**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**Region 4**
**Atlanta, Georgia**

# Preliminary Determination & Statement of Basis

Outer Continental Shelf Air Permit OCS-EPA-R4015

for

**Anadarko Petroleum, Inc.**
**EGOM Drilling Project**

**June 19, 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 |
| 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 | Green House Gas |
| GOM | Gulf of Mexico |
| HAP | Hazardous Air Pollutants |
| hp | Horsepower |
| IC | Internal Combustion |
| kPa | Kilopascals |
| $m^3$ | Cubic Meters |
| 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 |
| PM | Particulate matter |
| $PM_{2.5}$ | Particulate matter with an aerodynamic diameter less than 2.5 microns |
| $PM_{10}$ | Particulate matter with an aerodynamic diameter less than 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, 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 Transocean deepwater drilling vessel *Discoverer Spirit* 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 operation will last no more than 208 calendar days per year over a two-year period, and as such, will be considered a temporary source for purposes of permitting under the CAA’s Prevention of Significant Deterioration (PSD) program.

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 in addition to all supplemental materials provided and is proposing to issue Permit Number OCS-EPA-R40015 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 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

### 2.2 Facility Location

Anadarko is proposing to drill on the OCS in the Eastern Gulf of Mexico east of longitude 87°30’, west of the Military Mission Line (86°41’ west longitude), at least 100 miles from the Louisiana shoreline, and 125 miles to the Florida shoreline. The area contains both active lease blocks and lease blocks that

[1] *See* CAA section 328. The Department of the Interior has jurisdiction for CAA implementation west of 87°30’.

[2] Pursuant to 40 CFR 55.6(a)(3), the issuance of federal preconstruction and operating permits for OCS sources is governed by the administrative and public participation procedures in 40 CFR part 124 used to issue PSD permits. . Accordingly, EPA has followed the procedures of 40 CFR part 124 in issuing the draft permit. This Preliminary Determination describes the derivation of the permit conditions and the reasons for them as provided in 40 CFR § 124.7 and serves as a Fact Sheet as required by 40 CFR § 124.8 and statement of basis as required by 40 CFR § 71.7(a)(5).

the Bureau of Ocean Energy Management (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**

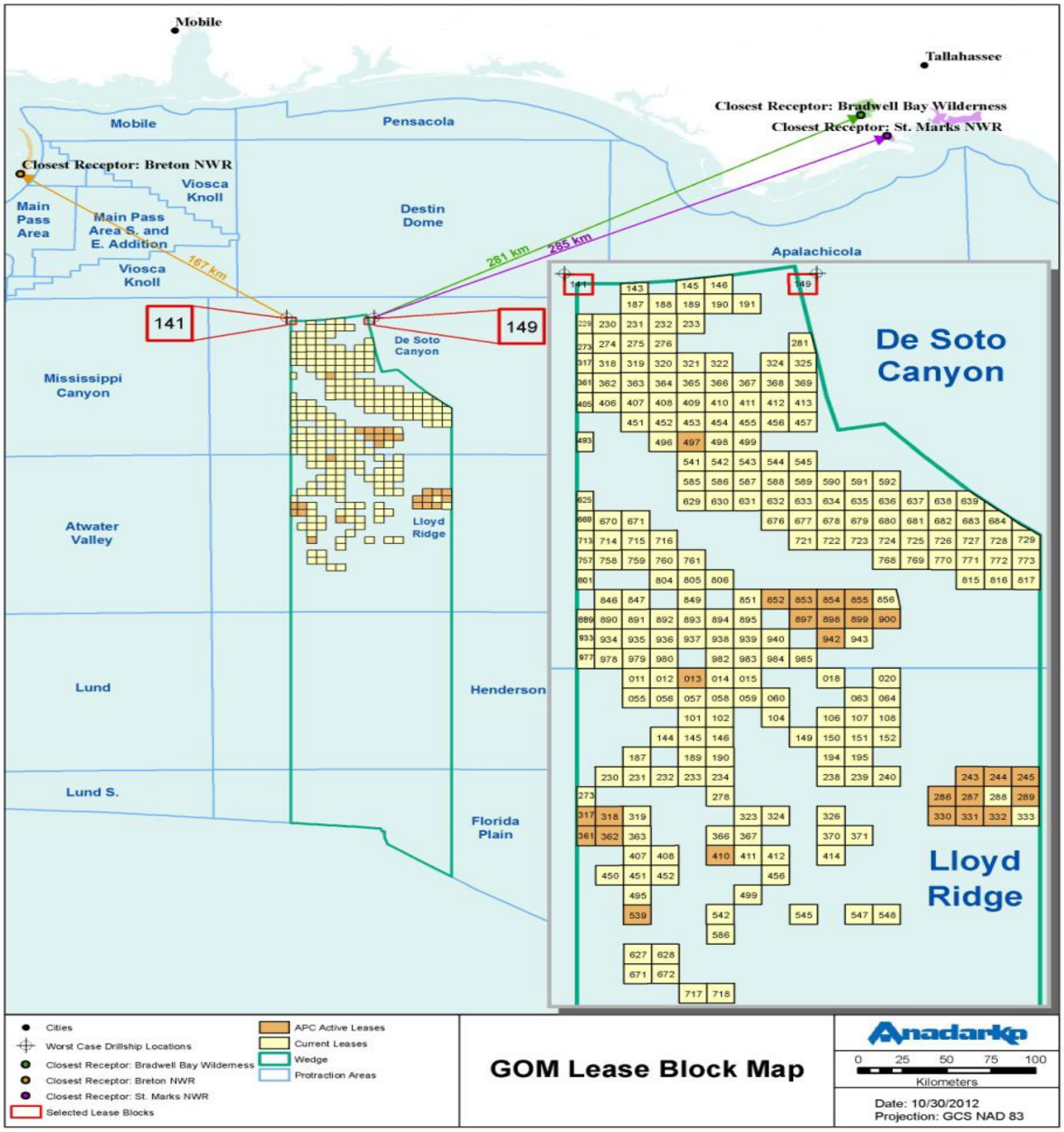



*Image Source: Anadarko Petroleum Corporation Application, December 2012*

# 3.0 Proposed Project

The proposed project will mobilize the *Discoverer Spirit*, up to two support vessels to transport personnel and supplies, and up to three vessels for the well completion phase. The *Discoverer Spirit* drillship was previously permitted by EPA for an earlier project, and therefore, EPA has relied on some earlier determinations made on equipment for the project described below. 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 facilities would be permitted separately. The operation will last no more than two years, and operate no more than 208 calendar days per year. Based on applicable permitting regulations, this project is a temporary source for PSD permitting purposes.

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.

**Figure 3-1 Drilling Vessel**

Based on emissions estimates and the applicable permitting thresholds, the project will have emissions of $NO_x$, and emissions of CO, VOC, PM, $PM_{10}$, and $PM_{2.5}$ that meet or exceed the respective significant emission rates and is subject to the PSD and Title V programs for $NO_x$ as the measured pollutant for criteria pollutants $NO_2$ and ozone and as a precursor to $PM_{2.5}$. Any facility that emits a regulated New Source Review (NSR) pollutant at levels meeting or exceeding PSD significant emission rates must perform a BACT analysis and comply with all subsequent regulatory obligations for that pollutant as described in Section 6.0 below. Based on Anadarko's permit application, GHGs will be emitted at close to the GHG PSD significant emission rate. Therefore, EPA has also included a condition in the draft permit that limits the project's total GHG emissions.

The emissions units to be used on the *Discoverer Spirit* drilling vessel are detailed in Sections 4.0 and 5.0 and Table 4-2. The diesel powered units include six main propulsion diesel electric generators (DR-GE-01 through DR-GE-06), one emergency generator (DR-GE-07), one remotely operated vehicle (ROV) emergency generator (DR-GE-08), two air compressor diesel engines (DR-AC-01 and DR-AC-02), a fast rescue craft, four escape capsules, third party engines, third party engines used only during the well completion phase, and miscellaneous emission sources and operations. Anadarko currently does not know the exact specifications of the third party equipment, as this equipment is leased on short notice. Anadarko selected representative equipment to develop emission calculations.

The *Discoverer Spirit* will be supported by up to two support vessels for the entire project and three well completion vessels. The support vessels will be used 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. Therefore, it is not known which specific vessels will be available when drilling commences. To accommodate for this uncertainty, Anadarko selected the largest support vessels (the supply boat *HOS Coral* and the anchor handling boat *Kirt Chouest*) and largest well completion vessels (a tug, a barge, and a stimulation vessel) to calculate emissions based on the worst-case scenario. Anadarko will maintain records of the engine specifications and number of hours each engine is operated within 25 miles of the *Discover Spirit* 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 miles of the *Discoverer Spirit*. Diesel units used to calculate emissions from the support vessel 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.

Support vessels are subject to applicable regulatory requirements when they are physically attached to the OCS source, whereby only the stationary source aspects of the vessels will be regulated (see Section 4.2); this includes off-loading and fuel transfer. These stationary source aspects are off-loading, fuel transfer, tanks, and the eight (8) stimulation vessel pumps (SV-PE-01 through SV-PE-08).

# 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 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 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 miles of a state's seaward boundary and those located beyond 25 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 miles of any state's seaward boundary.

Sources located beyond 25 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.

Also, beginning on January 2, 2011, greenhouse gases (GHGs) became subject to regulation under the PSD major source permitting program and a regulated NSR pollutant when emitted in amounts greater than certain applicability thresholds. GHGs are a single air pollutant defined in 40 CFR § 52.21(b)(49)(i) as the aggregate group of the following six gases:

- Carbon dioxide ($CO_2$);
- Nitrous oxide ($N_2O$);
- Methane ($CH_4$);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Sulfur hexafluoride ($SF_6$).

Due to the nature of GHGs and their incorporation into the definition of "subject to regulation," the determination of whether a source is emitting GHGs in an amount that triggers PSD applicability involves a calculation of the source's $CO_2$-equivalent ($CO_2e$) emissions and GHG mass emissions. *See* the EPA's PSD and Title V Guidance for Greenhouse Gases (March 2011) available online at www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf.

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 *Discoverer Spirit* were considered direct emissions while within 25 miles of the drilling vessel and are included in the PTE.

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. Therefore, Anadarko is required to apply BACT and address air quality impact requirements for CO and for $NO_X$, both as the measured pollutant for $NO_2$ and ozone and as a precursor to ozone. PSD review also applies to PM, $PM_{10}$, $PM_{2.5}$, and VOC (as the measured pollutant for ozone) 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** | 370 | 100 | Yes |
| **$NO_x$[1]** | 1,170 | 40 | Yes |
| **VOC[2]** | 64.10 | 40 | Yes |
| **PM** | 33.77 | 25 | Yes |
| **$PM_{10}$** | 23.48 | 15 | Yes |
| **$PM_{2.5}$** | 22.86 | 10 | Yes |
| **$SO_2$[3]** | 0.76 | 40 | No |
| **$H_2SO_4$** | 0.02 | 7 | No |
| **Pb** | 0.01 | 0.6 | No |
| **$CO_2e$** | 74,571 | 75,000 (subject to regulation threshold) | No |

[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 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 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 $NO_X$ and CO, it is considered a major source under title V and part 71. Therefore, Anadarko must apply for a Title V operating permit as provided in 40 CFR § 71.5(a)(1)(i) within 12 months of first becoming an OCS source on the lease blocks covered by this permit.

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 December 26, 2012 and updated on March 2013 and July 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. All permanent diesel engines onboard the *Discoverer Spirit* were constructed prior to July 11, 2005 and (see Table 4-2 below) have not been modified or reconstructed; therefore these diesel engines are not subject to NSPS 40 CFR part 60, subpart IIII. The *Discoverer Spirit* will have third party engines onboard that Anadarko will be unable to confirm until drilling has commenced. Also, the stimulation vessel used during well completion activities will have eight third party pump engines (SV-PE-01 through SV-PE-08) that will be utilized for OCS activities and could be subject to Subpart IIII. Anadarko will use new engines where available, and has identified which third party engines could be subject to this subpart. Anadarko used representative engines for all unknown engines, but may notify EPA prior to use of any new, modified, or reconstructed engine intended to be used or in replacement of any engines identified in Table 4-2, and shall submit to EPA a reevaluation of the applicability of pertinent NESHAP and NSPS regulations, as well as copies of the manufacturer engine certification to EPA standards. If the substitute engines are subject to this subpart, Anadarko will comply with all applicable requirements. Table 4-2 lists the model years of all permanent engines on the *Discoverer Spirit*, and lists the engine ratings for all engines potentially subject to this subpart.

