water within the Gulf of Mexico,* projected a 100-mile wide swath encompassing the variation in the depiction of the historic trade routes on contemporary maps. The routes generally struck a course north northeastward from Veracruz until reaching the Loop Current between 25º and 27.5º north latitude, then traveled westward to west Florida, then turned southeast, crossed the Florida Straits, and reached Havana. 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[2], shifting currents, and prevailing wind patterns and storms.

The paleographer and scientists analyzing the records admitted that due to the sheer volume of records[3] and limited study funding they were unable to examine all records for the period; however, the authors noted that the records that were examined were not detailed enough to identify accurately where a wreck occurred or was likely to have occurred. The authors reported that while vessel losses were noted throughout the historic record, the precise location of vessel loss was impossible to identify based on limiting factors such as the capabilities of sailors to accurately note where a wrecking event occurred using contemporary navigational techniques and tools. Additionally, the authors reported that the historic documents often noted that a vessel may have left a port such as Veracruz bound for New Orleans or

[2] Longitude, for example, could not be calculated with any degree of certainty until the perfection of the chronometer in the last quarter of the 18th century.

[3] The Archivo General de Indias in Seville contains some 80-86 million pages of documents in 46,000 *Legajos*, or "Bundles."

Havana, crossing over the deepwater protractions of the GOM, but never arrived at its final destination. These records would simply note that the vessel was lost enroute to their final destination. The authors concluded that it would be impossible to accurately identify losses of historic shipwreck sites based on archival information alone and that high-resolution survey data in these areas was necessary to accurately prevent impacts to significant archaeological sites (Krivor et al., 2011).

The study area (including the area of proposed bottom disturbance) continued to be 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 project area.

Based on these recent studies and findings, there is a likelihood that an archaeological resource may exist in the area of the proposed action and that ATP's proposed activities have the potential to cause impacts in the event that a resource is present. 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 drilling 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.

BOEMRE's regulation at 30 C.F.R. § 250.194 requires that an archaeological survey be conducted prior to development of leases within the high-probability zones for historic and prehistoric archaeological resources. Currently, the area of proposed bottom disturbance is designated as a high-probability block. ATP has conducted surveys covering the areas of potential bottom impacts and a review of that survey data indicates that no archaeological resources are present in the area of ATP 's proposed activities that could be damaged; therefore, no impacts are expected.

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 Macondo Event 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, a recent 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 was 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 water depth.

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 remains, such as the hull and wooden or ceramic 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 Macondo Event, the Catastrophic Spill Analysis in Appendix B of the Western Supplemental 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 similar to the Macondo Event, any substantive impact to archaeological resources is very unlikely because the potential impacts from a catastrophic spill would be similar to aforementioned routine and accidental issues. However, despite the recent Macondo Event, historical trends in the GOM (see Chapter 1.4) indicate that catastrophic spill events are not likely to occur as a result of drilling and temporary abandonment associated with the proposed action.

Conclusion

Based on the previous information, study conclusions, and the number of confirmed wrecks recently found in similar water depths, there is reason to believe that archaeological resources could be present in the area of the proposed action. Routine impacts may include damage and/or disturbance to the potential resources from drilling the well and associated equipment. ATP has conducted high-resolution surveys covering the area of potential effects (APE) and the surveys indicate that no archaeological resources are present in the area of ATP 's proposed activities that could be damaged; therefore, no impacts are expected. 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 proposed well sites and the historically low probability of a loss of well control/blowout. However, debris resulting from accidental events may impacts archaeological resources similar to those of routine impacts, such as contact with the well and/or well equipment. Since BOEMRE review of the available survey data indicates that no submerged archaeological resources are present in the area of the proposed action, no significant impacts are expected.

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 is approximately 2,810 ft (856 m) and the area of the proposed action is over 48 mi (77 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. 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 may involve the seabed deployment of receivers attached to degradable concrete anchors are deployed from the sea surface. These anchors have the potential to damage unknown archaeological resources that may exist in the area of the proposed action as they descend through the water column; however, their small size and relatively light weight (~65 lbs [34 kg]) is not expected to cause significant impacts.

Unknown archaeological resources that may be present in Mississippi Canyon Block 710 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 drilling 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, since BOEMRE review of the available survey data indicates no submerged archaeological resources are present in the area of the proposed action, 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.

