UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 4
Atlanta, Georgia

Preliminary Determination & Statement of Basis

Outer Continental Shelf Air Permit OCS-EPA-R4019
for

Anadarko Petroleum, Inc.
Diamond BlackHawk Drilling Project

November 14, 2014

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ABBREVIATIONS AND ACRONYMS

AP-42	AP-42 Compilation of Air Pollutant Emissions Factors
AQRV	Air Quality Related Values
BACT	Best Available Control Technology
Bbl	Barrels
BOEM	Bureau of Ocean Energy Management
Breton NWR	Breton National Wildlife Refuge
Btu	British Thermal Unit
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide (CO_2) Equivalent
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FLM	Federal Land Manager
GHG	Greenhouse Gas
GOM	Gulf of Mexico
HAP	Hazardous Air Pollutants
hp	Horsepower
IC	Internal Combustion
m^3	Cubic Meters
MMScf/day	Million Standard Cubic Feet per Day
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_X	Oxides of nitrogen
NSPS	New Source Performance Standards
NSR	New Source Review
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
Part 55	40 CFR part 55
PEMS	Parametric Emission Monitoring System
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 2.5 Microns
PM_{10}	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 10 Microns
ppm	Parts Per Million
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
SO_2	Sulfur Dioxide
Support Vessels	Support Boat, Anchor Handling Boat, Stimulation Vessel, Tug, Well Evaluation Vessel, and Barge
TPY	Tons Per Year
TVP	True Vapor Pressure
VOC	Volatile Organic Compounds

1.0 Introduction

Anadarko Petroleum Corporation, (the Applicant or Anadarko) has applied for an Outer Continental Shelf (OCS) air permit pursuant to section 328 of the Clean Air Act (CAA) from the United States Environmental Protection Agency (EPA) Region 4 for the proposed mobilization and operation of the deepwater drilling vessel *BlackHawk*, owned by Diamond Offshore Drilling Inc. and associated support fleet located on the OCS in the Gulf of Mexico east of longitude 87°30' (87.5°), west of the Military Mission Line (86°41' west longitude), and not within 125 nautical miles of the state seaward boundary of Florida. Anadarko proposes three phases of project activity: drilling, well completion, and production well maintenance. The project is expected to operate for five years and approximately 200 days per year.

The EPA Region 4 is the agency responsible for implementing and enforcing CAA requirements for OCS sources in the Gulf of Mexico east of 87°30' (87.5°).[1] The EPA has completed a review of Anadarko's application, including all supplemental materials provided, and is proposing to issue Permit Number OCS-EPA-R4019 to Anadarko for an exploratory drilling program subject to the terms and conditions contained in the draft permit. The draft permit incorporates applicable requirements from the federal PSD and title V operating permit programs, New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAP) as required by the OCS air quality regulations in 40 CFR part 55.

This document serves as a fact sheet, preliminary determination, and statement of basis for the draft permit. It provides an overview of the project, a summary of applicable requirements, the legal and factual basis for draft permit conditions, and the EPA's analysis of key aspects of the application and draft permit such as the best available control technology (BACT) analysis and Class II/Class I area air quality impact analysis. Additional information can be found in the draft permit accompanying this preliminary determination, as well as in the application materials and administrative record for this project, as discussed in Section 9 of this document.[2]

2.0 Applicant Information

2.1 Applicant Name and Address

Anadarko Petroleum Corporation
1201 Lake Robbins Drive
The Woodlands, Texas 77380

[1] *See* CAA section 328. The Department of the Interior has jurisdiction for CAA implementation west of 87°30'.
[2] The EPA must follow the administrative and public participation procedures in 40 CFR part 124 used to issue PSD permits when processing OCS permit applications under Part 55. 40 CFR § 55.6(a)(3). The EPA must also follow the administrative and public particpation procedures of 40 CFR part 71 when issuing permits to OCS sources subject to Title V requirements. 40 CFR § 71.4(d). Accordingly, the EPA has followed the procedures of 40 CFR parts 71 and 124 in issuing the draft permit. This Preliminary Determination & Statement of Basis serves as a statement of basis under 40 CFR § 124.7, a fact sheet under 40 CFR § 124.8, and a statement of basis under 40 CFR § 71.7(a)(5).

2.2 Facility Location

Anadarko is proposing to drill in the Eastern Gulf of Mexico located on the OCS waters east of longitude 87°30', west of the Military Mission Line (86°41' west longitude), at least 100 nautical miles from the Florida shoreline in the Bureau of Ocean Energy Management BOEM Central Planning Area, and at least 125 nautical miles from the Florida state seaward boundary in the BOEM Eastern Planning Area. The area contains both active lease blocks and lease blocks that the BOEM may lease in the future. The available lease blocks are identified in Figure 2-1 below.

Figure 2-1 - Anadarko Oil Site and Lease Blocks in Eastern Gulf of Mexico

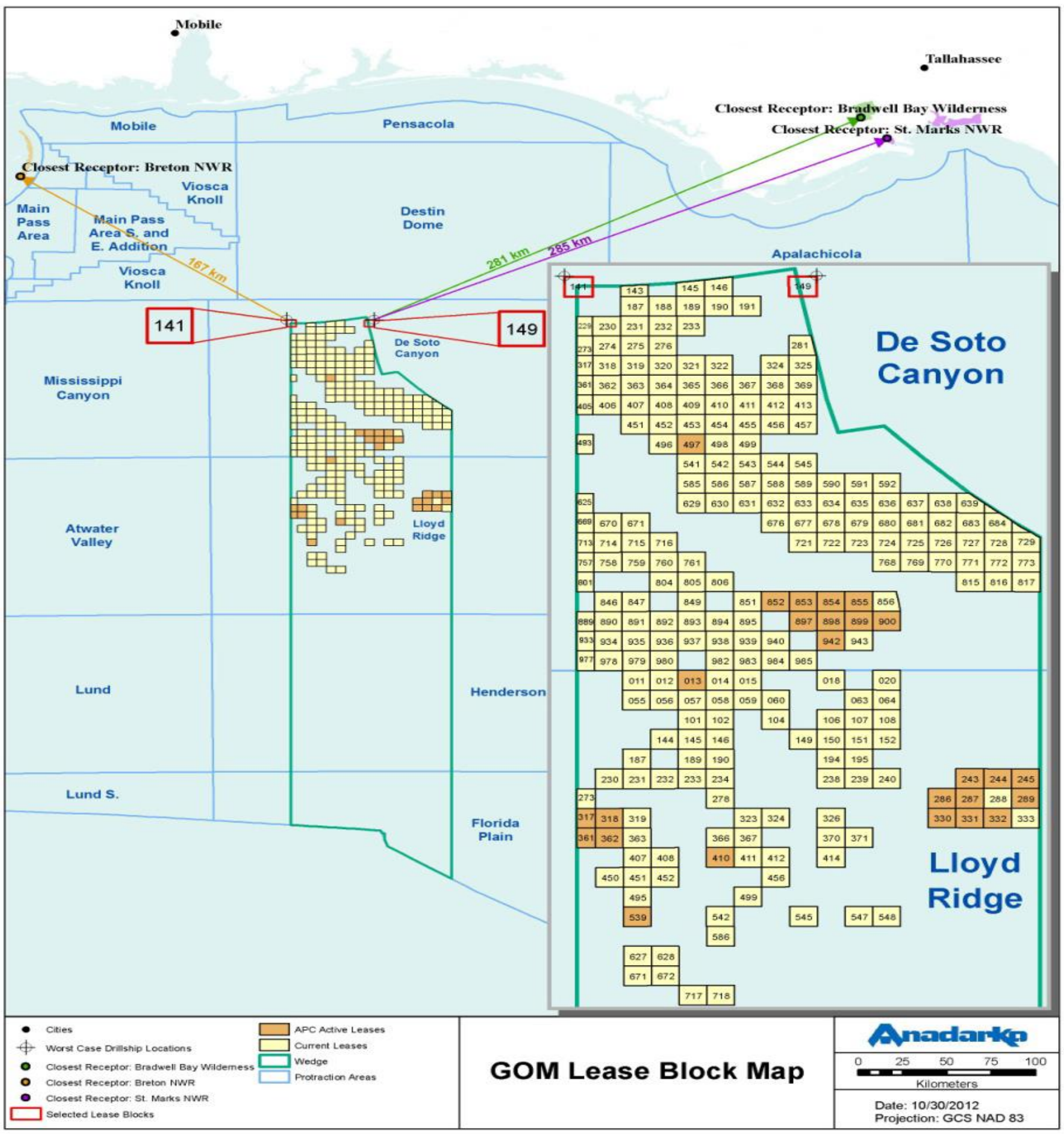

Image Source: Anadarko Petroleum Corporation Application, September 2013

3.0 Proposed Project

The proposed project will mobilize the *BlackHawk* drillship and associated support vessels. These vessels will include a combination of supply boats, an anchor handling boat, tug boats, barges, stimulation vessels, and well evaluation vessels. The proposed project will consist of three phases: the drilling phase, the well completion phase, and production well maintenance phase. At this time, there are no plans to establish permanent production platforms at the well site. Such permanent facilities would be permitted separately. Emissions from production well maintenance activities related to facilities on the sea floor are subject to regulation by this permit. The proposed project's annual operation will be limited by fuel use.[3]

Air pollutant emissions generated from the project include the criteria pollutants nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM), particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), and sulfur dioxide (SO_2), as well as other regulated air pollutants including volatile organic compounds (VOC), oxides of nitrogen (NO_X), and greenhouse gases (GHGs). VOC and NO_X are the measured precursors for the criteria pollutant ozone, and NO_X and SO_2 are measured precursors for $PM_{2.5}$.

Emissions are primarily released from the combustion of diesel fuel in the drilling vessel's main engines and in smaller engines that supply power for operating drilling equipment and support vessels. Emissions may also be released from other equipment such as fuel and mud storage tanks and from activities such as well completion, pumping heavy lubricating mud, painting, and welding and from flare emissions associated with well maintenance activities.

[3] This fuel limit is approximately equal to operations of 200 calendar days per year, assuming that the project operated 24-hours a day.

Figure 3-1 Drilling Vessel

Image Source: Online http://www.diamondoffshore.com/ Accessed on Aug. 4, 2014

Based on emissions estimates and the applicable permitting thresholds, the project will have emissions of NO_x CO, VOC, PM, PM_{10}, $PM_{2.5}$, and GHGs that meet or exceed the respective PSD and Title V significant emission rates and, hence, is subject to the PSD and Title V programs. Any facility that emits a regulated New Source Review (NSR) pollutant at levels meeting or exceeding its PSD significant emission rate must perform a BACT analysis for that pollutant and comply with all subsequent regulatory obligations for that pollutant as described in Section 6.0 below.

The emissions units to be used on the *BlackHawk* drilling vessel and the emissions units to be used on support vessels that will become a part of the OCS source are detailed in Sections 4.0 and 5.0 and Tables 4-2 and 4-3. The diesel powered units include eight main propulsion diesel electric generators (DR-ME-01 through DR-ME-08), one emergency generator (DR-GE-01), one emergency air compressor diesel engine (DR-AC-01), one fast rescue craft engine (DR-FR-01), six life boat engines (DR-LB-01 through DR-LB-06), 16 third-party engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21), five third-party well evaluation engines (DR-TP-12 through DR-TP-16), and eight pump engines on the stimulation vessel (SV-PE-01 through SV-PE-08). The third-party equipment is leased on short notice and the exact specifications are unknown. Anadarko selected worst-case equipment to develop emission calculations, but will identify the exact engines for the purpose of permit compliance and emissions inventory.

The *BlackHawk* will be supported by up to two support vessels for the entire project and four well completion vessels. The support vessels will be used, sometimes simultaneously, to transport personnel, supplies, and fuel to the drilling vessel, as required for the duration of the exploratory drilling. Various support and well completion vessels will be used interchangeably depending on availability. Anadarko selected the largest support vessels (the supply boat *HOS*

Coral and the anchor handling boat *Kirt Chouest*) and the largest well completion vessels (a tug, a barge, a stimulation vessel, and a well evaluation vessel) to calculate emissions based on the worst-case scenario. Anadarko will maintain records of the engine specifications and number of hours each engine will operate within 25 miles of the *BlackHawk* for any support vessel used in place of the *HOS Coral* (supply boat), the *Kirt Chouest* (anchor handling boat), or any vessel used during well completion. Emissions for the support vessel and the well completion vessel engines assume a worst-case value while at the drill site and within 25 nautical miles of the *BlackHawk*. Diesel units used to calculate emissions from the support vessels are detailed in Anadarko's OCS permit application materials and are included in the administrative record for this project as discussed in Section 9.0 of this document.

4.0 Legal Authority and Regulatory Applicability

4.1 EPA Jurisdiction

The 1990 CAA Amendments transferred authority for implementation of the CAA for sources subject to the Outer Continental Shelf Lands Act (OCSLA) from the Department of the Interior (DOI) to the EPA for all areas of the OCS with the exception of the Gulf of Mexico west of 87.5° longitude. Subsequently, the Consolidated Appropriations Act, 2012 (P.L. 112-74), transferred authority from the EPA to DOI for areas offshore the North Slope of Alaska.

4.2 OCS Air Regulations

Section 328(a)(1) of the CAA requires the EPA to establish requirements to control air pollution from OCS sources under the EPA's jurisdiction in order to attain and maintain federal and state ambient air quality standards and to comply with the provisions of part C (PSD) of title I of the CAA. The OCS Air Regulations at 40 CFR part 55 implement section 328 of the CAA and establish the air pollution control requirements for OCS sources and the procedures for implementation and enforcement of these requirements. The regulations define "OCS source" by incorporating and interpreting the statutory definition of OCS source:

OCS source means any equipment, activity, or facility which:

(1) Emits or has the potential to emit any air pollutant;
(2) Is regulated or authorized under the OCSLA (*see* 43 U.S.C. §1331 et seq.); and
(3) Is located on the OCS or in or on waters above the OCS.

This definition shall include vessels only when they are:

> (1) Permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources there from, within the meaning of section 4(a)(I) of the OCSLA (*see* 43 U.S.C. §1331 et seq.); or
> (2) Physically attached to an OCS facility, in which case only the stationary source aspects of the vessels will be regulated [*see* 40 CFR § 55.2; *see also* CAA § 328(a)(4)(C) and 42 U.S.C. § 7627].

Section 328 and part 55 distinguish between OCS sources located within 25 nautical miles of a state's seaward boundary and those located beyond 25 nautical miles of a state's seaward boundary [*see* CAA § 328(a)(1); 40 CFR §§ 55.3(b) and (c)]. In this case, Anadarko is seeking a permit for exploratory drilling operations that will be conducted exclusively beyond 25 nautical miles of any state's seaward boundary.

Sources located beyond 25 nautical miles of a state's seaward boundaries are subject to the NSPS in 40 CFR part 60; the PSD pre-construction program in 40 CFR § 52.21, if the OCS source is also a major stationary source or a major modification to a major stationary source; standards promulgated under section 112 of the CAA, if rationally related to the attainment and maintenance of federal and state ambient air quality standards or the requirements of part C of title I of the CAA; and the title V operating permit program in 40 CFR part 71. *See* 40 CFR §§ 55.13(a), (c), (d)(2), (e), and (f)(2), respectively. The applicability of these requirements to Anadarko's exploratory drilling program is discussed below.

The OCS regulations also contain provisions related to monitoring, reporting, inspections, compliance, and enforcement. *See* 40 CFR §§ 55.8 and 55.9. Sections 55.8(a) and (b) provide that all monitoring, reporting, inspection, and compliance requirements of the CAA apply to OCS sources. These provisions, along with the provisions of the applicable substantive programs listed above, provide authority for the monitoring, recordkeeping, reporting, and other compliance assurance measures included in the draft permit.

4.3 Prevention of Significant Deterioration (PSD)

The PSD program, as set forth in 40 CFR § 52.21, is incorporated by reference into the OCS Air Regulations at 40 CFR § 55.13(d)(2), and is applicable to major OCS sources such as this proposed project. The PSD program requires an assessment of air quality impacts from the proposed project and the utilization of BACT as determined on a case-by-case basis taking into account energy, environmental, and economic impacts, as well as other costs.

Under the PSD regulations, a stationary source is "major" if, among other things, it emits or has the potential to emit (PTE) 100 ton per year (TPY) or more of a "regulated NSR pollutant" as defined in 40 CFR § 52.21(b)(50); is "subject to regulation" as defined in 40 CFR § 52.21(b)(49); and is one of a named list of source categories. Any stationary source is also considered a major stationary source if it emits or has a PTE of 250 TPY or more of a regulated NSR pollutant. *See* 40 CFR § 52.21(b)(l).

"Potential to emit" is defined as the maximum capacity of a source to emit a pollutant under its physical and operational design. *See* 40 CFR § 52.21(b)(4). In the case of "potential emissions" from OCS sources, 40 CFR part 55 defines the term similarly and provides that:

> *Pursuant to section 328 of the Act, emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source, and while en route to or from the source when within 25 miles of the source, and shall be included in the "potential to emit" for an OCS source. This definition does not alter or affect the use of this term for any other purposes under 40 CFR §§ 55.13 or 55.14 of this*

> *part, except that vessel emissions must be included in the "potential to emit" as used in 40 CFR §§ 55.13 or 55.14 of this part. (40 CFR § 55.2)*

Thus, emissions from vessels servicing or associated with an OCS source that are within 25 miles of the OCS source are considered in determining the PTE or "potential emissions" of the OCS source for purposes of applying the PSD regulations. Emissions from such associated vessels are therefore counted in determining whether the OCS source is required to obtain a PSD permit, as well as in determining the pollutants for which BACT is required.

The drilling vessels and support fleet vessels may contain emission sources that otherwise meet the definition of "nonroad engine" as defined in section 216(10) of the CAA. However, based on the specific requirements of CAA section 328, emissions from these otherwise nonroad engines on subject vessels are considered as "potential emissions" from the OCS source. Similarly, all engines that are part of the OCS source are subject to the requirements of 40 CFR part 55, applicable to the OCS source, including control technology requirements.

Table 4-1 lists the PTE for each regulated NSR pollutant from the proposed project, as well as the significant emission rate for each regulated NSR pollutant. The permit application materials and Section 5.0 of this document contain information regarding the emissions factors used to determine PTE for the project. Emissions from the support vessels servicing the *BlackHawk* were considered direct emissions while within 25 nautical miles of the drilling vessel and are included in the PTE.

The requirements of the PSD program apply to this OCS source if the project PTE is at least 250 TPY for any regulated pollutant. Anadarko's exploration drilling program is a major PSD source because emissions of NO_X and CO exceed the major source applicability threshold of 250 TPY and, thus, is subject to PSD review for CO and NO_X (both as a measured pollutant for NO_2 and ozone and as a precursor to ozone and $PM_{2.5}$). PSD review also applies to PM, PM_{10}, $PM_{2.5}$, and VOC (as a measured pollutant and precursor for ozone), and GHGs because the source is a major source under the PSD regulations and because emissions of these pollutants exceed the respective significant emission rate thresholds. Section 6.0 of this document contains a discussion of the BACT analysis.

Table 4-1 Potential to Emit for Regulated NSR Pollutants

Pollutant	PTE (TPY)	Significant Emission Rate (TPY)	PSD Review Required
CO	540	100	Yes
NO_x[1]	1,447	40	Yes
VOC[2]	171	40	Yes
PM	58	25	Yes
PM_{10}	56	15	Yes
$PM_{2.5}$	56	10	Yes
SO_2[3]	1	40	No
H_2SO_4	0.03	7	No
Pb	0.02	0.6	No
GHGs	125,000	75,000	Yes

[1] NO_x is a measured pollutant for the criteria pollutants ozone and NO_2 and a precursor for ozone and $PM_{2.5}$.
[2] VOC is a measured pollutant and precursor for the criteria pollutant ozone.
[3] SO_2 is a precursor for the criteria pollutant $PM_{2.5}$.

