UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
SEATTLE, WASHINGTON

SUPPLEMENTAL STATEMENT OF BASIS FOR PROPOSED OUTER CONTINENTAL SHELF PREVENTION OF SIGNIFICANT DETERIORATION PERMITS NOBLE DISCOVERER DRILLSHIP

SHELL OFFSHORE INC.
BEAUFORT SEA EXPLORATION DRILLING PROGRAM
PERMIT NO. R10OCS/PSD-AK-2010-01

SHELL GULF OF MEXICO INC.
CHUKCHI SEA EXPLORATION DRILLING PROGRAM
PERMIT NO. R10OCS/PSD-AK-09-01

Date of Proposed Permit: July 6, 2011

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ABBREVIATIONS AND ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
BACT	Best Available Control Technology
BO.	Biological Opinion
BOEMRE	United Stated Bureau of Ocean and Energy management and Regulatory Enforcement
CAA	Clean Air Act
CFR	Code of Federal Regulations
COA	Corresponding Onshore Area
Discoverer	Noble Discoverer Drillship
DOI	United States Department of Interior
DP	Dynamic Positioning
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
Fed. Reg	Federal Register
HPU	Hydraulic Power Unit
ICAS	Inupiat Community of the Arctic Slope
MLC	Mud Line Cellar
MMS	Minerals Management Service
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NA	Not applicable
NAAQS	National Ambient Air Quality Standards
NMFS	National Oceanic and Atmospheric Administration National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSPS	New Source Performance Standards
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSR	Oil Spill Response
OxyCat	Oxidation Catalyst
Part 55	40 CFR Part 55
PDF	Portable Document Format
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
SCR	Selective Catalytic Reduction
SGOMI	Shell Gulf of Mexico, Inc.
SOI	Shell Offshore, Inc.
SIA	Significant Impact Area
The Services	Collectively the National Oceanic and Atmospheric Administration Fisheries and/or the U.S. Fish and Wildlife Service

ULSD.....Ultra-Low Sulfur Diesel

UNITS AND MEASUREMENTS

°F.....degree Fahrenheit
g .....grams
hp .....brake horsepower
hr.....hour
tpy .....tons per year

POLLUTANTS

CH_4 .....Methane
CO.....Carbon Monoxide
CO_2 .....Carbon Dioxide
CO_2e .....Carbon Dioxide Equivalent
GHG or GHGs.....Greenhouse Gases
HFC.....Hydrofluorocarbons
NH_3 .....Ammonia
NO_X.....Oxides of Nitrogen
N_2O .....Nitrous Oxide
PFC.....Perfluorocarbons
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
SO_2 .....Sulfur Dioxide
SF_6.....Sulfur hexafluoride
VOC .....Volatile Organic Compound

1 BACKGROUND/HISTORY

1.1 Introduction

On March 31, 2010, pursuant to Clean Air Act (CAA) section 328, 42, U.S.C. § 7627, the Environmental Protection Agency (EPA) Region 10 (Region 10) issued an Outer Continental Shelf (OCS) Prevention of Significant Deterioration (PSD) Permit to Construct, Permit Number R10OCS/PSD-AK-09-01 (2010 Chukchi Permit), to Shell Gulf of Mexico, Inc. (SGOMI) for operations in the Chukchi Sea. On April 9, 2010, Region 10 issued another OCS PSD Permit to Construct, Permit Number R10OCS/PSD-AK-2010-01 (2010 Beaufort Permit), to Shell Offshore, Inc. (SOI) to authorize operations in the Beaufort Sea.

The 2010 Chukchi and Beaufort Permits (2010 Permits) authorized SGOMI and SOI (collectively, "Shell") to construct and operate the Frontier Discoverer drillship (Discoverer),[1] and its air emission units to conduct air pollutant emitting activities for the purpose of oil exploration on lease blocks in the Chukchi and Beaufort Seas off the North Slope of Alaska as authorized by the United States Bureau of Ocean and Energy Management and Regulatory Enforcement (BOEMRE).[2] Both 2010 Permits provided for the use of an associated fleet of support ships (Associated Fleet), such as icebreakers, oil spill response (OSR) vessels, and a supply ship, in addition to the Discoverer.

OCS/PSD permits are governed by 40 Code of Federal Regulations (CFR) Part 55 (Part 55) and the procedural rules set forth in 40 CFR Part 124. See 40 CFR § 55.6(a)(3). As discussed in more detail below, following petitions for review to the Environmental Appeals Board (EAB or Board), the Board remanded the 2010 Permits back to Region 10 for further consideration of specific issues. This Supplemental Statement of Basis supplements the Statement of Basis for the 2010 Permits.[3] Together, they provide the basis[4] for the terms and conditions of the revised

[1] The Frontier Discoverer has since been renamed "The Noble Discoverer" and will be referred to in this document simply as "the Discoverer."

[2] The Secretary of the U.S. Department of the Interior (DOI) regulates and manages the development of mineral resources on the OCS. *See* 43 U.S.C. § 1334 (authorizing Secretary to administer leasing on the OCS). In particular, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) is responsible for overseeing the safe and environmentally responsible development of energy and mineral resources on the OCS. BOEMRE was established as a result of Secretarial Order 3302, signed on June 18, 2010, by the Secretary of the Interior. Secretary of the Interior, U.S. Department of the Interior, Secretarial Order No. 3302, *Change of the Name of the MMS to the Bureau of Ocean Energy management, Regulation and Enforcement* (June 18, 2010), *available at* http://elips.doi.gov/app_so/index.cfm?fuseaction=chroList/.

[3] See 40 CFR § 124.7. It also serves as a Fact Sheet as provided in 40 CFR § 124.8.

[4] As discussed in Section 2.1 below, EPA is reconsidering the position set forth in Section 2.3 of the Statements of Basis for the 2010 Permits with respect to the point of compliance with NAAQS and increment for sources located on the OCS. In proposing the 2011 Revised Draft Permits, Region 10 is therefore not relying on the position articulated in Section 2.3 of the Statements of Basis for the 2010 Permits, or in any response to comments relating to such discussion, notwithstanding any reference in this Supplemental Statement of Basis to the Statements of Basis for the 2010 Permit as providing support for proposed issuance of the 2011 Revised Draft Permits.

draft OCS/PSD permits authorizing air emissions from Shell's exploratory operations in the Chukchi Sea and the Beaufort Sea, respectively (2011 Revised Draft Permits).[5] This Supplemental Statement of Basis addresses the issues raised by the Board in its orders remanding the 2010 Permits to Region 10, as well as changes requested by Shell since issuance of the 2010 Permits, but generally does not reiterate or address other aspects of the 2010 Permits that are unchanged in the 2011 Revised Draft Permits. Because of the similarity of the changes made to the 2010 Permits for the Chukchi and Beaufort Seas in the 2011 Revised Draft Permits, Region 10 is issuing a single Supplemental Statement of Basis for both permits, noting any relevant differences between the revised draft permits as appropriate.

1.2 Past Permitting Actions and EAB Remand

As discussed above, in response to permit applications submitted by Shell for operations of the Discoverer drillship and the Associated Fleet in the Chukchi Sea and in the Beaufort Sea, Region 10 issued two permits: the 2010 Chukchi Permit on March 31, 2010 authorizing operation on the Chukchi Sea and the 2010 Beaufort Permit on April 9, 2010 authorizing operation on the Beaufort Sea.

Three groups filed petitions requesting that the Board grant review of both the 2010 Chukchi Permit and the 2010 Beaufort Permit. The Board consolidated review of the petitions and, after briefing and oral argument, issued a series of three orders: Order Denying Review in Part and Remanding Permits, dated December 30, 2010 (Remand Order I), Order on Motions for Reconsideration and/Or Clarification dated February 10, 2011 (Clarification Order), and Order on Four Additional Issues dated March 14, 2011 (Remand Order II).[6] The orders will be collectively referred to as the "EAB Orders."

In the EAB Orders, the Board denied review of the petitions, and thus did not issue a remand of the permits, regarding the following issues:

1. The determination that Best Available Control Technology (BACT) does not apply to vessels in the Associated Fleet that are not OCS sources (Remand Order I at 20-38);
2. The determination that Icebreaker #2 is not "physically attached" to the Discoverer when it is setting and retrieving anchors and that Icebreaker #2 is thus not itself part of the OCS source during this process (Remand Order II at 8-14);
3. Consideration of total particulate matter (PM), PM 10 microns or less in diameter (PM_{10}), and PM 2.5 microns or less in diameter ($PM_{2.5}$) emissions as $PM_{2.5}$ emissions in Region 10's BACT analysis (Remand Order II at 20-26);

[5] Permit Nos. R10OCS/PSD-AK-2009-01Rev.1 and R10OCS/PSD-AK-2010-01Rev.1.

[6] The petitions, briefs, and motions filed by the parties, as well as the orders of the Board relating to the 2010 Permits (Shell Gulf of Mexico, Inc and Shell Offshore, Inc., Frontier Discoverer Drilling Units, OCS Appeal Nos. 10-01 through 10-04) are available on the EAB Website at http://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/77355bee1a56a5aa8525711400542d23/de2e53f0c6b155f085257719005ba945!OpenDocument. For ease of reference in this document, filings in the EAB proceedings will be referred to by the title and date of the document and will not repeat the case name and number.

4. The determination to exclude from the air quality analysis emissions from the OSR vessels responding to a spill or other emergency, emissions from vessels that are not operating within 25 miles of the Discover, and emissions from the propulsion engine given the prohibition on operation of the propulsion engine while the Discoverer is an OCS source (Remand Order II at 26-40).

The Board issued a general remand of the 2010 Permits to Region 10 as to all other issues raised in the petitions, with specific direction and findings on the following issues:

1. The Board concluded that Region 10's determination that the Discoverer becomes an OCS source "between the time the Discoverer is declared by an on-site company representative to be secure and stable in a position to commence exploratory activity at the drill site until, due to retrieval of anchors or disconnection of its anchors, the vessel is no longer sufficiently stable to conduct exploratory activity" was not adequately supported by the record (Remand Order I at 39-55). The Board also concluded that Region 10's OCS source determination improperly delegated to Shell the determination of when the Discoverer becomes an OCS source (Remand Order I at 55-63).
2. The Board concluded that Region 10 had erred in conducting the environmental justice analysis to the extent it did not consider the 1-hour concentrations of nitrogen dioxide (NO_2) in light of the fact that EPA had concluded that assessing 1-hour NO_2 concentrations was necessary to ensure protection of public health and welfare and in fact had promulgated National Ambient Air Quality Standards (NAAQS) to measure 1-hour NO_2 concentrations, although the new standards had not yet become effective at the time of permit issuance. The Board therefore directed Region 10 to reconsider this issue on remand (Remand Order I at 63-81).
3. The Board concluded that the record did not support Region 10's decision not to require modeling of the formation of secondary $PM_{2.5}$ as part of the source impact analysis because the Board determined there was inadequate support in the record for Region 10's determination that the Discoverer will not emit significant quantities of $PM_{2.5}$ precursors (Remand Order at 14-19).
4. With respect to two issues raised in the petitions that relate to the applicability of standards that were not in effect at the time of issuance of the 2010 Permits—the 1-hour NO_2 NAAQS[7] and PSD requirements for greenhouse gases (GHGs)—the Board did not address the merits of these two issues. However, due to its decision to remand the permits on the basis of other issues, the EAB directed Region 10 to "apply all applicable standards in effect at the time of issuance of the new permits on remand" (Remand Order I at 82). In a subsequent order, the EAB clarified that the Agency had the discretion to determine whether a specific standard is "applicable" on remand. Clarification Order at 19-24.

[7] The 1-hour NO_2 NAAQS was raised in connection with two distinct issues: whether the permit was required to demonstrate that the project emissions would not cause or contribute to a violation of the recently promulgated, but not yet effective 1-hour NO_2 standard for purposes of meeting the requirements of PSD under 40 C.F.R § 52.21 and whether Region 10 had properly considered 1-hour concentrations of NO_2 in its environmental justice analysis.

5. The Board acknowledged that Region 10 had not asked the Board to decide the issue of the sufficiency of the preconstruction monitoring data and stated that the sufficiency of the preconstruction monitoring data is included within the scope of its general remand of the 2010 Permits (Clarification Order at 11-12).

With respect to the scope of review following issuance of revised permits in response to the EAB Orders, the Board stated that anyone dissatisfied with the revised permits must file a petition seeking the Board's review pursuant to 40 CFR § 124.19(f)(1(iii). The Board limited the scope of petitions on the revised permits to be issued on remand "to issues addressed by the Region on remand and to issues otherwise raised in the petitions before the Board in this proceeding but not addressed by the Region on remand." The Board specifically stated that "No new issues may be raised that could have been raised but were not raised in the present appeals [of the 2010 Permits]" (Remand Order I at 82).

1.3 Supplemental Application Materials

Shell has submitted the following supplemental application materials and requests for changes to the 2010 Permits since issuance of the EAB Orders: [8]

June 10, 2011	Supplemental Permit Application Materials
June 22, 2011	Shell Alaska Exploratory Drilling Program Air Quality Permit Application Air Quality Modeling Files for Analysis of Anchor Handler Operations During open Water Conditions
June 23, 2011	Greenhouse Gas Calculation Information

1.4 Key Changes in 2011 Revised Draft Permits

In addition to changes made in response to the EAB Orders, Region 10 is also proposing changes in response to additional information and requests from Shell. The key changes to the 2011 Revised Draft Permits, both in response to the EAB Orders and in response to additional requests and information from Shell, are as follows:

- A determination that the Discoverer is an OCS source when attached by at least one anchor at a drill site.

[8] The Administrative Record also contains numerous emails and correspondence between Shell and its consultants and EPA clarifying aspects of these materials.

- A condition based on Shell's permit application for a Coast Guard Safety zone prohibiting public access to areas within 500 meters of the Discoverer and a public access control program.
- A reduction in the total days of operation under each permit from 168 days during any rolling 12-month period to 120 days during the drilling season, with a maximum of 20 days (in hours) of that time drilling mud line cellars (MLCs) and 48 days of that time (in hours) drilling wells.
- A reduction of the drill season from July 1 through December 31 to July 1 through November 30.
- An increase from 10 days to six months in the time required for prior notification before locating at a new drill site.
- A limit on emissions of GHGs to ensure such emissions from the Discoverer and the Associated Fleet remain below the major source thresholds for GHGs and that the Discoverer does not trigger PSD permitting requirements for that pollutant.
- Substantial reductions in emissions from the main propulsion engines and generators on Icebreaker #1 through the installation of selective catalytic reduction (SCR) and oxidation catalyst (OxyCat).
- An increase of annual NO_X emissions from Icebreaker # 2 to reflect emission rates assumed in Shell's supplemental modeling analysis. The amount of this increase is substantially less than the decrease in NO_X emissions resulting from the installation of controls on Icebreaker #1.
- 1-hour NO_X limits to ensure that emissions from the Discoverer and the Associated Fleet do not cause or contribute to a violation of the new 1-hour NO_2 standard.
- Additional monitoring requirements for the SCR and OxyCat pollution control systems.
- Revisions to the 24-hour $PM_{10,}$ and $PM_{2.5}$ emissions limits to reflect Shell's supplemental air quality modeling to assure NAAQS and increment protection.
- The option of resupplying the Discoverer with the Supply Ship operating in the dynamic positioning (DP) mode in addition to resupplying by attaching the Supply Ship to the Discoverer (as was already authorized under the 2010 Permits). This results in an increase in emissions from the Supply Ship when operating in this mode as compared to the 2010 Permits.
- Replacement of the emergency generator on the Discoverer with a larger generator, but subject to additional restrictions on hours of operation and emissions as compared to the 2010 Permits.
- Identification of and fuel limits on seldom used engines on the Discoverer, Icebreaker #1 and #2, the Nanuq, and, for the Beaufort permit, the Point Class Tug (previously referred to as the Point Barrow Tug).