3.8.2.3. Alternative 3

Alternative 3, approval of the proposed action with mitigation, would allow the operator to undertake the proposed activities, as requested and conditioned in the plan; however, the operator would be required to undertake additional mitigation as identified by BOEMRE. The mitigation measure outlined in Chapter 2.4 is not expected to increase or decrease the potential for impact to archaeological resources from the proposed action. Alternative 3 does not differ from Alternative 2 because the additional mitigation measure does not address this resource (i.e., all assumptions, estimates, and conclusions are identical). See the analysis provided in Section 3.8.2.2 for this alternative for this resource.

4. CONSULTATION AND COORDINATION

Consultations with FWS and NMFS under Section 7 of the Endangered Species Act of 1973 on the effects of the Five-Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico were completed in 2007. The BOEMRE requested annual concurrence from both NMFS and FWS under these existing consultations. For 2010, NMFS communicated their concurrence, by an email message, to BOEMRE on December 3, 2009, and FWS communicated their concurrence, by an email message to BOEMRE on December 8, 2009.

In response to the Macondo Event, BOEMRE will request reinitiation of the existing consultations from both FWS and NMFS. The existing consultations remain in effect until the reinitiated consultation is completed and new Biological Opinions are available. In the interim, BOEMRE will continue to comply with all Reasonable and Prudent Measures and the Terms and Conditions under these existing consultations, along with implementing the current BOEMRE-imposed mitigations, monitoring, and reporting requirements. Based on the most recent and best available information at the time, BOEMRE 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.

5. PUBLIC COMMENT

Once the operator's plan was deemed submitted (as per 30 C.F.R. §250.231), it was placed on Regulations.gov on September 21, 2011 for a 10-day public review. Upon the close of the comment period on October 2, 2011, no comments were received.

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8. APPENDIX

Appendix A—Accidental Oil-Spill Discussion

Appendix A
Accidental Oil-Spill Discussion

ACCIDENTAL OIL SPILL DISCUSSION

Introduction

The past several decades of spill data for all water depths on the Gulf of Mexico Federal Outer Continental Shelf (OCS) show that accidental oil spills (≥1,000 barrels [bbl]) associated with oil and gas exploration and development are low-probability events in OCS waters of the Gulf of Mexico. However, as the 2010 Macondo Event in Mississippi Canyon Area, Block 252 (MC 252) has shown, there is a potential, however slight, for such spills to occur and the impacts have the potential to be catastrophic. The discussion in this appendix describes a low probability catastrophic spill specific to the proposed activity whereas Appendix B provides a more generic overview of potential impacts on the environment from a catastrophic event such as the Macondo spill.

Potential Sources of a Spill

Potential sources of hydrocarbon spills from an OCS drilling activity would include the following:

- a storage tank(s) 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 one of the proposed wells.

Facility Storage and Transfer Operations

As indicated above, offshore spills from an OCS activity are possible if an accident were to damage a storage tank on board the drilling rig, crewboat, or supply vessels. Transfer incidents during the offloading of diesel fuel to the drilling rig are also possible. The associated tank volumes will vary depending on the rig used and vessel support required for the proposed action. The specifics are outlined in the respective plan and in Chapter 1.4 of the SEA.

Blowout

The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) requires that all losses of well control (blowouts) be reported. In 2006, BOEMRE revised the regulations for incident reporting. Consequently, the number of losses of well control or blowouts reported for 2006 may be affected by this change and may make difficult a comparison with data from previous years. The current definition for loss of well control used by BOEMRE:

- 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; and/or
- uncontrolled flow resulting from a failure of surface equipment or procedures.

Blowouts can occur during any phase of development: exploratory drilling, development drilling, completion, production, or workover operations. Blowouts occur when improperly balanced well pressures result in sudden, uncontrolled releases of fluids from a wellhead or wellbore (PCCI, 1999; Neal Adams Firefighters, Inc. 1991). Historically, 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 occurred on April 20, 2010, at the Macondo well in Mississippi Canyon Block 252 (i.e., Macondo Event). Although this is a rare event, the blowout resulted in the loss of large quantities of gas (to date this volume is undetermined) and oil (estimated 4.9 million bbl of oil) (DHUC, 2010).