4.4 Title V

The requirements of the title V operating permit program, as set forth in 40 CFR part 71, apply to major OCS sources located beyond 25 nautical miles of any state's seaward boundaries. *See* 40 CFR § 55.13(f)(2). Because the PTE for this project is greater than 100 TPY for NO_X, CO, and VOCs, the project is considered a major source under title V and part 71.

The OCS permit application submitted by Anadarko seeks to obtain a title V operating permit in accordance with 40 CFR § 55.13(f)(2) and 40 CFR part 71 concurrently with the OCS preconstruction permit. Part 71 forms are included in Section 6 of Anadarko's application received on September 5, 2013. The draft permit includes conditions necessary to meet the requirements of the title V operating permit program. For example, the draft permit will include requirements for submittal of annual compliance certifications and annual fee payments (based on actual emissions), as well as monitoring, recordkeeping, and reporting requirements.

4.5 New Source Performance Standards (NSPS)

An OCS source must comply with any NSPS applicable to their source category. *See* 40 CFR § 55.l3(c). In addition, per 40 CFR § 52.21(j)(1), the PSD regulations require that each major stationary source or major modification meet applicable NSPS. A specific NSPS subpart applies to a source based on source category, equipment capacity, and the date when the equipment commenced construction or modification. Potentially applicable NSPS are discussed below.

4.5.1 Subpart IIII

NSPS, 40 CFR part 60, subpart IIII applies to stationary compression-ignition internal combustion engines that commence construction after July 11, 2005, and were manufactured after April 1, 2006. Relevant equipment specifications for the *BlackHawk* and the stimulation vessel are summarized below in Table 4-2 and Table 4-3, respectively. Engines installed on the drillship are subject to the emissions limitations and diesel fuel requirements of subpart IIII.

The life boats (LB-01 through LB-06) and the fast rescue boats (DR-FR-01) are classified as vessels. Therefore, only stationary source aspects are regulated. As they are used for man overboard and emergency escape scenarios, these units do not have any stationary source aspects and are not subject to subpart IIII.

The *BlackHawk* will have third party engines onboard, and the third party stimulation vessel will be equipped with eight pump engines all of which could be subject to subpart IIII. Anadarko used representative worst-case engines for all unknown engines, and therefore could substitute engines with equal or lesser emissions. Anadarko will use new engines where available, and has identified which third party engines could be subject to this subpart. Since Anadarko used representative engines for all unknown engines, they must notify the EPA prior to use of any new, modified, or reconstructed engine intended to be used or in replacement of any engines identified in Tables 4-2 and 4-3, and shall submit to the EPA a reevaluation of the applicability of pertinent NESHAP and NSPS regulations, as well as copies of the manufacturer engine certification to the EPA standards. The engines that Anadarko identified in their September 2013 application as third party engines (DR-TP-01 through DR-TP-11 and DR-TP17 through DR-TP-21) are EPA Tier 2 certified and are subject to subpart IIII. If the substitute engines are subject to this subpart, Anadarko will comply with all applicable requirements. Anadarko will need to provide the EPA certification indicating that any engines selected meet subpart IIII emissions standards.

The main diesel engines were constructed after the applicability date of July 11, 2005. Therefore, these engines are subject to the emissions limitations and diesel fuel requirements of subpart IIII. This requires compliance with 40 CFR § 94.8 standards for the eight main engines (DR-ME-01 through DR-ME-08), which have a displacement greater than 10 liters per cycle. A NO_X emission limit of 9.69 g/kW-hr and a PM emission limit of 0.15 g/kW-hr are the limits for each 720 rpm engine required under this subpart. These engines are International Maritime Organization (IMO) Tier II certified engines. To demonstrate compliance with the requirements in subpart IIII, Anadarko provided the IMO certification indicating that these engines meet 40 CFR 94.8 emissions standards. The emission standards and requirements in 40 CFR 94.8 correspond to the IMO standards for engines of this size. These standards are applicable when the engines are operating at maximum load. Anadarko will run the engines at the highest achievable load and conduct a stack test to demonstrate compliance.

The emergency air compressor engine (DR-AC-01) is a post-2007 engine and is classified as a nonroad engine subject to emission standards located in 40 CFR part 1039 Table 2, the exhaust opacity limits in 40 CFR 1039.105(b), and the sulfur fuel standard in 40 CFR 80.510(b). To demonstrate compliance, Anadarko provided the EPA Tier 3 certification indicating that this engine meets subpart 1039 emission standards in the supplemental material submitted on November 23, 2013, and found in the Administrative Record, and Anadarko will certify the sulfur fuel content used.

Based on specific engine size, model date, and displacement, 40 CFR part 60 subpart IIII requires the emergency generator (DR-GE-01) to comply with Tier 2 emissions standards for new marine engines as set forth in 40 CFR § 94.8. Compliance with the NSPS specifically requires that this engine be certified to the EPA Tier 2 standards. Since the *BlackHawk* is not a U.S. flagged vessel, it was constructed to different standards. The emergency generator is IMO

Tier II certified. The requirements for an engine the size of the emergency generator in 40 CFR § 94.8 do not incorporate the IMO standard. Since certification is an engine manufacturer process, it is not possible for this engine to obtain an EPA Tier certificate, even with emissions levels that meet the EPA certification requirements. *See* 40 CFR § 60.4211(c). Hence, compliance with the NSPS would require Anadarko to replace this engine with an engine that has been certified to EPA rather than IMO emission standards. Anadarko is requesting exemptions from subpart IIII for the emergency generator engine. Pursuant to 40 CFR § 55.7, the EPA may grant an exemption from a part 55 requirement, if the Administrator or the delegated agency finds that compliance is technically infeasible or will cause an unreasonable threat to health and safety.

The existing emergency generator was sized to meet the drillship's stringent space and weight distribution requirements in the vessel's design phase. Based on consultations with the engine manufacturer and the drillship owner, Anadarko has determined that any replacement engine would have to meet exacting output, weight, physical size, and shape restrictions dictated by the vessel's design constraints. Anadarko was not able to locate replacement engines for this vessel that would meet all the necessary criteria and fit the design footprint of the original engines as summarized in email communications to the EPA dated November 26, 2013, and included in the administrative record. Furthermore, if a suitable replacement engine could be found, replacing this engine would likely require a redesign of the engine bed frame and vessel structural modifications that would subsequently require recertification of the vessel. Based on these source-specific technical barriers, the EPA concludes that replacement of the DR-GE-01 unit for this operating scenario and this project is not technically feasible at this time. Thus, the EPA proposes to grant Anadarko's request for an exemption from subpart IIII.

Any exemption under §55.7 would necessitate compliance with substitute emissions and/or work practice requirements based on the next most stringent standard available. The EPA determined that the next most stringent standards for the DR-GE-01 unit is IMO certification standards for a comparable engine. Detailed information regarding IMO certification standards from the *Regulations for the Prevention of Air Pollution from Ships (Annex VI)* document can be found at the IMO's website, www.imo.org.

An exemption under §55.7 also requires an estimate of residual emissions derived from the difference between the estimated reductions that would be achieved by compliance with the original requirement and the estimated emission reductions that would be achieved by compliance with the proposed substitute requirements. In accordance with 40 CFR § 55.7(e)(3), Anadarko must then obtain emission reductions of a sufficient quantity to offset the estimated residual emissions. Anadarko calculated the differences in emissions that would be achieved by compliance with the original emission standards for each engine versus the estimated emissions from the substitute requirements as provided in the supplemental information submitted on November 11, 2013. As discussed above, the emergency generator engine (DR-GE-01) is a Category 2, commercial marine engine subject to emission standards located in 40 CFR part 94.8 Table A-1. The total residual emissions for the emergency generator are approximately 1.87 tons of NO_X and non-methane hydrocarbons (NMHC) combined (the calculated difference submitted by Anadarko only included NO_X emissions), and approximately 0.047 tons of particulate matter. Potential emissions of CO for the emergency generator are below the Tier 2 standards.

Since this OCS source will be located beyond 25 miles from any States' seaward boundary, the EPA is authorized to determine an adequate emission offset ratio to be protective of State and Federal ambient air quality standards and to comply with part C of title I of the CAA. *See* 40 CFR 55.7(e)(3). With respect to this specific project, the residual emissions are so low as to be essentially equivalent to the original emissions standards. As such, the EPA has determined that, based on currently available data, no emissions offsets will be required at this time. Taking into account the quality of the emissions factors currently available to estimate the substitute emissions and the uncertainty inherent in these estimates, this determination will be revisited by the EPA upon review of project specific operating data from the *BlackHawk* that is required by the draft permit. At that time, if the EPA determines that emissions reductions are appropriate, Anadarko will work with the EPA to identify suitable offsets to satisfy this requirement.

Anadarko must comply with all other applicable requirements of subpart IIII for engines DR-ME-01 through DR-ME-08, DR-AC-01, and DR-GE-01, and third party engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21) including recordkeeping, reporting, and the diesel fuel requirements of 40 CFR § 60.4207. Compliance with these permit requirements and the substitute control requirements will also meet the applicant's obligations for these engines under 40 CFR § 63 subpart ZZZZ, as discussed below in Section 4.6.

Table 4-2 *BlackHawk* Engine Specifications

Emissions Unit ID	Description	Make & Model	Rating[1] (hp)	Manufacture Year
DR-ME-01	Main propulsion generator #1	Hyundai-HiMsen	6,035 hp	2012
DR-ME-02	Main propulsion generator #2	Hyundai-HiMsen	6,035 hp	2012
DR-ME-03	Main propulsion generator #3	Hyundai-HiMsen	6,035 hp	2012
DR-ME-04	Main propulsion generator #4	Hyundai-HiMsen	6,035 hp	2012
DR-ME-05	Main propulsion generator #5	Hyundai-HiMsen	6,035 hp	2012
DR-ME-06	Main propulsion generator #6	Hyundai-HiMsen	6,035 hp	2012
DR-ME-07	Main propulsion generator #7	Hyundai-HiMsen	12,069 hp	2012
DR-ME-08	Main propulsion generator #8	Hyundai-HiMsen	12,069 hp	2012
DR-GE-01	Emergency Generator	Cummins QSK60DMGE	2,547 hp	4/2011
DR-LB-01	Life boat engine #1	Siyang N485-J	41 hp	
DR-LB-02	Life boat engine #2	Siyang N485-J	41 hp	
DR-LB-03	Life boat engine #3	Siyang N485-J	41 hp	
DR-LB-04	Life boat engine #4	Siyang N485-J	41 hp	
DR-LB-05	Life boat engine #5	Siyang N485-J	41 hp	
DR-LB-06	Life boat engine #6	Siyang N485-J	41 hp	
DR-AC-01	Emergency air compressor	Hatz 2M41	39 hp	9/2011
DR-FR-01	Fast rescue craft engine	Sabb-L4 Turbo	55 hp	
Third Party Engines				
DR-TP-01	Third party engine #1	Various-Tier II Certified	≤860 hp	Varies
DR-TP-02	Third party engine #2	Various-Tier II Certified	≤860 hp	Varies
DR-TP-03	Third party engine #3	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-04	Third party engine #4	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-05	Third party engine #5	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-06	Third party engine #6	Various-Tier II Certified	≤ 300 hp	Varies

DR-TP-07	Third party engine #7	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-08	Third party engine #8	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-09	Third party engine #9	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-10	Third party engine #10	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-11	Third party engine #11	Various-Tier II Certified	≤ 300 hp	Varies
DR-TP-12	Third party well evaluation engine #1	Detroit Diesel	≤ 140 hp	Varies
DR-TP-13	Third party well evaluation engine #2	Detroit Diesel	≤ 140 hp	Varies
DR-TP-14	Third party well evaluation engine #3	Detroit Diesel	≤ 140 hp	Varies
DR-TP-15	Third party well evaluation engine #4	Detroit Diesel	≤ 140 hp	Varies
DR-TP-16	Third party well evaluation engine #5	Detroit Diesel	≤ 140 hp	Varies
DR-TP-17	Third party engine #12	Various-Tier II Certified	≤ 126 hp	Varies
DR-TP-18	Third party engine #13	Various-Tier II Certified	≤ 126 hp	Varies
DR-TP-19	Third party engine #14	Various-Tier II Certified	≤ 126 hp	Varies
DR-TP-20	Third party engine #15	Various-Tier II Certified	≤ 126 hp	Varies
DR-TP-21	Third party engine #16	Various-Tier II Certified	≤ 126 hp	Varies

[1] Permit conditions may limit operation to less than rated capacity.

Table 4-3 Stimulation Vessel Engine Specifications

Emissions Unit ID	**Description**	**Make & Model**	**Rating[1] (hp)**	**Manufacture Year**
SV-PE-01	Stimulation Vessel Pump #1	Various	2,250 hp	Varies
SV-PE-02	Stimulation Vessel Pump #2	Various	2,250 hp	Varies
SV-PE-03	Stimulation Vessel Pump #3	Various	2,250 hp	Varies
SV-PE-04	Stimulation Vessel Pump #4	Various	2,250 hp	Varies
SV-PE-05	Stimulation Vessel Pump #5	Various	2,250 hp	Varies
SV-PE-06	Stimulation Vessel Pump #6	Various	2,250 hp	Varies
SV-PE-07	Stimulation Vessel Pump #7	Various	2,250 hp	Varies
SV-PE-08	Stimulation Vessel Pump #8	Various	2,250 hp	Varies

[1] Permit conditions may limit operation to less than rated capacity.

4.5.2 Subpart K

NSPS, 40 CFR part 60, subpart K, applies to petroleum liquids tanks with a capacity of greater than 40,000 gallons that commence construction or modification after March 8, 1974, and prior to May 19, 1978, or have a capacity greater than 65,000 gallons and commence construction or modification after June 11, 1973, and prior to May 19, 1978. All storage tanks on the drilling vessel were constructed after 1978; therefore, they are not subject to subpart K.

4.5.3 Subpart Ka

NSPS, 40 CFR part 60, subpart Ka, applies to petroleum liquids tanks with a capacity of greater than 40,000 gallons that are used to store petroleum liquids and for which construction is commenced after May 18, 1978, and prior to July 23, 1984. All storage tanks on the drilling vessel were constructed after 1984; therefore, they are not subject to subpart Ka.

4.5.4 Subpart Kb

NSPS 40 CFR part 60 subpart Kb applies to each storage vessel with a capacity greater than or equal to 75 cubic meters (m^3) that is used to store volatile organic liquids for which construction, reconstruction, or modification is commenced after July 23, 1984. This subpart does not apply to storage vessels with a capacity greater than or equal to 151 m^3 storing a liquid with a maximum true vapor pressure (TVP) less than 3.5 kilopascals (kPa) or with a capacity greater than or equal to 75 m^3 but less than 151 m^3 storing a liquid with a maximum true vapor pressure less than 15.0 kPa. As indicated in the application materials, all storage tanks were constructed after 1984. However, none of the fuel tanks included in the permit application are subject to subpart Kb because each tank has a capacity less than 75 m^3 or the liquid contained in them has a vapor pressure less than 3.5 kPa. This subpart also does not apply to condensate storage tanks that have a volume less than 1,589.874 m^3, if condensate is stored prior to custody transfer. None of the condensate storage tanks included in the permit application are subject to subpart Kb because each tank has a capacity less than 1,589.874 m^3 and the condensate will be stored prior to custody transfer. These parameters exempt the storage tanks from this subpart.

4.5.5 Subpart Dc

NSPS, 40 CFR part 60, subpart Dc, applies to owners and operators of steam generating units for which construction, modification, or reconstruction commenced after June 9, 1989, and that have a maximum heat input design capacity of 29 megawatts (MW) (100 million British thermal units per hour (MMBtu/hr)) or less but greater than or equal to 2.9 MW (10 MMBtu/hr). The proposed flowback boiler will be an 8 MMBtu/hr "SIGMA FIRED" SF-200SE flowback boiler, or equivalent, and is therefore not subject to subpart Dc.

4.6 National Emission Standards for Hazardous Air Pollutants (NESHAP)

Applicable NESHAP promulgated under section 112 of the CAA apply to OCS sources if rationally related to the attainment and maintenance of federal and state ambient air quality standards or the requirements of part C of title I of the CAA. *See* 40 CFR § 55.13(e).

NESHAP regulations set forth in 40 CFR part 63 apply to a source based on its source category listing. Many part 63 NESHAPs apply only if the affected source is a "major source" as defined in Section 112 and 40 CFR § 63.2. A "major source" is generally defined as a source that has a PTE of 10 tons per year or more of any single hazardous air pollutant (HAP) or 25 tons per year or more of all HAP combined. *See* section 112(a)(1) and 40 CFR § 63.2. An area source is any source that is not a major source as defined in section 112(a)(2) and 40 CFR § 63.2. Anadarko has estimated emissions of less than 25 TPY for all HAP combined and less than 10 TPY for each individual HAP. This makes the project an area source of HAPs.

4.6.1 Subpart ZZZZ

NESHAP, 40 CFR part 63, subpart ZZZZ, applies to stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. The regulations establish different standards for new and existing sources pursuant to CAA section 112. Area source engines rated above 500 hp that are constructed after December 19, 2002, and engines with a rating of 500 hp or less that are constructed after June 12, 2006, are considered "new" reciprocating internal combustion engines (RICE).

The drillship emergency air compressor (DR-AC-01) has a horsepower rating of 39 hp and was constructed after the June 12, 2006 applicability date. The drillship main engines (DR-ME-01 through DR-ME-08) and the drillship emergency generator (DR-GE-01) installed on the *BlackHawk* drillship were also constructed after June 12, 2006. In addition, the third party engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21) will be EPA Tier 2 certified and compliant with 40 CFR subpart IIII. Therefore, 40 CFR 63 subpart ZZZZ requires that these engines comply with the requirements of 40 CFR 60 subpart IIII as discussed above in Section 4.5.1. No further requirements under subpart ZZZZ apply to these engines.

The third party well evaluation engines and the stimulation vessel pump engines are existing non-emergency engines that were not constructed after the applicability dates, and must comply with the management practices as defined in 40 CFR § 63.6603. These management practices for the stimulation vessel pump engines are found in 40 CFR § 63.6603(c) and include:

- Change oil every 1,000 hours of operation or annually, whichever comes first. Or, utilize an oil analysis program as prescribed in 40 CFR § 63.6625(i) in order to extend the specified oil change requirement;
- Inspect and clean air filters every 750 hours of operation or annually, whichever comes first, and replace as needed;
- Inspect fuel filters and belts, if installed, every 750 hours of operation or annually, whichever comes first, and replace as needed; and
- Inspect all flexible hoses every 1,000 hours of operation or annually, whichever comes first, and replace as needed.

The management practices for the third party well evaluation engines are in Table 2d to this subpart and include:

- Change oil and filter every 1,000 hours of operation or annually, whichever comes first. Or, utilize an oil analysis program as prescribed in 40 CFR § 63.6625(i) in order to extend the specified oil change requirement;
- Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first, and replace as necessary; and
- Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.
- During periods of startup, minimize the engine's time spent at idle and minimize the engine's startup time at startup to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time the non-startup emission limitations apply.

Additionally, pursuant to 40 CFR § 63.6655 and 40 CFR § 63.6660, records of the above management practices must be maintained in readily-accessible, hard, or electronic form for at least five years following the date of each maintenance activity.