- Removal of several restrictions on the relative positions of vessels of the Associated Fleet with respect to the Discoverer based on Shell's supplemental air quality modeling showing such restrictions are not needed to assure compliance with the NAAQS.
- Removal of a condition limiting visible emissions from the Associated Fleet based on Region 10's determination that such requirement does not apply to vessels that are not an OCS source.
- A requirement to include in the operating report information required to be recorded under the permit, such as all emission calculations.

The 2011 Revised Draft Permits are supported by supplemental technical support and analyses that includes:

- A revised air quality analysis and supporting modeling, focusing in particular on the new 1-hour NO_2 and SO_2 NAAQS.
- A demonstration that the 2011 Revised Draft Permits meet all NAAQS, increments, and other applicable standards in effect at the time of proposal of the 2011 Revised Draft Permits.
- Supplemental information on and an analysis of secondary $PM_{2.5}$ formation.
- An analysis of air monitoring data collected since issuance of the 2010 Permits.
- A Supplemental Environmental Justice Analysis addressing the Board's concerns and demonstrating that the 2011 Revised Draft Permits will not have a disproportionately high and adverse human health or environmental effects on minorities or low income populations.

Overall, emissions of all regulated PSD air pollutants allowed under the 2011 Revised Draft Permits will decrease substantially in comparison to the 2010 Permits, largely as a result of the additional controls on Icebreaker #1 and the shortened operating season. Overall, annual emissions of key pollutants will decrease by more than 50%, with a small increase in ammonia as a result of the installation of SCR on Icebreaker #1.

1.5 Public Participation

1.5.1 Opportunity for Public Comment

The OCS regulations state that issuance of both OCS and PSD permits are governed by 40 CFR Part 124, Subparts A and C. See 40 CFR § 55.6(a) (3) and 124.1. Accordingly, Region 10 has followed the procedures of 40 CFR Part 124 in issuing the 2011 Revised Draft Permits.

Region 10 is seeking public comment on the provisions of the 2011 Revised Draft Permits that have been changed since issuance of the 2010 Permits and the information and analysis added to the record to support those changes. The public comment period runs until August 5, 2011 and all written comments must be emailed or postmarked by that date.

As discussed in Section 5, the revised conditions in the 2011 revised draft permits are based in part on the non-guideline Coupled Ocean-Atmosphere Response Experiment meteorological algorithm and the Plume Volume Molar Ratio Method nitrogen dioxide algorithm to predict air pollutant concentrations. These algorithms have not been approved by EPA for general use, but have been approved under the case-by-case alternative modeling provisions of EPA guidelines. Region 10 specifically requests public comment on the suitability of these modeling algorithms to predict air pollutant concentrations in connection with issuance of the 2011 Revised Draft Permits.

In accordance with the EAB Orders, any appeals of the 2011 Revised Draft Permits to the Board are limited to issues addressed by the Region in the 2011 Revised Draft Permits and to issues otherwise raised in the petitions on the 2010 Permits before the Board in this proceeding but not addressed by the Region in the 2011 Revised Draft Permits. No new issues may be raised that could have been raised but were not raised in appeals of the 2010 Permits. Remand Order I at 82.

Accordingly, only the conditions of the 2011 Revised Draft Permits that are proposed for revision in this proceeding and the information and analysis supporting those changes are open for public comment. If you believe any such condition of the 2011 Revised Draft Permits is inappropriate, you must comment on the permit and raise all reasonably ascertainable issues and submit all reasonably ascertainable 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. See 40 CFR § 124.13.

Written comments may be submitted by mail or email. Oral comments may be submitted during the public hearing in Barrow. Oral comments may also be recorded on cassette tape or CD, and submitted by mail. Region 10 recommends that all comments, including those submitted by email, cassette tape, or CD, include the commenter's contact information so that we may provide all commenters with notice of the final permit decision. If Region 10 cannot read a comment due to technical difficulties and cannot contact the commenter for clarification, Region 10 may not be able to consider the comment. Please be aware that any personal information, including addresses or phone numbers that are included with a public comment will be included in the public record for the permits.

Please identify in your comments whether the comments relate to the Chukchi permit, the Beaufort permit or both.

Send comments on the 2011 Revised Draft Permits to:

Email: R10ocsairpermits@epa.gov

Mail: Shell Discoverer Air Permits
EPA Region 10
1200 6th Ave, Ste. 900, AWT-107
Seattle, WA 98101

Fax: 206-553-0110

All timely comments will be considered in making the final decision, included in the record, and responded to by Region 10. Region 10 will prepare a statement of reasons for changes made in the final permit and a response to comments received, and will provide all commenters with notice of the final permit decision.

1.5.2 Public Hearing and Informational Meetings

Region 10 is holding an informational meeting and public hearing on the Revised Draft Permits as follows:

August 4, 2011

5:00pm-6:30pm Informational Meeting
7:00pm-9:00pm Public Hearing
Inupiat Heritage Center
Barrow, Alaska
Teleconference facilities are available at North Slope Borough Conference Centers

The purpose of the public hearing is to receive public comments on the Revised Draft Permits. For more information about the meeting or hearing, contact Suzanne Skadowski, Region 10 Community Involvement, at 206-553-6689 or skadowski.suzanne@epa.gov.

1.5.3 Administrative Record

The record for the 2011 Revised Draft Permits includes all documents in the record for the 2010 Permits; the 2011 Revised Draft Permits and this Supplemental Statement of Basis; the Supplemental Environmental Justice Analysis; the Technical Support Document Review of Shell's Supplemental Ambient Air Quality Impact Analysis (Region 10 Technical Analysis); the additional application materials and information submitted by Shell; and other materials relied on by Region 10 in issuance of the 2011 Revised Draft Permits.

The permit record for the 2011 Revised Draft Permits is available at EPA Region 10, 1200 6th Ave, Seattle, Washington, 9:00 am–5:00 pm, Monday-Friday. To request a copy of or to review these materials, contact Suzanne Skadowski as described above.

The 2011 Revised Draft Permits, the Supplemental Statements of Basis, and the supplemental permit application materials are available online at:

Online: http://yosemite.epa.gov/R10/AIRPAGE.NSF/Permits/ocsap/

These documents will also be available at the locations listed below. Please call in advance for available viewing times.

EPA Alaska Office, Federal Building, 222 West 7th Ave, Anchorage, Alaska (907-271-5083)

Barrow City Office, 2022 Ahkovak Street, Barrow, Alaska (907-852-4050)

Nuiqsut City Office, 2230 2nd Avenue, Nuiqsut, Alaska (907-480-6727)

Kaktovik City Office, 2051 Barter Avenue, Kaktovik, Alaska (907-640-6313)

Wainwright City Office, 1217 Airport Road, Wainwright, Alaska (907-763-2815)

Kali School Library, 1029 Ugrak Ave, Point Lay, Alaska (907-833-2312)

Point Hope City Office, 530 Natchiq Street, Point Hope, Alaska (907-368-2537)

Atqasuk City Office, 5010 Ekosik Street, Atqasuk, Alaska (907-633-6811)

Anaktuvuk Pass City Office, 3031 Main St, Anaktuvuk Pass, Alaska (907-661-3612)

For more information about the informational meeting, the public hearing, or the draft permits, to request a copy of the permit documents on CD, or to be added to Region 10's arctic permits mailing list, contact Suzanne Skadowski at 206-553-6689 or skadowski.suzanne@epa.gov.

2 REGULATORY APPLICABILITY

2.1 Introduction

The OCS regulations at 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. Part 55 establishes requirements to control air pollution from OCS sources in order to attain and maintain federal and state ambient air quality standards and to comply with the provisions of Part C of Title I of the Act. Part 55 applies to all OCS sources offshore of the states except those located in the Gulf of Mexico west of 87.5 degrees longitude.

Section 328 and Part 55 distinguish between OCS sources located within 25 miles of a state's seaward boundaries, referred to in this Supplemental Statement of Basis as "the Inner OCS," and those located beyond 25 miles of a state's seaward boundaries, referred to in this Supplemental Statement of Basis as "the Outer OCS." CAA § 328(a)(1); 40 CFR §§ 55.3(b) and (c). As with

the 2010 Beaufort Permit, the 2011 Beaufort Revised Draft Permit would authorize exploration drilling operations that will be conducted beyond 25 miles of Alaska's seaward boundary (the Outer OCS) and within 25 miles of Alaska's seaward boundary (the Inner OCS). In contrast, as with the 2010 Chukchi Permit, the 2011 Chukchi Revised Draft Permit would authorize exploration drilling operations only in the Outer OCS.

As discussed in more detail in the Statements of Basis supporting the 2010 Permits, sources located beyond 25 miles of a state's seaward boundaries are subject to the New Source Performance Standards (NSPS), in 40 CFR Part 60; the PSD 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 operating permit program under Title V of the CAA and 40 CFR Part 71. See 40 CFR §§ 55.13(a), (c), (d)(2), (e), and (f)(2), respectively.

With respect to the Inner OCS, Section 328 of the CAA provides that such sources are also subject to the NSPS and section 112 standards in the same manner as sources on the Outer OCS. See 40 CFR §§ 55.13(a), (c), and (e). In addition, OCS sources on the Inner OCS are subject to the same requirements as would be applicable if the sources were located in the corresponding onshore area (COA),[9] including the PSD and Title V requirements of the COA. See 40 CFR §§ 55.13(a), (d)(1), and (f)(1) and 55.14. Because the Inner OCS requirements are based on onshore requirements, and onshore requirements may change, Section 328(a)(1) requires that EPA update the OCS requirements as necessary to maintain consistency with onshore requirements (referred to as a "consistency update").

On February 10, 2011, EPA proposed to incorporate updated relevant COA requirements into the OCS Air Regulations pertaining to the State of Alaska. See 76 Fed. Reg. 7518. These requirements were promulgated in response to the submittal of a Notice of Intent on December 10, 2010, by Shell. On June 27, 2011 (76 Fed. Reg. 37274), Region 10 finalized the consistency update. Region 10 incorporated applicable provisions of the following Alaska Administrative Code (AAC) regulations by reference into 40 CFR § 55.14:

- Article 1 – Ambient Air Quality Management;
- Article 2 – Program Administration;
- Article 3 – Major Stationary Source Permits;
- Article 4 – User Fees;
- Article 5 – Minor Permits; and
- Article 9 – General Provisions.

As discussed in more detail below, although there have been changes to the COA regulations

[9] Defined in 40 CFR § 55.2 "Corresponding Onshore Area (COA) means, with respect to any existing or proposed OCS source located within 25 miles of a State's seaward boundary, the onshore area that is geographically closest to the source or another onshore area that the Administrator designates as the COA pursuant to § 55.5 of this part."

since the last consistency update, the changes result only minor changes to permit requirements.

Under section 40 CFR §§ 55.13(d)(2) and the COA regulations for Alaska (see 40 CFR § 55.14), the PSD permitting requirements set forth at 40 CFR § 52.21 are applicable to OCS sources located on the OCS off the coast of Alaska that qualify as major stationary sources required to obtain permits under 40 CFR § 52.21. 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" by establishing maximum allowable increases over baseline concentrations ("increments") and requiring that a permit applicant demonstrate that the proposed project will not cause or contribute to a violation of a NAAQS or increment. In addition, the PSD program includes a requirement for evaluating the effect that the proposed emissions are expected to have on air quality related values such as visibility, soils, and vegetation. The PSD program also requires the use of the BACT as determined on a case-by-case basis taking into account energy, environmental, and economic impacts and other costs.

Note that after further consideration of the terms of the CAA and its legislative history, EPA is reconsidering the interpretation described in Section 2.3 of the Statements of Basis for the 2010 Permits that EPA OCS permitting rules "*require* NAAQS and increment compliance in the ambient air" throughout the OCS (emphasis added). EPA is currently assessing how to apply the NAAQS and increment requirements at 40 CFR § 52.21(k) to OCS sources beyond 25 miles of a state's seaward boundary. And, for sources located within 25 miles of a state seaward boundary, it is considering how to apply those regulatory requirements consistent with the mandate in CAA § 328(a)(1) that requirements to control pollution from OCS sources located within 25 miles of the state seaward boundary "shall be the same as would be applicable if the source were located in the corresponding onshore area." Because these questions about the proper point of compliance with the NAAQS and increments for OCS sources are currently under review, Region 10 is not relying on the rationale in Section 2.3 of the Statements of Basis for the 2010 Permits (including the quoted language), or in any response to comments related to that discussion, as part of the basis for Region 10's decision to propose approval of the 2011 Revised Draft Permits. Resolving point of compliance questions is not necessary in these permitting actions because the record shows that, with the permit conditions that support excluding the area within 500 meters of the center of the Discoverer from ambient air, the Discover will not cause or contribute to a violation of the NAAQS or increment in the ambient air over any point on the OCS or within the state seaward boundary.

Under the PSD regulations, a stationary source is "major" if, among other things, it emits or has the potential to emit (PTE) 100 tons 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 PTE 250 tpy or more of a regulated NSR pollutant. 40 CFR § 52.21(b)(1). PTE 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).

As discussed in the Statements of Basis for the 2010 Permits, Shell's operations constitute a "major source" under the PSD regulations and the 2010 Permits therefore required compliance with the PSD regulations in 40 CFR § 52.21 and, in the Inner OCS, the COA regulations. Similarly, the 2011 Revised Draft Permits must require compliance with 40 CFR § 52.21 and, in the Inner OCS, the COA regulations.

The remainder of Section 2 and this Supplemental Statement of Basis discusses changes to the applicability of CAA regulations and requirements to the Discoverer and the Associated Fleet, changes to permit terms and conditions, and changes to the analyses supporting the 2011 Revised Draft Permits as compared to the 2010 Permits. Please refer to the Statements of Basis for the 2010 Permits for a discussion of regulations and requirements, permit terms and conditions, and analysis that are not changed in the 2011 Revised Draft Permits or this Supplemental Statement of Basis.

2.2 The "OCS Source"

Section 328 of the CAA establishes requirements to control air pollution from "OCS sources." Defining when the Discoverer becomes an "OCS source" therefore determines when CAA § 328 applies to and regulates air pollution from the Discoverer. As the Board emphasized in Remand Order I, this question is of primary importance because the later in time the Discoverer becomes an OCS source and the sooner it ceases to be an OCS source, the longer the period in which air pollution from the Discoverer is not required to be addressed by BACT controls and the more limited the inclusion of potential emissions from both the Discoverer and the Associated Fleet in the air quality analysis. Remand Order I at 39. Based on an evaluation of the new anchoring process Shell intends to use in light of the statutory and regulatory definition of OCS source, and the legislative history and policy behind CAA § 328 and the Outer Continental Shelf Lands Act (OCSLA), Region 10 proposes that the Discoverer be considered an OCS source at all times that the Discoverer is attached to the seabed at a drill site by at least one anchor.

2.2.1 Statutory and Regulatory Framework

Section 328 provides that

> The terms "Outer Continental Shelf source" and "OCS source" include any equipment, activity, or facility which—
>
> > **(i)** emits or has the potential to emit any air pollutant,
> > **(ii)** is regulated or authorized under the Outer Continental Shelf Lands Act [43 U.S.C. 1331 et seq.], and
> > **(iii)** is located on the Outer Continental Shelf or in or on waters above the Outer Continental Shelf.

> Such activities include, but are not limited to, platform and drillship exploration, construction, development, production, processing, and transportation. For purposes of this subsection, emissions from any vessel servicing or associated with an OCS source, including emission while at the OCS source or en route to or from the OCS source within 25 miles of the OCS source, shall be considered direct emissions from the OCS source.

42 U.S.C. § 7627(a)(4)(C).

Section 55.2 of the OCS regulations defines an OCS source by first incorporating the above language from sections (i), (ii), and (iii) of CAA § 328(a)(4)(C), and then adding:

> 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 therefrom, within the meaning of section 4(a)(1) of OCSLA (43 U.S.C. § 1331 et seq.); or
> >
> > (2) Physically attached to an OCS facility, in which case only the stationary sources aspects of the vessels will be regulated.
>
> 40 CFR § 55.2.