**Table 4-2 *Discoverer Spirit* Engine Specifications**

| Emissions Unit ID | Description | Make & Model | Rating (hp) | Manufacture Year |
|---|---|---|---|---|
| DR-GE-01 | Main propulsion generator #1 | Wärtsilä 18V32 LNE | 9,910 hp* | 1998 |
| DR-GE-02 | Main propulsion generator #2 | Wärtsilä 18V32 LNE | 9,910 hp | 1998 |
| DR-GE-03 | Main propulsion generator #3 | Wärtsilä 18V32 LNE | 9,910 hp | 1998 |
| DR-GE-04 | Main propulsion generator #4 | Wärtsilä 18V32 LNE | 9,910 hp | 1998 |
| DR-GE-05 | Main propulsion generator #5 | Wärtsilä 12V32 LNE | 6,610 hp | 1998 |
| DR-GE-06 | Main propulsion generator #6 | Wärtsilä 12V32 LNE | 6,610 hp | 1998 |
| DR-GE-07 | Emergency diesel engine | Wärtsilä 6R32LNE | 3,300 hp | 1998 |
| DR-GE-08 | Remotely operated vehicle (ROV) emergency generator | Cummins QSM11-G2NR3 (or equivalent) | 427 hp | 2004 |
| DR-EC-01 | Escape capsule diesel engine #1 | Lister Petter L4 (or equivalent) | 39 hp | 1997 |
| DR-EC-02 | Escape capsule diesel engine #2 | Lister Petter L4(or equivalent) | 39 hp | 1997 |
| DR-EC-03 | Escape capsule diesel engine #3 | Lister Petter L4(or equivalent) | 39 hp | 1997 |
| DR-EC-04 | Escape capsule diesel engine #4 | Lister Petter L4(or equivalent) | 39 hp | 1997 |
| DR-EC-05 | Escape capsule diesel engine #5 | Lister Petter L3(or equivalent) | 29 hp | 1997 |
| DR-EC-06 | Escape capsule diesel engine #6 | Lister Petter L3(or equivalent) | 29 hp | 1997 |
| DR-FR-01 | Fast rescue craft engine | Steyr M16 TCAM-MO236 K42(or equivalent) | 230 hp | 2000 |

| | | | | |
|---|---|---|---|---|
| DR-AC-01 | Air compressor diesel engine #1 | Sperre M-HL2/140 (or equivalent) | 18 hp | 1997 |
| DR-AC-02 | Air compressor diesel engine #2 | Sperre M-HL2/140 (or equivalent) | 15 hp | 1997 |
| DR-FL-01 | Diesel powered forklift engine | Caterpillar DP30K (or equivalent) | 30 hp | |
| **Third Party Engines** | | | | |
| DR-WL-01 | Wireline diesel engine #1 | Cummins C8.3 (or equivalent) | 275hp | |
| DR-WL-02 | Wireline diesel engine #2 | Cummins C8.3 (or equivalent) | 275 hp | |
| DR-EL-01 | Electric line diesel engine #1 | Caterpillar 3126B (or equivalent) | 300 hp | |
| DR-EL-02 | Electric line diesel engine #2 | Caterpillar 3126B (or equivalent) | 300 hp | |
| DR-CU-01 | Casing unit diesel engine #1 | Deutz F6L914 (or equivalent) | 124 hp | |
| DR-CU-02 | Casing unit diesel engine #2 | Deutz F6L914 (or equivalent) | 124 hp | |
| DR-WB-01 | Water blasting engine | Deutz BF 6 M 2012C (or equivalent) | 208 hp | |
| DR-VS-01 | Well evaluation engine #1 | Detroit 4-71 (or equivalent) | 140 hp | |
| DR-VS-02 | Well evaluation engine #2 | Detroit 4-71 (or equivalent) | 140 hp | |
| DR-VS-03 | Well evaluation engine #3 | Detroit 4-71 (or equivalent) | 140 hp | |
| DR-VS-04 | Well evaluation engine #4 | Detroit 4-71 (or equivalent) | 140 hp | |
| DR-VS-05 | Well evaluation engine #5 | Detroit 4-71 (or equivalent) | 140 hp | |
| **Well Completion Third Party Sources on Drillship** | | | | |
| DR-WC-01 | Tubing running unit engine | Deutz F6L914 (or equivalent) | 92 hp | |
| DR-WC-02 | Fluid filtration pump | Deutz BF 4 M 2012 (or equivalent) | 100 hp | |
| DR-WC-03 | Eline powerpack | John Deere 6068H (or equivalent) | 225 hp | |
| DR-WC-04 | Slickline powerpack | FPT N45 MST (or equivalent) | 126 hp | |
| DR-WC-07 | Coil Tubing (CT) powerpack | Detroit Diesel 6063KH74 (or equivalent) | 600 hp | |
| DR-WC-08 | CT pump | Caterpillar C27 ACERT (or equivalent) | 860 hp | |
| DR-WC-09 | Wireline engine #1 | Cummins C8.3 | 275 hp | |
| DR-WC-10 | Wireline engine #2 | Cummins C8.3 | 275 hp | |
| **Well Completion Stimulation Vessel** | | | | |
| SV-PE-01 | Stimulation vessel pump #1 | Caterpillar 3512 DITA | 2,250 hp | |
| SV-PE-02 | Stimulation vessel pump #2 | Caterpillar 3512 DITA | 2,250 hp | |
| SV-PE-03 | Stimulation vessel pump #3 | Caterpillar 3512 DITA | 2,250 hp | |
| SV-PE-04 | Stimulation vessel pump #4 | Caterpillar 3512 DITA | 2,250 hp | |
| SV-PE-05 | Stimulation vessel pump #5 | Caterpillar 3512 DITA | 2,250 hp | |
| SV-PE-06 | Stimulation vessel pump #6 | Caterpillar 3512 DITA | 2,250 hp | |
| SV-PE-07 | Stimulation vessel pump #7 | Caterpillar 3512 DITA | 2,250 hp | |
| SV-PE-08 | Stimulation vessel pump #8 | Caterpillar 3512 DITA | 2,250 hp | |

*horse power

### 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, all fuel tanks included in the permit application are not subject to subpart Kb because their vapor pressure is less than 3.5 kPa or their capacity is less than 75 $m^3$. 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. All condensate storage tanks included in the permit application are not subject to subpart Kb because their capacity is less than 1,589.874 $m^3$, and the condensate will be stored prior to custody transfer.

#### 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 a 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 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 HAPs 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 HAPs 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. All permanent engines on the *Discoverer Spirit* and all third party engines that are not subject to 40 CFR part 60, subpart IIII will be subject to management practices as defined in 40 CFR § 63.6603(c); this includes the main diesel engines (DR-GE-01 through DR-GE-06), emergency generator engines (DR-GE-07), well evaluation engines (DR-VS-01 through DR-VS-05), air compressor engines (DR-AC-01 and DR-AC-02), and the stimulation vessel pump engines (SV-PE-01 through SV-PE-08). The management practices for the non-emergency engines 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.

Additionally, pursuant to 40 CFR § 63.6655, 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.

The application identified third party engines that will be EPA Tier compliant, and thereby comply with 40 CFR part 60, subpart IIII. Subpart ZZZZ of 40 CFR 63 requires that these third party engines comply with the requirements of 40 CFR part 60, subpart IIII. Therefore, no further requirements under subpart ZZZZ apply to these third party engines (DR-WL-01 and DR-WL-02, DR-EL-01 and DR-EL-02, DR-CU-01 and DR-CU-02, DR-WC-01 through DR-WC-04, and DR-WC-07 through DR-WR-10, and DR-WB-01).

Emissions from the escape capsule engines and the fast rescue craft on the *Discoverer Spirit* 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 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.

### 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.

# 5.0 Project Emissions

This section describes the emission calculation basis for each emission source. The emission calculations are based on the previously permitted limits for *Discoverer Spirit* engines, EPA nonroad engine emission tier standards, analysis of fuel sulfur content, vendor-supplied emissions factors, EPA's TANKS 4.09d program, material safety and data sheets, AP 42 emission factors, and EPA publications. The total projected emissions for the project include emissions based on the worst-case total number of hours per year for each emission unit. Emissions from support vessels are based on the worst-case PTE support vessel of all available individual support vessels. Anadarko selected the drilling scenario to calculate the PTE because it represented the worst case conditions between the drilling and the well completion scenario. This scenario includes emissions from the *Discoverer Spirit* and the worst-case supply vessel. The drilling and well completion scenarios will not occur simultaneously. The additional units that will be used during the well completion scenario are provided in Appendix B of the December 2012 application located in the administrative record as referenced in Section 9 of this document. A summary of the PTE from regulated NSR pollutants are given in Table 5-1. The detailed emission calculations that follow are for the worst-case scenario only.

**Table 5-1 Potential to Emit Emissions (tpy)**

| Emission Unit ID | VOC | $NO_x$ | CO | $SO_2$ | PM | $PM_{10}$ | $PM_{2.5}$ | $H_2SO_4$ | Pb | GHGs ($CO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Main Propulsion Electric Generator Engines and Emergency Generator Average Annual Operating Emissions | 15.68 | 690.83 | 43.52 | 0.31 | 19.14 | 10.97 | 10.64 | 9.58E-3 | 5.55E-3 | 31,322 |
| ROV Emergency Generator | 0.05 | 0.22 | 0.12 | 2.38E-04 | 0.01 | 0.01 | 0.01 | 7.45E-06 | 4.31E-06 | 24.34 |
| Air Compressor (2) | 0.002 | 0.02 | 5.74E-3 | 1.00E-5 | 0.002 | 0.002 | 0.002 | 3.07E-07 | 1.74E-07 | 0.99 |
| Well Evaluation Engines (5) | 0.04 | 1.07 | 0.71 | 4.91E-4 | 0.10 | 0.10 | 0.10 | 1.53E-05 | 8.88E-06 | 50.11 |
| Escape Capsule Diesel Engine (6) | 0.034 | 0.42 | 0.09 | 1.53E-4 | 0.03 | 0.03 | 0.03 | 4.76E-06 | 2.17 E-06 | 12.25 |
| Diesel Powered Forklift Engine | 0.19 | 2.32 | 0.50 | 8.40E-4 | 0.17 | 0.17 | 0.17 | 2.62E-05 | 1.52E-05 | 85.76 |
| Wireline Diesel Engine (2) | 3.45 | 14.90 | 7.90 | 0.015 | 0.45 | 0.45 | 0.45 | 4.81E-04 | 2.79E-04 | 1,572 |
| Electric Line Diesel Engine (2) | 3.77 | 16.25 | 8.62 | 1.68E-2 | 0.49 | 0.49 | 0.49 | 5.25E-04 | 3.04E-04 | 1715 |
| Casing Unit Diesel Engine (2) | 1.55 | 6.69 | 5.07 | 6.92E-3 | 0.30 | 0.30 | 0.30 | 2.16E-04 | 1.25E-04 | 706.66 |
| Fast Rescue Craft | 0.03 | 0.14 | 0.09 | 1.29E-04 | 7.56 E-03 | 7.56E-03 | 7.56E-03 | 4.03E-06 | 2.33E-06 | 13.17 |
| Water Blasting Engine | 0.65 | 1.71 | 1.49 | 2.91 E-3 | 0.09 | 0.09 | 0.09 | 9.10E-05 | 5.27E-05 | 297 |
| Tanks (12) | 0.70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dust Collector (3) | 0 | 0 | 0 | 0 | 0.74 | 0.74 | 0.74 | 0 | 0 | 0 |
| Fugitive Emissions | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mud Degassing Vent | 5.57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 336 |
| Welding Operations | 0 | 0 | 0 | 0 | 0.20 | 0.20 | 0.20 | 0 | 8.42E-04 | 0 |
| Painting Operations | 9.00 | 0 | 0 | 0 | 0.13 | 0.13 | 0.13 | 0 | 0 | 0 |
| **Total *Discoverer Spirit*** | 40.73 | 734.57 | 68.06 | 0.35 | 21.85 | 13.69 | 13.36 | 1.10E-02 | 7.19E-03 | 36,136 |
| Worst-case Support Vessel | 23.36 | 435.62 | 301.57 | 0.41 | 11.92 | 9.80 | 9.51 | 1.27E-02 | 7.36E-03 | 38,435 |
| Worst-case Well Completion Scenario + Support Vessel | 57.68 | 1,144 | 354.36 | 0.73 | 32.84 | 22.50 | 21.89 | 2.28E-02 | 1.41E-02 | 71,843 |
| **Total (Drillship + Support Vessel)** | **64.10** | **1,170** | **369.69** | **0.76** | **33.77** | **23.48** | **22.86** | **2.37E-02** | **1.45E-02** | **74,571** |

Anadarko has proposed to only use ultra-low sulfur diesel fuel for all diesel emission units and support vessels. The sulfur content of ultra-low sulfur diesel fuel is defined as a maximum sulfur content of 15 parts per million (ppm) or 0.0015%. 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 0.02 tpy, the potential TRS PM contribution is minimal.