Emissions from the escape capsule engines and the fast rescue craft on the *BlackHawk* were included in the OCS source's PTE and emissions modeling, as required by 40 CFR part 55. These vessels are also subject to operating limits, and to monitoring, recordkeeping, and reporting requirements to ensure they will not exceed the potential emissions assumed in the application and impact review. However, these units do not have any stationary source aspects, as they are used for man-overboard and emergency escape scenarios, and are therefore not subject to subpart ZZZZ standards.

4.6.2 Subpart HHHHHH

NESHAP, 40 CFR part 63, subpart HHHHHH, applies to paint stripping and miscellaneous surface coating operations performed at area sources of HAP emissions. This project is considered an area source, as explained above. The spray painting operation performed on the drillship is part of the routine maintenance to protect the vessel from the marine environment. This activity meets the definition of "facility maintenance" provided in 40 CFR 63.11180 and, therefore, the spray painting operations on the drillship are not subject to subpart HHHHHH pursuant to 40 CFR 63.11170.

4.6.3 Subpart XXXXXX

NESHAP, 40 CFR part 63, subpart XXXXXX, applies to HAPs emitted from miscellaneous metal fabrication and finishing operations performed at area sources of HAP emissions. This project is considered an area source, as explained above. The welding operation performed on the drillship is part of the routine maintenance. This activity meets the definition of "facility maintenance" provided in 40 CFR 63.11522 and, therefore, the proposed welding operations on the drillship are not subject to subpart XXXXXX pursuant to 40 CFR 63.11514.

5.0 Project Emissions

This section describes the emission calculation basis for each emission source. The total projected emissions are based on estimations of the worst-case total fuel consumption for the drillship, support vessels, and well evaluation vessels. The emission factors are based on stack tests, AP-42, EPA publications, IMO and EPA nonroad engine emission tier limits, analysis of fuel sulfur content, vendor-supplied emissions factors, fuel mass balance, NSPS, BOEM guidance document, EPA's TANKS 4.09d program, and material safety and data sheets.

At the time of the application, Anadarko did not know the exact specifications for equipment leased from third party vendors. Therefore, Anadarko used the worst-case emission units for each category of air pollutant sources when calculating the PTE. These worst-case, or "equivalent," units will have equal or lower mass emissions to what was estimated for each criteria, toxic, and other regulated air pollutants on a short-term and long-term basis. The units that Anadarko identified with this description include: third party engines (DR-TP-01 through

DR-TP-21), supply boats, stimulation vessel, well evaluation vessel, tug boat, barge, and other miscellaneous sources (painting, welding, etc.).

During the drilling, well completion, and maintenance phases, various operating scenarios can occur, including but not limited to, the following:

- Worst-case gas well flowback;
- Worst-case oil well flowback;
- Worst-case stimulation vessel operations;
- Well completion third party equipment;
- Well evaluation vessel operations; and
- Worst-case drilling.

The emissions of any one scenario or combination of scenarios at a given time will not exceed the worst-case emissions calculated. Anadarko calculated the PTE for each of the scenarios listed above. The emission calculations determined that the highest PTE will result during the worst-case oil well flowback scenario for all pollutants except for NO_x, which will have the highest PTE during the well evaluation vessel operations. The discussion that follows is based on the worst-case scenario, and detailed calculations for the alternative scenarios are provided in Appendix B of the September 2013 application and in the supplemental information submitted in August 2014. These documents are located in the administrative record as referenced in Section 9 of this document.

Anadarko has proposed to only use ultra-low sulfur diesel fuel for all diesel emission units and ancillary vessels. The sulfur content of ultra-low sulfur diesel fuel is defined as a maximum sulfur content of 15 parts per million (ppm). Sulfur dioxide (SO_2) and sulfuric acid (H_2SO_4) emissions were calculated by a mass balance method. Based on a draft EPA document, EPA 420-R-03-008 titled "Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines" dated April 2003, Anadarko used a 98% conversion factor for SO_2 formation during diesel fuel combustion, with the other 2% of the sulfur assumed to be converted to sulfuric acid (H_2SO_4). The H_2SO_4 emissions were assumed to condense to form total reduced sulfur (TRS) particulate matter, primarily as sulfates in the atmosphere. Since the total amount of H_2SO_4 was calculated at 1.02 TPY, the potential TRS PM contribution is minimal.

5.1 *BlackHawk* Main Propulsion Electric Generator Engines (DR-ME-01 through DR-ME-08) and Emergency Generator (DR-GE-07) Analysis

Eight main engines provide power to the drilling vessel: six Hyundai-HiSen 9H32/40 diesel generators with a rated power output of approximately 6,035 hp each and two Hyundai-HiSen 18H32/40V diesel generators with a rated power output of approximately 12,069 hp each.

The Cummins QSK60-DM HPI emergency generator diesel engine, rated 2,547 hp, provides emergency power to the drilling vessel and is run periodically to ensure the engine will operate properly in the event of an emergency.

Anadarko proposed a drillship-wide fuel limit derived from the main engine fuel based emission factors. Emissions estimates for the *BlackHawk*'s main engines and emergency generator were based on an average fuel consumption of 112 cubic meters/day. This fuel limit is the highest fuel limit of all six scenarios. This results in an annual fuel limit of 18,438 cubic meters/year, which is equal to approximately 200 days per year of 24 hour per day operation and a power requirement of 86,400,00 kW. This will limit the maximum total emissions from the drillship.

5.2 *BlackHawk* Small Engines, Third Party Engines, and Miscellaneous Emission Sources Analysis

The following is a description of the additional emission units and the basis of the worst-case usage estimates for each engine:

Unit ID: Emergency Air Compressor Diesel Engine (DR-AC-01)

For the HATZ 2M41 air compressor rated at 39 hp, calculations are based the hourly and annual emissions operating at 100% load for a maximum of 100 hours per year per engine.

Unit ID: Life Boat Diesel Engines (DR-LB-01 through DR-LB-06)

The six SIYANG 485-J life boat engines rated at 41 hp are operated during maintenance and safety checks and in the event of an emergency. Non-emergency, planned operation time of a maximum of 1 hour per day for each engine was used for the emission calculations. The maximum annual emissions were calculated based on operating for a maximum of 100 hours per year per engine.

Unit ID: Fast Rescue Craft (DR-FR-01)

The SABB-L4 engine rated at 55 hp in the fast rescue boat is operated during maintenance checks, safety checks, and in the event of an emergency. Non-emergency, planned operation time of 1 hour per day was used for the emission calculations. The hourly and annual emissions were calculated based on operating 100 hours year per.

Unit ID: Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)

These units are portable and brought on the drillship as needed by a third party supplier. The exact engines available for use during the project had not been identified at the time of the application submittal. The worst-case engines listed below were chosen to calculate emissions and the potential to emit, since they represent engines that have both the most recent available technology, but are also the largest engines that will perform the required function. Any replacement engines for the project will meet the equivalent or a higher EPA Tier standard. These engines will be EPA Tier 2 certified, and the engines were grouped in the following categories:

- Third Party Engines ≤ 860 hp (DR-TP-01 and DR-TP-02)
- Third Party Engines ≤ 300 hp (DR-TP-03 through DR-TP-11)
- Third Party Engines ≤ 126 hp (DR-TP-17 and DR-TP-21)

The estimated annual emissions used 4,800 hours per year of operation per engine.

Unit ID: Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)

These units are portable and brought on the drillship as needed by a third party supplier. The exact engines available for use during the project had not been identified at the time of the application submittal. These units may be used on the drillship or the supply boat. These engines will be rated less than or equal to 140 hp and each engine will operate a maximum of 125 hours per year.

Unit ID: Tanks (DR-FT-01 through DR-FT-19)

Emissions are generated from the storage of diesel fuel (17 tanks) and helicopter fuel in tanks (2 tanks). The EPA TANKS 4.09d computer software program was used to calculate VOC emissions, using the properties of distillate fuel oil number 2 for diesel and Jet Napthha (JP-4). The average fuel usage for the drillship is 112 cubic meters/day; however, a throughput more than twice as large was used as a conservative assumption.

Unit ID: Condensate Tanks (DR-TP-24 through DR-TP-26)

The condensate stabilization process reduces the vapor pressure of the condensate liquids. This process separates the very light hydrocarbon gases from the heavier hydrocarbon components. Vapors produced from condensate stabilization are flared through the boom flare and these flash emissions are negligible. The stabilized condensate moves to the condensate storage tanks, and this fuel generates emissions. The EPA TANKS 4.09d computer software program was used to calculate VOC emissions, using the default TANKS properties for Gasoline RVP 13. Maximum hourly emissions were calculated for the month of June, which is the month with the historic highest emissions, and a throughput equal to twice the fuel usage was used as a conservative measure.

Unit ID: Mud Degassers (DR-VG-01 through DR-VG-04)

The *BlackHawk* has four mud degassers onboard. Two of the degassers are equipped with Burgess Magna-Vac vacuum degassers and two are equipped with Hampco degassers that are vertical separators that contain baffles. Drilling mud cools and lubricates the drill bit during the drilling process. When the drilling mud resurfaces it could contain hydrocarbons. Once the mud reaches the surface, it will off gas generating VOC emissions. The emission factor was based on a study commissioned by the BOEM, *Year 2005 Gulfwide Emission Inventory Study*, to develop a weighted average. The maximum hourly emissions per day are based on the expected ratio of annual throughputs of synthetic based muds and the BOEM study. Annual emissions were estimated using pounds per day emissions factors and 4,800 hours of operation per year.

Unit ID: Dust Collectors (DR-DC-01 through DR-DC-04)

Dry mud and cement are mixed with water to be used in drilling operations. Particulate matter in the form of dust is generated and controlled by using a dust collector. The drillship will have three National Oilwell Varco dust collectors and one Vortex Ventures dust collector. The $PM/PM_{10}/PM_{2.5}$ maximum hourly emission rate was calculated using a 0.00099 lbs/ton emission factor. The annual emissions were calculated based on 4,800 hours of operation.

Unit ID: Welding Operations (DR-WO-01)

Welding occurs on the *BlackHawk* as part of maintenance activities and generates $PM/PM_{10}/PM_{2.5}$ and HAP emissions. Emissions were calculated using 80 pounds per day of welding rods for 4,800 hours per year and 200 days per year.

Unit ID: Painting Operations (DR-PO-01)

Painting occurs on the *BlackHawk* as part of maintenance activities, and generates $PM/PM_{10}/PM_{2.5}$, VOC, and HAP emissions. Anadarko will use a combination of air assisted and airless spray guns for different proposed painting operations. The calculations used an air assisted spray gun with 30% transfer efficiency. However, Anadarko may use an airless spray gun with a 50% transfer efficiency during operations. Anadarko will use both paint and thinner. The emission calculations used 5,200 and 1,300 gallons of paints and thinner. The particulate matter emissions were calculated by multiplying by a fall-out factor. This fall-out factor assumes that the majority of emissions will settle, and only a portion of the emissions will become airborne particulate matter.

Unit ID: Fugitive Emissions from Diesel Fuel Lines (DR-FE-01)

Fugitive emissions are emitted from the diesel fuel lines. The component count is based on the number of diesel fuel valves, which was estimated from Table 2-4 of the EPA Protocol for Equipment Leak Emission Estimates. The connector count is a factor of the valve count, for a total of 484 connectors, 152 valves, and 16 pump seals.

Unit ID: Flowback Boiler (DR-TP-22)

The SIGMA FIRED SF-200SE, 8 MMBtu/hr flowback boiler will operate a maximum of 1,152 MMBtu/year based on 144 hours of annual operation during well completion activities.

UNIT ID: Boom Flare (DR-TP-23)

During well completion activities Anadarko may use a gas fired boom flare capable of processing 60 MMScf/day or 360 MMScf/year. The applicant estimated a typical VOC reduction efficiency of 98%. The Boom Flare will generate emissions of $PM/PM_{10}/PM_{2.5}$, CO, VOC, NO_x, SO_2, and GHGs.

5.3 Support Vessel Analysis

Various vessels that service the drilling vessel will generate emissions. These support vessels will transport personnel and supplies as required. The availability of specific support vessels during drilling operations was not known at the time of the application as outside vendors supply these units. The modeling calculations, described in Section 7.0, used one support vessel to estimate emissions, as described in the supplemental material submitted on February 7, 2014. The permit limits the fuel use of all support vessels to 200 barrels per day (bbl/day) and 40,000 barrels per year (bbl/year), to ensure that the emissions from all support vessels will not exceed those modeled. However, the descriptions below list the estimated fuel and hourly consumptions used to derive the PTE, and these PTE numbers are not reflected in the permit.

5.4 Supply Boat Analysis

Anadarko selected the largest expected supply boat (*HOS Coral*) as a worst-case basis for emissions calculations. The emissions the supply boat will generate within a 25 nautical mile radius of the *BlackHawk* are based on a fuel operating limit. Anadarko calculated their hourly usage to determine that the supply boat will consume 200 bbl/day or 40,000 bbl/year of diesel fuel.

5.5 Tug Boat Analysis

Various tug boats used during well completion activities will generate emissions. The availability of specific tug boats during well completion operations was not known at the time of the application as outside vendors supply these units.

Anadarko selected the largest expected tug boat as a worst-case basis for emissions calculations. The emissions that the operation of the tug boat will generate within a 25 nautical mile radius of the *BlackHawk* are based on a fuel operating limit. Anadarko calculated their hourly usage to determine that the tug boat will consume 125 bbl/day or 25,000 bbl/year of diesel fuel.

5.6 Barge Analysis

Various barges used during well completion activities will generate emissions. The availability of specific barges during well completion operations was not known at the time of the application as outside vendors supply these units.

Anadarko selected the largest expected barge as a worst-case basis for emissions calculations. The emissions that the operation of the barge will generate within a 25 nautical mile radius of the *BlackHawk* are based on the hourly operation of three electric generator engines rated at 456 hp (BG-LP-01 through BG-LG-03). These engines will operate 4,800 hours per year per engine.

5.7 Stimulation Vessel Analysis

Various stimulation vessels used during well completion activities will generate emissions. The availability of specific stimulation vessels during well completion operations was not known at the time of the application as outside vendors supply these units.

Anadarko selected the largest expected stimulation vessel as a worst-case basis for emissions calculations. The emissions that the operation of the stimulation vessel will generate within a 25 nautical mile radius of the *BlackHawk* are based on a fuel operating limit. Anadarko calculated their hourly usage to determine that the stimulation vessel will consume 225 bbl/day or 4,725 bbl/year of diesel fuel.

5.8 Well Evaluation Vessel Analysis

Well evaluation vessels used during well completion activities will generate emissions. The availability of specific well evaluation vessels during well completion operations was not known at the time of the application as outside vendors supply these units.

Anadarko selected the largest expected well evaluation vessel as a worst-case basis for emissions calculations. The emissions that the operation of the well evaluation vessel will generate within a 25 nautical mile radius of the *BlackHawk* are based on a fuel operating limit. Anadarko calculated their hourly usage to determine that the tug boat will consume 144 bbl/day or 28,800 bbl/year of diesel fuel.

Detailed emission factors for these sources are available in the application materials, which are included in the administrative record referenced in Section 9.0 of this document.

5.9 Compliance Methodology

Anadarko proposed a parametric emissions monitoring system (PEMS) in their September 2, 2014 submittal for the main diesel engines. This PEMS can monitor NO_x, CO, and O_2 in ppm. CO_2 emissions will be calculated from measured O_2 to comply with the GHG BACT limit. This system measures emissions in ppm which Anadarko will convert to g/KW-hr or lb/hr to demonstrate compliance with the respective BACT limits using the engine power output and flow rate. The proposed PEMS records the electric kilowatt power output and Anadarko will convert it to mechanical kilowatts. The system does not measure flow rate; therefore, Anadarko will conduct stack tests to measure the flow rate and then graph the engine flow rate vs. engine load. The PEMS will also monitor NO_x, CO, and O_2 once an hour and Anadarko will perform weekly calibrations. The PEMS cannot monitor VOC and particulate matter emissions. Anadarko will conduct a stack test and monitor the engine load in order to determine ongoing compliance with VOC and PM emissions.

The compliance demonstration method for the emergency generator diesel units (DR-GE-01), the emergency air compressor engine (DR-AC-01), the life boat engines (DR-LB-01 through DR-LB-06), the fast rescue craft (DR-FR-01), the simulation vessel pump engines (SV-PE-01 through SV-PE-08), the third party diesel engines (DR-TP-01 through DR-TP-21), and the flowback boiler (DR-TP-22) will include monitoring and maintaining a contemporaneous record of the hours of engine operation using an engine hour meter or log of operating hours. These units must also meet any applicable NSPS and NESHAP monitoring requirements.

The non-combustion units, the dust collectors (DR-DC-01 through DR-DC-04), the boom flare (DR-TP-23), painting operations (DR-PO-01), and welding operations (DR-WO-01), will demonstrate compliance through such methods as proper maintenance, the amount and type of relevant material consumed, and or recording the amount of time the equipment is used,.

Compliance demonstration for the support vessels as specified in the draft permit shall include monitoring and maintaining a contemporaneous record of operating and standby time within the 25 mile radius of the drilling vessel, barrels of diesel fuel on the support vessel entering the 25 mile radius, and barrels of diesel fuel on the support vessel exiting the 25 mile radius, and determining and recording the sulfur content upon receiving each fuel shipment.

Anadarko will supply the EPA with all records upon request. In addition, Anadarko will provide a semi-annual report of its emissions information and calculations in accordance with all relevant permit conditions.

6.0 Best Available Control Technology (BACT) and Recordkeeping Requirements

A new major stationary source subject to PSD requirements is required to apply BACT for each pollutant subject to regulation under the CAA that it has the potential to emit in amounts equal to or greater than the pollutant's significant emission rate. *See* 40 CFR § 52.21(j). Based on the emission inventory for the project, presented in Table 4-1 of the preliminary determination, NO_X, CO, VOC, $PM/PM_{10}/PM_{2.5}$, and GHGs are the CAA-regulated pollutants that will be emitted by Anadarko in quantities exceeding the respective significant emission rate. Therefore, BACT must be determined for each emission unit on the drillship *BlackHawk* that emits these pollutants while operating as an OCS source and the stimulation vessel pump engines.

The life boats and the fast rescue boat are included in the OCS source's PTE and emissions modeling, as required by 40 CFR part 55, and are subject to operating limits, monitoring, recordkeeping and reporting requirements to ensure they will not exceed the potential emissions assumed in the application and impact review. Vessels operating within 25 miles of the OCS source are not subject to BACT requirements unless they are attached to the OCS, and then only the stationary source aspects of the vessel are regulated. *See* 40 CFR § 55.2. These units do not have any stationary source aspects as they are used for man overboard and emergency escape scenarios only.

BACT is defined in the applicable permitting regulations at 40 CFR § 52.21(b)(12), in part, as:

> an emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event, shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61. If the Administrator

> determines that technological or economic limitations on the application of measurement technology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. The CAA contains a similar BACT definition, although the 1990 CAA amendments added "clean fuels" after "fuel cleaning or treatment" in the above definition. *See* CAA § 169(3).

On December 1, 1987, the EPA issued a memorandum describing the top-down approach for determining BACT. Memorandum from J. Craig Potter, Assistant Administrator for Air and Radiation, to the EPA Regional Administrators regarding Improving New Source Review (NSR) Implementation (Dec. 1, 1987). In brief, the top-down approach provides that all available control technologies be ranked in descending order of control effectiveness. Each alternative is then evaluated, starting with the most stringent, until BACT is determined. The top-down approach consists of the following steps:

Step 1: Identify all available control technologies.

Step 2: Evaluate technical feasibility of options from Step 1 and eliminate options that are technically infeasible based on physical, chemical, and engineering principles.

Step 3: Rank the remaining control technologies from Step 2 by control effectiveness, in terms of emission reduction potential.