OCSLA § 4(a)(1), which is referenced in the regulatory definition of OCS source in the case of vessels, states:

> The Constitution and laws and civil and political jurisdiction of the United States are extended to the subsoil and seabed of the Outer Continental Shelf and to all artificial islands, and to all installations and other devices permanently or temporarily attached to the seabed, which may be erected thereon for the purposes of exploring for, developing, or producing resources therefrom…

43 U.S.C. § 1333(a)(1)(emphasis added). Notably, EPA's regulatory definition of OCS source as related to vessels uses the same key terms as OCSLA § 4(a)(1) —"attached to the seabed," "erected thereon," and "used for the purpose of…" — but the phrasing is different. OCSLA § 4(a)(1) applies to devices "which may be erected there on and used for the purpose of…" in an explanatory clause. EPA's regulatory definition applies to devices that are "attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom," but goes on to explain that those terms are used "within the meaning of section 4(a)(1) of OCSLA." Moreover, as already noted, CAA § 328 describes the activities of a source as including but not limited to "platform and drillship exploration, construction, development, production, processing, and transportation."

2.2.2 OCS Source Determination in Prior Permit Proceedings for the Discoverer

In August 2009, Region 10 issued a proposed OCS/PSD permit for Shell's exploration activities in the Chukchi Sea, proposing that the Discoverer be considered an OCS source as defined in 40 CFR § 55.2 between placement of the first anchor on the seabed and removal of the last anchor from the seabed at a drill site. August 2009 Draft Chukchi Permit at 5.[10] Region 10 received comments on many aspects of the August 2009 Draft Chukchi Permit, including comments regarding when the Discoverer becomes an OCS source pursuant to the OCS regulations. Region 10 revised the permit in part to respond to these comments and proposed for public comment a new draft permit in January 2010, which replaced the Chukchi August 2009 Draft Permit in all respects. See January 2010 Draft Chukchi Permit at 5; Statement of Basis for January 2010 Draft Chukchi Permit at 3 n. 2.

In the January 2010 Draft Chukchi Permit, Region 10 solicited public comment on two options for determining when the Discoverer is an OCS source. January 2010 Draft Chukchi Permit at 5; January 2010 Chukchi Statement of Basis at 20-21. Option 1 was the same approach proposed in the August 2009 Draft Chukchi Permit, basing the Discoverer's status as an OCS source on whether the vessel is attached to the seabed by at least one anchor. Under Option 2, Region 10 proposed that the Discoverer be considered an OCS source "between the time the Discoverer is declared by an on-site company representative to be secure and stable in a position to commence exploratory activity at the drill site until, due to retrieval of anchors or disconnection of its anchors, the vessel is no longer sufficiently stable to conduct exploratory activity," as documented by certain records. *Id.* Region 10 also provided these two options for public comment in proposing the Beaufort OCS/PSD permit for the Discoverer on February 17, 2010. February 2010 Draft Beaufort Permit at 14.

After considering the public comments received regarding the options for the OCS source determination proposed in the draft permits, Region 10 selected Option 2 for defining when the Discoverer would be considered an OCS source in the final 2010 Permits. Region 10 explained that it was appropriate to apply the interpretation in Option 2 in order to give meaning to the entire regulatory definition of OCS source as it pertains to vessels, and given the facts specific to the Discoverer. Region 10 concluded that the Discoverer could not be considered to be both "erected on the seabed" and "used for the purpose of exploring, developing or producing resources therefrom" until the Discoverer was sufficiently secure and stable so as to be in a position to begin exploratory operations. See Response to Comments for 2010 Chukchi Permit, at 16-18; Response to Comments for 2010 Beaufort Permit, at 12.

[10] This was consistent with a permit issued by Region 10 in June 2008 in response to an application submitted by Shell for the Kulluk drill rig for operation in the Beaufort Sea that was appealed to the EAB on other grounds. Kulluk Drilling Unit, Alaska Outer Continental Shelf Air Quality Control Minor Permit Approval to Construct, No. R10OCS-AK-07-012, (June 18, 2008). Shell withdrew that permit application before the EAB ruled on the petition and EPA therefore terminated the permit before it was finalized. See Public Notice, "EPA Terminates Minor Source Air Permitting Activity for Shell Kulluk," April 24, 2009.

As discussed above, Region 10 received petitions challenging the 2010 Permits on several grounds, including Region 10's determination of when the Discoverer becomes an OCS source. Following briefing of all issues raised in the petitions and oral argument on the OCS source issue and two additional issues, the Board issued Remand Order I on December 30, 2010. The Board remanded the permits to Region 10 because, among other things, the Board determined that the Region had not included in the administrative record a reasoned explanation of its OCS source determination. The Board also concluded that the OCS source determination in the 2010 Permits improperly delegated to Shell the determination of when the Discoverer becomes an OCS source and thus subject to regulation under CAA § 328. Remand Order I at 8. The Board particularly noted that the Region had failed to analyze how its interpretation of 40 CFR § 55.2 is informed by the terms of CAA § 328 or OCSLA § 4(a)(1).

2.2.3 The Discoverer's Anchoring Process at a Drill Site

The Discoverer is a turret-moored drillship that is able to move under its own power. During transit, it is propelled by a 7,200 horsepower (hp) Mitsubishi engine. The drillship uses a Sonat Offshore Drilling turret mooring system that provides the ability for the drill rig floor to remain stationary while the vessel itself may rotate, allowing the vessel bow to be oriented into the wind. Exploration Plan 2009, pp 6-7 and Attachment A; United States Patent No. 4,509,448; Mooring Process for the Nobel Discoverer Drillship, Operations Guideline, dated April 21, 2011 (Mooring Operations Guideline), at 5. The mooring system uses a set of 8 mooring lines, buoys and anchors which are radially located around the drillship.

Based on information submitted by Shell following issuance of the Remand Orders, the Discoverer will now be anchored at a drill site using a significantly different process than the process described by Shell in its application for the 2010 Permits and on which those permits were based. The previous application materials submitted by Shell in 2009 stated that the Discoverer would transit to a drill site powered by the Discoverer's propulsion engine. When the Discoverer reached the approximate location of the drill site, the icebreaker/anchor handler (Icebreaker #2) would be used to attach mooring lines from the Discoverer to the seabed. Once there were enough mooring lines out to control the position of the vessel with the mooring lines, the Discoverer would be put into position and mooring lines adjusted. Once the Discoverer was positioned and the anchor lines were re-tensioned at the drill site, the Discoverer's on-site Shell representative would declare that the Discoverer is "secure and stable in a position to commence activity at the well location," an event that is recorded in log books on the Discoverer. Shell advised Region 10 that the propulsion engine would not be used after the Discoverer was declared "secure and stable in a position to commence activity at the well location." See Letter from Susan Childs, Shell, to Rick Albright, Region 10, re: Shell Gulf of Mexico, Inc., Supplemental Application for the Discoverer/Chukchi OCS/PSD Permits, dated December 13, 2009. When the Discoverer prepared to depart from the drill site, the process would be reversed – anchors would be de-tensioned and then the anchor lines released. *Id.*

In supplemental information submitted by Shell on April 22, 2011 after issuance of the Remand Orders, Shell stated that "[f]ollowing a re-evaluation of the location, the mooring system, and anchor laying procedure for the [] Discoverer, the process of pre-laying the anchors has been

adopted." Mooring Operations Guideline, at 4. The pre-laying process calls for Icebreaker #2 to proceed to the drill site ahead of the Discoverer and to position each of the 8 anchors, conduct a holding test for each anchor, and mark each anchor with a buoy. Each anchor will have two wires, one for later connection to the Discoverer and the other for connection to the surface buoy marking the anchor location. The Discoverer will transit to the general location of the drill site under its own power. When approximately one mile from the drill site, the Discoverer will turn off its propulsion engines and thereafter be towed by one of the Icebreaker/Anchor Handlers authorized under the permits (Icebreaker #1 or #2). The Discoverer's propulsion engine will be available on standby in case of an emergency that requires the Discoverer to be moved from the drill site. The Icebreaker will then tow the Discoverer to the drill site and position the Discoverer at the "drilling" position center of the buoy pattern. The Discoverer will then drop its ship's anchor and, once that anchor is secure, the Discoverer would detach from the icebreaker. The Icebreaker will then proceed to connect the Discoverer to each of the 8 mooring anchors. The Discoverer's ship's anchor will be raised and retrieved after the Discoverer is attached to the seabed by four of the 8 mooring anchors. Shell explains that pre-laying the anchors in this manner is operationally preferable to laying the anchors when attached to the Discoverer because the pre-positioned anchors are secured in advance, which eliminates the potential for error in securing and setting the anchors directly from the Discoverer. Mooring Operations Guideline at 4.[11]

When vacating a drill site, the process is reversed. The ship's anchor is deployed after four of the 8 mooring anchors are retrieved, next the remaining four mooring anchors are retrieved, then the ship's anchor is retrieved and raised, and, finally, the Discoverer starts its main propulsion engines and transits to within one mile of the next location where the anchoring process is repeated. Mooring Operations Guideline at 12.1 (transmitted by email from Mark Shindler, Shell consultant, to Doug Hardesty, Region 10 re: Mooring Process for the Noble Discoverer Drillship, dated May 30, 2011).

2.2.4 Region 10's Proposed Determination of When the Discoverer Becomes an OCS Source

As explained above, Shell has submitted supplemental application materials explaining that Shell proposes to use a different process for securing the Discoverer at the drill site by "pre-laying" 8 anchors. Region10 has carefully reviewed the information submitted by Shell about this new process in light of the statutory and regulatory definitions of OCS source and the policy and legislative history behind CAA § 328 and OCSLA § 4(a)(1), as directed by the Remand Order. Based on this review and analysis, Region 10 proposes to consider the Discoverer as an OCS source, subject to CAA § 328 requirements, from the time it is attached to the seabed by a single

[11] In a March 9, 2011 letter, Shell states that it does not concede that considering the Discoverer to be an OCS source when attached to the seabed by a single anchor is authorized by EPA's definition of OCS source, but that it is willing to accept the "one anchor down" test as an analogue to an "owner requested limit" for the purposes of these permits only, in order to minimize delays in the remand proceedings. Shell March 9, 2011 Letter at 2-3.

anchor at a drill site, which will first occur when the ship's anchor is secured at a drill site, until the last anchor is detached at the drill site. We believe this interpretation, in the context of this specific permitting action, is consistent with the relevant statutes and regulations applicable to this specific permitting action for the reasons explained below.

The statutory definition of OCS source in the CAA specifies that a source can engage in a wide range of activities, including but not limited platform and drillship exploration, construction, development, production, processing, and transportation. EPA's regulatory definition of OCS source with respect to vessels requires that a vessel be "permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom, as those terms are used in Section 4(a)(1) of OCSLA." 40 CFR § 55.2 (emphasis added). As discussed above, OCSLA § 4(a)(1) uses the same three terms or phrases ("attached," "erected," "used for the purpose of"), but with different phrasing: "permanently or temporarily attached to the seabed, which may be erected thereon for the purpose of exploring for, developing or producing resources therefrom" (emphasis added).

Region 10 believes that, as in OCSLA § 4(a)(1), the reference to "erected thereon" in 40 CFR § 55.2 is intended to reflect the process by which a vessel becomes attached to the seabed and used thereafter for the purpose of exploring, developing, or producing resources from the seabed. As the Board noted, there is no discussion in the legislative history for CAA § 328 or OCSLA § 4(a)(1) of "erected" in the context of defining what is an OCS source or the reach of OCSLA § 4(a)(1). And there is no indication in either the proposed or final OCS regulations that EPA intended that the terms "attached to the seabed," "erected thereon," and "used for the purpose of" be used in any way different or given any different meaning from the way those terms are used in OCSLA § 4(a)(1). To the contrary, the preamble to the final OCS regulation indicates that the language was intended to cover vessels meeting two requirements, that they be attached to the seabed and used for the specified purpose:[12]

> The definition of "OCS source" has been modified to clarify when EPA will consider vessels to be OCS sources. Section 328(a)(4)(C)(ii) defines an OCS source as a source that is, among other things, regulated or authorized under the OCSLA. The OCSLA in turn provides that the Department of Interior ("DOI") may regulate "all installations and other devices permanently or temporarily attached to the seabed, which may be erected thereon for the purpose of exploring, developing or producing resources therefrom, or any such installation or other device (other than a ship or vessel) for the purpose of transporting such resources." 43 U.S.C. § [4(a)(1)]. *Vessels therefore will be included in the definition of "OCS source" when they are "permanently or temporarily attached to the seabed" and are being used "for the purpose of exploring, developing or producing resources therefrom." This would include, for example, drill ships on the OCS.*

57 Fed. Reg. 40792, 40793 (September 4, 1992)(emphasis added).

[12] This provision was not included in the proposed 40 CFR Part 55, but was instead added to the definition of OCS source at promulgation of the final rule.

In this context, Region 10 believes (1) that that the Discoverer is "attached to the seabed" when it is attached to the seabed by at least one anchor, and (2) that the Discoverer is "erected [on the seabed]" when that attachment occurs at the location where the Discoverer may be used for the purpose of "exploring, developing, or producing resources [from the seabed]." This is because the verb "to erect" generally means "to construct" or "to build," definitions that generally suggest an intention that the activity be conducted according to some plan or specification. See The American Heritage® Dictionary of the English Language (definitions of erect, construct, and build); Merriam Webster (same). Requiring that the attachment to the seabed occur at the location where the OCS activity will (or is reasonably expected to) be conducted ensures that the attachment to the seabed is related to, and for the purpose of, engaging in a systematic, planned activity as an OCS source, and not, for example, for the purpose of waiting out a storm or anchoring in a harbor to get supplies. These interpretations of "attached" and "erected" are also consistent with the language of OCSLA § 4(a)(1), which used the phrase "which may be erected thereon" more as an explanatory phrase than as a separate requirement from attachment.

With respect to the criterion that the Discoverer be "used for the purpose of exploring, developing or producing resources," after further consideration of the issue, Region 10 believes that this criterion is met by the fact that the Discoverer is a drillship. Although the phrasing "used for the purpose of" could indicate a requirement that the Discoverer be actively exploring for resources in order for that criterion to be met, Region 10 believes such an interpretation is too narrow to be reasonable and is contrary to Congress's intent. According to common parlance, a hammer is a tool that is "used for the purpose of" hammering even when it is not in fact hammering a nail or other object. Similarly, Region 10 believes a drillship such as the Discoverer is clearly a vessel "used for the purpose of exploring, developing, or producing resources" even when it is not in fact engaged in the actual drilling of MLCs or drilling for oil. Its attachment to the seabed at a drill site confirms that the vessel is intended to be used for the purpose of exploring, developing, or producing resources from the seabed.

This interpretation of the regulatory definition of OCS source with respect to vessels is consistent not only with OCSLA § 4(a)(1), but also with the statutory definition of OCS source in the CAA. In Section 328(a)(4)(C), Congress specifically stated that the activities of an OCS source include construction. Congress's direction that construction activity be considered part of an OCS source indicates Congress's intent that the definition of OCS source be given an expansive meaning and is inconsistent with an interpretation that would require that construction of the source be fully completed and actually engaged in drilling activities before being considered an OCS source.[13]

[13] Region 10's interpretation of 40 CFR § 55.2's cross-reference to OCSLA § 4(a)(1), and its application to the Discoverer, is also consistent with regulations promulgated by the MMS, now the Bureau of Ocean and Energy Management, Regulation, and Enforcement (BOEMRE), under OCSLA. Those regulations define "facility" as "all installations or devices permanently or temporarily attached to the seabed. They include mobile offshore drilling units (MODUs), even while operating in the 'tender assist' mode (i.e. with skid-off drilling units) or other vessels engaged in drilling or downhole operations….." 40 CFR § 250.105. *Cf.* *Alliance to Protect Nantucket Sound, Inc. v. United States Dep't of the Army*, 398 F.3d 105, 109 (1st Cir. 2005) (interpreting the "which may be erected" clause in OCSLA § 4(a)(1)).