### 5.1 *Discoverer Spirit* Normal Operations Main Propulsion Electric Generator Engines (DR-GE-01 through DR-GE-06) and Emergency Generator (DR-GE-07) Analysis

Six main engines provide power to the drilling vessel: four Wärtsilä 18V32 LNE diesel generators with a rated power output of approximately 9,910 hp each and two Wärtsilä 12V32 LNE diesel generators with a rated power output of approximately 6,610 hp each.

The Wärtsilä 6R32 LNE emergency generator diesel engine, rated 3,330 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.

Emissions estimates for the *Discoverer Spirit*'s main engines and emergency generator were based on an average fuel consumption of 325 bbls/day which results in a combined generation of 237,245 kw/day (322,511 bbls/day) from all six engines.

The combined generation was multiplied by the pollutant specific emission factor. For the main propulsion engines, the $NO_x$ emission factor was based on the BACT limit in EPA Permit OCS-EPA-R4005-M1. The CO emission factor was based on the Wärtsilä LNE Engine Specifications at 50% load. The $SO_2$ and $H_2SO_4$ emission factor relied on the sulfur content of the fuel. The lead emission factor was obtained from EPA guidance document: Locating and Estimating Air Emissions from source of Lead and Lead Compounds. All other pollutants used AP-42 emission factors.

### 5.2 *Discoverer Spirit* Smaller Engine and Miscellaneous Emission Sources Analysis

The following is a description of the smaller emission units and the basis of the emissions estimates for each:

**Unit ID: Emergency ROV Generator (DR-GE-08)**

The Cummins QSM11-DM ROV emergency generator diesel engine emission calculations used 100 hours per year of non-emergency, planned operation time. The hourly and annual emissions were calculated based on operating at 100% load for this 425 hp engine.

**Unit ID: Air Compressor Diesel Engines (DR-AC-01 and DR-AC-02)**

The two Sperre M-HL2/140 air compressors calculations based the hourly and annual emissions on operating at 100% load for a maximum of 104 hours per year per engine. The engines are rated 18 hp and 15 hp, respectively.

**Unit ID: Escape Capsule Diesel Engines (DR-EC-01 through DR-EC-06)**

The four Lister Petter L4 and two Lister Petter L3 escape capsule engines are operated during maintenance and safety checks and in the event of an emergency. Non-emergency, planned operation time of 0.5 hours per day for each engine was used for the emission calculations. The hourly and annual emissions were calculated based on operating at 100% load for a maximum of 100 hours per year per engine, four 39 hp and two 29 hp.

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

The Steyr M16 TCAM MO236 K42 engine in the fast rescue boat, also known as a man overboard boat, is operated during maintenance checks, safety checks, and in the event of an emergency. Non-emergency, planned operation time of 0.5 hours per day was used for the emission calculations. The hourly and annual emissions were calculated based on operating at 100% load for a maximum of 100 hours per year for this 230 hp engine.

**Unit ID: Diesel Powered Forklift Engine (DR-FL-01); Wireline Diesel Engines (DR-WL-01 and DR-WL-02); Electric Line Diesel Engines ((DR-EL-01 and DR-EL-02); Casing Unit Diesel Engines (DR-CU-01 and DR-CU-02); Well Evaluation Diesel Engines (DR-VS-01 through DR-VS-05; Water Blasting Engine (DR-WB-01)**

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. Any replacement engines for the project will meet the equivalent or a higher EPA Tier standard. The following engines were selected as representative worst-case engines, since they represent engines that have both the most recent available technology, but are also the largest engines that will perform the required function

The Caterpillar DP30K diesel powered forklift engine calculations based the hourly and annual emissions on operating at 100% load for a maximum of 4,992 hours per year for this 30 hp engine.

The two Cummins C8.3 wireline diesel engines calculations based the hourly and annual emissions on operating at 100% load for a maximum of 4,992 hours per year per each 275 hp engine.

The two Caterpillar 3126B, Schlumberg electric line diesel engines based the hourly and annual emissions on operating at 100% load for a maximum of 4,992 hours per year per each 300 hp engine.

The two Deutz F6L914 casing unit diesel engines based the hourly and annual emissions on operating at 100% load for a maximum of 4,992 hours per year per each 124 hp engine.

The five Detroit 4-71 well evaluation engines diesel engines based the hourly and annual emissions on operating at 100% load for a maximum of 125 hours per year per each 140 hp engine.

The Deutz BF6M2012C water blasting engine calculations based the hourly and annual emissions on 100% load for 12 hours per day, and 2496 hours per year for this 208 hp engine.

**Unit ID: Tanks (DR-DT-01 through DR-DT-09 and DR-FT-01 through DR-FT-03)**

Emissions are generated from the storage of diesel fuel and helicopter fuel in 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. The average fuel usage for the Drillship is 325 bbls/day; however, a throughput twice as large with a 16% throughput contingency was used.

**Unit ID: Condensate Tanks (WC-CT-01 through WC-CT-03)**

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.

**Unit ID: Dust Collectors (DR-DC-01 through DR-DC-03)**

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 dust collectors, ASPA Engineering I-9-1400, ASPA Engineering I-16-2400, and FARR Company Tenkay 6D Mark IV. The $PM/PM_{10}/PM_{2.5}$ maximum hourly emission rate each was calculated based on a flow rate of 1400, 2400, 4000 cubic foot per minute for each dust collector respectively and a discharge rate of 0.05 lb/hr and 0.002 grains per cubic foot provided by the manufactures for DR-DC-03. The annual emissions were calculated based on 8,760 hours of operation.

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

Welding occurs on the *Discoverer Spirit* as part of maintenance activities and generates $PM/PM_{10}/PM_{2.5}$ and HAP emissions. Emissions were calculated using welding rods for 4,992 hours per year at a rate of 50 pounds per day.

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

Painting occurs on the *Discoverer Spirit* 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 the proposed painting operations. The calculations used an airless spray gun with 50% transfer efficiency and an air assisted spray gun with 30% transfer efficiency. The emission calculations were performed for both spray guns operating 2,496 hours per year per gun, by multiplying by the expected gallons per year usage. Anadarko will use both paint 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 242 connectors.

**Unit ID: Mud Degasser Vent (DR-VG-01)**

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 used 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 used pounds per day emissions factors and 4,992 hours of operation per year.

### 5.3 Support and Well Completion Vessel Analysis

Various vessels that service the drilling vessel and that will be used for specific well completion tasks will generate emissions. The support vessels will transport personnel and supplies as required. The well completion vessels may include a tug, barge, or stimulation vessel. The availability of specific support and well completion vessels during drilling operations was not known at the time of the application as outside vendors supply these units.

**Supply Boat**

Anadarko selected the largest expected supply boat (*HOS Coral*) as a worst-case basis for emissions calculations. The emissions that the operation of the supply boat will generate within a 25 nautical mile radius of the *Discoverer Spirit* are based on a fuel operating limit. Anadarko calculated their daily usage to determine that the supply boat will consume 17,098 gallons of diesel fuel.

**Anchor Handling Boat**

Anadarko selected the largest expected anchor handling boat (*Kirt Chouset*) as a worst-case basis for emissions calculations. The emissions that the operation of the supply boat will generate within a 25 nautical mile radius of the *Discoverer Spirit* are based on a fuel operating limit. Anadarko calculated their daily usage to determine that the anchor handling boat will consume 7,500 gallons of diesel fuel.

**Tug Boat**

The emissions that the operation of the tug boat will generate within a 25 nautical mile radius of the *Discoverer Spirit* are based on a fuel operating limit. Anadarko calculated their daily usage to determine that the tug boat will consume 340 barrels per day of diesel fuel.

**Barge**

The emissions that the operation of the barge will generate within a 25 nautical mile radius of the Discoverer Spirit are based on the hourly operation of the barge's electric generator engines rated at 456 hp. These engines will operate 504 hours per year per engine.

**Stimulation Vessel**

The emissions that the operation of the stimulation vessel will generate within a 25 nautical mile radius of the Discoverer Spirit are based on a fuel operating limit. Anadarko calculated their daily usage to determine that the stimulation vessel will consume 500 barrels per day 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.

### 5.4 Well Completion Emission Units

The well completion phases will include four sub-phases. The exact engine availability during these phases had not been identified at the time of the application submittal. The worst-case emissions sources were chosen to calculate emissions and the PTE. The well completion phase will use third party equipment and support vessels. Also, stimulation vessels, barges, and tug boats could be used during the well completion. Anadarko determined the representative worst-case 24-hour scenario from the four phases listed below:

- Worst-case gas well flowback scenario
- Worst-case oil well flowback scenario
- Stimulation vessel operations scenario
- Third party equipment operation scenario

These scenarios will not take place concurrently. Anadarko will only conduct one out of four scenarios or any ‘equivalent’ combination during a single day, and the resulting emissions will not exceed the worst-case daily emissions from the four scenarios listed above. The emissions generated during the worst-case third party equipment operation are the highest (i.e., worst-case) emissions for well completion. Supply boats (*HOS Coral or* equivalent) will also operate during this phase.

The emissions calculated for the worst-case well completion scenario were less than the emissions calculated for the drillship, see Table 5-1. The well completion scenarios will not occur at the same time as the drilling operations. Therefore, the drilling operation plus the worst-case support vessel was used to calculate the project’s PTE.

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.

### 5.5 Compliance Methodology

Continuous Emissions Monitoring (CEMS) instrumentation is often required to track specific emissions if monitoring of those emissions is critical to ensure that a requirement is being met, or to show that a requirement does not apply. However, the EPA understands the unique issues involved in requiring CEMS for emission units on deepwater drilling vessels, and an alternative system may be necessary to monitor pollutants. In consideration of the complexity of continuous compliance monitoring on a deepwater drillship in the marine environment, the draft permit allows Anadarko to choose monitoring systems for $NO_X$, CO, VOC, and $PM/PM_{10}/PM_{2.5}$ for the main generator diesel units (DR-GE-01 through DR-GE-06) and describes the use of an EPA-approved continuous emissions monitoring system, an EPA-approved alternative parametric monitoring method, or with prior written approval by the EPA a stack testing emissions monitoring system that may be used.

The compliance demonstration method for the emergency generator diesel units (DR-GE-07), the simulation vessel pump engines (SV-PE-01 through SV-PE-08), the ROV emergency generator (DR-GE-08), the small and third party diesel engines (DR-GE-08; DR-EC-01 through DR-EC-06, DR-FR-01, DR-AC-01 and DR-AC-02, DR-FL-01, DR-WL-01 and DR-WL-02, DR-EL-01 and DR-EL-02, DR-CU- 01 and DR-CU-02, DR-WC-01 through DR-WC-05, and DR-WC-07 through DR-WR-08), and the flowback boiler (DR-WC-05) will include monitoring and maintaining a contemporaneous record of the hours of engine operation using an engine hour meter, unit ID, date/time the engine started, date/time the engine shut down, the printed name of the person operating the equipment, the signature of the person operating the equipment, and when appropriate provide the engine tier certification. These units must also meet any applicable NSPS and NESHAP monitoring requirements.

Compliance demonstration for the support vessels under both operating scenarios 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, determining and recording the sulfur content upon receiving each fuel shipment, gallons of diesel fuel on the support vessel entering the 25 mile radius, and gallons of diesel fuel on the support vessel exiting the 25 mile radius.