Step 4: Evaluate the most effective controls from Step 3, considering economic, environmental and energy impacts of each control option. If the top option is not selected, evaluate the next most effective control option.

Step 5: Select BACT (the most effective option from Step 4 not rejected).

Below is a summary of the EPA's top-down BACT analysis for the *BlackHawk* and the equipment that is part of the OCS source during the well completion activities.

6.1 BACT Analysis for Internal Combustion Engines

The following large internal combustion engines (i.e., engines greater than 500 hp), on *BlackHawk* are included in this section of the BACT analysis: eight (8) main diesel engines (DR-ME-01 through DR-ME-08) and one (1) emergency generator (DR-GE-01). The following engines on the stimulation vessel are also included in this section and are considered large internal combustion engines: eight (8) stimulation vessel pump engines (SV-PE-01 through SV-PE-08).

The main diesel engines will not produce emissions at a steady rate. These engines operate at variable load based on drilling and operational power demand. The emergency generator engine will be tested periodically but not operated continuously. In addition, engine efficiency and performance typically degrade over time, resulting in increased emissions. These factors are important considerations in the BACT analysis for these units.

The following small internal combustion engines (i.e. engines less than 500 hp), on *BlackHawk* are included in this section of the BACT analysis: one (1) emergency air compressor engine (DR-AC-01), and (5) third party engines (DR-TP-12 through DR-TP-16). The temporary EPA Tier 2 certified third party engines onboard the *BlackHawk* consist of three types of engines, those rated less than or equal to 860 hp, 300 hp, or 126 hp. Therefore, these engines will consist of both small and large engines. The applicant identified available control technologies in the BACT analysis as if all engines are large engines. These engines include DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21.

6.1.1 NO_X BACT Analysis for all Internal Combustion Engines

NO_X emissions are generated as both a result of high temperature combustion (thermal NO_X) and oxidation of nitrogen present in the fuel (fuel-bound NO_X). Thermal NO_X emissions increase with an increase in combustion temperature, and are generally the main cause of NO_X emissions from a combustion source.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their OCS permit application submitted in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Selective Catalytic Reduction (SCR) (on the Large Internal Combustion Engines and Third Party Engines);
2. Selective Non-Catalytic Reduction (SNCR) (on the Large Internal Combustion Engines and Third Party Engines);
3. Direct Water Injection;
4. Exhaust Gas Recirculation System;
5. Derating of Existing Engines;
6. Water-in-Fuel Emulsions;
7. Intake Air Humidification/Cooling;
8. NO_X Absorber/Scrubber Technology;
9. $CSNO_x$ Emissions Abatement System (on the Large Internal Combustion Engines and the Third Party Engines);
10. Replacement of Older Engines with Newer Engines to Meet Higher EPA Tier Standard;
11. Camshaft Replacement/Retooling of Engines;
12. Lean De-NO_X Catalyst or Hydrocarbon SCR;
13. Low NO_x Engine (LNE) Design (Turbocharger with Aftercooler and High Injection Pressure System);
14. Performance Management including a Parametric Emission Monitoring System (Main Engines Only);

15. 4-Way Catalyst Converter;
16. Ignition Timing Retard; and
17. Good Combustion Practices.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

Step 2: Eliminate technically infeasible control options

After analyzing the 17 control technology options identified for the large diesel internal combustion engines, 13 of the options were eliminated as technically infeasible for all of the large diesel engines for the control of NO_X emissions (options 1 through 9, 11, 12, 15, and 16). Item 10 is technically feasible for the stimulation vessel pumps only, while item 14 only applies to the main generator engines.

After analyzing the 13 control technology options identified for the small internal combustion engines, 10 of the options were eliminated as technically infeasible for the control of NO_X emissions from all small diesel internal combustion engines (options 3 through 8, 12, 13, 15, and 16). Camshaft Replacement/Retooling of Engines, item 11, is technically feasible for only the well evaluation engines.

Below is a summary of the reasons for eliminating each of these options from further consideration in the top-down BACT analysis for this project. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

SCR (on the Large Internal Combustion Engines and Third Party Engines):
This option is technically infeasible due to limited space availability for the SCR unit and the necessary ancillary equipment (*e.g.*, urea storage tanks). The emergency diesel engine, third party engines, and the stimulation vessel pump engines will not operate for time periods long enough for the catalyst to reach its working temperature. The EPA agrees that this control technology is not technically feasible in this instance.

SNCR (on the Large Internal Combustion Engines and Third Party Engines): This technology requires the temperature of the exhaust gas to be greater than 1,700° Fahrenheit. The main and emergency diesel engines will operate at temperatures in the range of 329-365° F, which is below the SNCR operating range. In addition, this technology is not feasible due to limited space available for urea storage and other ancillary equipment.

Direct Water Injection: This technology is in development stages for marine applications and cannot be used at low loads (30-40%), which is within the planned operating loads for the main engines on the drillship. Also, this technology is in the development stages for marine applications, and is not feasible for smaller engines. The technology will require additional unavailable space for freshwater tanks. Injecting water into the engine increases the potential for engine damage as water may contact the combustion cylinder surface causing disintegration of lubricating oil film. This technology could also decrease the available power, which would cause a safety risk on the drillship.

Exhaust Gas Recirculation System: The technology is in development stages for marine applications and has primarily been applied to smaller high speed diesel engines (cars and trucks). In addition, use of EGR can reduce engine power output which can hinder safe drilling operations.

Derating of Existing Engines: This option is technically infeasible for all engines because it reduces peak power available for the engines, which is required to perform necessary operations, and thus impairs the ability to safely maintain the vessel's position and perform other functions related to drilling operations. Furthermore, the emergency generator will need to be able to operate at peak power when the main engines are inoperable.

Water-in-Fuel Emulsions: This technology would require derating of the engines (see above), and emulsified diesel in marine vessels can cause fuel tank corrosion issues. Additionally, emulsified fuel systems were designed for and installed on slow-speed engines burning heavy fuel oil. The existing engines on the *BlackHawk* and the pump engines on the stimulation vessel are designed and will be burning medium density diesel fuel. Installing an untested emulsified fuel system designed for heavy fuel oil use on the existing engines increases the potential for mechanical failure and poses a safety risk. In addition, this technology requires the installation of a mixing tank that would require significant retrofitting to the vessel, and also need to be pressurized. The pressurized fuel would increase pressure head that already exists in the fuel lines, and these lines could potentially fail.

Intake Air Humidification/Cooling: Humidification can require additional storage capacity for freshwater that is not available on the drill rig or stimulation vessel. Additionally, for the main diesel engines, heat input is required to produce high volumes of humid air, and at low loads the engines may not be able to produce a significant amount of heat making it difficult to control humidity.

NO_X Absorber/Scrubber Technology: This technology has been used primarily for on-road diesel applications or off-road applications for smaller engines such as backhoes, graders, and wheel loaders. In addition, this technology has not been demonstrated for use on comparable marine vessels or engines, and is still in the developmental stage.

CSNOx (on the Main Diesel Generator Engines): This technology is not in the commercial resale stage of development. In addition, this technology has not been demonstrated for engines operating at variable loads.

Replacement of Old Engines with New Engines (for the Main Diesel Generator Engines, the Emergency Generator, the Emergency Air Compressor Engine, the Third Party Engines, and Third Party Well Evaluation Engines): The main diesel generator engines currently meet the highest IMO Tier II standard available which is equal to the EPA Tier 2 (40 CFR Part 1043) standards for NO_x.

The drillship emergency generator currently meets the highest IMO Tier II certified rating. This engine is not EPA Tier certified, see Section 6.5.1, but it is the highest rated available engine.

The emergency air compressor engine currently meets the highest EPA Tier 3 standard.

The cleanest available third-party engines include EPA Tier III or Tier IV engines; however, these engines, at most, comprise 20% of the available inventory. Proposed drilling plans change on short notice, and require contracts within short timeframes. The vendors do not have their entire inventory available within these time constraints; therefore, they cannot guarantee the cleanest engines when the percentage of their inventory is this low.

The five third party well evaluation engines are pre-1998 engines and are not certified to any tier standard. These engines require deepwater, high-pressure, ratings. Currently only one vendor offers this technology and this vendor does not have any EPA Tier certified engines.

Camshaft Replacement/Retooling of Engines (Excluding Third Party Well Evaluation Engines): These retooling kits are only available for Detroit Diesel engines. This option has not yet been developed for larger engines (*e.g.*, 4-stroke); therefore, it is not technically feasible for all engines except the well evaluation engines that meet these requirements.

Lean De-NO_X Catalyst or Hydrocarbon SCR: According to the technology provider (Johnson Matthey Catalyst), this technology is not available for marine engines. This system also operates best at constant loads and is therefore not amenable for the main diesel engines or for the long periods of engine idle experienced by the emergency generator and the pump engines on the stimulation vessel.

LNE Design (on the Emergency Air Compressor Engine, Third Party Engines, Third Party Well Evaluation Engines, and Stimulation Vessel Pumps): This technology is intrinsic to an engine and retrofitting these engines is not feasible.

4-Way Catalyst Converter: The engines onboard the *BlackHawk* and the pump engines cannot sustain constant steady state loads and exhaust temperatures to sustain high catalyst performance. Non-combustible chemical elements present in engine lube oils may collect over time and damage the catalyst. This technology is not available for the engines onboard the *BlackHawk* and the pump engines on the stimulation vessel.

Sea Scrubber: This technology has not been tested on engines that operate at variable load or intermittently.

Ignition Timing Retard: This technology is infeasible due to intrinsic engine design, and will reduce engine power and combustion hindering stability.

The EPA agrees with the applicant that these control technologies are not technically feasible for the reasons discussed above.

Step 3: Rank the remaining control technologies by effectiveness

The control options not eliminated as technically infeasible in Step 2 of the top-down BACT analysis were then ranked by effectiveness. Table 6-1 lists the remaining control technologies that have not been ruled out as technically infeasible options ranked by effectiveness for the engines on the drilling vessel and the pump engines on the stimulation vessel.

Additional information regarding maintenance procedures and schedules are provided in Appendix G of the September 2013 application.

Table 6-1: Step 3 - NO_x Control Technologies Ranked by Effectiveness

Engine	Rank	Control Description	NO_x Control Effectiveness
Main Diesel Engines (DR-ME-01 through DR-ME-08)	1	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure with Performance Management and Parametric Emissions Monitoring System (PEMS)	45%
	2	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure	30%
	3	Good Combustion Practices/Engine Maintenance	Baseline
Emergency Generator Diesel Engine (DR-GE-01)	1	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure	30%
	2	Good Combustion Practices	Baseline
Emergency Air Compressor Engine (DR-AC-01)	1	EPA 40 CFR part 1039 Tier 3 Certified Engine	-[b]
	2	Good Combustion Practices	Baseline
Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)	1	EPA 40 CFR part 89 Tier 2 Certified Engine	~35 %
	2	Good Combustion Practices	Baseline
Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)	1	Camshaft Replacement/Retooling Engines	-[b]
	2	Good Combustion Practices	Baseline
Stimulation Vessel Pump Engines (SV-PE-01 through SV-PE-08)	1	Replacement of Old Engines with New Engines	Varies
	2	Good Combustion Practices	Baseline

*The application contains a ranking and cost analysis for SCR control technology; however, since this technology was determined to be technically infeasible it is not listed here.
[b] Baseline emissions were not included to calculate the relative control effectiveness.

Step 4: Evaluate most effective controls

The control technologies listed in Step 3 are further discussed below, and are evaluated against any relevant economic, environmental, or energy considerations.

Replacement of Old Engines with New Engines for the Stimulation Vessel Pump Engines: Anadarko provided a cost analysis in Appendix E of the September 2013 application for replacing the existing engines with newer engines meeting the EPA 40 CFR 89 tier 2 standards. The applicant estimated the cost of replacing the existing engines with compliant engines would result in a cost effectiveness of $34,670 per ton of pollutant removed.

Camshaft Replacement/Retooling of Engines for the Third Party Well Evaluation Engines: Clean Cam Technology Systems (CCTS) offers retrofit cam shaft reengineering kits for use on diesel engines. These kits are available for the well evaluation engines. The applicant determined that given the engine's minimal operating time of 125 hours per year the resulting emissions are minimal. These units will emit less than 5 TPY of NO_x. Given the minimal planned operation of this unit the Camshaft replacement/retooling for the well evaluation engines is cost prohibitive.

LNE Design for the Main Diesel Engines and Emergency Generator: LNE Design includes turbocharger, aftercooler, and a high injection pressure system. LNE design will reduce emissions by optimizing the intake valve's closing timing, and thereby change the compression and expansion ration. This control technology is technically feasible for these engines.

Step 5: Select BACT

After taking into account energy, economic, and environmental impacts in Step 4 of the BACT analysis, the EPA determined BACT for the diesel engines on the *BlackHawk* and for the pump engines on the stimulation vessel as discussed below and summarized in Table 6-2.

Main Engines: The EPA proposes three limits for NO_X emissions dependent on the engine load and based on the stack test data submitted to EPA on July 15, 2014. For all engines, the EPA proposes an emission limit of 10.57 g/kw-hr when the engines are operating at or above 50% load. This limit is based on the average emissions of the highest emitting engine. For the smaller main engines, DR-ME-01 through DR-ME-06, the EPA proposes a NO_X limit of 57.3 lb/hr when these engines operate at less than 50% load based on the upper bound of the 95% confidence interval of the stack test results for these engines operating at 60% load. For the larger main engines, DR-ME-07 and DR-ME-08, the EPA proposes a NO_x limit of 103.5 lb/hr when these engines operate at less than 50% load. This was also established on the stack test results and represents the upper bound of the 95% confidence interval for the large engines operating at 50% load. Emission limits for engines operating above 50% were set in g/kw-hr, while those below 50% were set in lb/hr. The lb/hr emission limit better reflects the fuel usage of the engines while operating at low loads.

Anadarko must comply with 40 CFR part 60 subpart IIII, as maintained in Condition 6.11, and described in section 4.5.1. All main engines operating within 10% of 100% peak load (or the highest achievable load) must comply with a NO_X limit of 9.69 g/kw-hr.

The EPA has included requirements for Performance Management that includes a Parametric Emission Monitoring System (PEMS). The PEMS will reduce NO_x emissions by notifying the permittee of instances when the engines emissions are increasing outside an established operating range, whereby the permittee will adjust the engines to operate optimally. Given the significant load variations required by the operations on the drillship and the information provided by the applicant and vendor, the EPA has determined that an averaging period of 24 hours on a rolling basis is appropriate in this case.

Emergency Generator Engine and Emergency Air Compressor Engine: The applicant estimated NO_x emissions at 7.85 g/kW-hr for the emergency generator and an operating time of 100 hours per year, and for the emergency air compressor engine the applicant estimated NO_x emissions at 0.012 lb/hp-hr and an operating time of 100 hours per year. Since these units will be operated minimally, measuring compliance with a numeric emission limit would be unreasonably burdensome and costly. Therefore, the EPA has determined that BACT for these two engines is use of work practice standards including good combustion practices and operating in accordance with the manufacturer's specifications, EPA Tier 3-certified engine for the emergency air compressor, LNE design for the emergency generator, and use of an IMO Tier-certified engine for the emergency generator. The engines will maintain compliance with the hourly operating limits specified above for each engine.

Pump Engines and Third Party Engines: These units will be used on an as-needed basis during drilling operations. The exact units are unknown prior to drilling, and therefore, other than monitoring these units' hourly usage, an advanced monitoring system would be cost prohibitive and impractical. Given the use of these emission units, the EPA has determined that BACT is more appropriately implemented as work practice standards to include either the use of EPA Tier-certified engines and/or good combustion practices. Furthermore, to maintain consistency with the emission estimates in the permit application, the draft permit includes operational limits for these units.

Table 6-2: NO_X BACT Conclusion

Emissions Unit ID	**BACT Control Options Technology and NO_X BACT Emission Limits***
DR-ME-01 thru DR-ME-08	IMO Tier II Standards, LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure with Performance Management, PEMS, and Good Combustion Practices; NO_x limit for loads at or above 50%: 10.57 g/kW-hr; NO_x limit for loads below 50 % for DR-ME-01 through DR-ME-06: 57.3 lb/hr; NO_x limit for loads below 50% for DR-ME-07 and DR-ME-08: 103.5 lb/hr
DR-GE-01	IMO Tier II Standards, LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure and Good Combustion Practices
DR-AC-01	40 CFR part 1039 EPA Tier 3 Standards and Good Combustion Practices
Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)	40 CFR part 89 EPA Tier 2 Standards and Good Combustion Practices
Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)	Good Combustion Practices

SV-PE-01 thru SV-PE-08	Good Combustion Practices

*Short-term limits are based on a 24-hour rolling average.

6.1.2 CO and VOC BACT Analyses for all Internal Combustion Engines

Incomplete combustion of the diesel fuel in the combustion chamber forms CO and VOC. Insufficient residence time during the final step in the oxidation of hydrocarbons during combustion will produce CO. The maximum oxidation of CO to CO_2 occurs when the combustion process maintains sufficient temperature, residence time, and oxygen supply. Also, most VOCs found in diesel exhaust are the result of unburned fuel, although some are formed as combustion products. VOC compounds participate in atmospheric photochemical reactions. These reactions can result in the formation of ozone. VOCs do not include methane, ethane, and other compounds that have negligible photochemical reactivity.

<u>Step 1: Identify all available control technologies</u>

The applicant identified the following available control technologies in their OCS permit application submitted in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Diesel Oxidation Catalyst;
2. Catalytic Diesel Particulate Filter;
3. 4-Way Catalyst Converter with Exhaust Gas Recirculation System;
4. Replacement of Older Engines with Newer Engines;
5. LNE Design (Turbocharger with Aftercooler and High Injection Pressure System);
6. Good Combustion Practices;
7. Ignition Timing Retard; and
8. Positive Crankcase Ventilation (VOC only).

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

<u>Step 2: Eliminate technically infeasible control options</u>

After analyzing the eight control technology options for the control of CO and VOC emissions, five were eliminated as technically infeasible for <u>all</u> diesel internal combustion engines (options 1 through 3, 7, and 8). Option 5 was eliminated as technically infeasible for the main diesel engines, the third party engines, and the third party well evaluation engines. Below is a summary of the reasons for eliminating each of these options from further consideration in the top-down BACT analysis for this project. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

Diesel Oxidation Catalyst: The engines onboard the *BlackHawk* and the pump engines on the stimulation vessel cannot sustain constant steady state loads or temperatures for a sufficient time necessary for high catalyst performance. This control technology can also cause pressure drop across the exhaust flow that results in back pressure on all the engines that could cause plugging of the engine, and thereby cause a safety concern. Non-combustible chemical elements present in engine lube oils may collect over time and damage the catalyst. In addition, this technology has not been designed or tested on large internal combustion engines nor is it commercially available.

Catalytic Diesel Particulate Filter: This control technology can cause pressure drop across the exhaust flow that results in back pressure on the engine that could cause plugging of the engine, and thereby causes a safety concern. Non-combustible chemical elements present in engine lube oils may collect over time and damage the catalyst. In addition, this technology has not been designed or tested on a commercially available scale comparable to the large main generator and emergency diesel engines. The EPA agrees with the applicant that this control technology is not technically feasible in this instance.

4-Way Catalyst Converter with Exhaust Gas Recirculation System: The engines onboard the *BlackHawk* and the pump engines on the stimulation vessel will not sustain constant steady-state loads or temperatures for a sufficient time necessary for high catalyst performance. Non-combustible chemical elements present in engine lube oils may collect over time and damage the catalyst. For these reasons, the EPA agrees with the applicant that this technology is not technically feasible.