In sum, based on the analysis discussed above, Region 10 proposes to consider the Discoverer an OCS source when it is attached to the seabed by at least one anchor at a drill site. This proposal is consistent with the regulatory definition of OCS source in 40 CFR § 55.2, which in turn is consistent with CAA § 328 and OCSLA § 4(a)(1) given the purpose and legislative history of these statutes. In reaching this conclusion, Region 10 notes that vessels used for oil exploration and production (not to mention OCS vessels used for other purposes) vary greatly in configuration. Therefore, Region 10's proposal in this case that the Discover is an OCS source as defined in 40 CFR § 55.2 when attached to the seabed by a single anchor at a drill site does not necessarily resolve when other types of vessels or drill rigs become OCS sources, an issue that will vary to some extent depending on the factual differences in the equipment used to carry out the OCS activity and the particular project.

The effect of this proposed change in when the Discoverer is considered an OCS source on permits terms and conditions and emissions is discussed in Section 3.1 below.

2.3 Applicability of Requirements that Became Effective After Issuance of the 2010 Permits

In remanding the 2010 Permits to Region 10, the Board directed Region 10 to apply "all applicable standards in effect at the time of issuance of the new permits on remand." Remand Order I at 82; Clarification Order at 24. Since the 2010 permits were issued, three additional PSD requirements have come into effect:[14]

- promulgation of a new 1-hour NO_2 NAAQS, which became effective on April 12, 2010 (75 Fed. Reg. 6474, February 9, 2010);
- promulgation of a new 1-hour SO_2 NAAQS, which became effective August 23, 2010 (75 Fed. Reg. 35520, June 22, 2010); and
- promulgation of regulations requiring control of GHGs from automobiles, which make GHGs subject to regulation under the CAA and subject to PSD requirements applicable to GHGs as of January 2, 2011. See 75 Fed. Reg. 17004 (April 2, 2010). To implement this requirement, EPA revised the definition of "regulated NSR pollutant" to include GHGs, along with promulgating provisions tailoring the applicability criteria that determine which stationary sources and modification projects become subject to PSD permitting requirements for GHGs. See 75 Fed. Reg. 31514 (June 3, 2010).

There have also been some changes to the COA regulations, although the changes to the permit terms and conditions required to address the COA changes are minimal.

The EAB recognized the Agency's discretion to determine whether a specific standard is "applicable" on remand. See Clarification Order at 24. In this case, changes made in response to the EAB Orders and additional changes requested by Shell required additional air quality and

[14] Although has EPA has promulgated $PM_{2.5}$ increments since issuance of the 2010 Permits, the requirement to demonstrate compliance with $PM_{2.5}$ increments does not come into effect until October 20, 2011. See 75 Fed. Reg. 64899, 64877, 64898-99 (October 20, 2010).

other technical analyses and resulted to changes in numerous permit conditions. Given the extent of these changes, Region 10 believes it is appropriate to require that the 2011 Revised Draft Permits meet all new requirements that have come into effect since issuance of the 2010 Permits. As discussed in more detail below, the 2011 Revised Draft Permits meet these requirements.

3 CHANGES IN PROJECT EMISSIONS AND PERMIT TERMS AND CONDITIONS

3.1 The OCS Source

As discussed in Section 2.2 above, Region 10 proposes that the Discoverer be considered an OCS source when attached by at least one anchor at a drill site. The 2011 Revised Draft Permits have been revised accordingly.

This change does not increase the PTE of the Discoverer and the Associated Fleet because the total number of operating days has been reduced from 168 to 120 and the anchor setting and retrieval is counted in that 120 day period. Total emissions under the 2011 Revised Draft Permits have been reduced significantly as compared to the 2010 Permits. Emissions during anchor handling have been modeled and determined to be less than the worst case operating scenario, which occurs during MLC drilling.

Note that, as under the 2010 Permits, Condition D.1 prohibits operation of the Propulsion Engine (FD-7) while the Discoverer is an OCS source.

3.2 Coast Guard Safety Zone

The air quality analysis submitted by Shell modeled emissions from the Discoverer beginning 500 meters from the center of the Discoverer and assumes that the Coast Guard will impose a safety zone of this distance around the Discoverer to exclude the public from the area in which the Discoverer's anchor array will be deployed and in which Shell will be conducting its main operations. See Shell March 18, 2011 Submittal at 38, n. 15. Shell has agreed that Region 10 will include in the 2011 Revised Draft Permits a requirement that Shell have in place during all times of operation as an OCS source a safety zone of at least 500 meters within which the Coast Guard prohibits public access. Shell has also stated in its application materials that Shell will develop in writing and implement a public access control program to locate, identify and intercept the general public by radio, physical contact, or other reasonable measures to inform the public that they are prohibited by Coast Guard regulations from entering the area within 500 meters of the Discoverer. Region 10 has included these provisions as consistent with Shell's demonstration that emissions from their exploratory operations will not cause or contribute to a violation of the NAAQS or applicable increment in any location that constitutes ambient air.

Thus, Shell's permit application demonstrates that it complies with the PSD regulations, regardless of EPA's ultimate decision about the point of compliance.[15]

3.3 Drillship Name Change

Due to a change in ownership of the Discoverer in the summer of 2010, the name of the vessel changed from the Frontier Discoverer to the Noble Discoverer.[16] As a result, Region 10 made several changes though out the draft permits to change the name of the drillship from Frontier Discoverer to Noble Discoverer.

3.4 Drill Site Notification

Region 10 has increased the time for giving prior notice of the location at a drill site from 10 days to six months. Although there are currently no other permitted exploratory drilling operations in the OCS north of Alaska, Region 10 is aware of additional permit applications for activity that could potentially operate in the Beaufort or Chukchi Seas. Region 10 intends to require all permitted operations to notify Region 10 regarding their anticipated drilling locations far in advance of each drilling season (six months) so that Region 10 can evaluate whether there is a need for additional air quality impact analyses.

3.5 Restrictions on Duration of Exploration Operations

Shell requested a reduction in the number of days the Discoverer is authorized to operate as an OCS source from 168 days during any rolling 12-month period to 120 days during any drilling season, as well as a one-month reduction in the drilling season (from July 1 to November 30). Shell based its air quality analysis on the 120-day limit on OCS activity and its requested drilling season. This reduction in the duration of exploration operations results in a substantial overall decrease in air pollutants authorized under the permit. Because this restriction is designed to ensure compliance with the NAAQS and because the annual NAAQS are set based on calendar years, the restriction can similarly apply on a calendar year basis (or, in the case of these permits, a drilling season which is limited by the permit to a specific 5 month period out of any calendar year). The decrease in the duration of exploration operations has resulted in a reduction in the annual NO_X emission limits for most sources.

Shell also requested restrictions on the type of activity conducted during the 120-day period of operations. Emissions are highest during the drilling of MLCs and Shell's air quality analysis is

[15] Ambient air is defined as "…that portion of the atmosphere, external to buildings, to which the general public has access." 40 CFR § 50.1(e). Ambient air does not include atmosphere over land owned or controlled by a source and to which the public access is precluded by a fence or physical barrier. See Letter from Douglas M. Costle, EPA Administrator to The Honorable Jennings Randolf, re: Ambient Air dated December 19, 1980; Letter from Steven C. Riva, EPA Region 2, to Leon Sedefian, New York State Department of Conservation, re: Ambient Air for the Offshore LNG Broadwater Project, October 9, 2007.

[16] Noble Corporation Press Release. Noble Corporation Closes Acquisition of Frontier Drilling. July 28, 2010. *http://phx.corporate-ir.net/phoenix.zhtml?c=98046&p=irol-newsArticle&ID=1453351&highlight*

based on the limited duration of this activity. Shell therefore requested an operational limit on "MLC activity" to 480 hours during any drilling season. "MLC activity" is defined as any time any MLC engine (FD-9 – 11) or hydraulic power unit (HPU) engine (FD-12 – 13) is operating. The draft permits also prohibit operation of the cementing and logging winch engines (FD-17 – 20) during "MLC activity."

Shell's air quality analysis is also based on limiting the duration of total "drilling activity" to 1,623 hours during any drilling season and the draft permits therefore also contain this restriction. Drilling activity is defined as any time when the top drive is engaged and turning the conventional rotary bit, as well as any period of MLC activity. This ensures that, to the extent MLC activity is less than 480 hours during the drilling season, the remaining time can be counted toward the overall limit on drilling activity.

3.6 Limits on Potential to Emit/Owner Requested Limits

3.6.1 Sulfuric Acid Mist

The 2010 Beaufort Permit imposed an Owner Requested Limit (ORL) under the COA regulations and a limit on PTE in all areas of the Outer OCS to limit the PTE for sulfuric acid mist so as to avoid PSD applicability for this pollutant. The 2010 Chukchi Permit has a similar limit, but it was erroneously characterized as a limit on PTE for SO_2 rather than for sulfuric acid mist. This error in the Chukchi permit has been corrected.

3.6.2 Greenhouse Gases

Beginning January 2, 2011, greenhouse gases (GHGs) are subject to regulation under the PSD permitting regulations if:

1. The stationary source is a new major stationary source for a regulated NSR pollutant that is not GHGs, and also will emit or will have the PTE 75,000 tpy CO_2e or more; or
2. The stationary source is an existing major stationary source for a regulated NSR pollutant that is not GHGs, and also will have a significant and net significant emissions increase of a regulated NSR pollutant that is not GHGs, and an emissions increase of 75,000 tpy CO_2e or more.

Beginning July 1, 2011, GHGs are also subject to regulation:

1. At a new stationary source that will emit or have the PTE 100,000 tpy CO_2e or more; or
2. At an existing stationary source that emits or has the PTE 100,000 tpy CO_2e, or more when such stationary source undertakes a physical change or change in the method of operation that will result in a significant and net significant emissions increase of 75,000 tpy CO_2e or more.

40 CFR § 52.21(b)(49)(iv) and (v); 75 Fed. Reg. 31514 (June 3, 2010). "Greenhouse gases (GHGs)" is the air pollutant defined in 40 CFR § 86.1818–12(a) as the aggregate group of six greenhouse gases: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). 40 CFR § 52.21(b)(49)(i). The term "tpy CO_2 equivalent emissions (CO_2e)" represents an amount of GHGs emitted, and is computed by multiplying the mass amount of emissions (tpy), for each of the six greenhouse gases in the pollutant GHGs, by the gas's associated global warming potential published at Table A–1 of 40 CFR Part 98, Subpart A (Global Warming Potentials). 40 CFR § 52.21(b)(49)(ii).

Since the Discoverer and Associated Fleet emit three of the six GHGs (CO_2, N_2O, and CH_4) and will be a new major stationary source for a regulated NSR pollutant that is not GHGs (specifically NO_X), it would also be subject to PSD for GHGs if its PTE GHGs is 75,000 tpy CO_2e or more.

Shell has requested that Region 10 include in each permit limits on the PTE GHGs such that it would not be subject to PSD for GHGs. For the Inner OCS in the Beaufort Sea, Shell requested an owner requested limit under the COA regulations. The 2011 Revised Draft Permits therefore include conditions that ensure that the PTE GHGs will not exceed 70,000 tpy CO_2e, along with monitoring, recordkeeping, and reporting requirements to ensure that the conditions are enforceable as a practical matter.

For the Discoverer and Associated Fleet, GHGs are emitted by various fuel combustion sources (engines, boilers) and by incinerators. Region 10 is therefore establishing three limitations in each permit:

- A GHG 12-month rolling limit of 70,000 tpy CO_2e;
- A total aggregate 12-month rolling limit for fuel combusted of 6,346,493 gallons; and
- A total aggregate 12-month rolling limit for waste combusted of 1,657,440 pounds.

The permits require Shell to monitor total fuel used by the Discoverer when it is an OCS source and total fuels used in all vessels in the Associated Fleet when they are within 25 miles of the Discoverer while it is an OCS source. The permits also require Shell to monitor total waste combusted in the Discoverer incinerator when it is an OCS source and total waste combusted in any incinerator in the Associated Fleet when they are within 25 miles of the Discoverer while it is an OCS source. These fuel and waste amounts are then used with the appropriate distillate fuel oil emission factors in EPA's Greenhouse Gas Reporting Rule (40 CFR Part 98, Subpart C, Tables C-1 and C-2); and the CO_2 emission factor in AP42 Table 2.1-7 (10/96) for incinerators, along with each greenhouse gas' associated global warming potential from 40 CFR Part 98,

Subpart A, Table A–1 – Global Warming Potentials, to calculate total CO_2e emissions in tpy on a 12-month rolling basis. [17]

A small amount of CH_4 may also be emitted by the Drilling Mud System (FD-32) and, in the Beaufort Sea, the Cuttings/Mud Disposal Barge (FD-34). When wells are drilled through porous, hydrocarbon bearing rock, drilling fluids (mud) circulated through the drill bit can carry gaseous hydrocarbons from the well back to drillship. These gases are typically released as fugitive emissions when the mud is processed for reuse on the drillship and stored on the Cuttings/Mud Disposal Barge; however, some of the emissions pass through a vent. Although fugitive emissions are not counted towards PSD applicability for exploratory drillships (see 40 CFR § 52.21(b)(1)(iii)), Shell has agreed to count all of these methane emissions under the PTE limit for GHGs.

Based on past drilling experience, Shell has estimated a conservative amount of hydrocarbon gas - 17 tons per drilling season - that could be released from the circulated mud. To account for this potential methane release while determining compliance with the GHG PTE limit, each permit assumes 17 tons per month of CO_2e emissions (0.798 tons per month of methane) will be released from the drilling mud and reduces the amount of GHGs that can be emitted from other operations to comply with the 70,000 tpy aggregate limit. To determine compliance with the 70,000 tpy limit, actual GHG emissions from combustion and incineration are added to the assumed mud emissions each month and then added to the previous 11 months of GHG emissions. Given that the PTE limit is 5,000 tpy less than the GHGs applicability threshold of 75,000 tpy of CO_2e and the conservative estimate of maximum GHG from the Drilling Mud System, Region 10 is not including additional conditions for monitoring these minimal GHGs. Region 10 believes this approach is conservative for the following reasons:

- Shell's assumed length of the hydrocarbon bearing zone of the well is what is expected to be found in the Chukchi Sea, but considered worst-case for the Beaufort Sea.
- Shell's estimate assumes 100% of the porous space in the rock drilled in the hydrocarbon bearing zone is filled with hydrocarbon which is typically not the case.
- Shell is assuming 97% of the gas is methane when actual testing of the muds has documented that 97% of the gas is a mix of ethane and methane (only methane is a GHG).
- Shell's estimate (17 tpy) is based on drilling 4 holes each season, while the permit conservatively assumes the total amount (17 tons) is emitted each month. The permit is therefore applying an additional safety factor of 5 to Shell's already conservative estimation assuming a 5-month drilling season.

[17] Note that consistent with Shell's emission inventory, Region 10 has included a provision stating that there shall be no emissions of any regulated NSR pollutant or GHGs from the shallow gas diverter system (FD-33), a device that emits only in the event of an emergency due to encountering shallow gas during drilling. Therefore, emissions from this source are not included in the PTE calculation for GHGs.

3.6.3 PTE Designations

Region 10 has removed the term "PTE" from the permit condition heading for those limits that were established in the 2010 Permits for purposes of ensuring that emissions from the Discoverer and the Associated Fleet do not cause or contribute to a violation of the NAAQS or increment, and reserved such heading for those permit terms imposed to limit the PTE of the source so as to avoid major source requirements. Region 10 believes it is appropriate to more accurately characterize in the permit the purpose for which such limits were created.

3.7 Other Emission Limit Changes

3.7.1 1-hour NO_X Emission Limits

As discussed above, since issuance of the 2010 Permits, a new 1-hour NO_2 NAAQS has come into effect. Shell's air quality analysis, which is discussed in Section 5 below and in the Region 10 Technical Analysis, demonstrates that emissions from the Discoverer and the Associated Fleet will not cause or contribute to a violation of the new 1-hour NO_2 NAAQS based on certain assumptions. Accordingly, Region 10 has included in the 2011 Revised Draft Permits 1-hour NO_X emission limits that correspond to the 1-hour NO_X emissions from the various emission units on the Discoverer and the Associated Fleet assumed in Shell's air quality modeling analysis. The permits also require stack testing for NO_2 to verify the NO_2/ NO_X ratios used in the air quality modeling analysis.