As indicated by the Macondo Event, the loss of well control in deep water has proven to be somewhat different than the loss of well control in shallow waters. Although many of the same wild well control techniques used in shallow-water were used to attempt to control the MC 252 well, these well control efforts were hindered primarily due to the water depth, which required reliance solely upon the use of

remotely-operated vehicles (ROVs) for all well intervention efforts. This is a concern in deep water because the inability to quickly regain control of a well may result in increases in the size of a spill, as occurred during the Macondo Event. The Macondo Event required that the operator cap and attempt well control efforts at the seabed in very deep water depths (approximately 5,000 ft; 1,524 m) and, although not simultaneously, the operator was also required to handle fire-fighting efforts at the surface when the incident first occurred (USDOI, BOEMRE, 2010).

The main scenario for recovery from a blowout event is via intervention with the Blowout Preventer (BOP) attached to the well. There are built in redundancies in the BOP system to allow activation of selected components with the intent to seal off the well bore. However, if the BOP fails, as indicated in the 1991 Final Report of the Joint Industry Program for Floating Vessel Blowout Control and by the MC 252 blowout incident, there are several available options to control a well blowout. Common kill techniques include bridging, capping/shut-in, capping/diverting, surface stinger, vertical intervention, offset kill, and relief wells (Neal Adams Firefighters, Inc. 1991). Capping options and other source control and containment options are described in more detail under the BOEMRE Spill Response Program Source Control and Containment section of this Appendix (see Table A-6). Although much has been learned about well control in deep water as a result of the Macondo Event, in the event that a deepwater subsea blowout occurs in the future, it is likely that an operator will be required to immediately begin to drill one or more relief wells to gain control of the well. This may be required whether or not this is the first choice for well control because the relief well is typically considered the ultimate final solution for well control.

It is estimated that drilling an intervention well in deep water can take anywhere from 30 to 120 days (Regg, personal communication, 1998; Stauffer, personal communication, 1998; McCarroll, personal communication, 1998; BP, 2010). 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 run casing before releasing the rig), and any problems mobilizing personnel and equipment to the location. The BOEMRE field engineers feel that, if a blowout were to occur, it is more likely for a blowout in deep water to occur at the seafloor rather than at the surface because there is less containment capability subsea (Regg, personal communication, 1998, Stauffer, personal communication, 1998, McCarroll, personal communication, 1998). Accordingly, the MC 252 blowout was a subsea blowout. However, it is possible that a surface blowout could occur.

The major differences between a blowout during the drilling phase versus the completion or workover phases is the drilling well tendency to "bridge off." Bridging is a phenomenon that occurs when severe pressure differentials are imposed at the well/reservoir interface and the formation around the wellbore collapses and seals the well. Deepwater reservoirs are susceptible to collapse under "high draw down" conditions. However, a completed well may not have the same tendency to passively bridge off as would a drilling well involving an uncased hole. Bridging would have a beneficial effect for spill control by slowing or stopping the flow of oil from the well (PCCI, 1999). There is a difference of opinion among blowout specialists regarding the likelihood of deepwater wells bridging naturally in a short period of time. 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, which lowers the probability of bridging (PCCI, 1999). Therefore, the potential for a well to bridge is greatly influenced by the phase of a well.

Estimating Future Potential Spills

OCS Spills in the Past

This summary of past OCS spills presents data for the period 1985-1999. The 1985-1999 time period was chosen to reflect more modern engineering and regulatory requirements than were required prior to this and because OCS spill rates are available for this period. The BOEMRE is presently in the process of updating these spill rates through 2010, which will include the recent Macondo Event in 2010; however, this update report was not available at this time (Anderson, personal communication, 2010). Information on spills that have occurred since 1999 is published on the BOEMRE website (USDOI, BOEMRE, 2010). Utilizing more recent information through mid-2010, there have been 4,123 deepwater wells spud by mid-2010 on the OCS, not counting bypasses, in water depths of at least 500 ft (152 m). There have been 20 blowouts from these deepwater wells; 3 resulted in a spill, but only 1 (the Macondo Event) resulted in a

spill >1,000 bbl. The other two spills were estimated to be 11 and 200 bbl of crude/condensate spilled (Morin, written communication, 2010).