Replacement of Old Engines with New Engines (for the Main Diesel Generator Engines, the Emergency Air Compressor Engine, the Third Party Engines, and Third Party Well Evaluation Engines): This option is technically infeasible for these engines for the same rationale provided above in Section 6.1.1. In addition, the IMO Tier standard that the main diesel generator engines maintain does not have a CO or VOC emission standard. Since the ship is already constructed, replacement of the engines at this juncture would require redesign and an engine certification process.

LNE Design (on the Emergency Air Compressor Engine, Third Party Engines, Third Party Well Evaluation Engines, and Stimulation Vessel Pumps): This option is technically infeasible for these engines for the same rationale provided above in Section 6.1.1.

Ignition Timing Retard: This option is technically infeasible for these pollutants for the same rationale provided above in Section 6.1.1.

Positive Crankcase Ventilation (VOC only): This technology is intrinsic to the engine design. Engine manufacturers have strict restrictions on installing upgrades to avoid violating warranties. The engines onboard the *BlackHawk* and the pump engines cannot be retrofitted to accommodate this technology. This technology would require significant ship redesign.

The EPA agrees with the applicant that these control technologies are not technically feasible for the reasons discussed above.

Step 3: Rank the remaining control technologies by effectiveness

The control options not eliminated as technically infeasible in Step 2 of the top-down BACT analysis were then ranked by effectiveness. Table 6-3 lists the remaining control technologies that have not been ruled out as technically infeasible options ranked by effectiveness for the engines on the drilling vessel and the pump engines on the stimulation vessel.

Additional information regarding maintenance procedures and schedules are provided in Appendix E of the September 2013 application.

Table 6-3: Step 3 - CO and VOC Control Technologies Ranked by Effectiveness

Engine	Rank	Control Description	CO and VOC Control Effectiveness
Main Diesel Engines (DR-ME-01 through DR-ME-08)	1	LNE Design Including Turbocharger, Aftercoolers, and High Injection Pressure	~30%
	2	Good Combustion Practices	Baseline
Emergency Generator Diesel Engine (DR-GE-01)	1	Replacement of Old Engines with New Engines	Varies
	2	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure	~30%
	3	Good Combustion Practices	Baseline
Emergency Air Compressor Engine (DR-AC-01)	1	EPA 40 CFR part 1039 Tier 3 Certified Engine	-[b]
	2	Good Combustion Practices	Baseline
Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)	1	EPA 40 CFR part 89 Tier 2 Certified Engine	~35 %
	2	Good Combustion Practices	Baseline
Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)	1	Camshaft Replacement/Retooling Engines	-[b]
	2	Good Combustion Practices	Baseline
Stimulation Vessel Pump Engines (SV-PE-01 through SV-PE-08)	1	Replacement of Old Engines with New Engines	Varies
	2	Good Combustion Practices	Baseline

[b] Baseline emissions were not included to calculate the relative control effectiveness.

Step 4: Evaluate Most Effective Controls

The control technologies listed in Step 3 are further discussed below, and are evaluated against any relevant economic, environmental, or energy considerations.

Replacement of Old Engines with New Engines for the Emergency Generator: The current emergency generator is an IMO Tier 2 certified engine; however, 40 CFR 89 Tier 2 compliant engines are the cleanest engines available. The IMO Tier standard that the emergency generator engine maintains does not have a CO or VOC emission standard. Anadarko, estimated that since these engines will operate no more than 100 hours per year, and therefore the replacement would be cost prohibitive.

Replacement of Old Engines with New Engines for the Stimulation Vessel Pump Engines: This option was determined to be cost prohibitive for CO and VOC control for the same rationale provided in Section 6.1.1.

LNE Design for the Main Diesel Engines and Emergency Generator: This option was determined to be technically feasible for CO and VOC control for the same rationale provided in Section 6.1.1.

Step 5: Select BACT

Main Engines: The EPA proposes three limits for CO emissions dependent on the engine load and based on the stack test data submitted to EPA on July 15, 2014. For all engines, the EPA proposes an emission limit of 2.8 g/kw-hr when the engines are operating at or above 50% load. This limit is based on the 95% confidence interval of engine DR-ME-08 operating at 90% load. For the smaller main engines, DR-ME-01 through DR-ME-06, the EPA proposes a CO limit of 16.6 lb/hr when these engines operate at less than 50% load based on the limit proposed by Anadarko that reflects the emissions from the stack test results. For the larger main engines, DR-ME-07 and DR-ME-08, the EPA proposes a VOC limit of 23.3 lb/hr when these engines operate at less than 50% load. This limit represents the average of thirty data points from the stack test results for the highest emitting engine recorded at 50% load.

The EPA proposes three limits for VOC emissions dependent on the engine load and based on the stack test data, referenced above. For all engines, the EPA proposes an emission limit of 0.8 g/kw-hr when the engines are operating at or above 50% load. This limit is based on the 95% confidence interval of the highest emitting engine operating at 60% load. For the smaller main engines, DR-ME-01 through DR-ME-06, the EPA proposes a VOC limit of 4.6 lb/hr when these engines operate at less than 50% load. For the larger main engines, DR-ME-07 and DR-ME-08, the EPA proposes a VOC limit of 6.2 lb/hr when these engines operate at less than 50% load. These limits are based on the stack test results submitted by Anadarko and the 95% confidence interval of the highest emitting engine operating at 60% and 50% load respectively.

Emission limits for engines operating above 50% were set in g/kw-hr, while those below 50% were set in lb/hr. The lb/hr emission limit better reflects the fuel usage of the engines while operating at low loads.

Given the significant load variations required by the operations on the drillship and the information provided by the applicant and vendor, the EPA has determined an averaging period of 24 hours on a rolling basis is appropriate in this case. BACT for the main engines will also include work practice standards including good combustion practices based on the current manufacturer's specifications for these and operating in accordance with the manufacturer's specifications and LNE design.

Emergency Generator Engine and Emergency Air Compressor Engine: The BACT determination in Section 6.1.1 is also applicable for CO and VOC.

Pump Engines and Third Party Engines: The BACT determination in Section 6.1.1 is also applicable for CO and VOC.

After taking into account energy, economic, and environmental impacts discussed above in Step 4 of the BACT analysis, the EPA determined BACT for the diesel engines on the *BlackHawk* and for the pump engines on the stimulation vessel as summarized in Table 6-4.

Table 6-4: CO and VOC BACT Conclusions

Emissions Unit ID	BACT Control Technology and CO and VOC BACT Emission Limits*
Main Diesel Engines (DR-ME-01 thru DR-ME-08)	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure and Good Combustion Practices; CO limit for loads at or above 50%: 2.8 g/kW-hr; CO limit for loads below 50 % for DR-ME-01 through DR-ME-06: 16.6 lb/hr; CO limit for loads below 50% for DR-ME-07 and DR-ME-08: 23.3 lb/hr
	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure and Good Combustion Practices; VOC limit for loads at or above 50%: 0.8 g/kW-hr; VOC limit for loads below 50 % for DR-ME-01 through DR-ME-06: 4.6 lb/hr; VOC limit for loads below 50% for DR-ME-07 and DR-ME-08: 6.2 lb/hr
Emergency Generator Engine (DR-GE-01)	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure and Good Combustion Practices
Emergency Air Compressor (DR-AC-01)	40 CFR part 1039 EPA Tier 3 Standards and Good Combustion Practices
Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)	40 CFR part 89 EPA Tier 2 Standards and Good Combustion Practices
Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)	Good Combustion Practices
SV-PE-01 thru SV-PE-08	Good Combustion Practices

*Short-term limits are based on a 24-hour rolling average.

6.1.3 PM/PM$_{10}$/PM$_{2.5}$ BACT Analysis for Internal Combustion Engines

Diesel particulate emissions are primarily products of incomplete combustion of diesel fuel and lubrication oil in the combustion chamber. The majority of the PM emissions from stationary diesel engines are PM$_{2.5}$; therefore, BACT for PM/PM$_{10}$/PM$_{2.5}$ is addressed concurrently since any control technology available for the control of PM$_{2.5}$ will also effectively control PM and PM$_{10}$.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their OCS permit application submitted in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Baghouse (Fabric Filter);
2. Ultra-Low Sulfur Diesel (ULSD) Fuel/ Low Ash Fuel;
3. Diesel Oxidation Catalyst;
4. Catalytic Diesel Particulate Filter;
5. Positive Crankcase Ventilation;
6. 4-Way Catalyst Converter with Exhaust Gas Recirculation System;
7. Replacement of Older Engines with New Ones;
8. Good Combustion Practices;
9. LNE design including Turbocharger with aftercooling and high injection pressure;
10. Fuel Injection timing Retard; and
11. Sea Scrubber.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

<u>Step 2: Eliminate technically infeasible control options</u>

After analyzing the 11 control technology options for the control of $PM/PM_{10}/PM_{2.5}$ emissions, six were eliminated as technically infeasible for <u>all</u> diesel internal combustion engines (options 3 through 6, 10, and 11). Option 1 was only identified for the main diesel engines. Below is a summary of the reasons for eliminating each of these options from further consideration in the top-down BACT analysis for this project. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

Baghouse (Fabric Filter) (on the Main Diesel Engines Only): Baghouses could cause a high pressure drop across the exhaust flow resulting in excessive back pressure on the engine. To avoid a large pressure drop across the baghouse, a fabric area larger than the space available on the drillship would be required. Due to space constraints on the vessels, this option is not feasible.

Diesel Oxidation Catalyst: This option is technically infeasible for these pollutants for the same rationale provided above in Section 6.1.2.

Diesel Particulate Filter/CDPF: This option is technically infeasible for these pollutants for the same rationale provided above in Section 6.1.2.

Positive Crankcase Ventilation: This option is technically infeasible for these pollutants for the same rationale provided above in Section 6.1.2.

4-Way Catalyst Converter with Exhaust Gas Recirculation System: This option is technically infeasible for these pollutants for the same rationale provided above in Section 6.1.2.

Replacement of Old Engines with New Engines (for the Main Diesel Generator Engines, the Emergency Air Compressor Engine, the Third Party Engines, and Third Party Well Evaluation Engines): This option is technically infeasible for these engines for the same rationale provided above in Section 6.1.1. In addition, the main diesel generator engines will comply with the most stringent PM standards available, specified in 40 CFR part 60, subpart IIII, and therefore this control technology is not applicable for these engines.

LNE Design on the Emergency Air Compressor Engines and Stimulation Vessel Pumps: This option is technically infeasible for these pollutants for the same rationale provided above in Section 6.1.1.

Sea Scrubber: This add-on control technology is used to reduce both SO_2 and particulate matter emissions. The EPA has contacted industry experts and has determined that this technology could be used on engines that operate at variable loads. However, the sea scrubber is skid mounted and would require additional unavailable space. Therefore, this technology is technically infeasible.

The EPA agrees with the applicant that these control technologies are not technically feasible for the reasons discussed above.

<u>Step 3: Rank the remaining control technologies by effectiveness</u>

The control options not eliminated as technically infeasible in Step 2 of the top-down BACT analysis were then ranked by effectiveness. Table 6-5 lists the remaining control technologies that have not been ruled out as technically infeasible options ranked by effectiveness for the engines on the drilling vessel and the pump engines on the stimulation vessel.

Additional information regarding maintenance procedures and schedules are provided in Appendix E of the September 2013 application.

Table 6-5: Step 3 - PM/PM_{10}/$PM_{2.5}$ Control Technologies Ranked by Effectiveness

Engine	**Rank**	**Control Description**	**PM/PM_{10}/$PM_{2.}$Control Effectiveness**
Main Diesel Engines (DR-ME-01 through DR-ME-08)	1	LNE Design Including Turbocharger, Aftercoolers, and High Injection Pressure, NSPS 40 CFR 60 Subpart IIII	30%
	2	ULSD	Varies
	3	Good Combustion Practices	Baseline
Emergency Generator Diesel Engine (DR-GE-01)	1	Replacement of Old Engines with New Engines	Varies
	2	LNE Design Including Turbocharger, Aftercoolers, and High Injection Pressure	30%

	3	ULSD	-[b]
	4	Good Combustion Practices	Baseline
Emergency Air Compressor Engine (DR-AC-01)	1	EPA 40 CFR part 1039 Tier 3 Certified Engine	-[b]
	2	ULSD	-[b]
	3	Good Combustion Practices	Baseline
Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)	1	EPA 40 CFR part 89 Tier 2 Certified Engine	~35 %
	2	ULSD	-[b]
	3	Good Combustion Practices	Baseline
Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)	1	ULSD	-[b]
	2	Good Combustion Practices	Baseline
Stimulation Vessel Pump Engines (SV-PE-01 through SV-PE-08)	1	Replacement of Old Engines with New Engines	Varies
	2	ULSD	-[b]
	3	Good Combustion Practices	Baseline

[b] Baseline emissions were not included to calculate the relative control effectiveness.

Step 4: Evaluate most effective controls

The control technologies listed in Step 3 are further discussed below, and are evaluated against any relevant economic, environmental, or energy considerations.

Replacement of Old Engines with New Engines for the Emergency Generator: This option was determined to be cost prohibitive for PM control for the same rationale provided in Section 6.1.2.

Replacement of Old Engines with New Engines for the Stimulation Vessel Pump Engines: This option was determined to be cost prohibitive for PM control for the same rationale provided in Section 6.1.1 and 6.1.2.

LNE Design for the Main Diesel Engines and Emergency Generator: This option was determined to be technically feasible for PM control for the same rationale provided in Section 6.1.1 and 6.1.2.

ULSD: The burning of fuel with ultra-low sulfur content results in lower particulate matter emissions compared to diesel fuel with a higher sulfur content. This control technology is technically feasible.

Step 5: Select BACT

After taking into account energy, economic, and environmental impacts in Step 4 of the BACT analysis, the EPA determined BACT for the diesel engines on the *BlackHawk* and for the pump engines on the stimulation vessel as summarized below and in Table 6-6.

Main Engines: The EPA proposes three limits for $PM/PM_{10}/PM_{2.5}$ emissions dependent on the engine load and based on the stack test data submitted to EPA on July 15, 2014. For all engines, the EPA proposes an emission limit of 0.40 g/kw-hr when the engines are operating at or above 50% load. For the smaller main engines, DR-ME-01 through DR-ME-06 the EPA, the EPA proposes a $PM/PM_{10}/PM_{2.5}$ limit of 2.0 lb/hr when these engines operate at less than 50% load. For the larger main engines, DR-ME-07 and DR-ME-08, the EPA proposes a $PM/PM_{10}/PM_{2.5}$ limit of 4.0 lb/hr when these engines operate at less than 50% load. All three limits were proposed by Anadarko and reflect the emissions from the stack test results. In addition, these limits will ensure that Anadarko complies with their proposed modeling. Emission limits for engines operating above 50% were set in g/kw-hr, while those below 50% were set in lb/hr. The lb/hr emission limit better reflects the fuel usage of the engines while operating at low loads.

Anadarko must comply with the limits of 40 CFR part 60 subpart IIII, as maintained in Condition 6.11, and described in section 4.5.1. All main engines operating within 10% of 100% peak load (or the highest achievable load) must comply with a $PM/PM_{10}/PM_{2.5}$ limit of 0.15 g/kw-hr.

Given the significant load variations required by the operations on the drillship and the information provided by the applicant and vendor, the EPA has determined an averaging period of 24 hours on a rolling basis is appropriate in this case. BACT will also include use ultra-low sulfur diesel and work practice standards including good combustion practices and operating in accordance with the manufacturer's specifications and LNE design.

Emergency Generator Engine and Emergency Air Compressor Engine: The BACT determination in Section 6.1.1 is also applicable for $PM/PM_{10}/PM_{2.5}$. In addition, BACT reduction of $PM/PM_{10}/PM_{2}$ also includes use of ULSD.

Pump Engines and Third Party Engines: The BACT determination in Section 6.1.1 is also applicable for $PM/PM_{10}/PM_{2.5}$. In addition, BACT for reduction of $PM/PM_{10}/PM_{2}$ also includes use of ULSD.

Table 6-6: $PM/PM_{10}/PM_{2.5}$ BACT Conclusions

Emissions Unit ID	BACT Control Technologies and $PM/PM_{10}/PM_{2.5}$ BACT Limits*
Main Diesel Generator Engines (DR-ME-01 thru DR-ME-08)	40 CFR part 60, subpart IIII Standards, LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure, ULSD, and Good Combustion Practices; $PM/PM_{10}/PM_{2.5}$ limit for loads at or above 50%: 0.40 g/kW-hr; $PM/PM_{10}/PM_{2.5}$ limit for loads below 50 % for DR-ME-01 through DR-ME-06: 2.0 lb/hr; $PM/PM_{10}/PM_{2.5}$ limit for loads below 50% for DR-ME-07 and DR-ME-08: 4.0 lb/hr
Emergency Generator Engine (DR-GE-01)	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure, ULSD, and good combustion practices
Emergency Air Compressor Engine (DR-AC-01)	40 CFR part 1039 EPA Tier 3 Standards, ULSD, and Good Combustion Practices

Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)	40 CFR part 89 EPA Tier 2 Standards, ULSD, and Good Combustion Practices
Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)	ULSD and Good Combustion Practices
SV-PE-01 thru SV-PE-08	ULSD and Good Combustion Practices

*Short-term limits are based on a 24-hour rolling average.

6.1.4 GHG BACT Analysis for Internal Combustion Engines

The majority of GHG emissions from the diesel internal combustion engines are in the form of carbon dioxide (CO_2). CO_2 is formed in the combustion chamber as a result of complete combustion of diesel when the carbon in the fuel is converted to CO_2.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their OCS permit application submitted in September 2013 supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Carbon Capture Storage (CCS);
2. Alternative/Biomass Fuel Sources;
3. CSNO$_x$ Emissions Abatement System;
4. Energy Efficiency; and
5. Good Combustion and Manufacturer Recommended Maintenance Practices.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

Step 2: Eliminate technically infeasible control options

After analyzing the five control technology options for the control of GHG emissions, three were eliminated as technically infeasible for all diesel internal combustion engines. Below is a summary of the reasons for eliminating each of these options from further consideration in the top-down BACT analysis for this project. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

CCS: This control option is technically infeasible due to space constraints. The space needed for the equipment necessary to capture and separate CO_2 from engine exhaust is not available on the drillship. Furthermore, the mobile nature of the source renders attachment to a fixed pipeline for CO_2 transport infeasible. Lastly, the injection of CO_2 in the deep sea has not been tested, and could significantly alter this ecosystem.

Alternative/Biomass Fuel Sources: The current supply market for biodiesel is not stable enough to be considered a viable option for this project. (Biodiesel was the only fuel addressed).

$CSNO_X$ Emissions Abatement System: This technology is currently in the licensing and commercial demonstration phase of development. While this technology is commercially available for certain types of marine uses, it has not been demonstrated in practice for use aboard a dynamically positioned mobile off shore drilling unit (i.e., vessels with variable load engines); therefore, it is technically infeasible for this project.

The EPA agrees with the applicant that these control technologies are not technically feasible for the reasons discussed above.

<u>Steps 3/4/5:</u>

The applicant identified energy efficiency operation and good combustion practices as BACT. Energy efficiency for the main engines will be accomplished through the use of the Parametric Emission Monitoring System (PEMS) and the inherent LNE design of the engine, identified in Section 6.1.1; this system is designed to optimize combustion. In addition, the main engines are some of the newest available. The LNE design of the emergency generator will also promote energy efficiency. The operation of the emergency air compressor engine, the third party engines, the third party well evaluation engines, and stimulation vessel pump engines per the manufacture design will ensure energy efficiency.