3.7.2 24-Hour PM_{10} and $PM_{2.5}$ Emission Limits

Region 10 has revised the 24-hour PM_{10} and $PM_{2.5}$ emission limits for several emission units to reflect the 24-hour emissions assumed in the air quality analysis submitted by Shell since issuance of the 2010 Permits. For some emission units, the 24-hour PM_{10} and $PM_{2.5}$ emission limits in the 2011 Revised Draft Permits have increased as compared to the 2010 Permits, while for some emission units, the limits have decreased. Overall, there has been a significant reduction in emissions of PM_{10} and $PM_{2.5}$ from the Discoverer and the Associated Fleet.

Finally, Region 10 added a heading for the 24-hour emission limits for Units FD-1 – 6 and also corrected a typo in Condition 6.1 by changing PM_{10} to $PM_{2.5}$.

3.8 Discoverer Emergency Generator and Seldom Used Sources

Since issuance of the 2010 Permits, Shell has replaced the emergency generator on the Discoverer (FD-8) and identified new smaller engines on the Discoverer that are used only on an intermittent basis. Shell calls these engines "seldom used sources." Shell included the new emergency generator and the seldom used sources on the Discoverer in the additional air quality analysis it has conducted and submitted to Region 10 since issuance of the 2010 Permits.

Shell has requested an aggregate fuel limit of 150 gallons of fuel in any rolling 7-day period for the emergency generator and the Discoverer seldom used sources. Region 10 has therefore

added the seldom used sources on the Discoverer to emission unit FD-8 and imposed this fuel restriction, along with monitoring, recordkeeping, and reporting requirements. Region 10 has also decreased the number of hours the emergency generator is able to operate from 48 on a 12-month rolling basis to 10 hours of operation during the drilling season and a restriction on the period of operation of the emergency generator from 12 pm to 2 pm to reflect assumptions in Shell's air quality analysis. Because this restriction is designed to ensure compliance with the NAAQS and because the annual NAAQS are based on calendar years, the restriction can similarly apply on a calendar year basis (or, in the case of these permits, a drilling season which is limited by the permit to a specific 5 month period out of any calendar year). Finally, consistent with the BACT analysis discussed in Section 4 below, Region 10 has added a requirement to employ good combustion practices for the emergency generator and the Discoverer seldom used sources, similar to the condition that applies to other sources for which BACT was determined to be no additional controls.

The 2011 Revised Draft Permits also include 1-hour limits for NO_X and 24-hour limits for PM_{10} and $PM_{2.5}$ for the emergency generator to reflect assumptions relied on in Shell's modeling analysis.

3.9 Shallow Gas Diverter System

Because the calculation of GHGs from the Discoverer and the Associated Fleet assume no emissions from this emission unit, Region 10 has added a condition requiring that there be no emissions of any regulated NSR pollutant or GHGs from this emission unit.

3.10 Associated Fleet Seldom Used Sources

Shell also identified smaller engines on Icebreaker #1, #2, the Nanuq, and the Point Class Tug that operate only on an intermittent basis. Shell refers to these engines as "seldom used sources" and requested an aggregate fuel limit of 100 gallons of fuel for the seldom used sources on each of these vessels in any rolling 7-day period. The draft permits impose these limits, along with monitoring, recordkeeping, and reporting requirements.

3.11 Icebreaker #1

Shell installed post-combustion controls (SCR and OxyCat) on the generator and propulsion engines on Icebreaker #1 to reduce emissions of NO_X, PM_{10}, and $PM_{2.5}$. Region 10 has revised the permit conditions for Icebreaker #1 to reflect the additional controls by removing references to uncontrolled emissions and requiring that emissions from the generator and propulsion engines be directed to operating SCR and OxyCat units. Monitoring, recordkeeping, and reporting to ensure good operation of the SCR and OxyCat have been included.

Emission limits have been reduced to reflect the additional controls and the assumptions used in the modeling analysis. Emissions from Icebreaker #1 have been reduced significantly as a result.

Annual NO_X emissions have been reduced from 850 to 41.59 tpy. Daily emissions of PM_{10} and $PM_{2.5}$ have been reduced from 1098 to 277.47 pounds per day.

3.12 Icebreaker #2

At Shell's request, Region 10 has revised the annual NO_X emission limit for Icebreaker #2 from 71.2 to 99.45 tons on a 12-month rolling basis. This increase allows for greater use of Icebreaker #2 within 25 miles of the Discoverer. The increase reflects the emission rate assumed in Shell's supplemental modeling analysis and is offset by much larger reductions in annual NO_X emissions from Icebreaker #1 and other units and vessels authorized under the permits.

The permit requires Shell to install an OxyCat control system on the propulsion and main generator engines on Icebreaker #2. This results in a decrease in particulate matter emissions from this vessel.

3.13 Supply Ship in Dynamic Positioning Mode

Shell has requested authorization to operate the Supply Ship in the DP mode as an alternative to tying the Supply Ship to the Discoverer to transfer supplies and other goods between the Supply Ship and the Discover. In the DP mode, the Supply Ship uses motive power (its propulsion engines) to keep the Supply Ship in position next to the Discoverer. Operation of the Supply Ship in the DP mode results in an increase in emissions as compared to emissions from the Supply Ship when tied to the Discoverer. Region 10 therefore requested that Shell provide an additional air quality analysis to demonstrate that operation of the Supply Ship in the DP mode, in conjunction with the existing emissions sources on the Discoverer and the Associated Fleet, will not cause or contribute to a violation of any NAAQS or applicable increment. This analysis is discussed in Section 5 below.

The 2010 Permits restricted the number of resupply events to 8 in any rolling 12-month period. Although Shell assumed a total of 24 resupply events in its additional air quality analysis, Shell did not request an increase on the maximum number of resupply events. Region 10 has added a permit term clarifying that each resupply of the Discoverer in DP mode counts toward the 8 resupply events authorized under the draft permits. Region 10 has also changed the period over which the 8 resupply trips accumulate from a rolling-12 month basis to the drilling season. Because this restriction is designed to ensure compliance with the NAAQS and because the annual NAAQS are based on calendar years, this restriction can similarly apply on a calendar year basis (or, in the case of these permits, a drilling season which is limited by the permit to a specific 5 month period out of any calendar year). In addition, because Shell's air quality analysis assumed each resupply event in DP mode would last 24 hours or less, the draft permits state that each 24-hour period of operation in DP mode is considered a separate resupply event.

In addition, Region 10 has also added emission limits for NO_X on a 1-hour basis and $PM_{2.5}$ and PM_{10} on a 24-hour basis to reflect the assumptions made in the modeling analysis, as well as testing and monitoring requirements.

3.14 Cuttings/Mud Disposal Barge

The 2011 Revised Draft Permit for the Beaufort Sea makes clear that each transit of the cuttings/mud disposal barge tug equals one of the 8 resupply events authorized under the draft permit. The Beaufort permit also clarifies that the prohibition on emissions from this barge applies to emissions from fuel combustion units.

3.15 Icebreaker Stack Height and Capacity Limits

As discussed in the Statements of Basis for the 2010 Permits, Shell has requested to use different icebreakers and supply ships in the future than those that were used in the air quality impact analyses supporting the 2010 Permits. This approach is unchanged in the 2011 Revised Draft Permits. Under both the 2010 Permits and the 2011 Revised Draft Permits, Icebreaker #1 is essentially a generic icebreaker and the permits include Conditions N.1 and O.1 in the Chukchi Sea and Beaufort Sea permits, respectively, that restrict the aggregate capacity of all engines, boilers, incinerators, $PM_{2.5}$ emissions, and PM_{10} emissions on any alternative icebreaker in order to ensure that total emissions will be no greater than what has been assumed in the current air quality impacts analysis. Similarly, under both the 2010 Permits and the 2011 Revised Draft Permits, Icebreaker #2 can be either the Tor Viking or a new icebreaker under construction currently identified only as Hull 247, and Region 10 has proposed a similar permit condition (Conditions O.1 and P.1 in the respective Chukchi and Beaufort permits) that restricts the aggregate capacity of the Tor Viking and the Hull 247 icebreaker. The Supply Ship is essentially a generic vessel and the permits include Condition P.1.2 and Q.1.2, respectively, to restrict the total horsepower of propulsion and non-propulsion engines on the Supply Ship.

In the 2010 Permits, in order to ensure that the air quality impact of these alternative icebreakers would be no greater than the ones included in the modeling analysis, Region 10 proposed "volume source" limits consistent with how the icebreakers and supply ship were included in the screening modeling conducted to support the 2010 Permits (Conditions N.9, O.11 and P.2, respectively, for the 2010 Chukchi Permit and Conditions O.9, P.11 and Q.2, respectively, for the 2010 Beaufort Permit).

The current refined modeling analysis submitted to support the 2011 Revised Draft Permits treats the icebreakers and Supply Ship in a different manner than the screening modeling technique used to support the 2010 Permits, and the previous volume source limits in the 2010 Permits are not sufficient to ensure consistency with how the icebreakers and the supply ship are included in the current modeling approach and, therefore, not sufficient to ensure that alternative icebreakers and Supply Ship would not have air quality impacts greater than those included in the modeling analysis. Region 10 is therefore proposing to replace the volume source limits with new stack height limits in each of the 2011 Revised Draft permits in order to restrict the alternatives for Icebreaker #1 and Icebreaker #2 to those with plume characteristics similar to the two icebreakers and the Supply Ship included in Shell's supplemental modeling analysis. These new conditions will ensure that any alternative icebreakers will not have an air quality impact greater than those considered in the air quality analysis supporting issuance of these draft permits.

Region 10 has also replacing the Supply Ship aggregate horsepower limitation with two new fuel consumption limitations that are consistent with the emissions used in the supplemental modeling analysis. The volume source limit for the Supply Ship has been deleted because the supplemental modeling analysis does not rely on a volume source approach for restricting alternative supply ships.

3.16 Associated Fleet Location Restrictions

In the air quality analysis supporting the 2010 Permits, which was based on a screening model, Shell had characterized the Associated Fleet as volume sources located certain distances away from the Discoverer. The 2010 Permits therefore contained the distance restrictions on which the air quality analysis was based.

As discussed in more detail in Section 5, the new air quality analysis submitted by Shell uses a refined model (AERMOD), an assumed 500 meter ambient air boundary around the Discoverer, and the Associated Fleet modeled as area polygons rather than as volume sources. The area polygons for the Associated Fleet extend to the hull of the Discoverer and are aligned with the wind for all hours. This source characterization represents a worst case scenario, as the emissions are aligned resulting in overlapping plumes and the highest possible modeled impacts. Because the new analysis was performed with a refined model and was not based on distance restrictions between the Discoverer and the Associated Fleet, Region 10 has removed the conditions in the 2010 Permits that impose distance restrictions on Icebreaker #1, Icebreaker #2, and the OSR fleet, as well as the related monitoring, recordkeeping, and reporting requirements for these conditions. These revisions are consistent with the latest air quality analysis that demonstrated compliance with all PSD requirements at all locations more than 500 meters from the Discoverer.

Note that Region 10 has moved to Section B (Source-Wide Requirements) the location monitoring provisions that were previously in some vessel-specific provisions of the permits. This ensures monitoring of location in connection with the requirements that apply to the Associated Fleet when operating within 25 miles of the Discoverer while the Discoverer is an OCS source.

3.17 Monitoring of SCR and OxyCat Operation

Region 10 has included additional parametric monitoring requirements to ensure the SCR and OxyCat pollution control systems required on the large engines on the Discoverer and the Associated Fleet are operating properly and achieving the anticipated pollutant reductions. Region 10 believes that the SCR and OxyCat systems will be effective if the inlet temperature to each system is high enough, the urea feed to the SCR system is operating, and the catalysts are still active. To ensure the continuing performance of these add-on control systems, on-going monitoring is required. For both emission control systems, the permits require monitoring and recording of the inlet temperature. The permits also require monitoring and recording of the urea flow to the SCR unit. To ensure each catalyst is still active, the permits require weekly measurements of NO_X and CO concentrations downstream of the SCR and OxyCat units with a

portable monitoring device. Comparing the weekly NO_X and CO measurements against values measured during previous stack testing is expected to provide a reasonable assurance that the catalyst is still active and that adequate urea is being fed to the SCR system. The permittee is also required to develop a monitoring plan to ensure proper installation and operation of the monitoring systems.

3.18 Test Methods for PM_{10} and $PM_{2.5}$

Since issuance of the 2010 Permits, EPA has promulgated the final revisions to Method 201A and 202 on December 21, 2010. 57 Fed. Reg. 80118. As a result, Region 10 changed throughout the permits the compliance method for each PM_{10} and $PM_{2.5}$ emission limit by removing the option to use EPA Method 201 and Other Test Method 28 to demonstrate compliance with the PM emission limits.

Region 10 has also added a provision stating that the permittee may substitute the use of Method 5 for Method 201A, provided Method 202 is used for condensable PM and all PM is considered to be $PM_{2.5}$.

3.19 Corresponding Onshore Area (COA) Requirements

3.19.1 COA Marine Vessel Visible Emission Standards

Region 10 has removed from the 2011 Revised Draft Permit for the Beaufort Sea Condition B.6, which applied to visible emissions from the Associated Fleet in the Inner OCS. This condition was based on COA regulation 18 AAC 50.070, which regulates visible emissions from marine vessels. Section 55.14 of 40 CFR Part 55 makes clear that the COA regulations apply to the "OCS source." Because the vessels in the Associated Fleet are not OCS sources (except for the Supply Ship when tied to the Discoverer), the COA regulations do not apply to the Associated Fleet. The exception to this is that emissions of the Associated Fleet are included as emissions of the Discoverer as an OCS source in determining the “potential to emit” of the Discoverer. Region 10's inclusion of this visible emission standard in the 2010 Beaufort Permit was therefore in error. Note that, under the Beaufort permit, the Discoverer is already subject to the more stringent visible emission standard in 18 AAC 50.055(a) for industrial process and fuel burning equipment while in the Inner OCS.

3.19.2 COA Assessable Emissions

Under the COA regulations, the default assessable emissions are generally potential emissions of each air pollutant in excess of 10 tpy as authorized by the permit. Based on the potential emissions of NO_X, PM_{10}, $PM_{2.5}$, CO, and VOC, Shell’s assessable emissions decreased from 2,053 to 576 tpy for operations on the Inner OCS in the Beaufort Sea.

3.19.3 Other COA Requirements

As discussed above, Region 10 recently finalized the consistency update for sources in the Inner OCS off the Coast of Alaska. Alaska Department of Environmental Conservation (ADEC) has made minor changes to the ADEC regulations incorporated by Region 10 in this last update and Region 10 has revised the COA provisions of the 2011 Revised Draft Permit for the Beaufort Sea to be consistent with the current COA requirements. Such changes included minor changes to monitoring, recordkeeping, and reporting requirements for visible emissions and sulfur compounds and the excess emission and permit deviation reporting form in Attachment A of the permits.

3.20 Operating Report

Region 10 has added a provision to ensure that the Operating Report includes the monitoring and recordkeeping Shell is required to conduct under the permits. This is important compliance information that should be included with the Operating Report.

4 BACT

As explained above, this Supplemental Statement of Basis does not address permit terms and conditions from the 2010 Permits that are unchanged in the 2011 Revised Draft Permits and were not otherwise subject to a petition for review. With regard to BACT, there are no changes to the limits identified in the 2010 Permits. However, as discussed above, Shell has identified additional smaller engines on the Discoverer that are used on an intermittent basis and that Shell describes as "seldom used sources." Such engines include engines on lifeboats and dive boats on the Discoverer. Shell has submitted a BACT analysis for the seldom used sources on the Discoverer as well as for the emergency generator (FD-8). These smaller engines and the emergency generator are used only on an intermittent basis and are subject to an aggregate fuel limit of 150 gallons per rolling 7-day period, which will ensure operation of these engines and annual emissions are minimal. Shell's analysis therefore concludes that any additional control technology on the emergency generator and the seldom used engines on the Discoverer would not be cost effective.

