UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 4
Atlanta, Georgia

Preliminary Determination & Statement of Basis

for Outer Continental Shelf
Air Permit OCS-EPA-R4005
for

Anadarko Petroleum Corporation
Phoenix Prospect: Lloyd Ridge 410 #1

March 23, 2011

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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
BOEMRE	Bureau of Offshore Energy Management, Regulation and Enforcement
Breton NWR	Breton National Wildlife Refuse
CAA	Clean Air Act
CBI	Confidential Business Information
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2e	CO_2 equivalent
m^3	Cubic Meters
Discoverer Spirit	Transocean Discoverer Spirit drill ship
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FLM	Federal Land Manager
GOM	Gulf of Mexico
HAP	Hazardous Air Pollutants
hp	Horsepower
IC	Internal Combustion
kPa	kilopascals
MSA	Magnuson-Stevens Fishery Conservation and Management Act
LNE	Low NO_x Engine
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 ten microns
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
rpm	revolutions per minute
SER	Significant emission rate
SO_2	Sulfur dioxide
Support Vessels	Work Boat, Crew Boat and Anchor Handling Boat
TPY	Tons Per Year
VHAP	Volatile Hazardous Air Pollutant
VOC	Volatile Organic Compound

1. Introduction:

Anadarko Petroleum Corporation ("Anadarko") has applied for a Clean Air Act (CAA) Outer Continental Shelf (OCS) air permit to authorize mobilization and operation of the Transocean Discoverer Spirit drill ship (Discoverer Spirit) and support vessels at Lloyd Ridge Lease Block 410 on the OCS in the Gulf of Mexico (GOM). Anadarko proposes to drill a single exploratory well to determine if natural gas reserves are present at this location. The operation will last less than 92 days, and as such, will be considered a "temporary source" for permitting purposes.

The United States Environmental Protection Agency (EPA) Region 4 is the agency responsible for implementing and enforcing CAA requirements for OCS sources in the GOM east of 87'30."[1] EPA has completed review of the application and supplemental materials and is proposing to issue Permit No. OCS-EPA-R4005 to Anadarko for an exploratory natural gas drilling project subject to the terms and conditions described in the permit.

This preliminary determination and state of basis document provides an overview of the project, summary of the applicable requirements, and EPA's analysis of key aspects of the application and permit, such as the Best Available Control Technology Analysis (BACT) and Class I area impact analysis. Additional, more detailed information can be found in the draft permit accompanying this document, as well as in the application and docket for this project.[2]

2. Applicant Information:

2.1 Applicant Name and Address

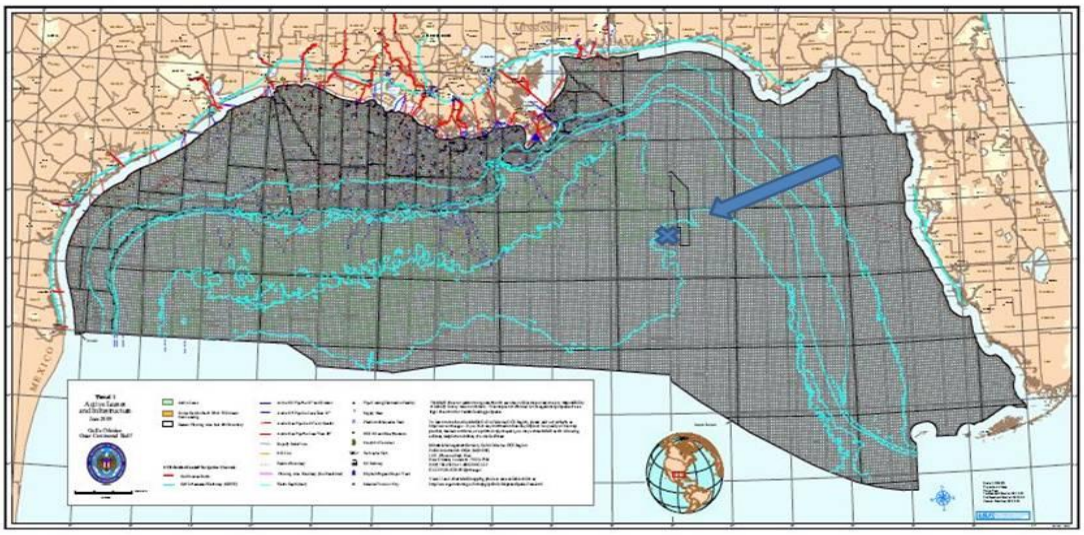
Anadarko Petroleum Corporation
1201 Lake Robbins Road
The Woodlands, Texas 77380

2.2 Facility Location

Anadarko is proposing to drill a single exploratory natural gas well in Lloyd Ridge lease block 410 located on the OCS waters of the GOM east of longitude 87.5 at latitude 27 34' 49.1016 and longitude 78 13' 29.28. The drill site is approximately 160 miles southeast of the mouth of the Mississippi River and 200 miles southwest of Panama City, Florida.

[1] (*see* Clean Air Act § 328), 42 U.S.C. § 7627. The Bureau of Offshore Energy Management Regulation and Enforcement (BOEMRE) has jurisdiction for Clean Air Act implementation west of 87'30".

[2] 40 CFR Part 124, Subparts A and C, contain the procedures that govern the issuance of both OCS and PSD permits. See 40 CFR §§ 55.6(a)(3) and 124.1. Accordingly, EPA has followed the procedures of 40 CFR Part 124 in issuing this 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 also serves as a Fact Sheet as provided in 40 CFR § 124.8.



3. Proposed Project:

The proposed project, known as the Phoenix Prospect, will mobilize the Discoverer Spirit, a work boat, a crew boat and an anchor handling boat to drill a single exploration well on the OCS in Lloyd Ridge Lease Block 410 to determine if natural gas reserves are present in this location. The well's objective depth is 16,100 feet true vertical depth sub-sea or 6,300 feet below the mud line of the seafloor and will be drilled in approximately 9,800 feet of water from the dynamically positioned Discoverer Spirit. The operation will last less than 92 days, and based on applicable permitting regulations, is a "temporary source" for permitting purposes.

Air pollutant emissions generated from the Phoenix Prospect include carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM), particulate matter with an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}), sulfur dioxide (SO_2) and volatile organic compounds (VOC) (known as criteria pollutants), as well as other regulated air pollutants, including green house gas pollutants. These emissions are primarily released from the combustion of diesel fuel in the engines that produce power for the thrusters to hold the dynamically positioned drill ship in place, as well as the power to operating the drilling equipment and stabilize the marine drilling risers. Emissions are also released from other equipment, such as fuel and mud storage tanks, and from activities, such as cementing the well and the use and pumping of heavy lubricating muds. Based on emissions estimates, and the applicable permitting thresholds, the project is considered to have significant emissions of nitrogen oxides (both as a criteria pollutant and ozone precursor) and is subject to the CAA's title I, Part C, Prevention of Significant Deterioration (PSD) program as a result of the emissions of NO_x.

The equipment to be used on the Discoverer Spirit drill ship includes six main propulsion diesel electric generators: four Wärtsilä 18V32 LNE diesel engines with a rated power output of

approximately 9,910 horsepower (hp) each and two Wärtsilä 12V32 LNE diesel engines with a rated power output of approximately 6,610 hp each. The emissions from the diesel engines will be controlled using Low NO_x Engine (LNE) design, turbo-charged after coolers, injection timing retard, and high injection pressure. Nitrogen Oxides will be further controlled using good combustion practices, enhanced with a Power Management System and NO_x Concentration Maintenance System.

The Discover Spirit will be supported by a work boat, crew boat and anchor handling boat (support vessels). The support vessels will be used to transport personnel, supplies, and fuel to the drill ship, as required, during the entire duration of the exploratory drilling. The anchor handling boat will act as a work boat or support vessel, but will not be used to set anchors while on site. The availability of specific support vessels that will be on location during the operation is not known at this time, so Anadarko selected the highest emitting work boat (HOS Coral), crew boat (Harlan S. McCall) and anchor handling (Kirt Chouest) boat available and used the maximum possible emissions in its application. The specific support vessels that will be on location during the operation will be identified prior to commencing operations.