Main Engines: The EPA proposes three limits for GHG emissions dependent on the engine load and based on the stack test data submitted to EPA on July 15, 2014. For all engines, the EPA proposes an emission limit of 856 g/kw-hr when the engines are operating at or above 50% load. This limit is based on the 95% confidence interval of the highest emitting engine operating at 50% load, for thirty of the data points. For the smaller main engines, DR-ME-01 through DR-ME-06, the EPA proposes a CO_2 limit of 4,700 lb/hr when these engines operate at less than 50% load. This is based on the 95% confidence interval for all small engines. For the larger main engines, DR-ME-07 and DR-ME-08, the EPA proposes a CO_2 limit of 8,299 lb/hr when these engines operate at less than 50% load. This limit was proposed by Anadarko and reflects the emissions from the stack test results. Emission limits for engines operating above 50% were set in g/kw-hr, while those below 50% were set in lb/hr. The lb/hr emission limit better reflects the fuel usage of the engines while operating at low loads.

Given the significant load variations required by the operations on the drillship and the information provided by the applicant and vendor, the EPA has determined an averaging period of 24 hours on a rolling basis is appropriate in this case. BACT will also include work practice standards including good combustion practices and operating in accordance with the manufacturer's specifications and LNE design.

Emergency Generator Engine and Emergency Air Compressor Engine: The BACT determination in Section 6.1.1 is also applicable for GHGs.

Pump Engines and Third Party Engines: The BACT determination in Section 6.1.1 is also applicable for GHGs.

After taking into account energy, economic, and environmental impacts, the EPA determined BACT for the diesel engines on the *BlackHawk* and for the pump engines on the stimulation vessel as summarized in Table 6-8. The respective emission limits are based on 40 CFR 98 Subpart C.

Table 6-8: GHG BACT Conclusions

Emissions Unit ID	**BACT Control Technologies and CO_2e Limits***
Main Diesel Generator Engines (DR-ME-01 thru DR-ME-08)	PEMS, LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure, and Good Combustion Practices; CO_2 limit for loads at or above 50%: 856 g/kW-hr; CO_2 limit for loads below 50% for DR-ME-01 through DR-ME-06: 4,700 lb/hr; VOC limit for loads below 50% for DR-ME-07 and DR-ME-08: 8,299 lb/hr
Emergency Generator Engine (DR-GE-01)	LNE Design Including Turbocharger and Aftercoolers, and High Injection Pressure and Good Combustion Practices
Emergency Air Compressor Engine (DR-AC-01)	Good Combustion Practices
Third Party Engines (DR-TP-01 through DR-TP-11 and DR-TP-17 through DR-TP-21)	Good Combustion Practices
Third Party Well Evaluation Engines (DR-TP-12 through DR-TP-16)	Good Combustion Practices
SV-PE-01 thru SV-PE-08	Good Combustion Practices

*Short-term limits are based on a 24-hour rolling average.

6.2 BACT Analysis for Third Party Flowback Boiler

The *BlackHawk* will operate a small 8 MMBtu/hr diesel fired flowback boiler (DR-TP-22) during well completion activities. The boiler is subject to BACT review for emissions of NO_x, CO, VOC, $PM/PM_{10}/PM_{2.5}$, and GHGs.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their OCS permit application submitted in September 2013 supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Flue Gas Recirculation (NO_x only);
2. Low NO_x Burners;
3. Good Combustion Practices; and
4. ULSD.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

Step 2: Eliminate technically infeasible control options

After analyzing the four control technology options for the control of NO_x emissions, two were eliminated as technically infeasible (options 1 and 2). Below is a summary of the reasons for eliminating each of these options from further consideration in the top-down BACT analysis for this project. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

Flue Gas Recirculation: This control technology requires retrofitting the boiler which would demand significant space reassignment. This is best suited for new units since it will require installation of ductwork, recirculation fans, air foils, and controls. This technology is technically infeasible for the flowback boiler on the *BlackHawk* which has limited space and is already constructed.

Low NO_x Burners: This technology produces longer flames and is therefore inappropriate for retrofit on smaller boilers.

The EPA agrees with the applicant that these control technologies are not technically feasible for the reasons discussed above.

Steps 3/4/5:

The applicant plans to operate the flowback boiler 1,152 MMBtu per year and 144 hours per year. Given the limited use of this emission unit, the EPA has determined that BACT is more appropriately implemented as work practice standards including good combustion practices based on the use of the most recent manufacturer's specifications issued for this boiler at the time that the boiler is operating and use of ULSD.

6.3 BACT Analysis for Boom Flare

The *BlackHawk* will operate a boom flare (DR-TP-23) subject to BACT review for emissions of NO_x, CO, VOC, $PM/PM_{10}/PM_{2.5}$ and GHGs. The boom supports the flare system and the associated piping. The boom primarily reduces heat radiation by locating flames far away from the drillship and personnel. The boom flare will be leased from a third party vendor. Pilot gas assistance is not necessary for certain types of boom flares. If the boom flare leased from the vendor requires pilot gas assistance, the emissions resulting from pilot gas assistance will be negligible. The flaring operation will take place primarily during the well completion operations, and not during drilling.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies for NO_x, CO, VOC, and $PM/PM_{10}/PM_{2.5}$, and GHGs in their OCS permit application submitted in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Comply with 40 CFR 60.18;
2. Proper Equipment Design and Maintenance;
3. Maintain Presence of Flame at Flare Tip at all times;
4. Flare Gas Minimization; and
5. Good Combustion Practices.

In addition the EPA further identified the following available control that is also referenced in our administrative record (see Section 9.0):

1. Flare Tip.

The EPA believes that the preceding lists identify all relevant and available control technologies as of the date of this preliminary determination.

<u>Step 2: Eliminate technically infeasible control options</u>

The flare gas minimization and flare tip control options were determined to be technically infeasible and for the control of NO_x, CO, VOC, $PM/PM_{10}/PM_{2.5}$, and GHG. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014, and the additional material found in the administrative record cited in Step 1.

Flare Gas Minimization: This requires a reconfiguration of the piping during a well control situation, and requires rerouting gas that would be directed to the flare back to the process which is infeasible during the offshore drilling process.

Flare Tip: Flare tips provide enhanced mixing by promoting an adequate air supply for efficient combustion. The type of flare tips available range depending on the fuel stream (i.e., steam-assisted, air-assisted, pressure-assisted, or non-assisted). The type of fuel and the pressure of the stream dictate which flare tip is appropriate. Since Anadarko will conduct an exploratory drilling project, the type of fuel and the amount of gas in the well are unknown. Therefore, this project cannot use a specified flare tip because the amount and pressure of the fuel cannot be determined beforehand and may vary during the project.

The EPA agrees with the applicant that these control technologies are not technically feasible for the reasons discussed above.

<u>Steps 3/4/5:</u>

Based on a review of the available control technologies, the EPA has determined that BACT for NO_x, CO, VOC, PM/PM_{10}/$PM_{2.5}$, and GHG emissions is more appropriately implemented as work practice standards including maintaining compliance with 40 CFR 60.18, use of good combustion practices, and proper equipment design and maintenance presence of a flame at the flare tip at all times.

6.4 BACT Analysis for Storage Tanks

The *BlackHawk*, the supply boat, and the anchor handling boat have various types of storage tanks subject to BACT review for VOC emissions. The tank loading emissions for the supply boat and anchor handling boat qualify as regulated stationary source activities. Onboard the *BlackHawk* there are diesel fuel, helicopter fuel, and condensate storage tanks. The following tanks on the *BlackHawk* are included in this analysis: DR-FT-01 through -19 (diesel fuel and helicopter fuel storage tanks) and DR-TP-24 through -26 (condensate tanks used for well completion activates). The tanks on the work boat are SB-DT-01 through -15 (diesel fuel storage tanks). The tanks on the anchor handling boat are AB-DT-01 through -19 (diesel fuel storage tanks). The fuel in these tanks will generate VOC emissions resulting from both breathing and working (*i.e.*, loading) losses.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their OCS permit application submitted in September 2013 supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Vapor Recovery Unit;
2. Thermal Oxidation System;
3. Adsorption System;
4. Internal Floating Roof or External Floating Roof;
5. Submerged Fill Pipe; and
6. Good Maintenance Practices.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

Step 2: Eliminate technically infeasible control options

After analyzing the above control technologies, all of the options were eliminated as technically infeasible for control of VOC emissions from the tanks, except for good maintenance practices. Below is a summary of the reasons for eliminating each of the above options from further consideration in the top-down BACT analysis for this project. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

Vapor Recovery Unit: This option is technically infeasible due to limited space availability.

Thermal Oxidation System: This option is technically infeasible due to limited space availability.

Adsorption System: This option is not effective for controlling low concentrations of VOC generated by diesel and base oil storage tanks. Furthermore, this option is technically infeasible since it would require additional space that is not available on the vessels.

Internal Floating Roof or External Floating Roof: This option is not effective for controlling VOC emissions from stored liquids of low vapor pressures, such as diesel oil. Furthermore, this option is technically infeasible since it would require additional space that is not available on the vessels.

Submerged Loading: This technology is technically infeasible due to limited space availability.

The EPA agrees with the applicant that these control technologies are not technically feasible for the reasons discussed above.

<u>Steps 3/4/5:</u>

Based on a review of the available control technologies, the EPA has determined that BACT is use of good maintenance practices. This will limit tank leakage and excessive VOC emissions. The amount of VOC emissions emitted from the tanks is contingent upon both the fuel type and the amount of fuel. Therefore, the applicant will maintain records of the tank identification, volume, and fuel type stored. For the *BlackHawk*, the EPA has determined that the fuel tanks DR-FT-01 through -19 (diesel fuel and helicopter fuel storage tanks) will have a VOC BACT limit of 0.69 tons per year and that the condensate tanks DR-TP-24 through -26 will have a VOC BACT limit of 9.65 tons per year. The EPA has determined that the diesel fuel storage tanks (SB-DT-01 through -15) on the supply boat will have a VOC BACT limit of 0.011 tons per year and that the diesel fuel storage tanks (AB-DT-01 through -19) on the anchor handling boat will have a VOC BACT limit of 0.10 tons per year. All of these emissions limits are on a 12-month rolling total basis. These emission limits reflect the modeling results from EPA’s TANKS 4.0.9d program found in the September 2013 application.

6.5 BACT Analysis for Cement and Mud Mixing Operations

The *BlackHawk* has cement and mud mixing operations (DR-DC-01 through DR-DC-04) subject to BACT review for emissions of $PM/PM_{10}/PM_{2.5}$.

<u>Step 1: Identify all available control technologies</u>

The applicant identified the following available control technologies in their OCS permit application submitted in September 2013 supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Dust Collector.

A review of the RBLC database did not reveal any other potential control technologies for the mud and cementing operations aboard the *BlackHawk.* The proposed dust collectors are cyclones that capture particulate matter and function as a control technology.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

<u>Step 2: Eliminate technically infeasible control options</u>

The applicant determined that use of dust collectors is technically feasible. For a detailed description of the control technology and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

<u>Steps 3/4/5:</u>

Based on a review of the available control technologies, the EPA has determined that BACT is the use of dust collectors with proper maintenance and operation. DR-DC-01 through DR-DC-04 are not closed systems and no pressure reading can be taken. Therefore, Anadarko will ensure proper maintenance and operation of the dust collectors in accordance with the most recent manufacturer's specifications at the time that these dust collectors are operating under this permit. In addition, Anadarko will ensure that the dust collector bin is not over capacity, and report any times where there is a high-level alarm at which time the operator will investigate the cause and take corrective action.

6.6 BACT Analysis for Mud Degassing

The *BlackHawk* has mud degassing operations (DR-VG-01 through DR-VG-04) subject to BACT review for emissions of VOCs and GHGs.

<u>Step 1: Identify all available control technologies</u>

A review of the RBLC database did not reveal any potential control technologies to capture and control fugitive emissions from the mud degassing operations aboard the *BlackHawk*. However, the mud degassers will vent through two control technologies. The vents are equipped with a vacuum degasser that will operate during normal operations. In addition, when a large amount of gas breaks out of the mud then the gas will pass through a vertical separator with baffles.

1. Best Management Practices.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

Step 2: Eliminate technically infeasible control options

Best management practices, the only control technology identified, was determined technically feasible. For a detailed description of this control technology and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

Steps 3/4/5:

Based on a review of the available control technologies, the EPA has determined that BACT for VOC and GHG emissions from mud degassing is the use of best management practices and manufacturer recommended maintenance practices. The EPA has determined the mud degassing operations will have a VOC BACT limit of 5.36 TPY combined on a 12-month rolling total basis. The EPA has determined the mud degassing operations will have a VOC BACT limit of 271 TPY of CO_2e combined on a 12-month rolling total basis, based on the *Year 2005 Gulfwide Emission Inventory Study*, US Department of Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, December 2007, referenced in Appendix B of the September 2013 application.

6.7 BACT Analysis for Painting Operations

The *BlackHawk* has painting operations (DR-PO-01) subject to BACT review for emissions of VOC and $PM/PM_{10}/PM_{2.5.}$

Step 1: Identify all available control technologies

The application states that a review of the RBLC database did not reveal any potential control technologies for emissions from the painting operations aboard the *BlackHawk*. However, Anadarko identified four different methods to apply paint in September 2013 supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. air assisted spray gun;
2. airless spray gun;
3. roller or brush; and
4. best management practices.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

Step 2: Eliminate technically infeasible control options

For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

Roller or Brush: The use of a roller brush is unsuitable for marine conditions for a variety of reasons. The marine coatings must be applied at a designated thickness that this method cannot insure. Also, the roller method does not achieve a good film continuity required for marine coatings. Lastly, application technology cannot reach all required areas aboard the drilling vessel.

Step 3: Rank the remaining control technologies by effectiveness

The control options not eliminated as technically infeasible in Step 2 of the top-down BACT analysis were then ranked by effectiveness. Table 6-7 lists the remaining control technologies with their respective transfer efficiencies that have not been ruled out as technically infeasible options.

Table 6-7: Step 3 - VOC Control Technologies Ranked by Effectiveness for the Painting Operations

Rank	Paint Application Method	Transfer Efficiency
1	Airless spray gun	50%-80%
2	Air assisted spray gun	30%

Steps 4/5:

The airless spray gun is used to paint large deck areas or bulkheads, and an air assisted spray gun is used to paint smaller areas (e.g., piping, brackets, and other multi-angle items).

The VOC contents of a coating dictate the preferred application area, and the method of operation. Low VOC paints tend to be very thick, which makes it difficult to apply to small areas. These paints are better for large areas.

Based on a review of the available control technologies, the EPA has determined that BACT for VOC and $PM/PM_{10}/PM_2$ emissions from painting is best management practices that include, but are not limited to, down spraying of paint and use of a containment system such as a shroud or a barrier around the section of the ship being painted whenever practical to prevent the airborne particulate matter from drifting into the atmosphere, and proper storage of coatings (and thinners) in non-leaking containers. The EPA has determined the painting operations will have an operating limit of 5,200 and 1,300 gallons per calendar year of primer and thinner, respectively, and Anadarko will use an airless spray gun with transfer efficiency of 50% or greater; where it is not practical to use an airless spray gun, the permittee may use an air assisted spray gun with a transfer efficiency of 30% or greater. The limits on the total gallons per year that Anadarko will use are based on their estimated annual usage.

6.8 BACT Analysis for Welding Operations

The *BlackHawk* has welding operations (DR-WO-01) subject to BACT review for emissions of $PM/PM_{10}/PM_{2.5}$.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in the supplemental information submitted in September 2013 supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014:

1. Emission Limit/Welding Rod Usage Limit;
2. Best Management Practices;
3. Routing to Control Device; and
4. Body Shop.

The EPA believes that the preceding list identifies all relevant and available control technologies as of the date of this preliminary determination.

Step 2: Eliminate technically infeasible control options

After analyzing the above control technologies, options three and four were eliminated as technically infeasible for control of $PM/PM_{10}/PM_{2.5}$ emissions from welding operations. Below is a summary of the reasons for eliminating these options from further consideration in the top-down BACT analysis. For detailed descriptions of the control technologies and references, please refer to the application submitted to the EPA in September 2013 and supplemental material submitted on September 18, 2013, November 26, 2013, December 5, 2013, February 11, 2014, July 15, 2014, September 2, 2014, and September 10, 2014.

Routing to Control Device: The welding operations generate fugitive emissions that a control device cannot adequately capture; therefore, this control technology is technically infeasible.

Body Shop: This control technology is technically infeasible due to space constraints.

Steps 3/4/5:

Based on a review of the available control technologies, the EPA has determined that BACT is requiring Anadarko to follow current manufacturer's recommendations for all equipment used in welding operations at the time that that welding occurs under this permit, including but not limited to, recommendations regarding voltage levels. This will limit excess $PM/PM_{10}/PM_{2.5}$ emissions. The applicant will maintain records of the types and amounts (in pounds) of welding rods used annually.

6.9 BACT Analysis for Fugitive Emissions

The applicant did not identify fugitive emissions in the BACT analysis potion of their permit application. However, based on similar permit applications, the EPA has determined that BACT is good maintenance practices to minimize fugitive emissions, including but not limited to minimizing the release of emissions from valves, pump seals, and connectors. The applicant will perform a daily check and report any leaks and corrective action taken.

7.0 Summary of Air Quality Impact Analyses

7.1 Required Analyses

The PSD rules at 40 CFR § 52.21(k) require the permit applicant to demonstrate that, for all regulated air pollutants that would be emitted at or in excess of the significant emissions rates provided in 40 CFR § 52.21(b)(23)(i), the allowable emission increases from a proposed new major stationary source or major modification, in conjunction with all other applicable emission increases or reductions at the source, would not cause or contribute to a violation of any NAAQS nor cause or contribute to a violation of any applicable "maximum allowable increase" over the baseline concentration in any area (known as PSD increments).[4] The ambient air quality impact analysis must be based on air quality models, databases, and other requirements specified in 40 CFR part 51, Appendix W, Guideline on Air Quality Models.

As discussed in Section 4.0 above (Table 4-1), the estimated potential to emit of CO, NO_X, PM_{10}, $PM_{2.5}$, VOC and GHG from the proposed project are above the PSD significant emission rates. NO_X is a measured pollutant for NO_2 and ozone. Therefore, the CO, PM_{10}, $PM_{2.5}$, NO_2, and ozone NAAQS and the PM_{10}, $PM_{2.5}$, and NO_2 PSD increments are relevant to the air quality impact assessment. There are no NAAQS or increments for GHG emissions.

As required by the May 8, 2008, final rules governing NSR implementation for fine particulate matter, 73 Fed. Reg. 28,321 (May 16, 2008), PSD permits must address directly emitted $PM_{2.5}$ as well as the pollutants responsible for secondary formation of $PM_{2.5}$ which include SO_2, NO_X, VOC, and ammonia. Therefore, Anadarko must address compliance with the 24-hour and annual $PM_{2.5}$ NAAQS considering both direct emissions and secondary contributions.

Under 40 CFR § 52.21(m), a PSD permit application must include an air quality analysis in connection with the demonstration required by 40 CFR §52.21(k). For each pollutant for which a NAAQS or PSD increment exists, 40 CFR § 52.21(m)(1)(iv) requires the analysis to include at least one year of pre-construction ambient air quality monitoring data, unless the EPA approves a shorter monitoring period (not less than four months). 40 CFR § 52.21(i)(5)(i) allows exemption from the requirement for pre-construction ambient monitoring if the net emissions increase of a pollutant from the proposed source or modification would cause air quality impacts less than the ambient monitoring thresholds (i.e., Significant Monitoring Concentrations) listed in 40 CFR § 52.21(i)(5)(i), which are provided in Table 7-1[5]. 40 CFR § 52.21(m)(2) requires post-

[4] The maximum allowable PSD increments are listed in 40 CFR § 52.21(c).