Region 10's review of the Shell BACT analysis for the "seldom used sources" and emergency generator found several minor inconsistencies and numerical values that Region 10 believes should be different from the values used by Shell. Region 10 also believes that the cost effectiveness calculation should take into account the sum of all pollutants controlled by a specific control technology, rather than considering cost effectiveness for each pollutant separately. After accounting for these changes, however, Region 10 agrees with Shell that the cost effectiveness values are still much higher than typically accepted for a BACT analysis, ranging from about $20,000 per ton of pollutant removed to over $3 million per ton of pollutant removed. Thus, Region 10 proposes that BACT for the emergency generator and the seldom used sources on the Discoverer is no additional add-on controls.

As discussed above, these emission units are subject to an aggregate fuel limit of 150 gallons per rolling 7-day period and also to the requirement that all fuel be ultra-low sulfur diesel. Region 10 also proposes to include a requirement that the engines be operated with good combustion practices, similar to the requirement imposed on other sources on the Discoverer for which the BACT analysis concluded that no additional controls were necessary. Note that the emergency generator is also subject to emission limits on hourly NO_X and daily PM_{10} and $PM_{2.5}$ emissions to be consistent with assumptions used in the air quality analysis.

5 AIR QUALITY ANALYSIS

5.1 Introduction

The PSD rules and implementing guidance require the permit applicant to demonstrate that, for all criteria air pollutants that would be emitted in excess of the significance thresholds at 40 CFR§ 52.21(b)(23)(i), the allowable emission increases (including secondary emissions) from a proposed new major stationary source, in conjunction with all other applicable emission increases or reductions at the source, would not cause or contribute to a violation of any NAAQS nor cause or contribute to a violation of any applicable "maximum allowable increase" over the baseline concentration in any area (referred to as a PSD "increment"). The analysis is based on air quality models, databases, and other requirements specified in the Guideline on Air Quality Models at 40 CFR Part 51, Appendix W. Section 5 of the Statements of Basis for the 2010 Permits contained a detailed air quality impacts analysis demonstrating that the emissions from the Discoverer and the Associated Fleet would not cause or contribute to a violation of the NAAQS or PSD increments in effect at the time of issuance of the 2010 Permits.

The EAB Orders directed Region 10 to give further consideration to several issues that relate to the air quality analysis underlying the 2010 Permits: Region 10's decision to base its environmental justice analysis on the NAAQS in effect at the time of permit issuance; requirements that have come into effect since issuance of the 2010 Permits; air monitoring data that has been collected since issuance of the 2010 Permits; and Region 10's assessment of the secondary formation of $PM_{2.5}$ as it relates to compliance with the $PM_{2.5}$ NAAQS. In addition, Shell has requested several changes to the 2010 Permits, including replacement of the emergency generator engine on the Discover, identification of groups of seldom-used engines on the Discoverer and the Associated Fleet, and a new operating scenario for the Supply Ship in the DP mode. Shell has submitted additional modeling and other information to address the EAB Orders and support its requested operational and permit changes.

Region 10 has prepared a detailed analysis of the supplemental modeling and information provided by Shell. See Technical Support Document, Review of Shell's Supplemental Ambient Air Quality Analysis for the Discover OCS Permit Applications in the Beaufort and Chukchi Seas, dated June 20, 2011 (Region 10 Technical Analysis). The Region 10 Technical Analysis focuses in particular on Shell's demonstration regarding NAAQS that have come into effect since issuance of the 2010 Permits, Shell's demonstration regarding operation of the Supply Ship in the DP mode, background air quality data available since issuance of the 2010 Permits, and secondary emissions of $PM_{2.5}$. A summary of that analysis is provided below.

For the reasons discussed in the Statements of Basis for the 2010 Permits, as supplemented by documents in the record, including the supplemental modeling and information provided by Shell and the Region 10 Technical Analysis, Region 10 believes that operation of the Discoverer and the Associated Fleet within the constraints of the 2011 Revised Draft Permits will not cause or contribute to a violation of any currently applicable NAAQS or increment.

5.2 Air Quality Model

A dispersion model is a computer simulation that uses mathematical equations to predict air pollution concentrations based on weather, topography, emissions data, and emissions source characteristics. AERMOD is the current model preferred by EPA for use in nearfield regulatory applications as provided in 40 CFR Part 51 Appendix W, Section 3.1.2, and Appendix A to Appendix W. AERMOD is a refined dispersion model that requires the use of representative meteorological data. Because meteorological data representative of the open Beaufort and Chukchi Seas were not available prior to issuance of the 2010 Permits, Shell used screening meteorology in conjunction with a screening model, SCREEN3, to predict worst-case ambient air impact concentrations from its exploratory drilling program in support of its application for the 2010 Permits. The use of screening meteorology typically results in a conservative analysis because it assumes a range of conditions conducive to high ambient pollution impacts, which may or may not be likely to occur frequently in the modeled domain.

Since issuance of the 2010 Permits, meteorological data representative of the open Beaufort and Chukchi Seas have become available. Shell therefore used AERMOD with representative meteorological data in its supplemental analysis for purposes of evaluating the impact of the project emissions for all applicable pollutants except for ozone and secondary formation of $PM_{2.5}$. As explained below, non-modeling assessments and analysis were used to evaluate ozone and secondary formation of $PM_{2.5}$.

Note that Shell submitted a single analysis for operation in both the Beaufort and Chukchi Seas, using the Associated Fleet to be authorized under the Beaufort 2011 Revised Draft Permit. Using the Associated Fleet for the Beaufort Sea to represent operations in the Chukchi Sea for modeling purposes is conservative as the Associated Fleet for the Beaufort Sea includes additional and different vessels with total emissions greater than the Associated Fleet for the Chukchi Sea. The emissions from the Beaufort Sea Associated Fleet represent a worst case scenario, and this approach therefore adequately supports issuance of both 2011 Revised Draft Permits.

5.3 Meteorological Data

AERMOD requires hourly surface meteorological data to estimate plume dispersion. Because the drilling season of July 1 to November 30 spans periods of both open water and ice in the Arctic, several different meteorological datasets were used to prepare model-ready input files. Shell's approach to preparing meteorological data for AERMOD includes both AERMET processing of meteorological data during periods with ice cover and AERMOD-COARE processing for periods of open water. Shell defined the open water period as the time a buoy could be deployed. Since issuance of the 2010 Permits, AERMOD-COARE has been approved by EPA for use in open water conditions in the Beaufort and Chukchi Seas. See Memorandum from George Bridgers, Office of Air Quality Planning and Standards (OAQPS), Re: "Model Clearinghouse Review of AERMOD-COARE as an Alternative Model Application in an Arctic Marine Ice Free Environment," dated March 1, 2011. Region 10 reviewed the profiler data, the quality assurance audits, high-resolution radiosonde data, temperature and potential temperature profiles, and other calculated parameters associated with the COARE dataset and found them to be representative for use in this case.

5.4 Shell Operating Scenarios

Shell's supplemental analysis included new proposed permit conditions and equipment not included in the 2010 Permits to address the EAB Orders and other changes requested by Shell. Many of the changes relate to emission reductions made in connection with Shell's demonstration that the emissions from the Discoverer and the Associated Fleet will not cause or contribute to a violation of the new 1-hour NO_2 NAAQS. Although there will be some increases in emissions from certain emission units as compared to the 2010 Permits, overall emissions from the Discoverer and the Associated Fleet on an annual and hourly basis will be reduced by more than 50% for NO_X, PM_{10}, $PM_{2.5}$, CO, and VOC, with lesser but still substantial reductions of SO_2.

The proposed changes include an emergency engine that was upgraded since issuance of the 2010 Permits, seldom used emergency equipment on the Discoverer drillship and Associated Fleet that was not identified in the applications for the 2010 Permits, a reduction of the number of days the Discoverer can operate under the permits, new restrictions on the number of hours the MLC and HPU equipment can be used and overall drilling can occur, installation of post combustion controls for particulate matter (PM) and NO_X on Icebreaker #1, and a new operating mode for the Supply Ship.

In the case of the Supply Ship, as under the 2010 Permits, Shell is proposing that up to 8 resupply trips be made during the drilling season when the Discoverer is an OCS source. The new operating mode for the Supply Ship contemplates the Supply Ship operating in DP mode instead of tying up to the Discoverer, as was provided for in the 2010 Permits. During DP mode, the Supply Ship uses motive power to keep the vessel in position next to the Discoverer, where cranes are used to transfer loads between the Supply Ship and the Discoverer. This results in higher emissions than if the Supply Ship was to anchor or tie up to the Discoverer. Shell has modeled the emissions associated with the Supply Ship operating in the DP mode using the

highest emitting candidate Supply Ship with a fixed emission point near one of the Discoverer's two cranes. Shell has also modeled the transit emissions from the Supply Ship within two kilometers of the Discoverer occurring the hour before and after DP mode operations. This new DP scenario for the Supply Ship represents an increase in emissions from the 2010 Permits during that period of operation.[18]

As discussed above, however, the net effect of the changes in operation and permit conditions to address the EAB Orders or otherwise requested by Shell have substantially decreased the overall emissions from the Discoverer and the Associated Fleet for all NAAQS pollutants both on an annual basis and hourly basis when compared to the 2010 Permits. A summary of the annual emissions changes resulting from the new operating restrictions and other operational changes for the Beaufort and Chukchi, are summarized in Tables 1 and 2 in Section 1 above.

Note that there will be a slight increase (0.18 tons/year) in NH_3 emissions associated with the installation of SCR control equipment on Icebreaker #1. This does not change the prior analysis supporting the Beaufort 2010 Permit for the Alaska State Ambient Air Quality Standard for NH_3 that applies under the COA regulations when the source is operating in the OCS because the increase in emissions is so small. There will also be a slight increase in H_2SO_4 from Icebreaker #1, but the requirement to use only ultra low sulfur diesel (ULSD) fuel in both the Discoverer and Associated Fleet still ensures that the PTE for H_2SO_4 will remain well below the Significant Emission Rate or SER.

Because Shell is reducing the number of days the Discoverer can operate as an OCS source as compared to the 2010 Permits, Shell assumed the 120-day limit on OCS activity in its new modeling of NO_2, SO_2, $PM_{10,}$ and $PM_{2.5}$ impacts. To ensure the modeled results are not underestimated by the selection of when during the 5 month (153 day) period the 120-day period of operation would occur, Shell modeled two 120-day periods during the drilling season: an "early season" period (July 1 through October 28th); and a "late-season" (August 3 through November 30th). Shell then took the higher of the two impacts for comparison to the air quality standards.

Shell also incorporated the various levels of operation during a 30-day drilling sequence in its NO_2, SO_2, PM_{10}, and $PM_{2.5}$ analysis. Shell did this by creating an AERMOD input file for each day and hour of the 120-day period (2,880 files) for each pollutant. Shell then ran AERMOD for each file and post-processed the results.

For modeling CO and NH_3 impacts, Shell used the full 5 month (153-day) meteorological period of potential operation. Shell also assumed the worst-case emissions for each unit and assumed all units are operating concurrently. This is a conservative and, therefore, acceptable, approach.

[18] Note that the draft permits still allow the Supply Ship to tie up to the Discoverer for any of the 8 resupply trips and, as such, still require BACT for sources on the Supply Ship that perform stationary-source-related activities while tied to the Discoverer. This is unchanged from the 2010 Permits.

Shell prorated the period averages in order to estimate the annual average impacts. For example, to estimate the annual average NO_2, $PM_{2.5}$ or SO_2 impacts, Shell multiplied the 120-day average impact by 0.329 (120 drilling days out of 365 days in a year). Shell's approach for estimating the annual average impact is reasonable since there are no impacts during non-drilling periods.

5.5 Receptor Grid, Source Locations, and Source Parameters

Shell used a local Cartesian coordinate system to define its primary modeling domain and cover all its overwater drilling and support operations. The prior screening modeling analysis supporting the 2010 Permits assumed the ambient air boundary was at the hull of the Discoverer. In the modeling submitted by Shell to support the 2011 Revised Draft Permits, Shell has modeled impacts beginning at the boundary of a circle with a radius of 500 meters from the center of the Discoverer. See Section 3.2.

The receptor grid extends out to 5 kilometers to characterize the pattern and location of maximum 1-hour impacts from the Discoverer and Associated Fleet. Shell used a 25 meter (m) spacing at the assumed ambient air boundary. Shell constructed the rest of the grid with 100 meter spacing out to one kilometer from the center of the Discoverer and 250 meter spacing from 1 to 5 kilometers from the center of the Discoverer. Additional receptors were placed at the closest on-shore communities or at 50 kilometer from the Discoverer in the direction of a community. This is because 50 kilometers is the maximum distance where AERMOD is recommended for use. The communities with additional receptors include Kaktovik and Deadhorse in the Beaufort Sea and Point Lay and Wainwright in the Chukchi Sea. Because Nuiqsut is in the same direction as Deadhorse from the permitted lease blocks but Nuiqsut is further away, the modeled concentration results from Shell's activities at Deadhorse can also be considered as conservatively representative of modeled concentrations from Shell's activities at Nuiqsut. Region 10 has reviewed Shell's receptor grid and determined that it has sufficient density and coverage for characterizing the maximum impacts from Shell's drilling operations. In addition, Region 10 verified that receptors placed at onshore locations or at 50 kilometers in the direction of potentially affected onshore locations were correctly located.

Modeled locations for the Discoverer and Associated Fleet during drilling are specified on a local coordinate system within the model. This was done so modeled concentrations can be placed at various locations throughout the permitted lease blocks in the impact analysis without re-doing modeling runs. Because the Discoverer is a turret moored ship and rotates with the wind, the orientation of the Discoverer and location of the Associated Fleet varies with wind direction. In the modeling analysis this varying orientation and Associated Fleet location was accounted for by orienting the ship into the wind on an hourly basis, and by moving the Associated Fleet to also line up with the wind in their respective locations, either in front or behind the Discoverer. Varying the orientation of the drillship and moving the Associated Fleet with the prevailing wind direction will provide the most conservative impact analysis because all the emissions are aligned such that the highest cumulative impacts from all equipment will occur. This also best reflects how the actual drilling operations are performed.

Shell provided emissions rates for each piece of equipment for each operating scenario. Table 1 contains the worst case emission rates for each piece of equipment regardless of operating scenario. Note that not all equipment will operate at the same time and some equipment only operates for restricted periods of time. For example the ice management vessels will generally not be operating in open water conditions, and the cementing and logging activities will not occur during MLC drilling. A full list of emissions under various operating scenarios can be found in Tables 2-2, 2-3 and 2-4 in Shell's March 18, 2011 submittal.

Table 1. Maximum Daily Emissions Rates (lb/day)

	NOx (lb/day)	$PM_{2.5}$ (lb/day)	PM_{10} (lb/day)	CO (lb/day)	SO_2 (lb/day)
Discoverer					
Generation	111.4	28.3	28.3	39.9	1.5E+00
MLC	170.6	4.3	4.3	79.3	2.9E-01
HPU	79.0	0.6	0.6	13.8	1.3E-01
Cranes	59.5	0.4	0.4	1.3	3.9E-02
Cementing/Logging	157.3	3.9	3.9	8.8	6.8E-02
Heaters	76.5	9.0	9.0	29.5	6.1E-01
Seldom-used	12.6	0.9	0.9	2.7	4.5E-03
Emergency	39.5	2.8	2.8	8.5	1.4E-02
Incinerator	3.3	4.6	5.3	20.2	1.6E+00
Primary Ice Management					
Propulsion	1576.9	246.4	246.4	712.9	6.7E+00
Heaters	36.1	6.0	6.0	9.0	3.8E-01
Seldom-used	8.4	0.6	0.6	1.8	3.0E-03
Incinerator	9.2	16.8	24.6	554.4	4.6E+00
Secondary Ice Management / Anchor Handler					
Propulsion	1625.4	254.0	254.0	734.8	6.9E+00
Heaters	14.4	2.4	2.4	3.6	1.5E-01
Seldom-used	8.4	0.6	0.6	1.8	3.0E-03
Incinerator	9.2	16.8	24.6	554.4	4.6E+00
Resupply Ship - transit mode					
Propulsion	704.4	18.8	18.8	151.7	2.5E-01
Resupply Ship - DP mode					
Propulsion	2817.4	75.1	75.1	606.9	1.0E+00
Offshore Management / Skimmer vessel					
Propulsion	1192.6	21.4	21.4	316.8	5.9E-01
Seldom-used	8.4	0.6	0.6	1.8	3.0E-03
Incinerator	7.5	13.7	20.0	450.0	3.8E+00
OSR vessel					
Propulsion	1618.6	3.0	3.0	8.7	8.1E-01
Seldom-used	8.4	0.6	0.6	1.8	3.0E-03
Incinerator	7.5	13.7	20.0	450.0	3.8E+00
OSR work boats					
Work	317.7	22.3	22.3	68.4	1.2E-01

In addition to providing the model with an emission rate, the release characteristics must be provided in order for the model to estimate how the release disperses over time. Region 10

reviewed all release characteristics and found them to be representative of the proposed equipment.