For the period 1985-1999, there were no spills ≥1,000 bbl from OCS platforms, eight spills ≥1,000 bbl from OCS pipelines, and no spills ≥1,000 bbl from OCS blowouts (Tables A-1 through A-3).

Table A-1

Historical Record of OCS Spills ≥1,000 Barrels from OCS Facilities, 1985-1999

Spill Date	Area and Block (water depth and distance from shore)	Volume Spilled (barrels)	Cause of Spill

No OCS facility spills ≥1,000 bbl during the period 1985-1999.

Table A-2

Historical Record of OCS Spills ≥1,000 Barrels from OCS Pipelines, 1985-1999

Spill Date	Area and Block (water depth and distance from shore)	Volume Spilled (barrels)	Cause of Spill
February 7, 1988	South Pass 60 (75 ft, 3.4 mi)	15,576	Service vessel's anchor damaged pipeline
January 24, 1990	Ship Shoal 281 (197 ft, 60 mi)	14,423*	Anchor drag, flange and valve broke off
May 6, 1990	Eugene Island 314 (230 ft, 78 mi)	4,569	Trawl drag pulled off valve
August 31, 1992	South Pelto 8 (30 ft, 6 mi)	2,000	Hurricane Andrew, loose drilling rig's anchor drag damaged pipeline
November 22, 1994	Ship Shoal 281 (197 ft, 60 mi)	4,533*	Trawl drag
January 26, 1998	East Cameron 334 (264 ft, 105 mi)	1,211*	Service vessel's anchor drag damaged pipeline during rescue operation
September 29, 1988	South Pass 38 (110 ft, 6 mi)	8,212	Hurricane Georges, mudslide parted pipeline
July 23, 1999	Ship Shoal 241 (133 ft, 50 mi)	3,189	Jack-up barge sat on pipeline

*condensate

Table A-3

Historical Record of OCS Spills ≥1,000 Barrels from OCS Blowouts, 1985-1999

Spill Date	Area and Block (water depth and distance from shore)	Volume Spilled (barrels)	Cause of Spill

No OCS blowout spills ≥1,000 bbl during the period 1985-1999.

Estimating Spill Rates Using Past OCS Spills

Data from past OCS spills are used to estimate future potential OCS spills. The BOEMRE has estimated spill rates for spills from the following sources: facilities, pipelines, and drilling. Spill rates for facilities and pipelines have been developed for several time periods, and an analysis of trends for spills is presented in *Update of Comparative Occurrence Rates for Offshore Oil Spills* (Anderson and LaBelle, 2000). Spill rates for the most recent period analyzed, 1985-1999, are presented here. Data for this period should reflect more modern spill-prevention requirements than was required prior to 1985. An internal review of recent historical data following the spill events that occurred as a result of hurricanes that occurred in the Gulf of Mexico from 2004 to 2009 indicated that there had been no change in the 1985-1999 spill rates identified in the aforementioned report. The BOEMRE is in the process of updating these spill rates, which will include the recent Macondo Event; however, significant changes to the spill rates for the entire OCS are not anticipated (Anderson, personal communication, 2010).

Spill rates for facilities and pipelines are based on the number of spills per volume of oil handled. Spill rates for blowouts are based on the number of blowouts with a release of oil per number of wells drilled. Spill rates for the period 1985-1999 are shown in Table A-4. It should be noted that there were no platform or blowout spills ≥1,000 bbl for the period 1985-1999. The use of "zero" spills would result in a zero spill rate. To allow for conservative future predictions of spill occurrence, a spill number of one was "assigned" to provide a non-zero spill rate for blowouts. Therefore, this spill rate already included the occurrence of the Macondo Event. The spill period was expanded to 1980 to include a spill for facilities. While there were no facility or blowout spills during the 1985-1999 period for which data are available, spills could occur in the future. In fact, a pipeline spill ≥1,000 bbl was reported subsequent to this period, so it is reasonable to include a spill to provide a non-zero spill rate. Spill rates are combined with site-specific data on production or pipeline volumes or number of wells being drilled to result in a site-specific risk for a spill to occur as a result of the proposed action.