The work boat engines will be rated at approximately 3,004 hp for the two main propulsion (Caterpillar) engines and 1,100 for the three thruster (Caterpillar) engines. The crew boat engines will be rated at approximately 1,350 hp for the five main propulsion (Cummins) engines and 400 hp for the one thruster (Cummins) engine. The anchor handling boat engines will be rated at approximately 7,600 hp for the two main propulsion (Caterpillar) engines and 1,474 hp for the three thruster (Caterpillar) engines. The emergency generator is powered by a (Wärtsilä 6R32 LNE) 3,257 hp engine.

Transocean Discoverer Spirit Drill Ship

The Discoverer Spirit is a dynamically-positioned drill ship that is designed for operation in deep water. As a dynamically-positioned drill ship, the Discoverer Spirit maintains its position over the desired location by using computer-controlled thruster propellers. Therefore, anchors are not needed in order to maintain its position.

4. Legal Authority / Regulatory Applicability:

4.1 EPA Jurisdiction

The 1990 CAA Amendments transferred authority for implementation of the CAA for sources subject to the Outer Continental Lands Act (OCSLA) from the Minerals Management Service (now the Bureau of Offshore Energy Management Regulation and Enforcement (BOEMRE)) to EPA for all areas of the OCS, with the exception of the GOM, west of 87.5 degrees longitude. Section 328(a)(1) of the CAA requires EPA to establish requirements to control air pollution from OCS sources east of 87.5 degrees longitude, in order to attain and maintain Federal and State ambient air quality standards and to comply with the provisions of part C (Prevention of Significant Deterioration) of title I of the CAA.

4.2 OCS Air Regulations

The OCS Air Regulations at Title 40 Code of Federal Regulations (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 the 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 (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 OCSLA (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.

40 CFR § 55.2; see also CAA § 328(a)(4)(C), 42 U.S.C. § 7627.

Section 328 and Part 55 distinguish between OCS sources located within 25 miles of states' seaward boundaries and those located beyond 25 miles of states' seaward boundaries. CAA § 328(a)(1); 40 CFR §§ 55.3(b) and (c). In this case, Anadarko is seeking a permit for an exploratory drilling operation that will be conducted exclusively beyond 25 miles of Florida's seaward boundary.

The OCS Air Regulations set forth the federal CAA requirements that apply to OCS sources. Sources located beyond 25 miles of states' seaward boundaries may be subject to the following CAA requirements, depending on the specific circumstances of the project: New Source Performance Standards (NSPS) 40 CFR Part 60; the PSD pre-construction program (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 or state ambient air quality standards or the requirements of Part C of Title I of the CAA; and the Title V operating permit program (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 exploration drilling program is discussed below.

The OCS regulations also contain provisions relating to monitoring, reporting, inspections, compliance, and enforcement. *See* 40 CFR §§ 55.8 and 55.9. Section 55.8(a) and (b) authorize EPA to require monitoring, reporting and inspections for OCS sources and 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 this proposed permit.

4.3 Prevention of Significant Deterioration

The PSD program, as set forth in the CAA and implementing regulations found at 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 Anadarko. The objective of the PSD program is to prevent significant adverse environmental impact from air emissions by a proposed new or modified source. The PSD program limits degradation of air quality to that which is not considered "significant." The PSD program requires an assessment of air quality impacts of the proposed project, and also requires the utilization of the best available control technology as determined on a on a case-by-case basis taking into account energy, environmental and economic impacts and other costs.

Under the PSD regulations, a stationary source is "major" if, among other things, it emits or has the PTE 100 ton per year (TPY) or more of a "regulated NSR pollutant" as defined in 40 CFR § 52.21(b)(50) and the stationary source is one of a named list of source categories. In addition to the preceding criteria, any stationary source is also considered a major stationary source if it emits or has the potential to emit 250 TPY or more of a regulated New Source Review (NSR) pollutant. 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. "Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is enforceable." 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 enroute 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 "potential to emit" 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. Drill ships and other vessels contain many 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 drill ships and subject support vessels are considered as "potential

emissions" from the OCS source. Similarly, nonroad engines that are part of the OCS source are subject to regulation as stationary sources.

Consequently, in determining the PTE for the Anadarko exploration drilling program, potential emissions from the work boat, crew boat and anchor handling boat were estimated and included. As discussed in Section 1, Anadarko has applied for an OCS major source permit authorizing operation of the Discoverer Spirit and its support vessels at Lease Block 410 of the GOM. Anadarko's application calculated the PTE from the project based on emissions from a proposed federally enforceable limit on the maximum consumption of diesel fuel for Discoverer Spirit over a 92 day period and assumed all engines on the support vessels run at 100% load while at drill the site.

Also, beginning on January 2, 2011, greenhouse gases (GHGs) became a regulated NSR pollutant under the PSD major source permitting program 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)
- sulfur hexafluoride (SF_6)

Due to the nature of GHGs and their incorporation into the definition of regulated NSR pollutant, the process for determining whether a source is emitting GHGs in an amount that would make the GHGs a regulated NSR pollutant includes a calculation of, and applicability threshold for, the source based on CO_2 equivalent (CO_2e) emissions as well as its GHG mass emissions. Consequently, when determining the applicability of PSD to GHGs, there is a two-part applicability process that evaluates both:

The sum of the CO_2e emissions in TPY of the six GHGs, in order to determine whether the source's emissions are a regulated NSR pollutant; and, if so;

The sum of the mass emissions in TPY of the six GHGs, in order to determine if there is a major source or major modification of such emissions.

For PSD permits issued from January 2, 2011, to June 30, 2011, PSD applies to the GHG emissions from a proposed new source if both of the following are true: (1) not considering its emissions of GHGs, the new source is considered a major source for PSD applicability and is required to obtain a PSD permit; and (2) the potential emissions of GHGs from the new source would be equal to or greater than 75,000 TPY on a CO_2e basis.

Table 1 lists the PTE for each regulated NSR pollutant from the project, as well as the significant emission rate (SER) for each regulated NSR pollutant. Section 5 contains information on the emissions factors used to determine PTE for emissions of CO, NO_x, PM,

PM_{10}, $PM_{2.5}$, SO_2, VOC and lead, which are the regulated NSR pollutants that are National Ambient Air Quality Standards (NAAQS) pollutants or precursors to NAAQS pollutants.

Table 1 - Potential to Emit for Regulated NSR Pollutants

Pollutant	Potential to Emit, TPY	Significant Emission Rate, TPY
CO	59.5	100
NO_x[1]	491.6	40
VOC[1]	10.6	40
PM	13.0	25
PM_{10}	6.4	15
$PM_{2.5}$[2]	6.9	10
SO_2	7.5	40
GHGs (CO_2e)	21,343	75,000 (subject to regulation threshold)

[1]VOC and NO_x are the measured precursors for the criteria pollutant Ozone.
[2] The sum of $PM_{2.5}$ emissions plus Sulfuric Acid Mist (Sulfate PM).

Because exploration drilling programs are not included in the list of source categories subject to a 100 TPY applicability threshold, the requirements of the PSD program apply if the project PTE is at least 250 TPY. From Table 1, it is evident that Anadarko exploration drilling program is a major PSD source because emissions of NO_x exceeds the major source applicability threshold of 250 TPY. Since no other pollutant exceeds the significant emission rate, Anadarko is only required to apply BACT and address air quality impact requirements for NO_x. Section 6 contains a discussion of the BACT analysis. Section 7 discusses the applicable provisions of the air quality impact analysis.

4.4 Title V

The requirements of the Title V operating permit program, as set forth at 40 CFR Part 71, apply to major OCS sources located beyond 25 miles of States' seaward boundaries. *See* 40 CFR § 55.13(f)(2). Sources subject to Title V and Part 71 must apply for an operating permit within 12 months of commencing operation. 40 CFR 71.5(a)(1)(i). However, because this is a temporary source (92 days) consistent with 40 CFR 52.21(i)(3), Anadarko is not required to apply for a Title V operating permit.