Anadarko will supply the EPA with all records upon request. In addition, Anadarko will provide a semi-annual report of 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, and $PM/PM_{10}/PM_{2.5}$ 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 *Discoverer Spirit* and the stimulation vessel pumps that emit these pollutants while operating as an OCS source.

The life boats and the fast rescue boats 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 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 EPA’s top-down BACT analysis for the *Discoverer Spirit* and the equipment that is part of the OCS source during the well completion activities.

The Anadarko application included BACT analyses for the diesel fork lift (DR-FL-01), the six escape capsule engines, and the fast rescue craft engines. These mobile sources are not a part of the OCS source and a BACT analysis is not required; therefore, the discussion below does not include these sources.

### 6.1 $NO_X$ BACT Analysis for Internal Combustion Engines

The following large internal combustion engines (i.e., engines greater than 500 hp) on the *Discoverer Spirit* are included in this section of the BACT analysis: six (6) main diesel engines (DR-GE-01 through DR-GE-06) and one (1) emergency generator (DR-GE-07). 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.

Also included in this section are the third party engines that will be onboard the *Discoverer Spirit* including: four (4) wireline diesel engines (DR-WL-01 and DR-WL-02 and DR-WC-09 and DR-WC-10), two (2) electric line diesel engines (DR-EL-01 and DR-EL-02), two (2) casing unit diesel engines (DR-CU-01 and DR-CU-02), one (1) water blasting engine (DR-WB-01), one (1) fluid filtration pump (DR-WC-02), one (1) eline power pack (DR-WC-03), one (1) slickline power pack (DR-WC-04), one (1) CT power pack (DR-WC-07), and one (1) CT pump (DR-WC-08). The third party engines include both large and small engines; the CT power pack and the CT pump are both rated over 500 hp. The applicant identified available control technologies in the BACT analysis as if all engines are large engines.

The following small internal combustion engines (i.e., engines less than 500 hp), on *Discoverer Spirit* are included in this section of the BACT analysis: one (1) ROV emergency generator (DR-GE-08), two (2) air compressor engines (DR-AC-01 and DR-AC-02), and (5) well evaluation engines (DR-VS-01 through DR-VS-05).

### *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.

<u>Step 1: Identify all available control technologies</u>
The applicant identified the following available control technologies in their OCS permit application submitted in December 2012 and supplemental material submitted in July 2013:

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. De-rating of Existing Engines
6. Water-in-Fuel Emulsions
7. Intake Air Humidification/Cooling
8. $NO_X$ Absorber/Scrubber Technology
9. Replacement of Old Engines with New Engines
10. Camshaft Replacement/Retooling of Engines
11. Lean De-$NO_X$ Catalyst or Hydrocarbon SCR
12. Low $NO_x$ Engine (LNE) Design (Including Turbo-charger with After coolers and High Injection Pressure)
13. LNE with Power Management System (PMS) and $NO_x$ Concentration Maintenance System (on the Main Diesel Engines)
14. EPA Tier 2 Standards
15. E-POD (on the Large Internal Combustion Engines and Third Party Engines)
16. 4-Way Catalyst Converter
17. Ignition Timing Retard (on the Well Completion Engines)
18. Good Combustion Practices

Step 2: Eliminate technically infeasible control options

After analyzing the 18 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 (options 1 through 8, 10, 11, 14, 15 and 16). Item 12 was eliminated as technically infeasible for the stimulation vessel pumps only, while item 13 only applies to the main generator engines. Item 9, Replacement of Old Engines with New Engines, incorporates item 14 (EPA Tier 2 Standards), and are therefore addressed below together.

After analyzing the 14 control technology options identified for the small internal combustion engines, 8 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, 11, and 16). Camshaft Replacement/Retooling of Engines, item 10, is technically feasible for only the well evaluation engines. Item 12 was eliminated for the air compressor engines only. Ignition Timing Retard, item 17, was only identified for 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 and references, please refer to the application submitted to EPA in December 2012 and supplemental material submitted in March 2013 and July 2013.

**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 itself as well as the necessary ancillary equipment (*e.g.*, urea storage tanks). In addition, the variable loads of the main diesel engines cannot maintain the required temperature for the catalyst to work. The emergency diesel engine, third party engines, and the stimulation vessel pumps will not operate for time periods long enough for the catalyst to reach the necessary working temperature. EPA agrees that this control technology is not technically feasible for this source, and therefore, even though the applicant provided a cost analysis for SCR, this analysis was not relied upon in EPA's decision.

**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. The stimulation vessel pumps will also operate at temperatures lower than those required.

**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 drill rig. The intermittent use of the emergency generator will not allow this technology to work. Also, this technology is in the development stages for marine applications, and is not feasible for smaller engines. This 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 drill rig.

**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. According to the engine manufacturers, EGR is not available at this time for the engines used on the *Discoverer Spirit* or the stimulation vessel.

**De-rating 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 and ROV engines 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 *Discoverer Spirit* 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.

**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. According to the engine manufacturer, Wärtsilä, this technology is not available for the main diesel engines.

**Replacement of Old Engines with New Engines (for the Third Party Engines Excluding the Water Blasting Engine):** Additional information submitted for the March 2013 supplemental package provided research based on the replacement of the third party engines with the cleanest available engine. The applicant contacted two vendors for each category of third party equipment, and provided the percentage of the cleanest available engines for each engine type. EPA Tier 2 engines are the cleanest available engines for the Tubing Running engine, CT Power Pack engine, CT Pump engine, and the Casing Unit engine categories.

For the Fluid Filtration Pump engine, Slickline Power Pack engine, Eline Power Pack engine, and the Wireline engine EPA Tier 3 or Tier 4 engines were found to be the cleanest available; however, these engines, currently comprise 20% of the available inventory, at most. Given that the proposed drilling plans change on short notice the vendors do not have their entire inventory available at any given time.

**Camshaft Replacement/Retooling of Engines (Excluding 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 Air Compressor Engine, Stimulation Vessel Pumps, and Well Evaluation Engines):** This technology is intrinsic to an engine and retrofitting these engines is not feasible.

**E-POD (on the Large Internal Combustion Engines and Third Party Engines):** This technology integrates SCR with a diesel oxidation catalyst or a catalytic diesel particulate filter. This technology is infeasible for the same reasons as SCR. EPA agrees that this control technology is not technically feasible for this source, and therefore, even though the applicant provided a cost analysis for E-POD, this analysis was not relied upon in EPA's decision.

**4-Way Catalyst Converter:** The engines onboard the *Discoverer Spirit* and the pump engines cannot sustain constant steady state loads and exhaust temperatures to sustain high catalyst performance. This technology is in the development stage and according to the main diesel engine's manufacturer, Wärtsilä, 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 *Discoverer Spirit* and the pump engines on the stimulation vessel.

**Ignition Timing Retard for Well Evaluation Engines Only:** This technology is infeasible due to intrinsic engine design and will reduce engine power and combustion, hindering stability.

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 E-2 of the December 2012 application and Appendix C of the July 2013 supplemental submittal. The engine maintenance plans outline specific procedures based on total hours of operation for each engine.

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

| Engine | Rank | Control Description | $NO_x$ Control Effectiveness |
|---|---|---|---|
| Main Diesel Engines (DR-GE-01 through DR-GE-06) | 1 | LNE design with Power Management System (PMS) | 45% |
| | 2 | LNE design including (Turbo-charge and after coolers, and high injection pressure) | 30% |
| | 3 | Replacement of Old engines with New engines (IMO Tier II) | 30% |
| | 4 | Use of engine w/intake air cooling and turbo charger, good combustion practices/engine maintenance, and enhanced work practice power management and $NO_x$ emissions maintenance system | Baseline |
| Emergency Diesel Engine (DR-GE-07) | 1 | LNE Design | 30% |

| | | | |
|---|---|---|---|
| | 2 | Replacement of Old Engines with New Engines | Varies |
| | 3 | Good Combustion Practices | Baseline |
| ROV Emergency Generator (DR-GE-08) | 1 | EPA 40 CFR part 89 Tier 2 certified Engine | -[b] |
| | 2 | LNE Design | 30% |
| | 3 | Good Combustion Practices | Baseline |
| Third Party Engines Excluding the Water Blasting Engine (DR-WL-01 and DR-WL-02, DR-EL-01 and DR-EL-02, DR-CU-01 and DR-CU-02, DR-WC-01 through DR-WC-04, and DR-WC-07 through DR-WR-10) | 1 | EPA 40 CFR part 89 Tier 2 Certified Engine | - [b] |
| | 2 | Replacement of Old Engines with New Engines | Varies |
| | 3 | LNE Design | 30% |
| | 4 | Good Combustion Practices | Baseline |
| Well Evaluation Engines (DR-VS-01 through DR-VS-05) | 1 | CAM Shaft Replacement/Retooling Engines | - [b] |
| | 2 | Good Combustion Practices | Baseline |
| Water Blasting Engine (DR-WB-01) | 1 | EPA 40 CFR part 89 Tier 3 Certified Engine | - [b] |
| | 2 | LNE Design | 30% |
| | 3 | Good Combustion Practices | Baseline |
| Air Compressor Engines (DR-AC-01 and DR-AC-02) | 1 | Replacement of Old Engines with New Engines | Varies |
| | 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 E-POD and SCR control technologies; however, since these technologies were determined to be technically infeasible they are not listed here.
[b] Baseline emissions were not included to calculate the relative control effectiveness.

Step 4: Evaluate Energy, Economic, and Environmental Impacts

**Replacement of Old Engines with New Engines for the Main Diesel Generators:** Anadarko provided a cost analysis in Appendix E-2 of the December 2012 application for replacing the existing IMO Tier I engines with newer engines that are IMO Tier II compliant. The applicant estimated the cost of replacing the existing engines with compliant engines would result in a cost effectiveness of $156,243 per ton of $NO_x$ removed.

**Replacement of Old Engine with New Engine for the Emergency Generator:** Anadarko provided a cost analysis in the March 2013 supplemental submittal for replacing the existing engine with newer engines meeting the EPA 40 CFR part 89 Tier 2 standards. The applicant determined that given the minimal planned operations of this unit the replacement of the existing engine with the cleanest available engine is cost prohibitive.

**Replacement of Old Engines with New Engines for the Stimulation Vessel Pump Engines:** Anadarko provided a cost analysis in Appendix E-2 of the December 2012 application for replacing the existing engines with newer engines meeting the EPA 40 CFR part 89 Tier 2 standards. The applicant estimated the cost of replacing the existing engines with compliant engines would result in a cost effectiveness of $75,788 per ton of $NO_x$ removed.

**Replacement of Old Engines with New Engines for the Air Compressor Engines:** Anadarko provided a cost estimate for the air compressor engines in the March 2013 supplemental submittal for replacing the existing engine with newer engines meeting the EPA 40 CFR part 89 Tier 3 standards. The applicant determined that given the minimal planned operations of this unit the replacement of the existing engine with the cleanest available engine is cost prohibitive.

**PMS and $NO_x$ Concentration Maintenance System on the Main Diesel Generators:** This system has been designed to enhance load management of the engines, ensure good combustion efficiency, and maintain load levels between 35 and 45%. The $NO_x$ concentration maintenance system will trigger an alarm if the $NO_x$ concentration reaches a specified threshold at which time the operator will investigate the cause of the emission increase and correct the underlying problem. Anadarko proposed to implement this technology.

**Camshaft Replacement/Retooling of Engines for the Well Evaluation Engines:** Anadarko provided a cost estimate for the air compressor engines in the July 2013 supplemental. The applicant determined that given the engine's minimal operating time of 104 hours per year, the resulting emissions are not economically feasible to control. These units will emit less than 1 tpy of $NO_x$. Due to the minimal planned operations of this unit, EPA agrees that Camshaft replacement/retooling for the well evaluation engines is cost prohibitive.

<u>Step 5: Determine BACT</u>

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 *Discoverer Sprit* and for the pump engines on the stimulation vessel as discussed below and summarized in Table 6-2.

***Discoverer Spirit* Main Engines:** The EPA proposes $NO_X$ emission limits of 12.7 g/kW-hr as BACT for the main engines on the *Discoverer Spirit* based on IMO certification data included with the application materials and a 5% margin of compliance to account for the variability of each engine's $NO_x$ emission rate with the varying engine load level and for the number of operating hours each engine has logged since significant maintenance was last performed. This is consistent with the stack test data presented in the application from September 2010. Consistent with EPA's past BACT determinations and permit issuances for engines on vessels, including this vessel, with $NO_x$ emissions of 12.7g/k-W-hr, EPA has included requirements for a PMS. The PMS designed by the owner of the drillship, Transocean, is intended to enhance the fuel oil, lubricant oil, and power management of the main engines on the *Discoverer Spirit* to ensure good combustion efficiency, maintain load levels to an average of 40%, and minimize emissions. 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 is appropriate in this case.