Table A-4

Spill Rates Used to Estimate the Future Potential for Spills

Spill Source	Volume of Oil Handled in Billions of Barrels	Number of Wells Drilled	Number of Spills ≥1,000 Barrels	Risk of Spill from Facilities or Pipelines per Billion Barrels	Risk of Spill from Drilling Blowout per Well
Facilities	7.41[a]	Not Applicable	1[a]	>0 to <0.13[c]	Not Applicable
Pipelines	5.81	Not Applicable	8	1.38	Not Applicable
Drilling	Not Applicable	14,067	1[b]	Not Applicable	>0 to <0.00007[c]

[a] There were actually zero spills ≥1,000 bbl from facilities during the period 1985-1999. The data shown represent 1980-1999. The spill period for facility spills was expanded to 1980 to include a spill for facilities to result in a non-zero risk.

[b] There have been no spills ≥1,000 bbl from blowouts during the period 1985-1999. One spill was "assigned" to provide a non-zero spill rate.

[c] There were no facility or blowout spills ≥1,000 bbl for the period 1985-1999; however, a non-zero spill rate was calculated by expanding the facility period to 1980 and by "assigning" a blowout spill. Therefore, the spill rates for these categories are presented as >0 but below the rates calculated by expanding the data period and assigning a spill.

Hydrocarbon Spill Transport

Subsurface Spills

Submerged oils provide unique challenges in oil tracking and fate and transport modeling. Research funded by BOEMRE to determine oil-spill behavior from subsurface well blowouts in deep water was conducted in June 2000 in the Norwegian Sea. This field experiment is referred to as DeepSpill. The conclusions of the DeepSpill field experiment, two other follow-up laboratory studies, and three model

comparisons were summarized in a 2005 report entitled *Review of DeepSpill Modeling Activity Supported by the DeepSpill JIP and Offshore Operators Committee* (Adams and Socolofsky, 2005). The aforementioned six activities resulted in several conclusions about the fate of oil spilled subsurface within deep water. This 2005 report indicated that jets of oil and gas (if present) will break up into droplets and bubbles. The buoyancy of the oil droplets and gas bubbles will form a buoyant plume, with the gas providing the dominant source of buoyancy (if present). Near the point of release, this plume will behave like a single phase plume. Although slight leakage of entrained seawater and fine oil droplets can be expected in the lee of the plume, basic plume features in this near source can be easily described with conventional integral plume models. Above a certain height, ambient stratification and ambient currents will separate the dispersed phases from the entrained water. Above a current speed of 2.5 cm/sec, the current is the major factor, and separation can be expected at elevations of 180 m (591 ft) or less. It was determined that plume dynamics were relatively unimportant when determining the fate of oil released at depths of 800-1,000 m (2,625-3,281 ft) because the plume stage is short when compared with the water depth (Adams and Socolofsky, 2005).

The DeepSpill work indicated that, above the point of separation, gas bubbles and large oil droplets rise toward the surface while small oil droplets continue with the entrained seawater as a buoyant jet. Some of the modeling work indicated that the oil would rise to surface closer to the release point. However, since the field experiment resulted in only a small fraction of the diesel oil being recovered at the surface, it was determined that much of the oil could have been contained in the form of much finer droplets that were much more widely dispersed. Although earlier studies such as the 1997 S.L. Ross study indicated that the gas would be expected to convert very quickly to hydrates during a deepwater release, the Macondo Event did not result in released gas converting to hydrates, which reinforces the 2005 report's modeling work conclusions (S.L. Ross Environmental Research Ltd., 1997; Adams and Socolofsky, 2005).

The National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (USEPA), and the White House Office of Science and Technology Policy released peer-reviewed, analytical summary reports about subsurface oil monitoring in the Gulf of Mexico during the Macondo Event response. Their second report contains preliminary data collected at 227 sampling stations extending from 1 to 52 km (0.6 to 32.3 mi) from the MC 252 wellhead. This data indicated that the movement of subsurface oil is consistent with ocean currents and that concentrations continue to be more diffuse as one moves away from the source of the leak. These results confirmed the findings of their previous report. The fluorometric sampling confirmed that the subsurface oil moved consistent with the observed ocean currents. During the MC 252 response, many techniques were tested to better understand the extent of this unprecedented oil spill, and it was discovered that fluorometric sampling was useful to help identify the location and concentration of subsurface oil. Fluorometers use light waves to detect anomalies in the water column. Fluorometry measurements show repeated signals between approximately 3,300 and 4,300 ft (1,000-1,400 m) deep that were consistent with diffused oil in the water. For the areas sampled, the fluorescence data indicated movement primarily west-southwest until June 2, 2010. In mid-June, fluorescence indicated movement toward the northeast within the Gulf. As previously indicated, these movements were generally consistent with observed ocean currents in the area at that time (USDOC, NOAA, 2010a).