4.5 New Source Performance Standards

Applicable NSPS apply to OCS sources. *See* 40 CFR § 55.l3(c). In addition, the PSD regulations require each major stationary source or major modification to meet applicable NSPS. *See* 40 CFR § 52.21(j)(1). A specific NSPS subpart applies to a source based on source category, equipment capacity, and the date when the equipment commenced construction or modification. As is explained below, while the Discoverer Spirit contains emission units that may be subject to NSPS requirements, the specific facts of this project are such that no NSPS applies. Potentially applicable NSPS are discussed below:

NSPS, 40 CFR Part 60, Subpart IIII, applies to stationary compression-ignition internal combustion (IC) engines, with the earliest applicability date being for units for which construction commenced after July 11, 2005. All diesel engines on board the Discoverer Spirit, were constructed prior to July 11, 2005, have not been modified or reconstructed and therefore are not subject to NSPS 40 CFR Part 60, Subpart IIII.

NSPS, 40 CFR Part 60, Subpart K, applies to petroleum liquids tanks with a capacity of greater than 40,000 gallons but less than 65,000 gallons and 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. The Discoverer Spirit was built in 2000; therefore, all storage tanks are exempt from Subpart K based on their construction date.

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. The Discoverer Spirit was built in 2000; therefore, all storage tanks are exempt from Subpart Ka based on their construction date.

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 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 Table 2 shows, all storage tanks on the Discoverer Spirit are exempt from Subpart Kb based operating pressure being less than 3.5 kPa or capacity being less than 75 m^3.

Table 2 - Discoverer Spirit Petroleum Storage Tanks

Tanks	Description	Volume (m^3)	Vapor Pressure (psia)	Pressure (kPa)
DR-DT-01	FWD, diesel fuel drain tank	4.3	0.012	0.083
DR-DT-02	AFT, diesel fuel drain tank	13.8	0.012	0.083
DR-DT-03	Diesel fuel overflow tank	98.2	0.012	0.083
DR-DT-04	STBD main diesel fuel storage tank	1985.5	0.012	0.083
DR-DT-05	Port main diesel fuel storage tank	1971.1	0.012	0.083
DR-DT-06	STBD engine room diesel fuel day tank	99.5	0.012	0.083
DR-DT-07	Port engine room diesel fuel day tank	99.5	0.012	0.083
DR-DT-08	STBD engine room diesel	99.5	0.012	0.083

	fuel settling tank			
DR-DT-09	Port engine room diesel fuel settling tank	99.5	0.012	0.083
DR-HT-01	Helicopter fuel tank	2.2	1.900	13.101
DR-OBT-01	Mud storage tank	59.8	0.649	4.475
DR-OBT-02	Mud storage tank	59.8	0.649	4.475

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). In addition, the PSD regulations require each major stationary source or major modification to meet applicable standards under 40 CFR Part 61, which are NEHSAPs. *See* 40 CFR §52.21 (j)(1). No source categories on board the Discoverer Spirit are currently regulated by NESHAPs promulgated at 40 CFR Part 61.

NESHAP, 40 CFR 61 Subpart J applies to pumps, compressors, pressure relief devices, sampling connection systems, open-ended valves or lines, and other units intended to operate in benzene service. 40 CFR 61 Subpart V applies to like units intended to operate in volatile hazardous air pollutant (VHAP) service. None of the fugitive components on the Discoverer Spirit will operate in benzene or VHAP service (≥ 10% by weight benzene or vinyl chloride) and, therefore, these regulations do not apply. Consequently, the emission units on the Discoverer Spirit are not subject to the requirements of Part 61.

After the PSD program regulations were developed, EPA also promulgated Section 112 NESHAP regulations in 40 CFR Part 63. Part 63 NESHAPs apply to a source based on the source category listing, and the regulations generally establish different standards for new and existing sources pursuant to Section 112. In addition, 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" or "HAP" or 25 tons per year or more of all HAP combined. Section 112(a)(1) and 40 CFR § 63.2. An "area source" is any source that is not a major source. See Section 112(a)(2) and 40 CFR § 63.2.

As Table 3 shows, Anadarko has estimated emissions of 0.1 tons/project for all HAPs combined. This makes the project an area source of HAP. No emissions units on the Discoverer Spirit are subject to 40 CFR Part 63, Subpart ZZZZ. Under that rule, engines with a rating of 500 horsepower (hp) or more at area sources constructed before December 19, 2002, and June 12, 2006, for engines with a rating of less than 500 hp, do not have to meet the requirements of 40 CFR Part 63, Subparts A and ZZZZ.

Table 3 – Discoverer Spirit Hazardous Air Pollutants

Hazardous Air Pollutant	Discoverer Spirit	Work Boat	Crew Boat	Anchor Handling Boat	Total TPY
Acetalde.	0.0	0.0	0.0	0.0	0.0
Form.	0.0	0.0	0.0	0.0	0.0
Benzene	0.1	0.0	0.0	0.0	0.1
Toluene	0.0	0.0	0.0	0.0	0.0
E-Ben.	0.0	0.0	0.0	0.0	0.0
Xylene	0.0	0.0	0.0	0.0	0.0

5. Project Emissions:

This section describes the emission calculation basis for each emission source. The emission calculations are based on stack testing, AP-42 Compilation of Air Pollutant Emissions Factors (hereafter referred to as "AP-42") and analysis of fuel sulfur content. The total projected emissions include emissions based on fuel consumption from the Discoverer Spirit diesel engines. Emissions from other sources on the Discoverer Spirit and support vessels are based on worst case PTE conditions for the individual sources. A summary of the PTE from all regulated NSR pollutants are given in Table 4 below.

Table 4 – Potential to Emit Emissions from all Sources (Regulated NSR Pollutants)

Pollutant	Discoverer Spirit	Work Boat	Crew Boat	Anchor Handling Boat	Total Project	PSD Significant Emission Rate, TPY	PSD Review Required
CO	31.4	12.3	0.9	14.9	59.5	100	No
NO_x[1]	332.6	68.4	20.6	70.0	491.6	40	Yes
PM	7.0	3.3	0.9	1.8	13.0	25	No
PM_{10}	4.0	0.8	0.5	1.0	6.4	15	No
$PM_{2.5}$[2]	4.2	1.0	0.6	1.1	6.9	10	No
SO_2	4.0	1.9	0.5	1.0	7.5	40	No
VOC[1]	7.1	1.4	0.4	1.7	10.6	40	No
Fluorides	0.0	0.0	0.0	0.0	0.0	3	No
Sulfuric Acid Mist	0.3	0.2	0.0	0.1	0.6	7	No
Hydrogen Sulfide	0.0	0.0	0.0	0.0	0.0	10	No
Total Reduced Sulfur	0.1	0.0	0.0	0.0	0.2	10	No
GHGs (CO_2e)	11,431.3	5,439.8	1,504.2	2,968.1	21,343	75,000 (subject to regulation threshold)	No

[1] VOC and NO_x are the measured precursors for the criteria pollutant Ozone

[2] The sum of $PM_{2.5}$ emissions plus Sulfuric Acid Mist (Sulfate PM)

5.1 Engine Stack Test and Analysis and Compliance Methodology

The Discoverer Spirit main electrical power is provided by six main propulsion diesel electric generators, four Wärtsilä 18V32 LNE diesel engines with a rated power output of approximately 9,910 hp each, two Wärtsilä 12V32 LNE diesel engines with a rated power output of approximately 6,610 hp each, and a emergency generator is powered by a (Wärtsilä 6R32 LNE) 3,257 hp engine. The Discoverer Spirit typically runs three engines at any one time with variable loads and a typical average load of 30 percent. Stack testing was used to generate emission factors used for NO_x and CO emissions for the six main propulsion engines. SO_2 emissions were estimated based on chemical analysis of the sulfur content of the diesel fuel and AP-42 factors were used for VOCs, PM, PM_{10}, $PM_{2.5}$ and HAPs. The specific emission factors used to estimate the project's emissions are in the application, which is available in the administrative record at the end of this document.

The Discoverer Spirit emissions estimates were based on maximum anticipated diesel fuel consumption (425 barrels per day), 92 days of drilling operation, and maximum NO_x and CO emission factors plus a safety factor based on stack testing results. CO and NO_x emissions from the main propulsion engines were determined using the results of stack testing that the company conducted prior to permit issuance. During this testing, CO and NO_x emission rates were measured while each engine operated at four different load levels across the expected range of normal operation. Because emissions may be affected by the operating and maintenance history of the individual engines, separate tests were conducted for each of the six main propulsion engines. The data from these tests will be used to prepare a graph of engine load versus emission rate in grams per kilowatt-hour (g/kW-hr) for each engine for compliance monitoring.