**Emergency Generator Engine, Remotely Operated Vehicle Emergency Generator, and Air Compressor Engines:** The applicant proposed a $NO_x$ emission limit of 3.20 lb/MMBtu for the emergency generator and an operating time of 100 hours per year. For the remotely operated vehicle emergency generator, the applicant proposed a $NO_x$ emission limit of 6.40 g/kW-hr and an operating time of 100 hours per year. For the air compressor engines, the applicant proposed a $NO_x$ emission limit of 0.031 lb/hp-hr and an operating time of 104 hours per year. However, 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 all four engines is use of work practice standards including good combustion practices and operating in accordance with the manufacturer's specifications, LNE design for the emergency generator and the remotely operated vehicle emergency generator, and use of an EPA Tier-certified engine for the remotely operated vehicle 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, and where applicable the use of LNE design. 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 Technology and $NO_X$ BACT Emission Limits* |
|---|---|
| DR-GE-01 thru DR-GE-06 | IMO Tier I Standards, LNE design with PMS; 12.7 g/KW-hr* |
| DR-GE-07 | LNE design and good combustion practices |
| DR-GE-08 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-AC-01 and DR-AC-02 | Good combustion practices |
| DR-WL-01 and DR-WL-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-EL-01 thru DR-EL-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-CU-01 thru DR-CU-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-VS-01 thru DR-VS-05 | Good combustion practices |
| DR-WB-01 | 40 CFR 89 EPA Tier 3 standards and LNE design |
| DR-WC-01 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-03 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-04 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-07 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-08 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-09 and DR-WC-10 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| SV-PE-01 thru SV-PE-08 | Good combustion practices |

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

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their OCS permit application submitted in December 2012:

1. Diesel Oxidation Catalyst
2. Catalytic Diesel Particulate Filter
3. Positive Crankcase Ventilation (VOC only)
4. 4-Way Catalyst Converter with Exhaust Gas Recirculation System
5. E-POD (on the Main Diesel Engines and the Emergency Generator and Third Party Engines)
6. Replacement of Older Engines with Newer Engines
7. LNE Design
8. Good Combustion Practices

Step 2: Eliminate technically infeasible control options

After analyzing the eight control technology options for the control of CO and VOC emissions, four were eliminated as technically infeasible for all diesel internal combustion engines (options 1 through 4). Option 5 was eliminated as technically infeasible for the main diesel engines and the emergency generator. Option 7 was eliminated for the stimulation vessel pumps, the air compressor engines, and 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 and references, please refer to the application submitted to EPA in December 2012 and supplemental information submitted in March 2013 and July 2013.

**Diesel Oxidation Catalyst:** The engines onboard the *Discoverer Spirit* 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, for the internal combustion engines, this technology has not been designed or tested on a commercially available scale comparable to the large main generator and emergency diesel engines. EPA agrees with the applicant that this control technology is not technically feasible, and therefore, even though the applicant provided a cost analysis for the Diesel Oxidation Catalyst on the main generator engines, this analysis was not relied upon in EPA's decision.

**Catalytic Diesel Particulate Filter:** The engines onboard the *Discoverer Spirit* 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 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. EPA agrees with the applicant that this control technology is not technically feasible, and therefore, even though the applicant provided a cost analysis for the catalytic diesel particulate filter on the main generator engines, this analysis was not relied upon in EPA's decision.

**Positive Crankcase Ventilation (VOC only):** This technology is intrinsic to the engine design. EPA agrees with the applicant that this control technology is not technically feasible because the engines onboard the *Discoverer Spirit* and the pump engines cannot be retrofitted to accommodate this technology. In addition, engine manufacturers have strict restrictions on installing upgrades to avoid violating warranties and emission standard certifications.

**4-Way Catalyst Converter with Exhaust Gas Recirculation System:** The engines onboard the *Discoverer Spirit* 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. This technology is in the development stages, and according to the engine manufacturer of the main diesel engines, Wärtsilä, it is not available. For these reasons, EPA agrees with the applicant that this technology is not technically feasible.

**E-POD (on the Large Internal Combustion Engines and Third Party Engines):** This technology integrates SCR with a diesel oxidation catalyst or a catalytic diesel particulate filter. This technology is infeasible for the same reasons as SCR. EPA agrees with the applicant that this control technology is not technically feasible, and therefore, even though the applicant provided a cost analysis for E-POD on the main generator engines this analysis was not relied upon in EPA's decision.

**Replacement of Old Engines with New Engines (for the Third Party Engines Excluding the Water Blasting Engine):** This option is technically infeasible for these engines for the same rationale provided above in Section 6.1.1.

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

<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 6-3 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-2 of the December 2012 application and Appendix C of the July 2013 supplemental submittal. The engine maintenance plans outline specific procedures based on total hours of operation for each engine.

**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-GE-01 through DR-GE-06)* | 1 | Replacement of Old engines with New engines (IMO Tier II) | 30% |
| | 2 | LNE Design | 30% |
| | 3 | Good Combustion Practices | Baseline |
| Emergency Diesel Engine (DR-GE-07) | 1 | LNE Design | 30% |
| | 2 | Replacement of Old Engines with New Engines | Varies |
| | 3 | Good Combustion Practices | Baseline |
| ROV Emergency Generator (DR-GE-08) | 1 | EPA 40 CFR part 89 Tier 2 Certified Engine | - [b] |
| | 2 | LNE Design | - [b] |
| | 3 | Good Combustion Practices | Baseline |
| Third Party Engines Excluding the Water Blasting Engine (DR-WL-01 and DR-WL-02, DR-EL-01 and DR-EL-02, DR-CU-01 and DR-CU-02, DR-WC-01 through DR-WC-04, and DR-WC-07 through DR-WR-10) | 1 | EPA 40 CFR part 89 Tier 2 Certified Engine | - [b] |
| | 2 | Replacement of Old Engines with New Engines | Varies |
| | 3 | LNE Design | 30% |
| | 4 | Good Combustion Practices | Baseline |
| Well Evaluation Engines (DR-VS-01 through DR-VS-05) | 1 | CAM Shaft Replacement/Retooling Engines | - [b] |
| | 2 | Good Combustion Practices | Baseline |
| Water Blasting Engine (DR-WB-01) | 1 | EPA 40 CFR part 89 Tier 3 Certified Engine | - [b] |
| | 2 | LNE Design | - [b] |
| | 3 | Good Combustion Practices | Baseline |
| Air Compressor Engines (DR-AC-01 and DR-AC-02) | 1 | Replacement of Old Engines with New Engines | Varies |
| | 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 E-POD, diesel oxidation catalyst, and catalytic diesel particulate filter control technologies; however, since these technologies were determined to be technically infeasible they are not listed here

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

Step 4: Evaluate Energy, Economic, and Environmental Impacts

**Replacement of Old Engines with New Engines for the Main Diesel Generators:** Anadarko provided a cost analysis in Appendix E-2 of the December 2012 application for replacing the existing IMO Tier I engines with newer engines that are IMO Tier II compliant. However, there is no IMO standard for CO or VOC emissions.

Replacement of old engines with new engines was determined to be technically feasible for all other engines (excluding the third party water blasting engine and the ROV emergency generator); however, this option was determined to be cost prohibitive for CO and VOC control for the same rationale provided in Section 6.1.1.

Step 5: Determine BACT

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 *Discoverer Sprit* and for the pump engines on the stimulation vessel as discussed below, and summarized in Table 6-4.

**Main Engines:** The EPA proposes a CO emission limit of 0.80 g/kW-hr, and a VOC emission limit of 0.08 lb/hp-hr (0.13 g/kW-hr). Anadarko provided stack test results in their December 2012 application for the main engines that included CO emissions. The 0.08 g/kW-hr emission limit is based on vendor specifications. However, based on the stack test results, Anadarko will be able to meet this limit at all loads including loads at or below 30%, if all engines are properly maintained. The stack test did not contain VOC emissions, therefore, this emission limit is based on an AP-42 emission factor. 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 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 engines, operating in accordance with the manufacturer's specifications, and LNE design.

**Emergency Generator Engine and 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.

**Table 6-4: CO and VOC BACT Conclusions**

| Emissions Unit ID | BACT Control Technology and CO and VOC BACT Emission Limits* |
|---|---|
| DR-GE-01 thru DR-GE-06 | LNE design and good combustion practices; 0.80 g/kW-hr CO, 0.08 lb/MMBtu (0.13 g/kW-hr) VOC |
| DR-GE-07 | LNE design and good combustion practices |
| DR-GE-08 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-AC-01 and DR-AC-02 | Good combustion practices |
| DR-WL-01 and DR-WL-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-EL-01 thru DR-EL-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-CU-01 thru DR-CU-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-VS-01 thru DR-VS-05 | Good combustion practices |
| DR-WB-01 | 40 CFR 89 EPA Tier 3 standards and LNE design |
| DR-WC-01 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-02 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-03 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-04 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-07 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-08 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| DR-WC-09 and DR-WC-10 | 40 CFR 89 EPA Tier 2 standards and LNE design |
| SV-PE-01 thru SV-PE-08 | Good combustion practices |

*Short-term limits are based on a 24-hour 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 December 2012:

1. Baghouse (Fabric Filter)
2. Ultra-Low Sulfur Diesel (ULSD) Fuel/ Low Ash Fuel
3. Diesel Oxidation Catalyst
4. Diesel Particulate Filter/CDPF
5. Positive Crankcase Ventilation
6. E-POD Technology (on Large Combustion Engines and Third Party Engines)
7. 4-Way Catalyst Converter with Exhaust Gas Recirculation System
8. Replacement of Older Engines with New Ones
9. Good Combustion Practices
10. LNE design including (Turbo-charger with aftercooling and high injection pressure)

Step 2: Eliminate technically infeasible control options

After analyzing the 11 control technology options for the control of $PM/PM_{10}/PM_{2.5}$ emissions, four were eliminated as technically infeasible for all diesel internal combustion engines (options 3 through 5 and 7). Option 1 was only identified for the main diesel engines. Option 6 was identified for only the main diesel engines and the emergency 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 and references, please refer to the application submitted to EPA in December 2012 and supplemental information submitted in March 2013 and July 2013.

**Baghouse (Fabric Filter) (on the Main Diesel Engines Only):** This technology is large and generally used for land-based sources. 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.

**E-POD on Large Combustion Engines and Third Party Engines:** 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 Third Party Engines Excluding the Water Blasting Engine):** This option is technically infeasible for these engines for the same rationale provided above in Section 6.1.1.

**LNE Design on the 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.

Step 3: Rank 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 6-5 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-2 of the December 2012 application and Appendix C of the July 2013 supplemental submittal. The engine maintenance plans outline specific procedures based on total hours of operation for each engine.