Therefore, in the event of a subsurface release of oil, it is anticipated that some (less than 13%) of the oil would remain subsurface, as described above, while the rest would surface (Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team., 2010). Based upon the DeepSpill research and experience gained during the MC 252 spill incident, it would be expected that any oil contained within the water column would be transported at that same depth by ocean currents. Refer to the section of this appendix entitled "Assumptions about the Characteristics and Fates of Spilled Hydrocarbons" for a discussion of the projected fate of this subsea oil.

Assumptions about the Characteristics and Fates of Spilled Hydrocarbons

Characteristics of Hydrocarbons

It is assumed that a typical diesel fuel oil is used for most drilling activities. Additionally, the oil that is generally produced in the GOM is a medium weight oil. Refer to Table 2 of Appendix B for further discussion regarding oil classification. For the purposes of this scenario, it will be assumed that the oil will have similar chemical characteristics as the oil spilled during the Macondo Event.

Subsurface Spills

If a subsurface spill occurs, it is anticipated that oil released would behave similarly to the oil released during the DeepSpill experiments and during the Macondo Event. Transport of oil in the water column and on the bottom will be dependent upon the properties of the oil, characteristics of the waterbody, and properties of suspended or bottom sediments (Coastal Response Research Center, 2007).

The DeepSpill experiment was conducted in the Norwegian Sea at the Helland Hansen site in June 2000 and included four controlled discharges of oil and gas from a water depth of 844 m (2,769 ft). This experiment was part of the DeepSpill project, organized as a Joint Industry Project (JIP), involving 23 oil companies and BOEMRE. Analysis of water samples taken during this experiment with a rosette sampler (guided by images from the echo sounder) revealed how the composition of the crude oil and diesel released as part of this experiment changed on its way to the sea surface due to dissolution of the water soluble components into the ambient water. The echo sounder images indicated that the methane gas did not reach the sea surface, with the signal from the rising cloud of gas bubbles vanishing from the images at about a water depth of 150 m (492 ft). The crude oil and the diesel oil did reach the sea surface in a relatively shorter period of time than expected. The crude oil release did form water-in-oil emulsion, which was also evident during the Macondo Event. This research also indicated that slicks from a submerged oil release were thinner than those resulting from surface spills, allowing them to weather more rapidly (Johansen et al., 2001). However, the oil released subsea that reached the water surface as a result of the Macondo Event did not seem to behave any differently than would a surface spill of the same oil.

The experiments indicated that oil is water-extracted after its subsea release on its way up to the sea surface. The rate of this extraction depends upon the solubility of the compounds in the water. For example, close to the surface, the naphthalenes are almost completely extracted from the oil. This is important because the water-soluble compounds are the most toxic ones when exposed to marine biota. The results from the experiments showed that the rising of the oil through the water column represents a kind of "stripping" process of some of the most toxic compounds in the oil. Therefore, a portion of the most toxic compounds are left in the water column. The largest concentration of hydrocarbons in the water column will be basically inside the "cloud" of rising oil droplets while the peak concentration may be deeper due to a larger exposure of oil droplets that has passed by. In a surface-generated slick, the most toxic compounds typically evaporate rather than dissolve into the sea (Johansen, et al., 2001).