During the permit term, NO_x emissions will be monitored using the emissions vs. load graphs prepared from the source test data. The load for each engine will be monitored and emission rates will be determined by interpolating between the data points on the graphs. The permit will also specify procedures for calculating emission rates for time periods when engine load data is unavailable or when the actual engine load exceeds the highest load reached during the stack testing.

5.2 Smaller Emission Units

The following is a description of the smaller emission units and how emissions were calculated:

DR-GE: Emergency Diesel Engine
The emergency diesel engine (shown below) provides emergency power to the drill ship. An operation time of 30 minutes per week was used for the emission calculations.

DR-EC: Escape Capsules
The escape capsule engines are used to power the escape capsules (shown below). The engines are run periodically to ensure the engines will operate properly in the event of an emergency. An operation time of five minutes per week was used for the emission calculations.

DR-AC: Emergency Air Compressors
The emergency air compressor engines (shown below) power backup air compressors in the event the main air compressors go down. The engines are periodically run to ensure the engines will operate properly in the event of an emergency. An operation time of 15 minutes per week was used for the emission calculations.

DR-FL: Forklift
The forklift engine powers the forklift (shown below), which is used to lift and move equipment. An operation time of one hour per day, four days a week, was used for the emission calculations.

DR-WL: Wire Line Units

The wire line engines power the wire line units (shown below), that are to insert or remove the wire line from the well. Wire line units are used for collecting data and for running and retrieving down hole tools in the well. An operation time of 24 hours per day, 3 days for the project, was used for the emission calculations.

DR-EL: Electric Line Units

The electric line engines (shown below) are used to supply electric lines to the drill ship operations. An operation time of 24 hours per day, 4 days for the project, was used for the emission calculations.

DR-CU: Casing Crew Units
The casing crew unit engines (shown below) are used by the casing crew during well casing operations. Casing is pipe used to line the hole. An operation time of 12 hours per day, once a week, was used for the emission calculations.

5.3 Support Vessels

The support vessels will be used to transport personnel, supplies, and fuel to the drill ship, as required, during the entire duration of the exploratory drilling. The availability of specific support vessels that will be on location during the operation was not known at the time of the application, as these units are supplied by outside vendors based on availability. Anadarko selected the highest emitting work boat, crew boat and anchor handling boat available and used the maximum possible emissions for their estimates in the application.

The work boat calculations were based on 100% load for all engines while at the drill site with no reduction for standby time, 29 hours per trip (total 899 hours) and one trip every 3 days (31 trips total). The crew boat calculations were based on 100% load for all engines while at drill site with no reduction for standby time, 8 hours per trip (total 368 hours) and one trip every 2 days (46 trips total). The anchor handling boat calculations were based on 100% load for all engines, the assumption of burning 7,500 gallons of diesel fuel per day for a total of 899 hours within a 25 mile radius of the Discoverer Spirit and during standby time at the Discoverer Spirit.

The calculated emissions for the crew boat, work boat and anchor boat were based on maximum load for maximum potential to emit. However, these are conservative "worst case" assumptions, and do not represent how these boats will typically operate. Detailed emission factors for these sources are available in the administrative record referenced at the end of this document.

6. Best Available Control Technology 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 would have the potential to emit in significant amounts. *See* 40 CFR § 52.21(j). Based on the emission inventory for the project, presented in Table 1 of the preliminary determination, NO_x is the only CAA regulated pollutant that will be emitted by Anadarko in quantities exceeding the significant emission rate. Therefore, BACT must be determined for each emission unit on the Discoverer Spirit which emits NO_x, while the drill ship is operating as an OCS source.

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

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. 42 USC § 7479(c).

EPA has developed a "top-down" process to ensure that a BACT analysis satisfies the applicable legal criteria. The top-down BACT analysis consists of a five-step process which provides that all available control technologies be ranked in descending order of control effectiveness, beginning with the most stringent. *See, e.g., In re Prairie State Generation Company,* 13 E.A.D. 1, PSD Appeal No. 05-05, (EAB, August 24, 2006); *In re Knauf Fiber Glass, GmbH,* 8 E.A.D. 121, 142 (EAB, February 4, 1999); *In re Masonite Corp.* 5 E.A.D. 551, 568-569 (EAB, November 1, 1994). 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.

6.1 NO_x BACT Analysis for the Main Propulsion Generator Engines (DR-GE-01 through DR-GE-06)

The Main Propulsion and Generator Engines are used to power the thrusters that hold the ship on location, as well as power the drilling equipment and other operational needs of the ship. The main engines operate at variable load based on drilling and operational power demand, and extensive "reserve" power is required to adjust for Gulf currents and subsea soil densities. Hence, NO_x emissions are not emitted from these engines at a steady state. In addition, engine efficiency and performance typically degrades over time, resulting in increased NO_x emissions. These factors are important considerations in the BACT analysis for these engines.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their OCS permit application submitted in November 2009:

1. Exhaust Gas Recirculation (EGR)
2. Ignition Timing Retard (ITR)
3. Derate Engines
4. Direct Water Injection (DWI)
5. Water-in-fuel Emulsions
6. Intake Air Humidification/Cooling
7. NO_x Adsorber/Scrubber Technology
8. Combination of DWI + EGR
9. Selective Catalytic Reduction (SCR)
10. Good Combustion Practices

EPA requested additional information regarding the BACT analysis from the applicant and received supplemental information on February 10, 2010, December 14, 2010, February 2,

2011, and March 7, 2011. The supplemental information includes the following additional control technologies as part of Step 1 of the top-down BACT analysis for NO_x emissions:

11. Good Combustion Practices
12. EPA Tier 2 Standards, as set forth in 40 CFR Part 89 or 94
13. Replacement of older engines with newer ones
14. CAM Shaft replacement/retooling of engines
15. Lean De-NOx catalyst (LNC) or hydrocarbon SCR (HC-SCR)
16. High Injection Pressure (HIP)
17. Turbo charger/after cooler
18. Low NO_x Engine (LNE) design (w/HIP, ITR, and turbo charger/after cooler)
19. Good Combustion Practices with Power Management System (PMS) and NOx concentration maintenance system.

Step 2: Eliminate technically infeasible control options

After analyzing the 19 control technology options, 11 of the options were eliminated as technically infeasible for control of NO_x emissions from the main engines on the Discoverer Spirit. 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 and supplemental information submitted to EPA in November 2009, February 2010, December 2010, February 2011 and March 2011.

Exhaust Gas Recirculation: The technology is in development stages for marine applications and according to the engine manufacturer (Wärtsilä) not available for the main engines operating on the Discoverer Spirit.

Derate Engines: Further derating the engines will decrease the available power, which would cause an unreasonable safety risk. In addition, according to Wärtsilä, this is not an available technology for the main engines operating on the Discoverer Spirit.

Direct Water Injection: This technology is in development stages for marine applications and cannot be used at low loads (30-40%), which is the planned operating load for the main engines. According to Wärtsilä, this is not an available technology for the main engines operating on the Discoverer Spirit.

Water-in-Fuel Emulsions (emulsified diesel): 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 are designed and will be burning medium density fuel (diesel). 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 that is unacceptable for this project.

Intake Air Humidification/cooling (fogging): The technology is in development stages for marine applications, and according to Wärtsilä not available for the main engines operating on the Discoverer Spirit.

Adsorber/Scrubber Technology: The technology is in development stages for diesel engines and according to Wärtsilä not available for the main engines operating on the Discoverer Spirit.

Combination of DWI + EGR: These technologies are in development stages for marine applications and according to Wärtsilä not available for the main engines operating on the Discoverer Spirit.