[5] Due to the recent vacatur of the its significant monitoring concentration for $PM_{2.5}$ (see Section 7.2), this exemption is not applicable for $PM_{2.5}$.

construction ambient air quality monitoring if the EPA determines it is necessary to determine the effect that emissions from the source or modification may have on air quality.

An additional impact analysis is required by 40 CFR § 52.21(o), including an analysis of the impairment to visibility, soils, and vegetation that would occur as a result of the proposed project or that would occur as a result of any commercial, residential, industrial, and other growth associated with the source. Analysis for vegetation having no significant commercial or recreational value is not required.

For sources impacting Federal Class I areas,[6] 40 CFR § 52.21(p) requires the EPA to consider project impacts to PSD increments in these areas and any demonstration by the Federal Land Manager (FLM) that emissions from the proposed source would have an adverse impact on air quality related values, including visibility impairment. If the EPA concurs with the demonstration, the rules require that the EPA shall not issue the PSD permit.

7.2 PSD Class II Air Quality Impact Assessment

An air quality impact assessment was performed for the operation of the *BlackHawk* deepwater drilling vessel and associated support vessels. The modeled operating scenario was that which produced the worst-case impact.

As discussed in Section 4.0, the estimates of maximum annual emissions of NSR regulated pollutants from the *BlackHawk* drilling vessel and associated supporting vessels resulted in estimated emissions of CO, PM_{10}, $PM_{2.5}$, VOC, and NO_X greater than the PSD significant emissions rate. Hence, CO, PM_{10}, $PM_{2.5}$, and NO_2 are subject to ambient impact assessment. The VOC and NO_X pollutants are measured pollutants for ozone and precursors for $PM_{2.5}$. Therefore, impact assessments are also provided for ozone and secondary $PM_{2.5}$.

The modeling procedures took into consideration the January 22, 2013 decision by the federal Court of Appeals for the District of Columbia Circuit (D.C. Circuit) concerning use of the $PM_{2.5}$ significant monitoring concentration (SMC) and significant impact levels (SIL) as the basis for exemption from pre-construction air quality monitoring and cumulative NAAQS and PSD increment compliance modeling. *See Sierra Club v. EPA*, 705 F.3d 458 (D.C. Cir. 2013). The D.C. Circuit vacated and remanded the $PM_{2.5}$ SILs. Accordingly, project impacts less than the SILs cannot serve as the sole justification for eliminating cumulative NAAQS and PSD increment compliance modeling. While permit applicants may continue to use the $PM_{2.5}$ SILs in their analysis, they must provide additional information and justification to support a conclusion that a project's impacts will not cause or contribute to a NAAQS or PSD increment exceedance.

The court also vacated the $PM_{2.5}$ SMC. As a result of the court's decision, project impacts less than the $PM_{2.5}$ SMC can no longer be used to exempt the project from pre-construction ambient air quality monitoring. However, permit applicants may use existing air quality observations in lieu of pre-construction monitoring if supporting information demonstrates that the existing

[6] Class I areas are defined in 40 CFR § 52.21(e). Mandatory Class I areas (which may not be redesignated to Class II or III) are international parks, national wilderness areas larger than 5,000 acres, memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres.

ambient air quality data provides representative or conservative ambient concentrations for the impact area.

The ambient impact modeling was performed using dispersion and transport models and modeling techniques that follow the EPA regulatory guidelines (*see* 40 CFR Part 51, Appendix W) and applicable guidance memorandum (*see* Support Center for Atmospheric Modeling (SCRAM); http://www.epa.gov/scram001/).

Since the proposed drilling will occur at several locations, the worst case emissions were assumed to be located at the drilling site where the greatest onshore and near shore impacts could occur. The OCS project impact area for the Class II area analysis, the area containing modeling receptors, was established 25 nautical miles from any state's seaward boundary, extending shoreward until the project's estimated impact is less than the significant impact level. For this project the nearest Class II area receptor is more than 50 km from the closest drilling location.

7.2.1 Air Quality Model Selection

Because the closest Class II area receptor is more than 50 km from the nearest proposed drilling location (i.e., limited to 100 nautical miles from shore in BOEM Central Planning Area and 125 nautical miles in the Eastern Planning Area), the air quality impact analyses involve long-range transport and dispersion conditions. The EPA's preferred model for long-range transport assessments (CALPUFF/CALMET modeling system Version 5.8 (release 070623)) was selected to estimate potential impacts in the OCS Class II area. It should be noted that this same EPA-preferred long-range transport and dispersion model is appropriate for the PSD Class I impact assessment. In addition, the Class II coherent plume visibility assessment was performed using the VISCREEN model (Version 88341). Figure 2-1 provides the modeling area used in the PSD Class II and Class I assessments as well as locations of other significant features (*e.g.*, nearest PSD Class I areas).

7.2.2 Characteristics of Modeled Operational Scenarios

The primary PM_{10}, $PM_{2.5}$, and NO_X emission sources associated with the proposed exploration drilling activities are the diesel-fired engines on the drilling vessel. Additionally, the OCS air regulations require emissions from vessels servicing the OCS sources while en route to and from the source when within 25 nautical miles of the drilling operation to be considered direct emissions from the OCS source. Therefore, the impacts from the associated fleet of vessels that support the primary drilling activity were included.

The *BlackHawk* and support vessel emission sources include the following:

- Main Diesel Generator Engines (8),
- Emergency Generator Engine (1),
- Emergency Air Compressor (1),
- Life Boat Engines (6),
- Fast Rescue Craft Engine (1),
- Dust Collectors (3),
- Mud Degassers (4)/Degassing Vents (3),

- Dust Collectors (3),
- Fuel Storage Vessels (18),
- Fugitive Emissions (diesel fuel system),
- Flowback Boiler (1),
- Boom Flare (1),
- Cement and Mud Mixing,
- Third Party Engines (21),
- Painting and Welding Operations, and
- Support Vessels (i.e., barges, tug boat, evaluation vessel, supply boats).

The basis for the maximum short-term (1 to 24 hour) and long-term (annual) emission rates for these sources are discussed below. The maximum hourly emission rates were conservatively used in all modeled impact assessments. Additionally, all NO_X emissions were conservatively modeled to represent NO_2 emissions.

Six operating scenarios that could occur during drilling, well completion, and maintenance phases were considered. Because the exact emission units and their specifications were not available for each scenario, the potential worst-case emission units and their maximum potential emissions for each scenario were considered. The scenario providing the maximum emissions was used in this ambient impact assessment. This provides Anadarko sufficient operational flexibility to utilize various “equivalent” equipment in each scenario. These scenarios were evaluated to determine which scenario would result in maximum hourly, 24-hour, and annual potential to emit emission rates.

The basis of *BlackHawk’s* modeled maximum short-term (1-hour to 24-hour) emissions and annual emissions are provided in the August 2013 BlackHawk PSD/Title V Permit Application Operations in the Eastern Gulf of Mexico, the August 2013 Air Quality Dispersion Modeling Analysis Report BlackHawk EGOM Drilling, Completion, and Maintenance document, and the supplemental material submitted on November 12, 2013, February 5, 2014, February 7, 2014, and July 18, 2014, contained in the Administrative Record.

Anadarko is requesting authorization for the *BlackHawk* drilling vessel, and its associated support fleet, to operate in any of Anadarko’s lease blocks located within the eastern Gulf of Mexico (EGOM) as listed in Section 2.2 of this document and any additional lease block in the EGOM whose nearest drilling location is at least 185 km (100 nautical miles) from the nearest shore in the Bureau of Ocean Energy Management (BOEM) Central Planning Area and more than 232 km (125 nautical miles) from the nearest shore in the BOEM Eastern Planning Area. To ensure the modeled worst-case impact conditions were included, all impact modeling estimates were performed with the drilling vessel located at the northwest corner of the closest lease block to the shoreline and to the nearest PSD Class I area (Breton National Wildlife Refuge (NWR)).

The modeling locations of the associated support vessels for the *BlackHawk* can also affect the modeled impacts. The modeled worst-case impact location for the support boats is 25 nautical miles from the main drilling vessel in the direction of the closest receptor (*i.e.*, toward the Breton NWR). This support vessel location was used for all impact assessments. For dispersion analysis the maximum total emissions (i.e., drillship and support vessels) for each pollutant were considered. The modeled emission rates represent the worst-case combination among the different operating scenarios.

In addition to emission rates, the modeling analysis requires information regarding stack heights and other exit parameters that characterize exhaust flow from emission points. These release characteristics have an important influence on the results of the analysis. Exhaust stack parameters for the *BlackHawk* drilling vessel, as well as the support vessels, assumed all emissions emitted through a single stack on the drillship and support boat. The stack parameters were based on the main engine of the drillship and the characteristics of the worst-case support boat emissions. Because of the long distance to the nearest modeled receptor, the vessel orientation and building downwash considerations were not considered as they should not significantly affect the modeled impacts.

7.2.3 Meteorological Data

The three-year meteorological dataset (2001-2003) developed by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) was used for the PSD Class II and Class I impact assessments. This 4-km VISTAS Domain 2 dataset was developed by the Federal Land Managers using the approved regulatory version of CALMET (Version 5.8, Level 070623). The dataset was developed using observations from 100 to 109 surface stations, 10 upper air stations, nine overwater stations and 92 to 103 precipitation stations, depending on the meteorological year. This sub-domain includes a 50 km buffer past the Breton Class I area, far enough east for receptors along western Florida, and far enough south to include a 100 km buffer around the drilling location to allow re-circulation of puffs.

7.2.4 Building Downwash

Building downwash accounts for the effect of nearby structures on the flow of emissions from their respective release structures. However, as noted above, building downwash effects were not included in the modeling as they will not significantly affect concentrations when the nearest receptors are located more than 100 km from the location of the emissions. Because of this, FLMs typically do not request downwash be included in long-range PSD Class I impact assessments.

7.2.5 Receptor Locations

The seaward boundaries and Air Quality Control Regions for Louisiana, Mississippi, and Alabama extend for three nautical miles offshore and for nine nautical miles offshore Florida. For the Anadarko Class II modeling analysis, discrete receptors were located 25 nautical miles from the seaward boundaries of Louisiana, Mississippi, Alabama, and Florida. The receptors were placed at 1-km intervals but controlling concentrations were resolved to 100m, if needed. Because all of these receptors are over water, terrain elevations were assigned an elevation of 0 m (*i.e.,* sea level) for the Class II impact analysis. Each Class I area receptor was obtained from the National Park Service website at: http://www.nature.nps.gov/air/Maps/Receptors/index.cfm.

7.2.6 Project Impact Assessment

This section presents the estimated ambient concentrations associated with the emissions from the proposed *BlackHawk* exploration activities. If a pollutant's estimated impact exceeds an EPA SIL for that pollutant, the impacts of the facility must be included with the impacts of other increment-consuming sources to evaluate total increment consumption. Exceeding a SIL also requires that the evaluation of compliance with the applicable NAAQS take into account background concentrations and the contributions of other regional sources.

The SILs are screening values that have been used since 1980 to identify de minimis impacts. However, as discussed above, on January 22, 2013, the D.C, Circuit vacated the $PM_{2.5}$ SIL and SMC provisions adopted in the EPA's PSD Regulations (40 CFR 51.166 and 40 CFR 52.21). As discussed below, the EPA's review of Anadarko's application is consistent with the D.C. Circuit's decision.

The proposed project's worst-case hourly emissions from the *BlackHawk* drilling vessel, as well as the associated support vessels, were modeled for comparison to the SMC and SIL for NO_2, PM_{10}, and $PM_{2.5}$. The maximum modeled project concentrations at the discrete 25-nautical mile receptors were compared to the PSD Class II SILs for NO_2, PM_{10}, and $PM_{2.5}$. Similarly, the maximum modeled pollutant concentrations at the discrete 25-nautical mile receptors were compared to the SMC for these pollutants.

The impact modeling results are provided and compared to the SIL and SMC in Table 7-1. Because all maximum predicted NO_2, PM_{10}, and $PM_{2.5}$ concentrations are less than the SIL, the project's estimated impacts are not considered to cause or contribute to a violation of the associated NAAQS or PSD increments. Furthermore, all maximum predicted concentrations are also much less than the SMC; therefore, no pre-construction ambient monitoring is required.

Table 7-1
Maximum Modeled PSD Class II Area Concentrations SIL Comparison
(Receptors 25 Nautical Miles from Shoreline)

Pollutant	Averaging Period	*BlackHawk* Max. Concentration (ug/m^3)	Significant Impact Levels (ug/m^3)	Significant Monitoring Concentrations (ug/m^3)
NO_2[a]	1-hour[b]	5.04	7.5	None
	Annual	0.09	1.0	14
$PM_{2.5}$	24-hr[b]	0.12	1.2[c]	Vacated
	Annual	0.009	0.3[c]	None
PM10	24-hr	0.14	5.0	10
	Annual	0.01	1.0	None
CO	1-hour	13.66	2,000	None
	8-hour*	-	500	575

[a] Annual NO_2 was conservatively assumed to be 100 percent NO_x. One-hour NO_2 modeled value provided is three year average of the maximum daily 1-hour NO_X concentration at each receptor with 100 percent NO_2 conversion.
[b] Maximum (100 percentile) values are provided not 98[th] percentile.
[c] The $PM_{2.5}$, SIL, and SMC were vacated in January 2013.
*The CO 8-hour SIL is 500 ug/m^3. Because the modeled 1-hour concentration is below the CO 8-hour SIL, the 1-hour modeling results can be used to demonstrate compliance with the 8-hour SIL

The vacatur and remand of the $PM_{2.5}$ SIL resulted in a need for additional demonstration that the use of the SIL is appropriate to identify insignificant impacts. Similarly, the SMC was vacated so pre-construction ambient air quality monitor is required. Applicants may submit existing ambient air quality data collected from existing monitoring networks in lieu of pre-construction monitoring if such data are demonstrated to be representative or conservative for the impact area.

Anadarko reviewed the available $PM_{2.5}$ air quality monitoring data for the EGOM. Although there are no existing $PM_{2.5}$ measurements in the vicinity of Anadarko's lease blocks, there are a number of shore-based monitors. Because of the scarcity of $PM_{2.5}$ sources in the EGOM and the project's large distance from land-based sources, the background ambient $PM_{2.5}$ concentrations in the EGOM OCS are expected to be lower than any onshore concentrations. Therefore, the existing onshore ambient monitoring data used in the application, provides conservative background ambient $PM_{2.5}$ concentrations for the project location. The reported maximum $PM_{2.5}$ 24-hour and annual Design Values from the 18 existing shore-based monitors for the 2009-2011 period were 28 and 10.4 ug/m^3, respectively.

The PSD $PM_{2.5}$ 24-hour NAAQS is 35 ug/m^3 and the PSD Class II SIL is 1.2 ug/m^3. The annual $PM_{2.5}$ NAAQS is 12 ug/m^3 and the Class II SIL is 0.3 ug/m^3. The difference between the $PM_{2.5}$ NAAQS and the selected conservative ambient background concentrations are larger than the $PM_{2.5}$ Class II SILs. The fact that the maximum impacts from project emissions are substantially less than the SILs (*i.e.,* Table 7-1 Class II maximum project impacts are 10.0% of the 24-hour and 0.3% of the annual $PM_{2.5}$ SIL) provides further support for the use of the SILs in this application. Hence, it is reasonable to conclude that this proposed source with a $PM_{2.5}$ impact below the $PM_{2.5}$, SIL values will not cause or contribute to a violation of the $PM_{2.5}$ NAAQS.

In terms of the PSD Class I areas where compliance with the PSD increments are of concern, the SILs are used as a screening tool to assess whether a full cumulative Class I increment assessment is needed. The $PM_{2.5}$ increments became effective relatively recently (Major Source Baseline date of October 20, 2010; trigger date of October 20, 2011). Because of different meteorological conditions, PSD increment consuming emissions from outside the EGOM would not affect a Class I area at the same time as emissions originating from the EGOM. Therefore, given the conservative project emission rates and release location (*i.e.*, nearest possible distance to a Class I ambient receptor), the small number of other possible $PM_{2.5}$ increment consuming emission sources in the EGOM and onshore areas, and the unlikely combined simultaneous contributions from land-based and OCS $PM_{2.5}$ emission sources, the use of the $PM_{2.5}$ Class I SILs should not jeopardize PSD Class I increments.

7.2.7 Ozone

Both VOC and NO_X are precursors to ozone formation. The project's estimated VOC and NO_X emissions exceed the significant emission rate of 100 TPY. Thus, assessment of the project's ozone impacts is required. The estimated project emissions are provided in Table 4-1. An adequate ozone formation model has not been developed for this type of sole source application. Hence, the EPA concurred that a qualitative or relative assessment could be performed.

To put the project's NO_X and VOC emissions in perspective, the applicant compared the proposed project emissions to Gulf of Mexico emissions reported in the 2008 Emissions Inventory from the Bureau of Safety and Environmental Enforcement (BSEE). This inventory indicates there are 3,027 point sources that emit either VOC or NO_X located in the Gulf of Mexico west of 87 degree 30 minute longitude. The 2008 Gulfwide Emission Inventory Study Report (latest inventory report of the Bureau of Energy Management, Regulation and Enforcement) provides estimates of total emissions of NO_X and VOC from all the sources in the Gulf of Mexico. Comparing the proposed project emissions with these estimates reveals that the proposed project emissions are about 0.15% of total NO_X and 0.10% of total VOC Gulf of Mexico emissions.

For further comparison, Table 7-2 presents the statewide total NO_X emissions from the 2008 National Emissions Inventory (NEI) for the states around the Gulf of Mexico as summarized from information provided in the Technical Support Document for the EPA Federal Transportation Rule (EPA-HQ-OAR-2009-0491). This document shows that on-road sources contributed the most to the total NO_X emissions in the Gulf States. Estimated project emissions are very small when compared with the total NO_X emissions of nearly 4.0 million tons from the five Gulf States.

Table 7-2
State NO_X Emissions for Gulf States in the 2008 NEI

State	NO_X Emissions (TPY)
Alabama	421,467
Florida	895,436
Louisiana	548,439

Mississippi	278,745
Texas	1,827,200
Total	**3,971,287**

Another consideration is the distance from the closest Anadarko lease location to the coastline. The nearest coastline is at the mouth of the Mississippi Delta more than 180 km from the nearest lease location. Therefore, emissions of NO_X and VOCs from the project need to travel more than 100 miles to reach the coastline to potentially contribute to onshore ozone concentrations. In addition, the wind speeds and direction in the eastern Gulf of Mexico changes frequently, so the project emissions will be distributed over a wide area. Based on the above information and considerations, project emissions are not expected to significantly impact ozone formation along and near the coastal areas of the Gulf of Mexico.

7.2.8 Additional Impact Assessments

An additional impacts analysis was performed in accordance with PSD requirements in 40 CFR § 52.21(o). The analysis evaluates the potential impacts that the emissions from the proposed exploration activities could have on growth, soils, vegetation, and visibility in the OCS impact area of concern.

7.2.8.1 Growth

The potential growth of industrial, commercial, and residential sources as a result of the proposed exploration activities is expected to be minimal. The current infrastructure that supports the well-developed oil and gas activities in the area just west of the proposed drilling activities is adequate to support the proposed drilling activities and no additional growth is expected.

7.2.8.2 Soil and Vegetation

The potential impacts of the proposed project on the soils and vegetation in the project's impact area must be considered. Assessment of impacts to vegetation having no significant commercial or recreational values is not required. Due to the location of the proposed exploration activities in the eastern Gulf of Mexico more than 150 km from any coastline and the modeled project impacts of less than significant levels, no significant impact from the proposed project to soils or vegetation is expected.