Likewise, the theory that not all of the oil would surface as a result of a subsurface deepwater release was found to be an accurate assessment based upon observations during the Macondo Event. During the Macondo Event it was discovered that, due to the high speed of its release, some of the oil was naturally stripped off (naturally dispersed as oil droplets) as it rose to the surface in a water depth of approximately 5,000 ft (1,524 m). These oil droplets are neutrally buoyant and remain in the water column until they biodegrade. At this time, it is estimated that about 13 percent of the oil was lost into the water column as a result of this stripping (Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team., 2010). The NOAA, USEPA, and the White House Office of Science and Technology Policy's summary report about subsurface oil monitoring in the Gulf of Mexico after the MC 252 blowout indicated that average fluorescence in the depths of interest – 3,300 and 4,300 ft (1,005 and 1,311 m) – at sampled locations ranged from 4 to 7 parts per million oil. This estimated value is slightly higher than the laboratory-confirmed values previously reported, which at their highest, near the wellhead, were approximately 1-2 parts per million oil. The fluorometric signal to detect the presence of oil was strongest near the wellhead and decreased with distance, which was consistent with previous sampling. (USDOC, NOAA, 2010a).

For the Macondo Event, there is no published estimate of the amount of oil dispersed throughout the water column due to the use of subsurface dispersants at the wellhead; however, a total of 16 percent was estimated to have been dispersed by the application of chemical dispersants both on and below the surface (Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team., 2010). The chemically dispersed oil ended up deep in the water column and just below the surface because both surface and subsurface application was used. Dispersion, whether natural or chemical, increases the likelihood that the oil will be biodegraded, both in the water column and at the surface. However, until it is biodegraded, naturally or chemically dispersed oil, even in dilute amounts, can be toxic to vulnerable species (Lubchenco et al., 2010). Studies are presently ongoing to assess the short and long-term effects of dispersant usage during the Deepwater Horizon event.

Surface Spills

When oil is released in seawater, a combination of physicochemical and biological processes immediately begin to transform the oil into substances with characteristics that differ from the original material, while physical transport processes begin to dissipate it. Physicochemical processes include evaporation, emulsification, dissolution, and photo-oxidation, which are collectively referred to as weathering. Biological processes include microbial oxidation. Microbes consume the oil, and wave action, sun, currents, and continued evaporation and dissolution continue to break down the residual oil in the water and on shorelines. Transport processes include spreading, dispersion and entrainment, sinking and sedimentation, and stranding, which can lead to tar ball formation. These processes are described by the National Research Council (NRC, 2003).

For this scenario, it is assumed that oil would behave somewhat similarly to that spilled during the MC 252 spill. The MC 252 oil was relatively high in alkanes. Because alkanes are made up of single-bonded carbon chains that microorganisms can readily use as a food source, MC 252 oil was considered likely to biodegrade more readily than other crude oils. The MC 252 oil was also considered to be less toxic than some crude oils generally because it was relatively much lower in polyaromatic hydrocarbons (PAHs). The PAHs are highly toxic chemicals that tend to persist in the environment for long periods of time, especially if the spilled oil penetrated into the substrate on beaches or shorelines. The MC 252 oil was also low in sulphur. Like all crude oils, MC 252 oil contained volatile organic compounds (VOC's) such as benzene, toluene, and xylene. Some VOC's are acutely toxic but because they evaporate readily, they are generally a concern only when oil is fresh (USDOC, NOAA, 2010b).

It was estimated by the MC 252 National Incident Command's technical group that approximately 36 percent of the oil spilled as a result of the Macondo Event was lost once it reached the water surface due to dissolution, evaporation, and natural dispersion (Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team., 2010). The majority of this oil that was lost due to evaporation and dissolution (23%). Additional oil was lost due to these same processes as it weathered, although at a much smaller percentage. The evaporation rate was based upon scientific research and observations conducted during the Macondo Event (Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team., 2010).