EPA Tier 2 emission standards: The engines currently on the Discoverer Spirit meet Tier 1 standards of the International Marine Organization (IMO) 2008 NO_x Technical Code (Regulation 13), which for this type Wärtsilä engine (25-30 liter/cylinder displacement operating at 720 rpm), is identical to EPA Tier 1 (40 CFR Part 94) standards of approximately 12.1 g/kW-hr of NO_x. According to the drill ship owner, certification to meet these standards is part of the inherent design of the engine and there is no upgrade available for an existing IMO Tier 1 certified engine to meet either IMO or EPA Tier 2 standards. For these types of engines, the IMO and EPA Tier 2 standards are 9.7 g/Kw-hr and 11 g/kW-hr, respectively. In order for the main engines on the Discoverer Spirit to meet either IMO or EPA Tier 2 (Part 94) standards, the engines would have to be replaced with newer engines. The technical feasibility of this option is discussed below.

Replacement of Older Engines with Newer Engines: There are several options to consider when analyzing the feasibility of replacing the existing engines on the Discoverer Spirit with newer, lower NO_x emitting engines. The first option considered was to replace the existing engines with similar engines meeting IMO Tier 2 (9.7 g/kW-hr) NO_x emission standards. The applicant provided documentation from Transocean (drill ship owner) that new IMO Tier 2 certified engines are not available for this drilling project. Therefore, this option is not considered feasible as BACT for this particular drilling project. Additionally, installing newer engines (of a similar type) which meet EPA Tier 2 (Part 94) NO_x standards (11 g/kW-hr) would not achieve any NO_x reductions compared to engines meeting IMO Tier 2 standards.

Finally, EPA requested the applicant consider replacing the main engines on the Discoverer Spirit with engines certified to meet or exceed EPA Tier 2 (Part 89) NO_x emission standards (6.4 g/kW-hr), which serve a similar purpose to the main engines on the Discoverer Spirit. A comparable drilling project has proposed the use of Electro Motive Diesel (EMD) engines that are EPA Tier 2 (Part 89) certified and predicted to meet annual NO_x emission limits as low as 5.5 g/kW-hr of NO_x. The applicant provided additional information regarding this option in March 2011. The Discoverer Spirit currently has 6 main engines totaling 37,400 kW of power to the drill ship. In order to meet this power requirement, the applicant would need to install 10 of the EMD engines (4,027 kW each) certified to meet EPA Tier 2 (Part 89) NO_x emission standards. Since there is physically not enough room on the Discoverer Spirit to install 10 EMD engines of this size, this option of replacing the existing engines with EPA Tier 2 (Part 89) certified engines is technically infeasible for this project.

CAM Shaft Replacement/Retooling of Engines: Retrofitting the camshaft using a retooling kit is only available for smaller (*e.g.,* 2-stroke) engines and has not been developed for larger engines (*e.g.,* 4-stroke).

Lean De-NO_x Catalyst (LNC) or Hydrocarbon SCR (HC-SCR): This technology is not commercially available for large marine engines according to the technology provider (Johnson Matthey Catalyst).

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 5 below lists the remaining control technologies that have not been ruled out as technically infeasible options ranked by effectiveness.

Table 5: Step 3 Control Technologies Ranked by Effectiveness

Rank	Control Description	NO_x Control Effectiveness
1	SCR with urea injection	80–90%
2	LNE Design with Good Combustion Practices (GCP) with the PMS and a NO_x concentration maintenance system	45%
3	LNE design meeting EPA/IMO Tier 1 standards: · Ignition Timing Retard (ITR) · Turbo Charger/After cooler · High Injection Pressure (HIP)	30%
4	Good Combustion Practices of uncontrolled engine	Baseline

Step 4: Evaluate the energy, environmental and economic impacts

SCR using urea: The applicant provided information regarding the cost effectiveness of installing and operating SCR to control NO_x emissions from the main engines on the Discoverer Spirit. The applicant estimated the total cost effectiveness of reducing 299 TPY of NO_x was over $43,000 per ton removed and concluded that SCR should be eliminated as BACT.

EPA, however, does not concur with several of the assumptions in the applicant's analysis. Specifically, for this project, we do not agree with several of the costs assumed, including sunk costs (*e.g.,* dry dock costs) or other costs (*e.g.,* NO_x Stack testing) that would occur regardless of the installation of an SCR system. In addition, EPA does not concur with the applicant's justification for including both ship and project contingency costs at 20% and

6.5% respectively. EPA did concur with the applicant's approach of not amortizing the capital costs of installing an SCR system on the drill ship, since the drill ship is leased, and the project is expected to last less than 1 year.

Based on the specific information relevant to this proposed project, EPA's independent cost analysis calculated the total cost effectiveness of installing and operating an SCR as approximately $18,250 per ton of NO_x removed (based on the applicant's originally proposed 16 g/kW-hr BACT emission limit). Furthermore, if the cost analysis is adjusted to reflect the NO_x emission limit (12.7 g/kW-hr) determined by EPA to represent BACT for the main engines, the total cost effectiveness is higher (approximately $23,000/ton removed). Therefore, EPA concludes that requiring SCR to control NO_x emissions from this particular project, anticipated to last only 92 days, is not cost effective and is not BACT for this project.

Power Management System and NOx concentration maintenance system: The applicant has proposed to supplement the good combustion practices outlined by the manufacturer with use of a Power Management System (PMS) and a NO_x concentration maintenance system. The PMS has recently been designed by the owner of the drill ship, Transocean, to enhance the load management of the engines, ensure good combustion efficiency, and maintain load levels to 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 quickly. Detailed information on these additional systems can be found in the supplemental application dated December 14, 2010. EPA has included additional recordkeeping and monitoring requirements for these new systems to help determine their long-term effectiveness as both a compliance tool and emissions reductions technology.

After taking into account energy, economic, and environmental impacts in Step 4 of the BACT analysis, EPA determined that the remaining control options ranked in Step 3 of the top-down BACT analysis are feasible. Hence, EPA has concluded that BACT is use of certified IMO Tier 1 engines with Low NO_x Engine design (including ignition timing retard, turbo charger/after cooler, and high injection pressure) and good combustion practices with use of PMS and NO_x concentration maintenance system.

Step 5: Select BACT

The applicant originally proposed a NO_x emission limit of 16 g/kW-hr as BACT for the main engines on the Discoverer Spirit and in supplemental information revised their proposal to 15 g/kW-hr. This limit is based on maximum NO_x emission rate during the stack test.

The main engines on the drill ship are certified at construction to meet Tier 1 standards of the IMO's 2008 NO_x Technical Code (Regulation 13). At engine speeds of 720 rpm, the engines on the Discoverer Spirit were designed to meet NO_x emission limits of 12.1 g/kW-hr operating at engine test bed conditions, which can vary significantly from the onsite drilling conditions.

EPA reviewed the emission data from the most recent set of stack tests performed in September 2010. The average NO_x emissions rate for each engine at a variety of loads (from 19% to 60%), ranged from 10.78 g/kW-hr to 13.40 g/kW-hr, with an overall engine average of 12.04 g/kW-hr of NO_x emissions. The variability of each engine NO_x emission rate depends on several factors, including the engine load level and the number of operating hours the engines has logged since significant maintenance was last performed on the engine.

EPA has determined that the NO_x emission limit which represents BACT for the main engines on the Discoverer Spirit is 12.7 g/kW-hr (including a typical 5% margin of compliance). Given the significant load variations required by the operations on the drill ship, EPA has determined an averaging period of 24 hours is appropriate in this case.

6.2 NO_x BACT Analysis for the Emergency Diesel Engine (DR-GE-07)

The applicant submitted additional information on February 10, 2010, regarding the NO_x BACT analysis for the emergency diesel engine (DR-GE-07) operating on the Discoverer Spirit.

Step 1: Identify all available control technologies

The applicant identified the following available control technologies in their supplemental OCS permit application submitted on February 10, 2010:

1. Exhaust Gas Recirculation (EGR)
2. Ignition Timing Retard (ITR)
3. Derate Engines
4. Direct Water Injection (DWI)
5. Water-in-fuel Emulsions
6. Intake Air Humidification/Cooling
7. NO_x Adsorber/Scrubber Technology
8. Combination of DWI + EGR
9. Selective Catalytic Reduction (SCR)
10. Good Combustion Practices

Step 2: Eliminate technically infeasible control options

After analyzing the 10 control technology options, 8 of the options were eliminated as technically infeasible for control of NO_x emissions from the main engines on the Discoverer Spirit. Since the emergency diesel engine on the drill ship is physically similar to the main engines, please refer to the summary in the top-down BACT analysis for the main engines (Section 8.1 of the preliminary determination) for the reasons for eliminating each of these options from further consideration. For detailed descriptions and references, please refer to the supplemental information submitted to EPA on February 10, 2010.