5.6 Background Monitoring Data

In order to ensure the NAAQS are protected, modeled concentrations are combined with existing monitored background data and then evaluated against the air quality standards to ensure compliance. The monitored data should represent impacts from sources not specifically modeled, such as natural, area-wide, long-range transport, and distant stationary sources.

As discussed in the Statements of Basis supporting the 2010 Permits, because there are no islands, platforms, or infrastructure in the Beaufort or Chukchi Seas in the vicinity of Shell's offshore operations on which to install, operate, and maintain ambient air quality monitoring equipment, it is appropriate to use onshore preconstruction monitoring data as a conservative representation of background concentrations in the vicinity of Shell's operations. The onshore data is expected to be conservative because these onshore monitoring stations will be somewhat influenced by local sources that are not present in the vicinity of Shell's offshore operations.

The 2010 Permits were supported by background monitoring data collected at the Wainwright Near-Term site for the 2010 Chukchi Permit and, for the 2010 Beaufort Permit, at Badami and at a number of other monitoring stations in the Prudhoe Bay area. The Deadhorse monitoring site was predicted to have the highest $PM_{2.5}$ concentrations in the network and was therefore selected as the location for installation of collocated $PM_{2.5}$ monitors for the monitoring network, including the monitoring sites in Wainwright.

Several of the monitoring stations Shell relied on for issuance of the 2010 Permits have continued to collect background monitoring data. The Wainwright Permanent site became operational in late 2009 and replaced the Wainwright Near-Term site. In addition, a monitoring station has been established in the Village of Point Lay, located on the Chukchi Sea, and has been collecting data since June 2010. Region 10 has reviewed the quarterly reports, including instrument operating parameters, and analyzed the measured air pollutant data collected for the periods from March 6, 2009 to December 31, 2010 for the Wainwright, Point Lay, Badami, and Deadhorse monitoring stations and has concluded that the data were collected in accordance with the applicable Quality Assurance Project Plans (QAPP) for the monitors and met applicable quality control and quality assurance requirements. The ADEC has reviewed the quarterly reports, including instrument operating parameters, and analyzed the measured air pollutant data collected for the CCP, Pad A, and Endicott SDI monitoring stations and has concluded that the data was collected in accordance with the applicable QAPPs for the monitors and met applicable quality control and quality assurance requirements. Table 2 and Table 3 summarize the monitoring sites, pollutants, and years of record that Region 10 is relying upon for the air quality analyses for the 2011 Revised Draft Permits.

Table 2. Ambient Air Monitoring Sites, Pollutants, and Years of Record for Chukchi Sea Operations

	Wainwright Near-term	Wainwright Permanent	Point Lay
$PM_{2.5}$	3/6/09 - 12/7/09[a]	12/10/09 - current[b]	6/1/10 – current
PM_{10}	11/8/08 - 12/7/09[a]	10/7/09 - current[b]	6/1/10 – current
NO_2	11/8/08 - 12/7/09	9/14/09 - current	6/1/10 – current
O_3	11/8/08 - 12/7/09	9/14/09 - current	6/1/10 - current
SO_2	11/8/08 - 12/7/09	9/14/09 - current	6/1/10 - current
CO	11/8/08 - 12/7/09	9/14/09 - current	6/1/10 - current

[a.] Data include impacts from local fugitive dust events.
[b] Data include impacts from two wildfire events in 2010.

Table 3. Ambient Air Monitoring Sites, Pollutants, and Years of Record for Beaufort Sea Operations

	Badami	Deadhorse	A Pad[a]	CCP[b]	Endicott SDI[c]
$PM_{2.5}$	8/20/09 - 12/31/10	10/23/09 - current	NA	NA	NA
PM_{10}	NA	NA	NA	1/2/06 – 12/30/09	NA
NO_2	8/15/09 - 12/31/10	NA	1/1/06 – 12/31/09[d]	1/1/06 – 12/31/09	2/1/07 - 1/31/08
O_3	NA	NA	1/1/06 – 12/31/09	1/1/06 – 12/31/09	NA
SO_2	NA	NA	1/1/06 – 12/31/09	1/1/06 – 12/31/09	2/1/07 - 1/31/08
CO	NA	NA	NA	NA	2/1/07 - 1/31/08

NA – Monitoring for this pollutant not conducted
[a] The site labeled A Pad here was listed in the previous Statement of Basis for the Beaufort permit as BPXA Prudhoe Bay.
[b] The site labeled CCP here was listed in the previous Statement of Basis for the Beaufort permit as BPXA Prudhoe Bay.
[c] The site labeled Endicott SDI here was listed in the previous Statement of Basis for the Beaufort permit as BPXA Liberty.
[d] 2008 data did not meet PSD criteria as the 3rd quarter data did not meet the 80% completeness requirement.

Region 10 has evaluated the available monitoring data from these onshore sites and has determined which are most representative of background values for use in the air quality analyses for offshore locations near the Shell lease blocks in both seas as well as at onshore communities where the air quality impact of the Discover and Associated Fleet is being evaluated. Table 4 summarizes the monitoring sites and the background values that Region 10 believes best represent offshore locations in the Beaufort and Chukchi Seas.

Table 4. Background Values for Use with Modeled Impacts at Offshore Locations Near Shell Lease Blocks for the 2011 Revised Draft Permits

		Beaufort Sea		Chukchi Sea	
Pollutant	Averaging Period	Concentration ($\mu g/m^3$)	Data Source	Concentration ($\mu g/m^3$)	Data Source
NO_2	1-hour	varies by hour	Badami	varies by hour	Wainwright
	Annual	1	Badami	2	Wainwright
$PM_{2.5}$	24-hour	6	Badami	11	Wainwright[a]
	Annual	3	Badami	2	Wainwright[a]
PM_{10}	24-hour	53	CCP	79	Wainwright[a]
SO_2	1-hour	13	SDI	23	Wainwright
	3-hour	11	SDI	14	Wainwright
	24-hour	4	SDI	5	Wainwright
	Annual	2	SDI	0.4	Wainwright
CO	1-hour	1742	SDI	959	Wainwright
	8-hour	1094	SDI	945	Wainwright

[a.] Only uses 2010 data from the Wainwright Permanent Site

Region 10 believes that the two monitoring sites to the east of Prudhoe Bay (Badami and SDI) are the most representative of background concentrations at the Shell lease blocks covered by the 2011 Revised Draft Permit for Shell's operations in the Beaufort Sea. However, since the CCP site is the only monitoring site in the Beaufort Sea area that has collected PM_{10} data, it has been used as the PM_{10} value for the Beaufort offshore locations. Region 10 believes that the Wainwright monitoring sites are the most representative of background at the Chukchi Sea lease blocks because they (1) are closer to the Shell lease blocks than the Point Lay site, (2) have a more robust data set with 2 years of available data for most pollutants, and (3) they generally have lower values, which are more representative of the expected offshore concentrations.

Table 5 summarizes the monitoring sites and background values that Region 10 believes are appropriate for evaluating impacts in the identified onshore communities. The Point Lay and Wainwright monitoring sites along the Chukchi Sea have been used to determine background values in each of those villages. In the case of Nuiqsut and Kaktovik, because there are no quality assured monitoring data being collected in either of these villages, Region 10 has generally used data from the monitoring sites closest to each of those villages. Specifically, where available, Region 10 has used data from sites to the west of Prudhoe Bay for Nuiqsut and sites to the east of Prudhoe Bay for Kaktovik, with a preference for more recent data if more than one site has data for the same pollutant. As discussed above, the only monitoring site along the Beaufort Sea that has collected PM_{10} data was the CCP site and so it has been used for both Nuiqsut and Kaktovik. In addition, the only site that has collected CO data in the Beaufort Sea area was SDI so it also has been used for both Nuiqsut and Kaktovik. From the available data, Region 10 calculated background values following the provisions of the applicable appendices to 40 CFR Part 50 and EPA modeling guidance.

Table 5. Background Values for Use with Modeled Impacts at Onshore Locations

		Point Lay		Wainwright		Nuiqsut		Kaktovik	
Pollutant	Averaging Period	Concentration ($\mu g/m^3$)	Data Source	Concentration ($\mu g/m^3$)	Data Source	Concentration ($\mu g/m^3$)	Data Source	Concentration ($\mu g/m^3$)	Data Source
NO_2	1-hour	41	Point Lay	38	Wainwright	94	A Pad	21	Badami
	Annual	2	Wainwright	2	Wainwright	11	A Pad	1	Badami
$PM_{2.5}$	24-hour	7	Point Lay	13	Wainwright	17	Deadhorse	6	Badami
	Annual	2	Point Lay	2	Wainwright	4	Deadhorse	3	Badami
PM_{10}	24-hour	65	Point Lay	114	Wainwright	53	CCP	53	CCP
SO_2	1-hour	14	Point Lay	12	Wainwright	14	A Pad	10	SDI
	3-hour	14	Point Lay	14	Wainwright	180	A Pad	11	SDI
	24-hour	14	Point Lay	5	Wainwright	15	A Pad	4	SDI
	Annual	0.4	Wainwright	0.4	Wainwright	4	A Pad	2	SDI
CO	1-hour	1029	Point Lay	959	Wainwright	1742	SDI	1742	SDI
	8-hour	1029	Point Lay	945	Wainwright	1094	SDI	1094	SDI

Note that, the Wainwright Permanent site began operation in September 2009 and has now replaced the Wainwright Near-Term site, which ceased operation in December 2009. As discussed in the Statement of Basis for the 2010 Chukchi Permit, because the Wainwright Near-Term site was determined to be unduly impacted by local fugitive dust sources, days with high dust impacts were excluded from the determination of the offshore $PM_{2.5}$ and PM_{10} background values supporting issuance of the 2010 Chukchi Permit, although such days were still included for the onshore background values. See 2010 Chukchi Statement of Basis at 106-107. Now that there is one year of data for the Wainwright Permanent site that includes the drilling season, Region 10 believes it is appropriate to consider only the $PM_{2.5}$ and PM_{10} data from the Wainwright Permanent site for determining the appropriate offshore $PM_{2.5}$ and PM_{10} concentrations in the Chukchi Sea. Data from the Wainwright Near-Term site has still been considered for purposes of determining the appropriate onshore $PM_{2.5}$ and PM_{10} concentrations onshore in Wainwright and has also been considered for all other pollutants.

For the annual NO_2 and SO_2 standards, the background value is the highest calendar year average from the relevant monitoring site. For the 24-hour PM_{10}, 3-hour and 24-hour SO_2, and 1-hour and 8-hour CO standards, Region 10 is using the highest value for either of the possible 5-month drill seasons at the appropriate monitoring sites.

For the 24-hour $PM_{2.5}$ standard, Region 10 calculated the 98^{th} percentiles for each available 5-month drill season and averaged those values over the available drill seasons at each monitoring site. See Memorandum from Tyler Fox, OAQPS, re: "Model Clearinghouse Review of Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS," dated February 26, 2010. For the annual $PM_{2.5}$ standard, Region 10 calculated the annual average for each calendar year of data available for the four $PM_{2.5}$ monitoring sites and averaged them over available years.

Note that the Wainwright Permanent and Point Lay $PM_{2.5}$ sites were potentially impacted by wildfires on 6 days during the 2010 drilling season. Region 10 has not excluded any of those potentially impacted days from the determination of $PM_{2.5}$ background values and has included them in the 98^{th} percentile calculations, although it is possible they could be excluded from

consideration with appropriate documentation. Excluding these wildfire days from consideration would result in a background concentration of only 5 $\mu g/m^3$.

For the 1-hour SO_2 standard, Region 10 selected the highest 1-hour value from any available 5-month drilling season. Memorandum from Stephen Page, OAQPS re: "Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program," dated August 23, 2010; Memorandum from Tyler Fox, OAQPS, re: "Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard," dated August 23, 2010.

Region 10 has not calculated a single 1-hour NO_2 background value for the modeling of maximum offshore impacts. This is because, consistent with EPA guidance for modeling conducted in connection with the 1-hour NO_2 standard, Shell has used paired modeled and monitored concentrations based on hour-of-day in its modeling analysis for the 1-hour NO_2 NAAQS. See discussion in Section 5.7 below; Memorandum from Tyler Fox, OAQPS, re: "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard," dated March 1, 2011.

5.7 Modeling Results

5.7.1 New 1-Hour NO_2 NAAQS

As discussed above, since issuance of the 2010 Permits, a new 1-hour NO_2 NAAQS went into effect on April 12, 2010. The new 1-hour NO_2 NAAQS is attained when the 3-year average of the 98th-percentile point of the annual distribution of daily maximum 1-hour concentrations does not exceed 100 ppb (188 $\mu g/m^3$) at each monitor within an area. With the form of the new standard being probabilistic, a much stricter averaging period, and the more complex analysis procedures associated with the form of the new standard, EPA issued guidance to clarify the applicability of current guidance in 40 CFR Part 51, Appendix W with respect to procedures for demonstrating compliance with the new 1-hour NO_2 NAAQS. See Memorandum from Stephen Page, OAQPS, re: "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program," dated June 29, 2010; Memorandum from Tyler Fox, OAQPS, re: "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard," dated March 1, 2011.

As discussed above, Shell is proposing to use the AERMOD dispersion model using an AERMET-by-pass approach for the meteorological data and Plume Volume Molar Ratio Method (PVMRM) (Hanrahan 1999), which is considered a Tier 3 application under Section 5.2.4 of Appendix W. This PVMRM method is considered a non-regulatory-default option within AERMOD and requires approval by the Regional Office on a case-by-case basis, pursuant to Sections 3.1.2.c, 3.2.2.a, and A.1.a(2) of Appendix W. The AERMET-by-pass approach, in this case AERMOD-COARE, also requires Regional Office approval. Region 10, in consultation with OAQPS, approved the use of AERMOD-COARE on May 6, 2011. See Memorandum from George Bridgers, OAQPS, re: "Model Clearinghouse Review of AERMOD-COARE as an

Alternative Model Application in an Arctic Marine Ice Free Environment," dated March 1, 2011. Region 10 gave Shell conditional approval to use AERMOD-COARE in its air quality analysis for the 2011 Revised Draft Permits on May 8, 2011 pursuant to Section 3.2.2.a of Appendix W. See E-mail from Herman Wong, Region 10 Modeling Contact, to Andy Hawkins dated May 8, 201, re: Approval request for non-guideline modeling – Shell Disco and Kulluk dispersion modeling.

Region 10 is specifically requesting public comment on the use of AERMOD-COARE and PVMRM, including the models, their inputs, and all applicable associated documents for use in issuance of the 2011 Revised Draft Permits. Regional office review and approval of PVMRM and the underlying key modeling inputs for PVMRM are discussed in more detail in the Region 10 Technical Analysis.

The NO_X emissions created during combustion are partly nitric oxide (NO) and partly NO_2. After the combustion gas exits the stack, additional NO_2 can be created due to atmospheric reactions. The modeling of ambient NO_2 concentrations therefore requires ambient data or assumptions regarding the atmospheric conversion of NO to NO_2. Section 5.2.4 of the Appendix describes several approaches that may be considered in modeling annual average NO_2 impacts. These approaches are also generally applicable in modeling 1-hour NO_2 impacts. Memorandum from Stephen Page, OAQPS, re: "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program," dated June 29, 2010.