Once surfaced, the MC 252 oil appeared as black or dark brown oil, sheens, and water-in-oil emulsion, or mousse. The MC 252 oil also formed tar balls. As MC 252 oil reached the surface and spread out across the water, its lighter components, including VOC's, soon evaporated, leaving heavier components behind. Fresh oil appears as a black or dark brown, thick, sticky liquid with petroleum odor. On open water, this oil will spread quickly. In the intertidal zone, this oil could pick up silt and sediment and sink. On the beach, this form of oil could release sheen when washed by tides or waves and could also penetrate beach substrate. Some of the remaining MC 252 oil became sheen, a very thin layer of floating oil (less than 0.0002 inches or 0.005 mm) that can be transparent, grey, silver, or rainbow-colored. Light sheens will degrade quickly while heavier sheens may concentrate on shorelines. The MC 252 oil also mixed with water to form a sticky, pudding-like water-in-oil emulsion, or mousse, typically brown, reddish, or orange in color. Typically, crude oil emulsifies on the sea surface as winds and waves mix it with water, but MC 252 oil also appeared to be incorporating water as it rose to the surface through 5,000 ft (1,524 m) of water. Water content reduces ignitability and biodegradability. Winds and waves tear oil and mousse patches into smaller pieces, eventually producing tar balls. The MC 252 tar balls typically were in the form of small, hard, black pellets. Tar balls can range in size from 5mm to 5 cm (0.20 to 2 inches). Tar balls can be very persistent in the marine environment and travel long distances. On the beach, tar balls may soften in hot sun. In intertidal waters, tar balls can pick up sediment or silt and sink. Occasionally, some burn residue can be mistaken for tar balls. Burn residue is brittle, hard, asphalt-like, and typically mixed with unburned fresh oil. Some of the MC 252 oil gathered offshore just below the water surface in thick mats or patches of emulsified oil (USDOC, NOAA, 2010a).

Dispersion increases the likelihood that the oil will be biodegraded, both in the water column and at the surface. Oil that is chemically dispersed at the surface will move into the top 20 ft (6 m) of the water column where it will mix with surrounding waters and begin to biodegrade. While there is more analysis to be done to quantify the rate of biodegradation in the Gulf after the MC 252 spill, early observations and preliminary research results showed that some of the oil biodegraded fairly quickly. Bacteria that break down the dispersed and weathered surface oil are abundant in the Gulf of Mexico in large part because of the warm water, the favorable nutrient and oxygen levels, and the fact that oil enters the Gulf of Mexico through natural seeps regularly (Lubchenco et al., 2010).

Using the information obtained as a result of the response to the Macondo Event, it is evident that, large amounts of oil could remain on the water surface and within the water column for some period of time during an ongoing spill event if it is not successfully contained by some other subsea source control measure. Approximately 17% of the oil was captured through the subsea containment effort during the Macando Event (Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team., 2010).

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. The BOEMRE has requirements for preparedness to respond to a spill in the event of an accidental spill (30 C.F.R. Part 254 and 30 C.F.R. 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 an 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 BOEMRE, operators are required to provide a regional oil-spill-response plan (ROSRP). During the review of a 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 the BOEMRE 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		

BOEMRE Spill-Response Program

The BOEMRE 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 BOEMRE address issues such as spill prevention and response, in-situ burning, and dispersant use. In addition, BOEMRE works with the U.S. Coast Guard (USCG) and other members of the multiagency National Response System to further improve spill-response capability in the Gulf of Mexico.

Subsurface Response

Most oil-spill response strategies and equipment are based upon the simple principle that oil floats. However, as evident during the Macondo Event, 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 Macondo Event, 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 Macondo Event. 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 Macondo Event may account for the observed differences in slick behavior between the experiments and the Macondo Event. 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-5).

Table A-5

Primary Cleanup Options Used during the MC 252 Response

	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, 2010b.

Source Control and Containment

After the Deepwater Horizon event occurred, BOEMRE issued NTL No. 2010-N10 which became effective on November 8, 2010. This NTL applies only to operators conducting operations using subsea blowout preventers (BOPs) or surface BOPs on floating faculties. The NTL also informs lessees that BOEMRE 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 Oil Spill Response Plans that include this containment information at this time, operators were notified of BOEMRE's intention to evaluate the adequacy of each operator to comply in the operator's current OSRP. The type of information that BOEMRE will review for 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
- Storage facilities.

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 feet 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 feet and has the capacity to contain 60,000 barrels of oil per day. 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 Macondo response and continue to work in the Gulf. Together, the Helix ships and related equipment can handle up to 55,000 barrels of oil a day, 70,000 barrels of liquid natural gas and 95 million cubic feet of natural gas at depths up to 8,000 feet. 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. Another group, Wild Well Control, is also providing some subsea containment capability and debris removal to offshore operators.

The BOEMRE 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, BOEMRE's enhanced oversight, and industry's heightened safety awareness since the Macondo Event, it is reasonable to conclude that an accidental spill event is not very likely to occur.

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