Selective Catalytic Reduction (SCR): EPA concurs with the applicant's determination that this control option is not technically feasible for use on emergency diesel

engines, which only operate intermittently during short weekly periods of engine operation. SCR systems require a longer period of operating time in order to reach a minimum temperature before the system can operate.

Replacement Engines: Additionally, while the applicant did not address it specifically for the emergency generator, EPA considered the option of replacing the existing emergency generator with a newer engine that would potentially meet lower emission standards (*e.g.*, EPA or IMO Tier 2 NO_x standards). Information provided in the BACT analysis for the main engines indicates that newer engines certified to meet either EPA or IMO Tier 2 emission standards are not readily available. Therefore, EPA dismissed this option as technically infeasible as BACT for the emergency generator.

Step 3: Rank the remaining control technologies by effectiveness

The only remaining technically feasibly control technology option for the emergency generator operating on the Discoverer Spirit is the use of good combustion practices.

Step 4: Evaluate the energy, environmental and economic impacts

The energy, environmental and economic impacts analysis is used to differentiate the remaining options. Since, the only remaining technically feasibly control technology option for the emergency generator operating on the Discoverer Spirit is the use of good combustion practices, this evaluation was not needed.

Step 5: Select BACT

As part of good combustion practices, the owner of the drill ship (Transocean) will operate the emergency generator according to the manufactures specifications. The applicant proposed an emission limit of 11 g/kW-hr as BACT for the emergency generator on the Discoverer Spirit. Since the emergency generator will only operate 30 minutes per week for the duration of the project, showing compliance with a numeric emission limit would be unreasonably burdensome and costly. Therefore, EPA has determined that BACT for the emergency generator is limiting the use of the engine to 30 minutes per week, operating in accordance to the manufacturers' specifications and limiting NO_x emissions to 0.719 tons for the duration of the project.

6.3 NO_x BACT Analysis for the Smaller Diesel Engines

The applicant also submitted additional information on February 10, 2010, regarding the NO_x BACT analysis for 12 smaller diesel engines operating on the Discoverer Spirit. These engines include: two escape capsule diesel engines (DR-EC-01 and 02); two emergency air compressor diesel engines (DR-AC-01 and 02); one diesel powered fork lift (DR-FL-01); two wire line diesel engines (DR-WL-01 and 02); two electric line diesel engines (DR-EL-01 and 02); and two casing unit diesel engines (DR-CU-01 and 02).

The applicant anticipates escape capsules (2) and emergency air compressors (2) would typically be run for a few minutes each week during routine checks of the engines' operation. The forklift will be used on an as needed basis during the drill ship operations and the portable engines (*i.e.*, wire line units, casing units, and electric line units) would only be run for a short number of days during the project. Given the limited use of these emission units, EPA has determined that BACT is good combustion practices. Furthermore, to reduce the emissions and maintain consistency with the emission estimates in the permit application, the permit proposes to limit the use of these smaller diesel engines. Table 6 below describes the operating limits that will be incorporated into the OCS permit associated with the additional BACT determination of limited use for these emission units.

Table 6 - BACT Operating limits for Smaller Diesel Engines

Unit ID	Description	Short-Term Operating Limits	Long-Term Operating Limit
DR-EC-01	Escape capsule diesel engine #1	5 minutes/week	1.1 hours/project duration
DR-EC-02	Escape capsule diesel engine #2	5 minutes/week	1.1 hours/project duration
DR-AC-01	Emergency air compressor diesel engine #1	15 minutes/week	23.0 hours/project duration
DR-AC-02	Emergency air compressor diesel engine #2	15 minutes/week	23.0 hours/project duration
DR-FL-01	Diesel powered forklift engine	1 hour/day 4 days/week	52.6 hours/project duration
DR-WL-01	Wire line diesel engine	None	72.0 hours/project duration
DR-WL-02	Wire line diesel engine	None	72.0 hours/project duration
DR-EL-01	Schlumberger electric line diesel engine	None	96.0 hours/project duration
DR-EL-02	Schlumberger electric line diesel engine	None	96.0 hours/project duration
DR-CU-01	Casing unit diesel engine #1	None	156.0 hours/project duration
DR-CU-02	Casing unit diesel engine #2	None	156.0 hours/project duration

7. Summary of Applicable Air Quality Impact Analyses:

7.1 Required Analyses

As discussed in Section 4 above and provided in Table 1, under the proposed OCS/PSD permit for Anadarko's Phoenix Prospect, the potential emissions from the proposed OCS

source would be in excess of the PSD significance emission rate for NO_x, the measured pollutant for nitrogen dioxide and the measured precursor for the criteria pollutant ozone. Emissions of other regulated pollutants do not equal or exceed the significant emission rates.

The applicable PSD permitting requirements for proposed major new sources or major modifications to existing sources generally require applicants to perform an air quality impacts analysis. However, the PSD regulations also provide that certain provisions of the analysis are not required for temporary sources that meet specific requirements. The PSD regulations at 40 CFR § 52.21(i)(3) provide exemptions for the analyses requirements of paragraphs (k) [NAAQS and PSD increment analyses], (m) [Pre-construction and post-construction monitoring], and (o) [Additional impact analysis] to major sources and major modifications for a particular pollutant if the allowable emissions of that pollutant from the source,: (i) would impact no Class I area and no area where the applicable increment is known to be violated, and (ii) would be temporary. Temporary sources are discussed in the regulations at 40 CFR 52.21(i)(3) and also explained in the pre-amble to the August 7, 1980, amended regulations for Prevention of Significant Deterioration of Air Quality (40 CFR 51.24, 52.21) as sources operating less than 2 years in a given location. 45 *Fed. Reg*. 52676, 52719 (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 (FLM) 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 for nitrogen dioxide are listed in 40 CFR § 52.21(c). There are no increments for ozone. There are PSD Class I, II and III increments applicable to areas designated Class I, II and III. 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.

Table 7. Nitrogen dioxide Ambient Air Quality Standards

Pollutant	**Averaging Period**	**National Ambient Air Quality [µg/m³ (ppm)]**		**PSD Increment [µg/m³]**		**PSD Significant Impact [µg/m³(ppm)]**		**PSD De Minimis Impact Levels [µg/m³]**
Nitrogen Dioxide	1-Hour	188[i, n] (0.100)	None	TBD	TBD	TBD	7.55[n] (0.004)[d]	
	Annual	100 (0.053)	Same	2.5	25	0.1	1	14

Notes:
TBD – To be determined
d – Recommended Interim SIL.
i – 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 $\leq$ standard.
n – Values in ug/m3 are estimates. EPA to provide conversion from ppm to ug/m³.

7.2 Anadarko Qualification as a Temporary Source

Anadarko has requested an air quality permit for a maximum of 92 days of potential exploratory drilling activity at any location in the Lloyd Ridge 410 lease block in the Eastern GOM. This permit limited operation would qualify the project as temporary (*i.e.,* less than 2 years), which is one criterion required of the 40 CFR § 52.21(i)(3) exemption from the air quality impact analysis and monitoring. The following sections address the impact related criterion for temporary source exemption.

7.2.1 Impact to PSD Class I Areas and Areas of Known PSD Increment Violation

The impact related criterion that must be met for a 40 CFR § 52.21(i)(3) exemption is that the project emissions must not impact any PSD Class I area and no area where the applicable increment is known to be violated. The Lloyd Ridge 410 lease block is located in the Eastern GOM approximately 163 miles from the nearest shoreline. There are no known areas in the GOM violating the NO_2 PSD increment. Nor, based on the screening analysis discussed below, does EPA believe the project's NO_2 emissions will impact any onshore areas.

The nearest PSD Class I area to Lloyd Ridge lease block 410 is Breton National Wildlife Refuse (Breton NWR) located on the southeast coast of Louisiana, approximately 278 km from the proposed drilling site. To demonstrate no PSD Class I area impacts, Anadarko's potential impact to Breton NWR's important Air Quality Related Values (AQRV) and PSD increments were evaluated. The FLM for each PSD Class I area (*i.e.,* U.S. Fish & Wildlife Service, U.S. Forest Service, and National Park Service) has the charge to protect the AQRV while U.S. EPA ensures the PSD increments are protected. The U.S. Fish and Wildlife Service (FWS) is the FLM for Breton NWR.