7.2.8.3 Visibility

The estimate of project impact on visibility in the project's impact area was assessed using the EPA plume impact screening model VISCREEN. The VISCREEN model estimates the potential visual impact of a plume caused by a proposed project's emissions. A VISCREEN Level I analysis was conducted to determine if emissions from the proposed exploration activities could result in an adverse impact on visibility at the closest visibility sensitive Class II area receptor. The project's particulate matter and NO_X emissions were provided as inputs, while the default values were used for background ozone, stability class, and wind speed (default background ozone concentration of 0.04 parts per million, and default stability and wind speed are 6 and 1 meter per second, respectively). VISCREEN conservatively evaluated whether a plume from the *BlackHawk* drilling vessel, and associated support vessels, will produce a plume perceptible to an observer under worst-case meteorological conditions at a specific location. Several angles between the observer's line of sight and the sun's radiation (θ) were considered.

The application of VISCREEN is limited to distance less than or equal to 50 km. Therefore, to conservatively estimate the potential visual impact in the impact area that is more than 150 km from the drilling location, the much smaller 50 km distance was used in the VISCREEN analysis. Two criteria are assessed in the analysis, delta E and contrast. Delta E, also called plume perceptibility, refers to the color difference between the plume and background (*i.e.*, brightness, color hue, and color saturation). The default threshold or "critical" value for delta E is 2.0. Contrast, also referred to as green contrast value or Cp, represents the contrast of a plume against a background such as the sky or a terrain feature. Change in contrast is measured in terms of green color wavelength. The default threshold or "critical" value for contrast is 0.05.

Tables 7-3 provides the results of the VISCREEN modeling for the *BlackHawk* drilling vessel. This table shows that the default threshold for Delta E and contrast (Cp) were not exceeded for sky or terrain backgrounds by the drilling vessel at 50 km distance. Therefore, the proposed *BlackHawk* exploration activities are not expected to impair the local visibility at the closest areas of concern, 25 nautical miles from each state's seaward boundary.

Table 7-3
VISCREEN Level 1 *BlackHawk* Results

Background	Θ	Distance (Source-Observer)	Delta E		Contrast	
			Critical	Plume	Critical	Plume
Sky	10	50 km	2.00	1.870	0.05	-0.007
Sky	140	50 km	2.00	0.599	0.05	-0.011
Terrain	10	50 km	2.00	0.175	0.05	0.003
Terrain	140	50 km	2.00	0.055	0.05	0.002

7.3 PSD Class I Areas Analyses

The PSD Class I areas nearest to the project location are Breton National Wildlife Refuge (167 km distant), Bradwell Bay Wilderness Area (285 km distant), and Saint Marks Wilderness Area (281 km distant). The FLM for Breton and Saint Marks Wilderness Areas is the Fish & Wildlife Service (FWS). The FLM for the Bradwell Bay Wilderness Area is the National Forest Service. The proposed project impacts to PSD Class I areas included visibility and nitrogen and sulfate deposition (i.e., FLM's Air Quality Related Values (AQRV) of concern) and EPA required assessment of PSD Class I increments. The PSD increments were assessed using the same model and modeling procedures as used for the PSD Class II impact assessment.

7.3.1 Air Quality Model Selection

The EPA-preferred model for long-range transport assessments, CALPUFF Version 5.8, was used to evaluate potential AQRV and PSD increment impacts. This model is also recommended by the FLMs.

7.3.2 Modeling Procedures

The modeling procedures used for the Class I area impact analyses followed the recommendations of the Interagency Workgroup on Air Quality Modeling and the FLM Air Quality Related Values Workgroup (FLAG), outlined in the FLAG Phase I Report - Revised (2010). The selected options for the CALPUFF modeling system followed the procedures and defaults approved by the FLM and/or the EPA. Total NO_X emissions were modeled to represent NO_2 emissions. Visibility extinction coefficients and total deposition fluxes were calculated for 24-hour and annual averages, respectively. Comparisons to the regulatory standards and/or FLM target values were based on the maximum modeled values from the modeled three-year meteorological dataset. Project Class I area SIL analysis did not include chemistry conversion and puff depletion.

The CALPUFF chemistry transformations depend on the ambient ammonia and ozone concentrations. Because of the low ammonia background concentration expected over the Gulf of Mexico, the FLM requested value of 3 ppb was used. The ozone background concentrations for the 2001-2003 modeled years were those included with the meteorological dataset. A conservative background value of 65 ppb was used for any missing values.

The Class I area modeling assessment used the operational scenarios that produce the maximum hourly emissions. These maximum hourly emission rates were used for both the short-term (i.e., 24-hour) and long-term annual impact assessments (see Section 7.2.2).

To provide the worst-case impact condition the drilling vessel was located at their closest location – the NW corner of the lease block nearest Breton. For all impact analyses, support vessels were modeled as point sources located 25 nautical miles from the drilling vessel in the direction of the nearest shore receptor and Breton NWR.

7.3.4 Meteorological Data

The three-year meteorological CALMET processed dataset (2001-2003) developed by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) was obtained from the Florida Department of Environmental Protection and used for the PSD Class I impact assessment. This dataset, the same as used for the PSD Class II impact assessment, covers the Gulf of Mexico region of interest.

7.3.5 Modeling Results

The maximum Class I area estimated impacts from the proposed exploratory drilling emissions are provided in Table 7-4. The accepted PSD Class I annual SIL is also provided in this table. The maximum modeled concentrations associated with the proposed project emissions for the

BlackHawk drilling vessel are less than the SIL. Therefore, the project is considered to have no significant impact on the PSD Class I increments.

Table 7-4
Maximum Modeled Class 1 Concentrations

Class I Area	**Criteria Pollutant**	***Averaging Period***	***BlackHawk Max. Concentration*** (ug/m^3)	***EPA SIL*** (ug/m^3)
Breton NWR	NO_2[a]	Annual	0.0279	0.1
	PM2.5[b]	24-hr	0.0639	0.07[c]
		Annual	0.0042	0.06[c]
	PM10	24-hr	0.0738	0.3
		Annual	0.0049	0.2
St. Marks NWR and Bradwell Bay Wilderness*	NO_2[a]	Annual	0.0027	0.1
	PM2.5[b]	24-hr	0.0205	0.07[c]
		Annual	0.0007	0.06[c]
	PM10	24-hr	0.0236	0.3
		Annual	0.0008	0.2

*St Marks NWR and Bradwell Bay Wilderness were modeled together by including all receptors from both Class I areas. Therefore, the provided concentrations represent the worst-case concentration for both Class I areas.
[a] NO_X was assumed to be 100 percent converted to NO_2.
[b] 100 percent (maximum) values are provided using direct $PM_{2.5}$ emissions only.
[c] The Class I $PM_{2.5}$ SIL was vacated in January 2013.

Given the conservative emission rates and release location (i.e., nearest possible distance to Class I ambient receptor), and small number of other possible increment consuming $PM_{2.5}$ emission sources in the eastern Gulf of Mexico, the use of the $PM_{2.5}$ SIL should not jeopardize PSD Class I increment at this area.

The CALPUFF estimates of deposition of acid-forming compounds from the project's emissions are provided in Table 7-5. This table also contains the FLM accepted Deposition Analysis Thresholds (DAT) established for areas east of the Mississippi. The DAT is defined as the additional amount of nitrogen or sulfur deposition within a PSD Class I area below which estimated project impacts are considered negligible [Federal Land Manager's Air Quality Related Values Workgroup, Phase I Report – Revised June 2008]. The estimated project deposition rates are much less than the DAT. Therefore, the project associated Class I area deposition should be negligible.

Table 7-5
Estimated Class I Area Deposition Fluxes (kg/ha/yr)

Class I Area	***BlackHawk***	
	Nitrogen Deposition	Sulfur Deposition
Breton NWR	0.00716	0.0001
St. Marks/Bradwell Bay	0.00282	0.0000209
Deposition Analysis Threshold	0.010	0.005

The visibility concern at Breton NWR is regional haze. The project's contribution to regional haze is addressed as the 24-hour change in extinction. The FLM considers a five percent change in extinction to be just perceptible. The FLM accepted procedure known as Method 8 was used. Method 8 employs the IMPROVE extinction equation using monthly relative humidity adjustment factors, annual background aerosol concentrations, and 98th percentile modeled values at each receptor to provide estimates of the change in extinction associated with project emissions.

Visibility extinction coefficients were calculated for 24-hour averages. Comparison with FLM-recommended criteria for regional visibility impacts is shown by calculating the change in 24-hour extinction for each Class I receptor. The CALPUFF modeling system was used to predict both the extinction coefficient attributable to emissions from the project as well as the background extinction coefficients for that day's meteorology.

The Method 8 estimated project associated changes in visibility extinction for the *BlackHawk* vessel resulted in a small number of days with more than five percent change in extinction. Table 7-6 provides a summary of the Method 8 visibility modeling assessment for both Breton NWR and St. Marks NWR. The *BlackHawk* assessment for Breton NWR resulted in two days over a three-year period from 2001 through 2003 exceeding five percent change in extinction with a maximum of 5.18 percent. Both days had changes of less than 10 percent. The St. Marks NWR assessment resulted in no days exceeding five percent change in extinction and a maximum of 1.23 percent.

Table 7-6
Summary of Method 8
Maximum Estimated Change in Extinction for Drilling Operations

Class I Area	**Parameter**	***Year***		
		2001	***2002***	***2003***
Breton NWR	98th Percentile 24-hr Average % Change	5.18	3.55	4.42
	No. Days >5% Change 98th Percentile Threshold	2	0	0

	No. Days >10 % Change 98th Percentile Threshold	0	0	0
St. Marks NWR	98th Percentile 24-hr Average % Change	1.23	0.87	1.18
	No. Days >5% Change 98th Percentile Threshold	0	0	0
	No. Days >10 % Change 98th Percentile Threshold	0	0	0

The estimated impacts of the proposed project's emissions on the nearest PSD Class I area shows visibility impacts for Breton NWR of 0.2% greater than the FLM perceptibility level on two days over a three year period. The drilling vessel's deposition levels are less than the FLM's DAT values. The Breton NWR FLM reviewed this PSD Class I area impact assessment and indicated that because of the conservative assumptions contained in the emission estimates and analyses, and the temporary nature of the activity, they expected no significant project-related impacts.

8.0 Additional Requirements

8.1 Endangered Species Act and Essential Fish Habitat of Magnuson-Stevens Act

Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies, in consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service and/or the U.S. Fish and Wildlife Service (collectively, "the Services"), to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of a species listed as threatened or endangered, or result in the destruction or adverse modification of designated critical habitat of such species. *See* 16 U.S.C. §1536(a)(2); *see also* 50 CFR §§ 402.13 and 402.14. The federal agency is also required to confer with the Services on any action which is likely to jeopardize the continued existence of a species proposed for listing as threatened or endangered or which will result in the destruction or adverse modification of critical habitat proposed to be designated for such species. *See* 16 U.S.C. § 1536(a)(4); *see also* 50 CFR §§ 402.10. Further, the ESA regulations provide that where more than one federal agency is involved in an action, the consultation requirements may be fulfilled by a designated lead agency on behalf of itself and the other involved agencies. *See* 50 CFR §§ 402.07. In addition, Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NOAA with respect to any action authorized, funded, or undertaken by the agency that may adversely affect any essential fish habitat identified under the MSA.

The Bureau of Ocean Energy Management (BOEM) of the DOI is the lead federal agency for authorizing oil and gas exploration activities on the OCS. Therefore, BOEM serves as the Lead Agency for ESA section 7 and MSA compliance for Anadarko's exploration activities. In accordance with section 7 of the ESA, BOEM consults prior to a lease sale with NOAA Fisheries and FWS to ensure that a sale proposal will not cause any protected species to be jeopardized by oil and gas activities on a lease. In addition, BOEM requests annual concurrence from the Services to ensure current activities remain consistent with the terms and conditions of the Biological Opinion issued for the lease sale activities.

Since the BOEM consultations address the same exploratory drilling activities authorized by the air permit that the EPA is issuing to Anadarko, the EPA relied in part on those conclusions for the preliminary determination. In addition, NOAA Fisheries considered the scope of the proposed action and did not identify any routes of effects for air quality. Based upon the best available data and technical assistance from the Services, the EPA determined that the issuance of this OCS permit to Anadarko for exploratory drilling is not likely to cause any adverse effects on listed species and essential fish habitats beyond those already identified, considered and addressed in the prior consultations.

8.2 National Historic Preservation Act

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties. Section 106 requires the lead agency official to ensure that any federally funded, permitted, or licensed undertaking will have no effect on historic properties that are on or may be eligible for the National Register of Historic Places. The BOEM is the lead agency permitting Anadarko's activity in the Gulf of Mexico. The environmental effects of offshore drilling in the Gulf were analyzed by the BOEM in multi-sale Environmental Impact Statements, covering sales in 2007 through 2012, and for 2012 through 2017, accessible on the web at http://www.boem.gov/nepaprocess/#Recent NEPA Documents.

BOEM typically conducts section 106 consultation at the pre-lease stage by prior agreement with the Advisory Counsel for Historic Preservation rather than at the individual post-lease permit level. In order to reach a Finding of No Significant Impact, mitigation is carried out at the post-lease plan level by requiring remote sensing survey of the seafloor in areas considered to have a high probability for archaeological resources. Any cultural resources discovered during that inspection are required by regulation to be reported to BOEM with 72 hours. No significant archaeological properties are anticipated in this location, but should anything be discovered there as a result of the operator's investigations, BOEM would consult with the State Historic Preservation Office and the Advisory Counsel for Historic Preservation.

8.3 Executive Order 12898 – Environmental Justice

Executive Order 12898, entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs federal agencies, including the EPA, to the extent practicable and permitted by law, to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of regulatory programs, policies, and activities on minority populations or low-income populations. *See* Executive Order 12898, 59 Fed. Reg. 7629 (February 11, 1994). Consistent with Executive Order 12898 and the EPA's environmental justice policy (OEJ 7/24/09), in making decisions regarding permits, such as OCS permits, the EPA gives appropriate consideration to environmental justice issues on a case-by-case basis, focusing on whether its action would have disproportionately high and adverse human health or environmental effects on minority or low-income populations.

The EPA has concluded that this proposed OCS air permitting action for Anadarko's exploratory drilling operation on the Gulf of Mexico would not have a disproportionately high adverse human health or environmental effects on minority or low-income populations. The closest drill site is located approximately 100 miles southeast of the nearest Louisiana shoreline, and 125 miles south of the nearest Alabama and Florida in the Gulf of Mexico. The project is located more than 150 miles offshore in ultra-deepwater and the EPA is not aware of any minority or low-income population that may frequently use the area for recreational or commercial reasons. In addition, since the project is located well away from land, the project's emissions impacts will be dispersed over a wide area with no elevated concentration levels affecting any onshore populated area. *See* Section 7.0 of this document pertaining to air quality impact for further information.

9.0 Public Participation

9.1 Opportunity for Public Comment

The EPA must follow the administrative and public participation procedures in 40 CFR part 124 used to issue PSD permits when processing OCS permit applications under Part 55 as well as the administrative and public participation procedures of 40 CFR part 71 when issuing Title V permits to OCS sources. 40 CFR §§ 55.6(a)(3), 71.4(d). Accordingly, the EPA has followed the procedures of 40 CFR parts 71 and 124 in issuing the draft permit. As provided in 40 CFR parts 71 and 124, the EPA is seeking comments on the Anadarko OCS air permit OCS-EPA-R4019 during the public comment period as specified in the public notice. Public notice is also being provided as required under 40 CFR § 71.

Any interested person may submit written comments on the draft permit during the public comment period. If you believe that any condition of the permit is inappropriate, you must raise all reasonably ascertainable issues and submit all reasonably available arguments supporting your position by the end of the comment period. Any documents supporting your comments must be included in full and may not be incorporated by reference unless they are already part of the administrative record for this permit or consist of state or federal statutes or regulations, the EPA documents of general applicability, or other generally available referenced materials.

Comments should focus on the proposed air quality permit, the permit terms, and the air quality aspects of the project. If you have comments regarding non-air quality impacts, leasing, drilling safety, discharge, or other similar issues not subject to this public comment period, you should submit them during the leasing and plan approval proceedings of the BOEM, which is the lead agency for offshore drilling.

All timely comments related to the proposed action will be considered in making the final decision and will be included in the administrative record and responded to by the EPA. The EPA may summarize the comments and group similar comments together in our response instead of responding to each individual comment.

All comments on the draft permit must be received by email at **R4OCS permits@epa.gov**, submitted electronically via www.regulations.gov (docket #EPA-R04-OAR-2014-0728), or **postmarked by December 15, 2014**. Comments sent by mail should be addressed to: USEPA Region 4, Air Permits Section APTMD, 61 Forsyth Street, SW, Atlanta, GA 30303. An extension of the 30-day comment period may be granted if the request for an extension is filed within 30 days and it adequately demonstrates why additional time is required to prepare comments. All comments will be included in the public docket without change and will be made available to the public, including any personal information provided, unless the comment includes Confidential Business Information or other information in which disclosure is restricted by statute. Information that you consider Confidential Business Information or otherwise protected must be clearly identified as such and must not be submitted through e-mail. If you send e-mail directly to the EPA, your email address will be captured automatically and included as part of the public comment. Please note that an e-mail or postal address must be provided with your comments if you wish to receive direct notification of the EPA's final decision regarding the permit and the EPA's response to comments submitted during the public comment period.

For general questions on the draft permit, contact: Ms. Eva Land at 404-562-9103 or land.eva@epa.gov.

9.2 Public Hearing

The EPA will hold a public hearing if the Agency determines that there is a significant degree of public interest in the draft permit. Public hearing requests must be in writing and received by EPA by **December 8, 2014.** Requests should be sent by email to **R4OCSpermits@epa.gov** or by mail addressed to: USEPA Region 4, Air Permits Section, 61 Forsyth Street, SW, Atlanta, GA 30303. Requests for a public hearing must state the nature of the issues proposed to be raised in the hearing. If a public hearing is held, you may submit oral and/or written comments on the draft permit at the hearing. You do not need to attend the public hearing to submit written comments. If the EPA determines that there is a significant degree of public interest, The EPA will hold a public hearing on December 18, 2014, at:

West Florida Public Library

239 North Spring Street
Pensacola, Florida 3250
(850) 436-5043

If a public hearing is held, the public comment period will automatically be extended to the close of the public hearing. If no timely request for a public hearing is received, or if the EPA determines that there is not a significant degree of public interest, a hearing will not be held. Such an announcement will be posted on the EPA's website at:

http://www.epa.gov/region4/air/permits/ocspermits/ocspermits.html, or you may call the EPA at the contact number above to verify if the public hearing will be held.

9.3 Administrative Record

The administrative record contains the application, supplemental information submitted by Anadarko, correspondence (including e-mails) clarifying various aspects of Anadarko's application, other material used in EPA's decision, and correspondence with other agencies. The administrative record and draft permit are available on www.regulations.gov (docket# EPA-R04-OAR-2014-0728) and through the EPA's website at:

http://www.epa.gov/region4/air/permits/ocspermits/ocspermits.html.

These websites can be accessed through free internet services available at local libraries.
The draft permit and the administrative record are also available for public review at the EPA Region 4 office at the address listed below. Please call in advance for available viewing times.

EPA Region 4 Office
61 Forsyth Street, SW
Atlanta, GA 30303
Phone: (404) 562-9043

To request a copy of the draft permit, preliminary determination or notice of the final permit action, please contact: Ms. Rosa Yarbrough, Permit Support Specialist at 404-562-9643 or yarbrough.rosa@epa.gov.

9.4 Final Determination

The EPA will make a decision to issue a final permit or to deny the application for the permit after the Agency has considered all timely comments on the proposed determination. Notice of the final decision shall be sent to each person who has submitted written comments or requested notice of the final permit decision, provided the EPA has adequate contact information.