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

| Engine | Rank | Control Description | $PM/PM_{10}/PM_{2.5}$ Control Effectiveness |
|---|---|---|---|
| Main Diesel Engines (DR-GE-01 through DR-GE-06)* | 1 | Replacement of Old engines with New Engines (IMO Tier II) | 30% |
| | 2 | LNE Design | 30% |
| | 3 | ULSD | Varies |
| | 4 | Good Combustion Practices | Baseline |
| Emergency Diesel Engine (DR-GE-07) | 1 | LNE Design | 30% |
| | 2 | Replacement of Old Engines with New Engines | Varies |
| | 3 | ULSD | - [b] |
| | 4 | Good Combustion Practices | Baseline |
| ROV Emergency Generator (DR-GE-08) | 1 | EPA 40 CFR part 89 Tier 2 Certified Engine | - [b] |
| | 2 | LNE Design | - [b] |
| | 3 | ULSD | - [b] |
| | 4 | Good Combustion Practices | Baseline |
| Third Party Engines Excluding the Water Blasting Engine (DR-WL-01 and DR-WL-02, DR-EL-01 and DR-EL-02, DR-CU-01 and DR-CU-02, DR-WC-01 through DR-WC-04, and DR-WC-07 through DR-WR-10) | 1 | EPA 40 CFR part 89 Tier 2 Certified Engine | - [b] |
| | 2 | Replacement of Old Engines with New Engines | Varies |
| | 3 | LNE Design | 30% |
| | 4 | ULSD | - [b] |
| | 5 | Good Combustion Practices | Baseline |

| | | | |
|---|---|---|---|
| Well Evaluation Engines (DR-VS-01 through DR-VS-05) | 1 | CAM Shaft Replacement/Retooling Engines | - [b] |
| | 2 | Good Combustion Practices | Baseline |
| Water Blasting Engine (DR-WB-01) | 1 | EPA 40 CFR part 89 Tier 3 Certified Engine | - [b] |
| | 2 | LNE Design | - [b] |
| | 3 | ULSD | - [b] |
| | 4 | Good Combustion Practices | Baseline |
| Air Compressor Engines (DR-AC-01 and DR-AC-02) | 1 | Replacement of Old Engines with New Engines | Varies |
| | 2 | ULSD | - [b] |
| | 3 | 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 |

*The application contains a ranking and cost analysis for E-POD, diesel oxidation catalyst, and catalytic diesel particulate filter control technologies; however, since these technologies were determined to be technically infeasible they are not listed here.
[b] Baseline emissions were not included to calculate the relative control effectiveness.

Step 4: Evaluate Energy, Economic, and Environmental Impacts

**Replacement of Old Engines with New Engines for the Main Diesel Generators:** Anadarko provided a cost analysis in Appendix E-2 of the December 2012 application for replacing the existing IMO Tier I engines with newer engines that are IMO Tier II compliant. However, there are no IMO Tier I standards for $PM/PM_{10}/PM_{2.5}$ emissions.

Replacement of old engines with new engines was determined to be technically feasible for all other engines (excluding the third party water blasting engine and the ROV emergency generator); however, this option was determined to be cost prohibitive for $PM/PM_{10}/PM_{2.5}$ control for the same rationale provided in Section 6.1.1.

Step 5: Determine BACT

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 *Discoverer Sprit* and for the pump engines on the stimulation vessel as discussed below, and summarized in Table 6-6.

**Main Engines:** The EPA proposes a PM emission limit of 0.1 lb/MMBtu (0.15 g/kW-hr) and a $PM_{10}/PM_{2.5}$ emission limit of 0.06 lb/MMBtu (0.09 g/kW-hr) as BACT for the main engines on the *Discoverer Spirit* based on the AP-42 emission factors. 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 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 Air Compressor Engine**: The BACT determination in Section 6.1.1 is also applicable for $PM/PM_{10}/PM_{2.5}$.

**Pump Engines and Third Party Engines**: The BACT determination in Section 6.1.1 is also applicable for $PM/PM_{10}/PM_{2.5}$.

**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*** |
|---|---|
| DR-GE-01 thru DR-GE-06 | IMO Tier I Standards, LNE design and ULSD; PM: 0.1 lb/MMBtu (0.15 g/kW-hr); $PM_{10}$/ $PM_{2.5}$: 0.06 lb/MMBtu (0.09 g/kW-hr) |
| DR-GE-07 | LNE design and good combustion practices and ULSD |
| DR-GE-08 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-AC-01 and DR-AC-02 | Good combustion practices and ULSD |
| DR-WL-01 and DR-WL-02 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-EL-01 thru DR-EL-02 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-CU-01 thru DR-CU-02 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-WB-01 | 40 CFR 89 EPA Tier 3 standards and LNE design and ULSD |
| DR-VS-01 thru DR-VS-05 | Good combustion practices and ULSD |
| DR-WC-01 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-WC-02 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-WC-03 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-WC-04 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-WC-07 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-WC-08 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| DR-WC-09 and DR-WC-10 | 40 CFR 89 EPA Tier 2 standards and LNE design and ULSD |
| SV-PE-01 thru SV-PE-08 | Good combustion practices and ULSD |

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

### 6.2 BACT Analysis for Flowback Boiler

The *Discoverer Spirit* will operate a small 8 MMBtu/hr diesel fired flowback boiler (DR-WC-05) during well completion activities. The boiler is subject to BACT review for emissions of $NO_x$, CO, VOC, and $PM/PM_{10}/PM_{2.5}$.

Step 1: Identify all available control technologies

The applicant proposed the following available control technologies in their OCS permit application submitted in December 2012:

1. Flue Gas Recirculation
2. Low $NO_x$ Burners
3. Ultra-Low Sulfur Diesel (ULSD) (for particulate matter only)
4. Good Combustion Practices

Step 2: Eliminate technically infeasible control options

After analyzing the 4 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 and references, please refer to the application submitted to EPA in December 2012.

**Flue Gas Recirculation:** This control technology would require retrofitting the boiler which would require significant space reassignment. This technology is technically infeasible for the flowback boiler on the *Discoverer Spirit.*

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

Steps 3/4/5: Rank/Evaluate/Determine BACT

The applicant plans to operate the flowback boiler only 144 hours per year during the well completion phase only. 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 *Discoverer Spirit* will operate a boom flare (DR-WC-06) subject to BACT review for emissions of $NO_x$, CO, VOC, and $PM/PM_{10}/PM_{2.5}$. The boom supports the flare system and the associated piping. The boom primarily reduces heat radiation by locating flames far away thereby protecting the drillship and personal. The booms 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 $PM/PM_{10}/PM_{2.5}$ in their OCS permit application submitted in December 2012, and EPA further identified available controls that are referenced in our administrative record, see Section 9.0:

1. Flare Tip
2. Maintain compliance with 40 CFR 60.18
3. Good Combustion Practices

Step 2: Eliminate technically infeasible control options

Anadarko determined options 2 and 3 as technically feasible for the control of $NO_x$, CO, VOC, and $PM/PM_{10}/PM_{2.5}$.

**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 a flare tip because the amount and pressure of the fuel cannot be determined beforehand and may vary during the project.

Steps 3/4/5: Rank/Evaluate/Determine BACT

Based on a review of the available control technologies and given the limited use of this emission unit, the EPA has determined that BACT for $NO_x$, CO, VOC, and $PM/PM_{10}/PM_{2.5}$ is more appropriately implemented as a work practice standards including, maintaining compliance with 40 CFR 60.18 and use of good combustion practices, and proper flare maintenance.

**6.4 BACT Analysis for Storage Tanks**

The *Discoverer Spirit*, the work boat, and the anchor handling have various types of storage tanks subject to BACT review for emissions of VOC. The tanks onboard the *Discoverer Spirit* include diesel fuel, helicopter fuel, and condensate storage tanks. The tank loading emissions for the work boat and anchor handling boat qualify as regulated stationary source activities. The following tanks on the *Discoverer Spirit* are included in this analysis: DR-DT-01 through -09 (diesel fuel storage tanks); DR-FT-01 through -03 (helicopter fuel storage tanks); WC-CT-01 through -03 (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 December 2012:

1. Vapor Recovery Unit
2. Thermal Oxidation System
3. Adsorption System
4. Internal Floating Roof or External Floating Roof
5. Submerged Fill Pipe

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. 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 and references please refer to the application submitted to EPA in December 2012.

**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 and base 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.

Steps 3/4/5: Rank/Evaluate/Determine BACT

Based on a review of the available control technologies, 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 *Discoverer Spirit*, EPA has determined that the fuel tanks DR-DT-01 through -09 (diesel fuel storage tanks) and DR-FT-01 through -03 (helicopter fuel storage tanks) will have a VOC BACT limit of 0.71 tons per year and that the condensate tanks WC-CT-01 through -03 will have a VOC BACT limit of 9.26 tons per year. EPA has determined that the diesel fuel storage tanks (SB-DT-01 through -15) on the work boat will have a VOC BACT limit of 0.08 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 December 2012 application.

### 6.5 BACT Analysis for Cement and Mud Mixing Operations

The *Discoverer Spirit* has cement and mud mixing operations 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 their OCS permit application submitted in December 2012:

1. Dust Collector

The applicant states that a review of the RBLC database did not reveal any other potential control technologies for the mud and cementing operations aboard the *Discoverer Spirit.*

Step 2: Eliminate technically infeasible control options

The applicant determined that the use of dust collectors is technically feasible.

Steps 3/4/5: Rank/Evaluate/Determine BACT

Based on a review of the available control technologies, EPA has determined that BACT is the use of a dust collector with proper maintenance and operation on each of the three dust collectors, and this will include maintaining a constant minimum air supply pressure reading (at the cyclone-filter pressure regulator gauge) between 90 and 105 psi, for the volume based upon 0.9 SCFM per pulse for DR-DC-03. DR-DC-01 and DR-DC-02 are not closed systems and no pressure reading can be taken. Therefore, 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 *Discoverer Spirit* has mud degassing operations (DR-VG-01) subject to BACT review for emissions of VOCs.

Step 1: Identify all available control technologies

The application states that 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 *Discoverer Spirit*.

Step 2: Eliminate technically infeasible control options

There were no control technologies identified in Step 1.

Steps 3/4/5: Rank/Evaluate/Determine BACT

Based on a review of the available control technologies, EPA has determined that BACT for VOC emissions from mud degassing is proper maintenance and operation of all units associated with this process, and the mud degassing operations will have a VOC BACT limit of 5.57 tpy 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 December 2012 application.

## 6.7 BACT Analysis for Painting Operations

The *Discoverer Spirit* 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 *Discoverer Spirit*. However, Anadarko identified three different methods to apply paint in the December 2012 application and in the supplemental information submitted in March 2013:

1. Air assisted spray gun
2. Airless spray gun
3. Roller or brush

Step 2: Eliminate technically infeasible control options

**Roller or Brush:** Anadarko found that 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 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: Evaluate/Determine BACT

The airless spray gun is used to paint large deck areas or bulkheads; while, an air assisted spray gun is used to paint smaller areas, such as 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, 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. EPA has determined the painting operations will have an operating limit for the airless spray gun of 57 and 24 gallons per week of primer and thinner, respectively, and an operating limit for the air assisted spray gun of 60 and 25 gallons per week of primer and thinner, respectively, based on the applicant's estimate.

## 6.8 BACT Analysis for Welding Operations

The *Discoverer Spirit* has welding operations (DR-WO-01) subject to BACT review for emissions of $PM/PM_{10}/PM_2$.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in the supplemental information submitted in July 2013:

1. Emission Limit/Welding Rod Usage Limit

2. Best Management Practices
3. Routing to Control Device
4. Body Shop

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 $PM/PM_{10}/PM_2$ 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 and references please refer to the application submitted to EPA in July 2013.

**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: Rank/Evaluate/Determine BACT

Based on a review of the available control technologies, EPA has determined that BACT is best management practices including following current manufacturer's recommendations for all equipment used in welding operations, including but not limited to, voltage levels.

### 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, EPA has determined that BACT is good maintenance practices to minimize fugitive emissions, including minimizing the release of emissions from valves, pump seals, and connectors. The applicant will report any leaks and corrective action taken.

## 7.0 Summary of Applicable Air Quality Impact Analyses

### 7.1 Required Analyses

The PSD permitting regulations for proposed major new sources generally require applicants to perform an air quality impact analysis for those pollutants that the project emits in significant quantities, as discussed in Sections 4.0 and 5.0, and provided in Table 4-1. However, the PSD regulations also provide that certain provisions of the analysis are not required for temporary sources that meet specific conditions. The PSD regulations at 40 CFR § 52.21(i)(3) do not require temporary sources to perform National Ambient Air Quality Standards (NAAQS) and PSD increment analyses (*See* 40 CFR § 52.21(k)), preconstruction and post-construction monitoring (*See* 40 CFR § 52.21(m)), and additional impact analysis (*See* 40 CFR § 52.21(o)) if the allowable emissions of the subject pollutant from the source would impact no Class I area and no area where the applicable increment is known to be violated. EPA considers sources operating for less than two years in a given location to be temporary sources for PSD permitting purposes. *See* Amended Regulations for Prevention of Significant Deterioration of Air Quality, 45 Fed. Reg. 52676, 52719, 52728 (August 7, 1980).

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

The maximum allowable PSD increments are listed in 40 CFR § 52.21(c) and those applicable to this project are given in Table 7-1 below. There are no increments for ozone. There are PSD Class I, II, and III increments applicable to areas designated Class I, II, and III, respectively. 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. There are currently no areas designated Class III.