7.2.2. Air Quality Related Values

Visibility, nitrogen deposition, and sulfate deposition are the AQRV of concern at Breton NWR. The FLM used a Q/D screening procedure to determine if refined air quality impact modeling was required to quantify estimated impacts [Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report – Revised October 2010]. The value of Q is the sum of the annual emissions (in tons per year based on 24-hour maximum allowable emissions) of all the visibility affecting pollutants emitted from the project (*i.e.,* NO_x, PM_{10}, $PM_{2.5}$, SO_2, and sulfuric acid). The D value is the distance, in km, of the project from the PSD Class I area. The FLM considers values of Q/D less than or equal to 10 to be not significant, *i.e.* project's emissions would have no significant impact to the Class I area.

Although the project activities will be permit limited to 92 days, the Q value in this screening analysis should be based on the maximum 24 hour emissions associated with the permitted activities (*i.e.,* drill ship and support boat operations) annualized over the full 365 annual days. This maximum 24-hour potential to emit was based on a daily

maximum diesel fuel use of 425 barrels per day. The normal or average daily diesel fuel use is 220 barrels.

The sum of the project's pollutant emissions for the 92 day permit period, including the drill ship and support boat operations, is 682.62 tons. When the 92 day emissions are annualized for full year operation, the total Q emissions are 2,708.21 tons/year. Dividing the total annualized emissions by the distance to the closest PSD Class I area (*i.e.,* Breton NWR) yields the largest Q/D value of 9.74 – a value less than the FLM's FLAG guidance value of 10. Therefore, the project's impact to AQRV will be insignificant. Anadarko's OCS permit application contains the Q/D screening analysis for the proposed project's operation.

The applicant's Q/D analysis was provided to the FWS for their evaluation. Based on the project's emissions and the distance of the project from Breton NWR, the FWS assessment was that refined impact modeling would not show any significant project related impacts to the AQRV at the Breton NWR PSD Class I area. Therefore, they did not request a refined quantitative PSD Class I AQRV analysis be included in the OCS permit application.

7.2.3. PSD Class I Area Increment

Similar to the FWS evaluation, very small NO_2 impacts are anticipated at the Breton NWR because of the large travel distance. The applicant performed a screening impact assessment, rather than a refined resource intensive long-range air quality modeling analysis, to provide confirming demonstration that the proposed project's impact to the PSD Class I increment would not be significant.

The screening PSD Class I increment assessment used EPA's near-field screening model SCREEN3 to provide conservative estimates of ambient concentration from 50 to 100 km from the project location [Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised; EPA-454/R-92-019, Office of Air and Radiation, October 1992]. The resultant SCREEN3 ambient concentrations were used to estimate the project's NO_2 impacts at Breton NWR. Because there is only an annual NO_2 PSD Class I increment, the annual average hourly emission rates based on the permit limiting 92 day operational for the drill ship and support boats were used with the worst-case emission release characteristics. Section 7 of Anadarko's May 2010 permit application addendum contains the PSD Class I increment SCREEN3 modeling analysis.

Table 8 and Table 9 provide the SCREEN3 modeling results for distances up to 100 km, and the EXCEL GROWTH exponential estimated concentrations for distances beyond 100 km. This combined SCREEN3 modeling and EXCEL GROWTH extrapolation of project impacts estimate concentrations less than the PSD significant impact level (SIL) for distances greater than 175 km. This screening impact assessment estimated a concentration at 278 km, the distance of the nearest PSD Class I area, of almost two orders of magnitude less than the PSD Class I SIL. Therefore, the project NO_2

emissions should not significantly impact the available PSD increment of any PSD Class I area.

Table 8. Project Screening Impact Estimates

Distance (Km)	SCREEN3 NO_x µg/m^3 result for One Rig Engine	SCREEN3 NO_x µg/m^3 result for One Boat	Total SCREEN3 NO_x µg/m^3 for 3 Rig Engines and 3 Boats	EXCEL Extrapolated Total NO_x µg/m^3	Adjusted Annual NO_2 µg/m^3
10	23.21	34.03	171.72	N/A	10.303
20	12.7	14.88	82.74	N/A	4.964
30	8.552	9.283	53.505	N/A	3.21
40	6.431	6.726	39.471	N/A	2.368
50	5.136	5.239	31.125	N/A	1.868
60	2.239	2.165	13.212	N/A	0.793
70	1.916	1.836	11.256	N/A	0.675
80	1.674	1.592	9.798	N/A	0.588
90	1.485	1.404	8.667	N/A	0.52
100	1.335	1.255	7.77	N/A	0.466
150	N/A	N/A	N/A	0.948	0.171
175	N/A	N/A	N/A	0.401	0.072
200	N/A	N/A	N/A	0.17	0.031
225	N/A	N/A	N/A	0.072	0.013
250	N/A	N/A	N/A	0.03	0.005
257	N/A	N/A	N/A	0.024	0.004
278	N/A	N/A	N/A	0.012	0.002

Estimated SCREEN3 Total NOx based exponential relationship using Excel GROWTH formula

Estimated NO_x µg/m^3 = ROUND(GROWTH(B22:B31,A22:A31,A32),3)

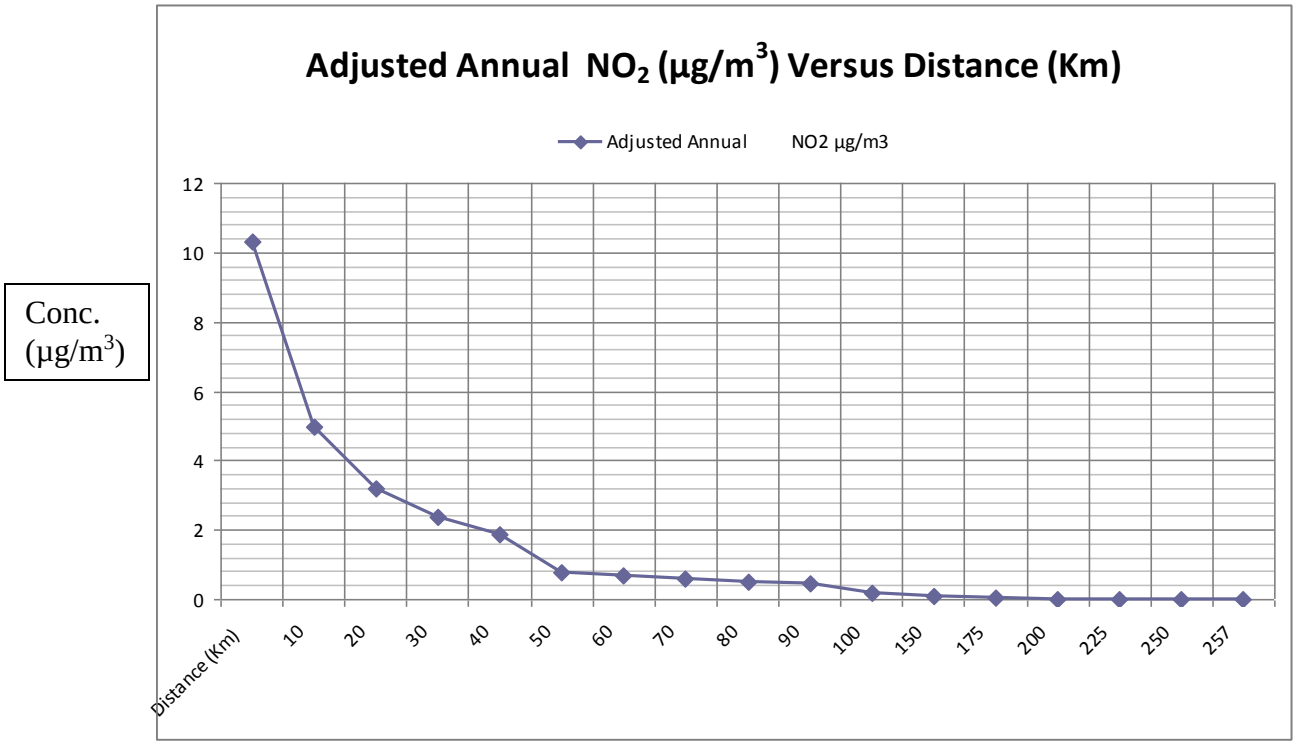
Adjusted NO_2 ug/m^3 concentration = Total µg/m^3 value)(0.08)(0.75 NO_2/1.0 NOx)

Y (predicted NOx) = b*m^X Where X = distance to location

m = 0.968188588 m = INDEX(LOGEST(*known_y's*,*known_x's*),1,1)

b = 23.96561146 b = INDEX(LOGEST(*known_y's*,*known_x's*),1,2)

Table 9. Adjusted Annual NO_2 Versus Distance



7.2.4. Summary

Anadarko's permit limited exploratory drilling operation of less than 2 years in the Lloyd Ridge 410 lease block qualifies as a temporary emissions source. The provided PSD Class I area screening analyses addressing AQRV and PSD increment impacts were evaluated by EPA and reveal no expected significant impacts at the nearest PSD Class I area of Breton NWR.