**Table 7-1 Ambient Air Quality Concentration Values**
**(Amended to show only project PSD pollutants)**

| Pollutant and Averaging Period | National Ambient Air Quality Standards (μg/m³ (ppm)) | | PSD Increments (μg/m³) | | PSD Significant Impact Levels (μg/m³) | | PSD *De Minimis* Impact Levels (μg/m³) |
|---|---|---|---|---|---|---|---|
| | **Primary** | **Secondary** | **Class I** | **Class II** | **Class I** | **Class II** | |
| Particulate Matter ($PM_{10}$) *24-hr*<br>*Annual* | 150<br>None | 150<br>None | 8[b]<br>4 | 30[b]<br>17 | 0.3<br>0.2 | 5<br>1 | 10 |
| Particulate Matter ($PM_{2.5}$) *24-hr*<br>*Annual* | 35[f]<br>12[g] | 35[f]<br>15[g] | 2[b]<br>1 | 9[b]<br>4 | 0.07<br>0.06 | 1.2<br>0.3 | 4 |
| Carbon Monoxide *1-hr*<br>*8-hr* | 40,000 (35)[b]<br>10,000 (9)[b] | None<br>None | | | | 2000<br>500 | 575 |
| Ozone *1-hr*<br>*8-hr (1997)*<br>*8-hr (2008)* | (0.12)<br>(0.08)[i]<br>(0.075)[i] | (0.12)<br>(0.08)[i]<br>(0.075)[i] | | | | | 100[j] |
| Nitrogen Dioxide *1-hr*<br>*Annual* | 188[h, k] (0.100)<br>100 (0.053) | None<br>100 (0.053) | <br>2.5 | <br>25 | <br>0.1 | 7.55[k](0.004)[d]<br>1 | <br>14 |

Notes:
b- Not to exceed more than once a year
d – Recommended interim SIL
f– Achieved when the average of the annual 98th percentile 24-hour concentration averaged over the years modeled is ≤ standard.
g –Achieved when the average of the annual mean concentration over the number of years modeled is ≤ standard.
i – Achieved when the average of the annual fourth-highest daily maximum 8-hour average concentrations is less than or equal to the standard.
j- Measured in tons/year of volatile organic compounds.
h- Achieved when the 98th percentile of the annual distribution of the daily maximum 1-hour average concentrations averaged over the number of years modeled is ≤ standard.
k – Values in ug/m³ are estimates. These may change when values and/or ppm to μg/m³ conversion procedures are provided by the EPA.

## 7.2 Qualification as a Temporary Source

Anadarko has requested an air quality permit for a maximum of 208 calendar days per year of potential exploratory drilling activity conducted over a period of two years. The proposed activity will be in OCS waters in the Eastern Gulf of Mexico east of longitude 87.5 degrees and west of the Military Mission Line (86.88 degrees longitude) at distances of at least 100 miles from any shore. Since the project will operate for no more than two years, the project is considered a temporary source under the applicable

PSD regulations. Therefore, the following sections address the impact related criteria for temporary sources in 40 CFR § 52.21(i)(3).

### 7.3 Area of Known PSD Increment Violation

The impact-related criteria that must be met for a temporary source under 40 CFR § 52.21(i)(3) require that the project emissions must not impact any PSD Class I area nor any area where the applicable increment is known to be violated. The wedge of available lease blocks (Figure 2-1) for the proposed exploratory drilling activity is located in the Eastern Gulf of Mexico approximately 100 miles (160.9 km) from the Louisiana shoreline and 125 miles (201.1 km) from the Florida shoreline. There are no known areas in the Eastern Gulf of Mexico violating the $NO_2$, $SO_2$, or particulate matter ($PM_{10}$, $PM_{2.5}$) PSD increments. Therefore, the proposed project's emissions will not impact any area where applicable increments are known to be violated. Nor, based on the analysis discussed below, does EPA believe the project's emissions will significantly impact any onshore areas.

### 7.4 PSD Class I Areas Impact Analyses

The nearest PSD Class I area to the lease block wedge is Breton National Wildlife Refuge located on the southeast coast of Louisiana, approximately 167 km from the proposed nearest drilling site. St. Marks National Wildlife Refuse and Bradwell Bay Wilderness located in Florida, two other PSD Class I areas within a 300 km radius of the proposed drilling sites, are located approximately 285 km and 281 km, respectively, from the nearest potential lease block. Anadarko evaluated the project's potential impacts to Air Quality Related Values (AQRV) (*e.g.*, visibility, and nitrogen and sulfur deposition) and PSD increments at these three PSD Class I areas. The Federal Land Managers for these PSD Class I areas (U.S. Fish & Wildlife Service and Forest Service) have an affirmative responsibility to protect the AQRV. The assessment of Class I impacts was addressed using the same model as used and approved by the Federal Land Manager for the AQRV assessment.

#### 7.4.1 Model Selection and Class I Area Modeling Procedures

The EPA-preferred model for long-range transport assessments, CALPUFF Version 5.8, was used to evaluate potential AQRV and PSD increment impacts at the three PSD Class I areas within 300 km of potential lease block locations. The other components of the CALPUFF system used in the impact assessment were CALMET Version 5.8 and CALPOST Version 5.6394 or Version 6.221.

The recommendations of the Interagency Workgroup on Air Quality Modeling and the Federal Land Manager Air Quality Related Values Workgroup and guidance provided in the following documents were used in defining the models and methods used in the PSD Class I impact assessments: Guideline on Air Quality Models (40 CFR Part 51, Appendix W), EPA Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule, and EPA Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations.

The CALPUFF modeling options used in the impact assessment were the default recommended by Federal Land Managers Air Quality Related Workgroup Phase I Report (Revised June 2008) and EPA, as appropriate. This model is also an appropriate regulatory model (i.e., a model approved under 40 CFR part 51, Appendix W) to estimate the impact of the project emissions on the PSD Class I increments.

The CALPUFF modeling assessment used the operational maximum emissions, as described below, from the drilling vessel and support vessels. Because the ambient standards and AQRV of concern have averaging periods of 24-hours or greater, the maximum emissions were those associated with these periods. The emission rates for the most significant sources of pollutants modeled (*e.g.*, internal combustion engines for the Transocean *Discoverer Spirit* drilling vessel and support vessels) were based on the worst-case emission scenario in terms of potential to emit and air quality impact for the two phases associated with this permit – the drilling phase and well completion phase. Modeling with the worst-case conditions for these two permitted operational phases gives Anadarko the flexibility to operate at any location within the worst-case lease block or any other lease block location further from the Class I areas.

The worst-case project emissions and location for the drilling and well completion vessel were modeled with the support vessels. For Breton NWR, the northwest corner of the Desoto Canyon lease block 141 was the closest worst-case location. For St. Marks NWR and Bradwell Bay Wilderness, the northeast corner of Desoto Canyon lease block 149 was the closest worst-case location. The modeling assumed that all emissions would be emitted through a single stack associated with the main drillship engines, the largest source of emissions for the proposed operations. All $NO_x$ emissions for the two operational phases were conservatively assumed to be 100 percent $NO_2$. The stack exit parameters used were based on measured values during stack tests (September 2010) of the main engines of the Discoverer Spirit drillship. The lowest exit velocity and lowest exit temperature measured across the operating loads of these tests were conservatively used in the modeling analyses. Because of the proximity of the emission sources on the drillship compared to the long travel distances to the PSD Class I areas, and the use of the stack with the largest emissions, the modeling results should provide acceptable estimates of PSD Class I area impacts.

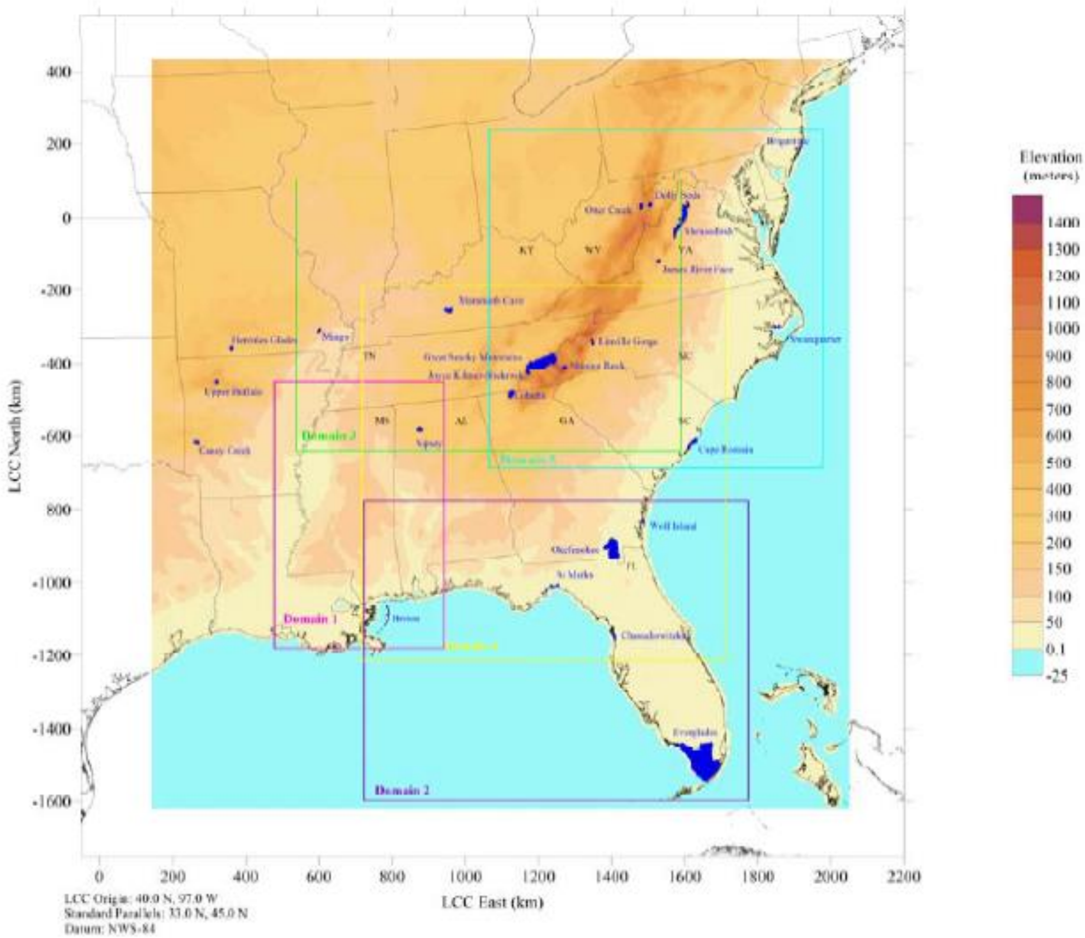
The support vessels include a combination of work and/or crew boats and an anchor handling boat that will be used to transport personnel, supplies, and fuels to the drillship. Because the support vessels will be used interchangeably based on availability, the potential hourly, daily, and annual emissions were estimated for the worst-case boats and used in the modeling to conservatively account for the worst-case support vessels available. The modeling considered the support vessels docked at the drillship and while reroute to/from the drillship, when within 25 miles of the worst-case drillship location.

### 7.4.2 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 I impact assessment. This dataset covers the Gulf of Mexico region of interest in five sub-domains. These meteorological data were processed using the regulatory version of CALMET (Version 5.8). The dataset was developed using observations from 100 to 109 surface stations, 10 upper air stations, 9 overwater stations and 92 to 103 precipitation stations, depending on the meteorological year. The sub-domain 2 was used for this assessment. Figure 7 displays the region of interest, the location of the proposed Anadarko site, and the VISTAS sub-domain 2.

**Figure 7-1 VISTAS Regional Haze Rule Modeling Domains**
**(Anadarko: Class I Air Quality Modeling Analysis Report: Figure 4-1)**

Figure 4-1. VISTAS RHR Model Domains




### 7.4.3 Model Outputs

The CALPUFF-estimated hourly concentrations were averaged for comparison with the annual and 24-hour $PM_{10}/PM_{2.5}$ and annual $NO_2$ Class I PSD significant impact levels (SIL) and increments. Extinction coefficients for 24-hour daily periods and annual total deposition fluxes were estimated. The highest estimated values for the 3-year period were used in comparisons with the significant impact levels and Deposition Analysis Thresholds (DAT). For visibility assessment, the 98 percentile modeled changes in extinction from vessel emissions (*i.e.*,CALPOST Method 8) were compared to the Federal Land Manager target value that is associated with the just-perceptible change in extinction.

### 7.4.4 Atmospheric Chemistry

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 Federal Land Manager requested value of three parts per billion was used. The ozone background concentrations for the 2001-2003 modeled years were those included with the meteorological dataset. A conservative background value of 80 parts per billion was used for any missing ozone values.

### 7.4.5 Modeling Results

The maximum Class I area estimated impacts of $NO_2$ and $PM_{10}/PM_{2.5}$ from the proposed exploratory drilling and well completion emissions are provided in Tables 7-2a and 7-2b, respectively. Because the drilling emissions were updated from the original application and remodeled, Table 7-2a only includes the remodeled drilling impacts at the closest Class I area. The Breton NWR impacts would be larger than those for the more distant St. Marks NWR and Bradwell Bay Wilderness locations. These tables show the maximum modeled concentrations associated with the proposed two phased project emissions are much less than the PSD Class I SILs. Therefore, the project is not considered to have significant impacts on the PSD Class I area.

The January 2013 court vacatur and remand of the $PM_{2.5}$ SIL must be considered in this assessment. The use of the $PM_{2.5}$ SIL in this application is to determine whether the project's emissions will have a significant impact to PSD Class I areas within 300 km of the project location. The court indicated the $PM_{2.5}$ SIL alone cannot be used to determine if a project's impact would cause or contribute to a NAAQS or PSD increment exceedance. The use of the $PM_{2.5}$ SIL as an indication of insignificant impact on a Class I area was not the basis for the court's $PM_{2.5}$ SIL vacatur. Given the basis for the $PM_{2.5}$ SIL, the use as significant impact indicator, and the lack of any other objective concentration, the use as an impact level considered small enough to qualify a project for the temporary sources exemption of no impact to Class I areas appears appropriate. The fact that the maximum modeled project impacts are considerably smaller the Class I SIL (i.e., the Table 7-2 maximum project impacts are 89.0% of the 24-hour and 6.3% of the annual $PM_{2.5}$ SIL) supports the conclusion that the project impacts are insignificant at all PSD Class I areas of concern.

The CALPUFF estimates of deposition of acid-forming compounds from the project's drilling and well completion emissions are provided in Tables 7-3a and 7-3b. Because the drilling emissions were updated from the original application and remodeled, Table 7-3a only includes the remodeled drilling impacts at the closest Class I area. The Breton NWR impacts would be larger than those for the more distant St. Marks NWR and Bradwell Bay Wilderness locations. These tables also contains the Federal Land Manager accepted 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. *See* 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.

The visibility parameter of concern at Breton National Wildlife Refuge is regional haze. The project's contribution to regional haze is addressed as the 24-hour change in light extinction. The Federal Land Manager considers a five percent change in extinction to be just perceptible. Federal Land Manager-accepted procedures were used to provide estimates of the change in extinction associated with project emissions. The CALPUFF post-processor (CALPOST) performs the updated approved Method 8 employing the IMPROVE extinction equation using monthly relative humidity adjustment factors, annual background aerosol concentrations, and 98$^{th}$ percentile modeled values at each receptor.

The Method 8 estimates of project associated changes in visibility extinction provide information for the evaluation the visibility impacts. On a daily basis, the project's drilling and well completion emissions resulted in no days exceeding 0.5 deciview (*i.e.*, approximately a five percent change in light extinction).

Tables 7-4a and 7-4b provide summaries of the results of the Method 8 modeling analyses. Because the drilling emissions were updated from the original application and remodeled, Table 7-4a only include the remodeled drilling impacts at the closest Class I area. The Breton NWR impacts would be larger than those for the more distant St. Marks NWR and Bradwell Bay Wilderness locations. These tables reveal the Method 8 98th percentile values for project drilling and well completion emissions are less than 0.5 deciview (*i.e.*, five percent change in extinction).

**Table 7-2a Class I Area Project Impacts for Drilling Operations**

| Class I Area | Parameter | Class I Area Modeling Significance Level ($\mu g/m^3$) | Meteorological Data Year | | |
|---|---|---|---|---|---|
| | | | 2001 ($\mu g/m^3$) | 2002 ($\mu g/m^3$) | 2003 ($\mu g/m^3$) |
| Breton NWR | $NO_2$ – Annual | 0.1 | 0.0150 | 0.0261 | 0.0245 |
| | $PM_{2.5}$ - 24 hour | 0.07 | 0.0335 | 0.0235 | 0.0375 |
| | $PM_{2.5}$ – Annual | 0.06 | 0.0012 | 0.0018 | 0.0023 |
| | $PM_{10}$ - 24 hour | 0.32 | 0.0401 | 0.0281 | 0.0448 |
| | $PM_{10}$ – Annual | 0.16 | 0.0014 | 0.0022 | 0.0027 |

**Table 7-2b Class I Area Project Impact for Well Completion Operations**

| Class I Area | Parameter | Class I Area Modeling Significance Level ($\mu g/m^3$) | Meteorological Data Year | | |
|---|---|---|---|---|---|
| | | | 2001 ($\mu g/m^3$) | 2002 ($\mu g/m^3$) | 2003 ($\mu g/m^3$) |
| Breton NWR | $NO_2$ - Annual | 0.1 | 0.0138 | 0.0240 | 0.0225 |
| | $PM_{2.5}$ - 24 hour | 0.07 | 0.0558 | 0.0391 | 0.0623 |
| | $PM_{2.5}$ - Annual | 0.06 | 0.0019 | 0.0030 | 0.0038 |
| | $PM_{10}$ - 24 hour | 0.32 | 0.0663 | 0.0465 | 0.0741 |
| | $PM_{10}$ - Annual | 0.16 | 0.0023 | 0.0036 | 0.0045 |
| St. Marks NWR and Bradwell Bay Wilderness* | NO2 - Annual | 0.1 | 0.0021 | 0.0010 | 0.0020 |
| | $PM_{2.5}$ - 24 hour | 0.07 | 0.0114 | 0.0177 | 0.0133 |
| | $PM_{2.5}$ - Annual | 0.06 | 0.0006 | 0.0004 | 0.0006 |
| | $PM_{10}$ - 24 hour | 0.32 | 0.0135 | 0.0211 | 0.0158 |
| | $PM_{10}$ - Annual | 0.16 | 0.0007 | 0.0005 | 0.0007 |

* St. Marks NWR and Bradwell Bay Wilderness were modeled together by including all receptors from both of these Class I areas. Therefore, the concentrations provided are the highest for both Class I areas considered together.

**Table 7-3a Estimated Class I Area Deposition Fluxes for Drilling Operations**

| Class I Area | Parameter | Class I DAT Values (Kg/ha/yr) | Meteorological Data Year | | |
|---|---|---|---|---|---|
| | | | 2001 (Kg/ha/yr) | 2002 (Kg/ha/yr) | 2003 (Kg/ha/yr) |
| Breton NWR | Nitrogen | 0.01 | 0.0032 | 0.0059 | 0.0071 |
| | Sulfur | 0.005 | 8.81E-06 | 1.74E-05 | 1.82E-05 |

**Table 7-3b Estimated Class I Area Deposition Fluxes for Well Completion Operations**

| Class I Area | Parameter | Class I DAT Values (Kg/ha/yr) | Meteorological Data Year | | |
|---|---|---|---|---|---|
| | | | 2001 (Kg/ha/yr) | 2002 (Kg/ha/yr) | 2003 (Kg/ha/yr) |
| Breton NWR | Nitrogen | 0.01 | 0.00299 | 0.00548 | 0.00659 |
| | Sulfur | 0.005 | 4.22E-05 | 8.31E-05 | 8.67E-05 |
| St. Marks NWR and Bradwell Bay Wilderness* | Nitrogen | 0.01 | 0.00164 | 0.00215 | 0.00174 |
| | Sulfur | 0.005 | 1.03E-05 | 1.44E-05 | 9.16E-06 |

* St. Marks NWR and Bradwell Bay Wilderness were modeled together by including all receptors from both of these Class I areas. Therefore, the concentrations provided are the highest for both Class I areas considered together

**Table 7-4a Method 8 - 98th Percentile Extinction Change for Drilling Operations**

| Class I Area | Parameter | | Meteorological Data Year | | |
|---|---|---|---|---|---|
| | | | 2001 | 2002 | 2003 |
| Breton NWR | Method 8 | 98th Percentile 24-hr Average Extinction Change % | 4.97% | 4.02% | 4.09% |
| | | No. of Days > 5 % Extinction Change Threshold | 0 | 0 | 0 |
| | | No. of Days > 10 % Extinction Change Threshold | 0 | 0 | 0 |

**Table 7-4b Method 8 - 98th Percentile Extinction Change for Well Completion Operations**

| Class I Area | Parameter | | Meteorological Data Year | | |
|---|---|---|---|---|---|
| | | | 2001 | 2002 | 2003 |
| Breton NWR | Method 8 | 98th Percentile 24-hr Average Extinction Change % | 4.69% | 3.74% | 3.84% |
| | | No. of Days > 5 % Extinction Change Threshold | 0 | 0 | 0 |
| | | No. of Days > 10 % Extinction Change Threshold | 0 | 0 | 0 |
| St. Marks NWR* | Method 8 | 98th Percentile 24-hr Average Extinction Change % | 0.74% | 0.23% | 0.30% |
| | | No. of Days > 5 % Extinction Change Threshold | 0 | 0 | 0 |
| | | No. of Days > 10 % Extinction Change Threshold | 0 | 0 | 0 |

* Because St. Marks NWR and Bradwell Bay Wilderness are located very close to each, the provided St. Marks modeling results are appropriate to both Class I areas.

### 7.5 Conclusions

Because the draft permit limits Anadarko's project exploratory drilling and well completion operations in the Desoto Canyon lease blocks to no more than 2 years, the project qualifies as a temporary emission source for purposes of PSD permitting. The CALPUFF project impact modeling for the PSD Class I areas within 300 km of the project's location show maximum impacts less than the PSD Class I area significant impact levels for all proposed project PSD pollutants. The AQRV impact assessment of sulfur and nitrogen deposition results in maximum impacts that are less than the Federal Land Manager Deposition Analysis Thresholds. Finally, the project's estimated impact on Class I area is within the Federal Land Manager's acceptable perceptibility level. The Federal Land Manager's evaluation supports these conclusions, found in the *Air Dispersion Modeling Protocol,* May 2013, available in the administrative record. Therefore, the estimated maximum operational emissions from the proposed drilling and well completion activities are not expected to significantly impact the nearest PSD Class I area of Breton National Wildlife Refuge nor any more distant PSD Class I areas.

# 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.

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. The proposed OCS permit includes a condition requiring Anadarko to comply with all other applicable federal regulations, which includes the results of any current and future biological opinions.

### 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 Eastern Gulf of Mexico. The environmental effects of 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 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 the 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 shorelines in the Gulf of Mexico. Given the proposed drilling sites are located offshore in ultra-deepwater, 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.

# 9.0 Public Participation

### 9.1 Opportunity for Public Comment

Pursuant to 40 CFR 55.6(a)(3), the issuance of federal preconstruction and operating permits for OCS sources is governed by the administrative and public participation procedures in 40 CFR part 124 used to issue PSD permits. As provided in part 124, the EPA is seeking comments on the Anadarko OCS air permit OCS-EPA-R40015 during the public comment period as specified in the public notice.

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, 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 EPA. The EPA may summarize the comments and group similar comments together in our response instead of responding to each individual comments.

All comments on the draft permit must be received by email at **R4OCSpermits@epa.gov**, submitted electronically via www.regulations.gov (docket #EPA-R04-OAR-2014-0487) or postmarked by **July 21, 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 should not be submitted through e-mail. If you send email directly to the EPA, your email address will be captured automatically and included as part of the public comment. Please note that an email 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 **July 14, 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 EPA determines that there is a significant degree of public interest, EPA will hold a public hearing on **July 31, 2014**, at:

**West Florida Public Library**
239 North Spring Street
Pensacola, Florida 32502
(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 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 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 rational process, and correspondence with other agencies. The administrative record and draft permit are available on www.regulations.gov (docket# EPA-R04-OAR-2014-0487) and through the EPA’s website at:

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

These web sites 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**

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 related to 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.