8. 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. 16 U.S.C. §1536(a)(2); see also 50 CFR 402.13, 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. 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. 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. BOEMRE is the lead federal agency for authorizing oil and gas exploration activities on the OCS. Therefore, BOEMRE has served as the Lead Agency for ESA Section 7 and MSA compliance for Anadarko's exploration activities. In accordance with Section 7 of the ESA, BOEMRE 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.

Since the BOEMRE consultations address the same exploratory drilling activities authorized by the air permit that EPA is issuing to Anadarko, EPA relied in part on those conclusions for our final determination. Based upon the best available data and informal consultation with the Services, EPA determined that the issuance of this CAA 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 CAA permit includes a condition requiring Anadarko to comply with all other applicable federal regulations. EPA received concurrence from the FWS and NOAA that our Section 7 ESA consultation requirements were met on August 12, 2010 and January 24, 2011, respectively. These letters are included in the administrative record.

8.2 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) 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 BOEMRE is the lead agency permitting Anadarko's Well #1 in Lease Area OCS G-31846. Lease OCS G-31846 in Lloyd Ridge (LL) Area Block 410 was included in BOEMRE Lease Sale 205. The environmental effects of Sale 205 were analyzed in a multi-sale Environmental Impact Statement, covering sales in 2007 through 2012 accessible on the web at http://www.gomr.boemre.gov/PDFs/2007/2007-018-Vol1.pdf.

BOEMRE typically conducts Section 106 consultation at the pre-lease stage by prior agreement with the Advisory Counsel for Historic Preservation (ACHP) 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. At the time this lease was sold, LL410 was not considered to have a high probability for containing archaeological remains such as a shipwreck. Potential impacts are further addressed by the fact that the plan approved by BOEMRE (Plan N-9141) specified that the well would be drilled from a dynamically positioned semi-submersible rig without anchors. The Area of Potential Effect, then, would be limited to the well bore itself, which typically is visually inspected by a

Remotely Operated underwater Vehicle prior to spudding. Any cultural resources discovered during that inspection are required by regulation to be reported to BOEMRE 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, BOEMRE would enter into consultation with State Historic Preservation Office and ACHP.

8.3 Executive Order 12898 – Environmental Justice

Executive Order (EO) 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* EO 12898, 59 Fed. Reg. 7629 (February 11, 1994) Consistent with EO 12898 and EPA's environmental justice policy (OEJ 7/24/09), in making decisions regarding permits, such as OCS and PSD permits, EPA gives appropriate consideration to environmental justice issues on a case-by-case basis, focusing on whether its action would have disproportionately high and adverse human health or environmental effects on minority or low-income populations.

EPA has concluded that this proposed OCS air permitting action for Anadarko's exploratory drilling operation on the GOM would not have a disproportionately high and adverse human health or environmental effects on minority or low-income populations. The drill site is located approximately 160 mile southeast of the mouth of the Mississippi River and 200 miles southwest of Panama City, Florida in the central GOM. Since the project is located more than 150 miles out in the GOM in ultra deep water, 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 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. Finally, given the projects temporary nature, it will have a minimal air impact on all populations. *See* Section 7 of this document pertaining to air quality impact.

9. Public Participation:

9.1 Opportunity for Public Comment

These proceedings are subject to the EPA Procedures for Decisionmaking, set forth at 40 CFR Part 124. As provided in Part 124, EPA is seeking public comment on the Anadarko OCS air permit OCS-EPA-R4005 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 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 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. The objective of the OCS air quality program, including the PSD program to which this source is subject, is to prevent significant adverse environmental impact from air emissions by a new or modified OCS source. If you have more general concerns regarding non-air quality impacts, such as offshore leasing, drilling safety, discharge, etc., these should be addressed during the leasing and permitting proceedings of the Bureau of Ocean Energy Management Regulation, and Enforcement, which is the lead permitting agency for this project.

All timely comments will be considered in making the final decision, included in the record, and responded to by EPA. EPA may group similar comments together in our response, and will not respond to individual commenters directly.

All comments on the proposed permit, and requests for a Public Hearing (see below), must be received by email or postmarked by April 25, 2011. An extension of the 30-day comment period may be granted if the request for an extension adequately demonstrates why additional time is required to prepare comments. Comments must be sent or delivered in writing to the address below. All comments will be included in the public docket without change and may be made available to the public, including any personal information provided, unless the comment includes Confidential Business Information (CBI) or other information in which disclosure is restricted by statute. Information that you consider CBI or otherwise protected should be clearly identified as such and should not be submitted through e-mail. If you send e-mail directly to EPA, your e-mail address will be captured automatically and included as part of the public comment. Please note that an e-mail or postal address must be provided with your comments if you wish to receive direct notification of EPA's final decision regarding the permit and EPA's response to comments submitted during the public comment period. For questions on the proposed permit, please contact: Mr. Sean Lakeman at 404-562-9043 or Lakeman.sean@epa.gov.

Submit comments on the proposed permit and requests for a public hearing to:

Sean Lakeman
EPA Region 4, APTMD
61 Forsyth Street, SW
Atlanta, GA 30303
Fax: (404) 562-9019
Email: R4OCSpermits@epa.gov

9.2 Public Hearing

EPA has discretion to hold a Public Hearing if we determine there is a significant amount of public interest in the proposed permit. Requests for a Public Hearing must be received by

EPA by e-mail or mail by April 25, 2011, at the address given above, and state the nature of the issues proposed to be raised in the hearing. You may submit oral or written comments on the proposed permit at the public hearing. You do not need to attend the public hearing to submit written comments. If there is significant public interest, EPA will hold a public hearing on the draft OCS permit on May 4, 2011, at the location given in the public notice. If a public hearing is held, the public comment period shall automatically be extended to the close of the public hearing. If no request for a public hearing is received by April 25, 2011, or EPA determines that there is not significant interest, *the hearing will be cancelled.* An announcement of cancellation will be posted on EPA's website at: http://www.epa.gov/region4/air/permits/OCSPermits/OCSpermits.html, or you may call EPA at the contact number above to determine if the public hearing will be held.

9.3 Administrative Record

The administrative record contains the application, supplemental information submitted by Anadarko, and correspondence, including e-mails, between Anadarko and its consultants and EPA clarifying various aspects of Anadarko's application. The draft permit and the administrative record are available for public review at the EPA Region 4 office and the Bay County Public Library at the addresses listed below. Please call in advance for available viewing times.

Bay County Public Library
Northwest Regional Library System
898 W 11th Street
Panama City, FL 32412-0625
(850) 522-2119

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

The administrative record and draft permit are also available on EPA's website at: http://www.epa.gov/region4/air/permits/OCSPermits/OCSpermits.html.

To request a copy of the draft permit, preliminary determination, or notice of the final permit action, please contact: Ms. S. Elaine Knight, Permit Support Specialist at: 404-562-9643, or R4OCSpermits@epa.gov.

9.4 Final Determination

A final decision to issue a final permit, or to deny the application for the permit, shall be made after all comments have been considered. 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 EPA has adequate contact information.