For NO_2/ NO_X in-stack ratios, Shell conducted 90 specific stack tests on equipment being used on the Discoverer and the Associated Fleet at different loads and control scenarios. One of the issues identified during the Region 10 review was varying NO_2/ NO_X in-stack ratios at different loads and for different control equipment. Because of the ranges of NO_2 ratios, Shell chose to use generic ratios for the equipment based on the type of controls on the equipment. In order to ensure the use of generic ratios would be protective of the NAAQS, Region 10 requested and Shell provided several AERMOD runs with varying ratios based on actual testing of the permitted equipment. Shell submitted additional modeling runs with alternative in-stack ratios on April 29, 2011. Region 10 also performed independent testing of these ratios to ensure the 1-hour NO_2 NAAQS was being protected should the ratios vary. It was determined that the ratios do make a difference in the modeled concentrations, but in all cases reviewed, the NAAQS were protected.

For the background NO_2 values, Shell used the Badami monitoring data for the Beaufort Sea, and Wainwright data for the Chukchi Sea. Shell initially used hour-by-hour pairing of modeled concentrations with background NO_2 data. Region 10 determined hour-by-hour pairing of monitored data may not be representative of the entire modeling domain or of background sources. Thus, Region 10 requested that Shell use a diurnal profile of monitoring data for the drilling season based on the 98^{th} percentile values by hour-of-day, to be combined with modeled concentrations by hour-of-day Shell's April 29, 2011 Submittal included the pairing of modeling results with the 98^{th} percentile diurnal profiles by hour-of-day based on the monitoring data in both the Beaufort and Chukchi Seas. This difference in pairing methodology did change overall cumulative modeled concentrations but in all cases the 1-hour NO_2 NAAQS are protected.

Results of the modeling indicate the maximum modeled 98th percentile total impacts (including background values) of 81.6 $\mu g/m^3$ in the Beaufort Sea and 174.0 $\mu g/m^3$ in the Chukchi Sea.[19] These 98th percentile impacts at the location of maximum modeled impact are below the NAAQS and, given the conservative modeling approach, demonstrate compliance. The large differences in modeling concentrations between the two seas are due to varying meteorological conditions coupled with varying emissions in the two locations. In the Chukchi Sea, the frequency of wind directions and dispersion conditions are such that the resulting concentrations (that is, the impacts from the Discoverer's operations in the Chukchi Sea) are higher than in the Beaufort. Also note that in the case of the Chukchi Sea modeling analysis, the higher impacts are seen occurring northwest of the proposed drilling activities, which is away from the North Slope communities of Point Lay and Wainwright. Figures 4 and 5 in the Region 10 Technical Analysis illustrate this phenomenon. Note that the maximum modeled impacts occur near Shell's assumed ambient air boundary, a typical finding for sources with short stacks and plumes subject to downwash. Modeled impacts generally decrease as the distance from this location of maximum modeled impact increases, and in general there is a rapid decrease in concentrations as the distance from the Discoverer increases in both locations. Also note, as discussed above, the Beaufort Sea Associated Fleet emissions were modeled for the Chukchi Sea and so these impacts are higher than they would be if the Chukchi Sea Associated Fleet emissions had been modeled.

Modeled impacts at communities along the Beaufort Sea also indicate that concentrations associated with emissions authorized under the 2011 Revised Draft Permit for the Beaufort Sea will be well below the 1-hour NO_2 NAAQS at all locations. At Kaktovik, the maximum modeled 98th percentile impact was 37.0 $\mu g/m^3$, while the maximum modeled impacts at Deadhorse and Nuiqsut were 98.9 $\mu g/m^3$ (represented by 50 kilometers in the direction of Deadhorse and Nuiqsut). It is important to note that these impacts include monitored background concentrations, which in all cases are a significant portion of the total impact.

Modeled impacts at communities along the Chukchi Sea also indicate that concentrations associated with emissions authorized under the 2011 Revised Draft Permits will be well below 1-hour NO_2 NAAQS at all locations. At Point Lay the maximum modeled 98th percentile impact was 52.8 $\mu g/m^3$ while at Wainwright the maximum 98th percentile modeled impact was 42.9 $\mu g/m^3$. Both of these estimated impacts are based on modeled concentrations at 50 kilometers in the direction of the communities because AERMOD is used to predict impacts at distances of 50 kilometers or less. Actual impacts will be lower than those reported above as the communities are further away than 50 kilometers and additional dispersion will further lower concentrations. Again, these estimates include background concentrations, which are a significant portion of the total impact. Table 6 below provides the maximum modeled concentrations for the 1-hour NO_2 standard at the modeled location of maximum impact and in the on shore communities.

[19] Note that these maximums are derived from several modeling scenarios that Region 10 requested Shell perform based on varying in-stack NO_2/ NO_X ratios. Values are taken from Shell's May 19, 2011 submittal.

5.7.2 New 1-Hour SO_2 NAAQS

A new 1-hour SO_2 NAAQS came into effect on August 23, 2011. That standard is attained when the 3-year average of the 99th-percentile point of the annual distribution of daily maximum 1-hour concentration does not exceed 75 ppb (196 $\mu g/m^3$). See 75 Fed. Reg. 35520-35603 (June 22, 2010). Because Shell is proposing to use ultra low sulfur diesel (ULSD), 1-hour SO_2 impacts are minimal when compared with the NAAQS. Shell used a very conservative approach to demonstrate compliance with the 1-hour SO_2 NAAQS. This conservative approach assumed a single wind direction for the entire drilling season, all equipment operating concurrently, plume heights and vertical dispersion coefficients for Associated Fleet sources were fixed to worst case predictions for the entire period, and the highest 1-hour SO_2 concentrations were used for background values.

Even with the conservative assumptions used, the modeled impacts were minimal. In the Beaufort Sea, the worst case modeled SO_2 impact at the 500 meter assumed ambient air boundary for the Discoverer was 35.0 $\mu g/m^3$, while the impacts at Kaktovik were 12.9 $\mu g/m^3$ and at Nuiqsut 15.4 $\mu g/m^3$. For the Chukchi Sea, the worst case modeled impacts at the assumed 500 meter boundary were 40.3 $\mu g/m^3$, while at Point Lay and Wainwright (modeled at 50 kilometers in the direction of these locations) the impact was 16.2 $\mu g/m^3$ and 14.2 $\mu g/m^3$ respectively. Again, the modeled impacts include the worst case monitored background concentration for the areas. In both the Beaufort and Chukchi Seas the background value is a significant portion of the modeled concentrations for all areas. Table 7 below shows the modeled concentrations for the 1-hour SO_2 standard at the modeled location of maximum impact and in the on shore communities.

In summary, for the 1-hour SO_2 NAAQS, Shell used a very conservative approach to model the impacts of its drilling operations. The conservative analysis indicates the SO_2 NAAQS is protected in both the Beaufort and Chukchi Seas at all locations at or beyond the assumed ambient air boundary and at all locations on shore.

Table 6. 1-hour NO_2 Modeled Impacts at Various Locations

Location	Distance from Drilling Location (km)	Shell Only Impact[2] ($\mu g/m^3$)	Background Concentration[3] ($\mu g/m^3$)	Total Impacts (including background) ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	% of NAAQS
Beaufort Sea						
Maximum Modeled Impact	0.5	72.3	9.3	81.6	188	43%
Kaktovik	14	16	21.0	37.0	188	20%
Deadhorse (84 km from nearest lease block)[1]	50	4.9	94.0	98.9	188	53%
Nuiqsut (182 km from nearest lease block)[1]	50	4.9	94.0	98.9	188	53%
Chukchi Sea						
Maximum Modeled Impact	2	160.8	13.2	174.0	188	93%
Point Lay (99 km from nearest lease block)[1]	50	11.8	41.0	52.8	188	28%
Wainwright (105 km from nearest lease block)[1]	50	4.9	38.0	42.9	188	23%

[1] Modeling concentrations 50 km away in the direction of village (50 km recommended AERMOD distance limit)

[2] NO_2 concentrations are highest impact from Table 5 or Table 6 in ALTERNATE APPROACHES TO EVALUATING 1-HOUR NO_2 IMPACTS FOR THE SHELL DISCOVERER DRILLSHIP – NO_2 PAIRING AND NO_2/NOX RATIOS

[3] Background Concentrations at villages from June 23 memo from Chris Hall titled "EPA's Determination of Appropriate Background Values for the Chukchi Sea and Beaufort Sea OCS Permits"

Table 7. 1-hour SO_2 Modeled Impacts at Various Locations

Location	Distance from Drilling Location (km)	Shell Only Impact[2] ($\mu g/m^3$)	Background Concentration[3] ($\mu g/m^3$)	Total Impacts (including background) ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	% of NAAQS
Beaufort Sea						
Maximum Modeled Impact	0.5	22	13.0	35.0	196	18%
Kaktovik	14	2.9	10.0	12.9	196	7%
Deadhorse (84 km from nearest lease block)[1]	50	1.4	14.0	15.4	196	8%
Nuiqsut (182 km from nearest lease block)[1]	50	1.4	14.0	15.4	196	8%
Chukchi Sea						
Maximum Modeled Impact	2	17.3	23.0	40.3	196	21%
Point Lay (99 km from nearest lease block)[1]	50	2.2	14.0	16.2	196	8%
Wainwright (105 km from nearest lease block)[1]	50	2.2	12.0	14.2	196	7%

[1] Modeling concentrations 50 km away in the direction of village (50 km recommended AERMOD distance limit)

[2] SO_2 concentrations are from Tables 3-9 and 3-10 in Discoverer Drillship Impact Evaluation for SO_2 and NO_2 Using AERMOD Chukchi and Beaufort Seas, Shell Alaska Exploratory Drilling Program

[3] Background Concentrations at villages from June 23 memo from Chris Hall titled "EPA's Determination of Appropriate Background Values for the Chukchi Sea and Beaufort Sea OCS Permits"

5.7.3 Secondary $PM_{2.5}$

$PM_{2.5}$ is either directly emitted from a source (primary emissions) or formed through chemical reactions among pollutants emitted by the source or already in the atmosphere (secondary formation). EPA promulgated AERMOD as an acceptable model for performing near-field analyses of primary pollutants (Appendix A to Appendix W of 40 CFR 51—Summaries of Preferred Air Quality Models, Part A–1). EPA has not developed and recommended, however, a near-field model that includes the necessary chemistry algorithms to estimate secondary impacts in an ambient air analysis.

To address this issue, EPA issued modeling guidance in 2010 to give further direction on how to conduct an ambient impact analyses for $PM_{2.5}$. See Memorandum from Tyler Fox, OAQPS, re: Model Clearinghouse Review of Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS, dated February 26, 2010; Memorandum from Steve D. Page, OAQPS, re: Additional Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS, dated March 23, 2010. This guidance provides that, with appropriate selection of representative background monitoring data, much of the $PM_{2.5}$ secondary formation from background sources should be adequately accounted for in most cases, but that in the case of a source that emits significant quantities of $PM_{2.5}$ precursor emissions, some assessment of their potential contribution to cumulative impacts as secondary $PM_{2.5}$ may be necessary. This assessment could include using other models for the secondary component, such as a photochemical model.

For these permits, Region 10 is using $PM_{2.5}$ ambient monitoring data from onshore locations (Badami and Wainwright, the closest monitoring locations to the permitted lease blocks in the two seas) that include the impacts of secondary $PM_{2.5}$ from existing onshore sources. These onshore monitors are expected to have accounted for much of the secondary formation that will occur in the two regions (i.e. the monitors are exposed to secondary formation from existing regional emissions sources). For each permit, Region 10 took the resulting 24-hour monitored background values and added the two-year average of the maximum 24-hour modeled concentration resulting from the emissions from the permitted sources (unpaired in time) to determine the total 24-hour $PM_{2.5}$ impact. This approach is consistent with the "First Tier" approach described in the March 23, 2010 $PM_{2.5}$ Guidance Memo and is considered conservative.

Results of this approach indicate a maximum 24-hour $PM_{2.5}$ concentration in the Beaufort of 18.2 $\mu g/m^3$ and 23.4 $\mu g/m^3$ in the Chukchi at the assumed ambient air boundary (500 meters from the Discoverer) and lower levels as the distance from the Discoverer increases. In other words, the modeling indicates that primary $PM_{2.5}$ impacts at the expected locations of maximum impact, including background (which is expected to include secondary $PM_{2.5}$ impacts from existing sources), are less than 67% of the $PM_{2.5}$ NAAQS of 35 $\mu g/m^3$. Based on these results, the contribution from secondary $PM_{2.5}$ emissions from the Discoverer and Associated Fleet could be as high as 11.6 $\mu g/m^3$ at the locations of maximum impact before the NAAQS would be threatened.

It is important to note that secondary formation of $PM_{2.5}$ will generally be low near the emission release point (here, the Discoverer), where modeled concentrations are highest, because there has not been enough time for the secondary chemical reactions to occur. Instead, secondary $PM_{2.5}$

impacts will generally occur farther from the emission source. It is therefore unlikely that maximum primary $PM_{2.5}$ impacts and maximum secondary $PM_{2.5}$ impacts from the Discoverer and the Associated Fleet will occur at the same time (paired in time) or location (paired in space), providing further assurance that emissions from secondary formation of $PM_{2.5}$ will not threaten- compliance with the NAAQS. The fact that the $PM_{2.5}$ modeling assumed that the Discoverer would be operating in a single drilling location for 3 years, when that scenario is unlikely to occur, further supports the conclusion that emissions to be authorized under the permits will not cause or contribute to a violation of the NAAQS based on the contribution of $PM_{2.5}$ precursor emissions.

Moreover, secondary $PM_{2.5}$ formation is a complex photochemical reaction that requires a mix of precursor atmospheric pollutants in sufficient quantities for significant secondary formation to occur. Available $PM_{2.5}$ monitoring data from the onshore communities along the Beaufort and Chukchi Seas, and in potential transport areas where monitoring is performed, show low levels of $PM_{2.5}$, generally in the range of 2 ug/m^3. The higher $PM_{2.5}$ values recorded on monitors in the North Slope generally occur on days where windblown dust or fires are believed to be contributing factors. Thus, there is no indication that secondary formation of $PM_{2.5}$ from existing sources in the North Slope is currently causing or contributing to a violation of the $PM_{2.5}$ NAAQS in the onshore communities.

Emissions of the $PM_{2.5}$ precursor SO_2 from the Discoverer and the Associated Fleet are less than 2 tpy, less than the $PM_{2.5}$ Significant Emission Rate (SER) for that precursor. See 40 CFR§§ 52.21(b)(23)(i). Emissions of the $PM_{2.5}$ precursor NO_X from the Discoverer and the Associated Fleet are considerably higher, at 336 tpy.[20] As a point of comparison, however, actual emissions of NO_X from point sources in the North Slope oil and gas fields near Deadhorse are approximately 65,000 tpy, yet the total (not just the secondary) $PM_{2.5}$ concentrations in Deadhorse are quite low. Given the amount of NO_X emissions to be authorized under these permits in comparison to NO_X emissions in the North Slope area in general, it is unlikely that NO_X emissions from the Discoverer and the Associated Fleet would be expected to cause or contribute to a violation of the $PM_{2.5}$ NAAQS given the generally low levels of $PM_{2.5}$ recorded at monitoring stations in the area.

In summary, the updated modeling uses background $PM_{2.5}$ monitoring results that are expected to include secondary $PM_{2.5}$ formed from precursor emission from other existing sources, and $PM_{2.5}$ monitoring data throughout the North Slope is generally low except on days where windblown dust or fires are a contributing factor. The refined $PM_{2.5}$ modeling submitted by Shell indicates that a significant margin of safety exists before the $PM_{2.5}$ NAAQS would be threatened and there is conservatism built into the current modeling assumptions due to the fact that maximum primary and secondary $PM_{2.5}$ impacts are unlikely to occur at the same location or at the same time and the fact that the Discoverer is unlikely to remain at the same location for 3 years. Based

[20] Region 10 has not made a determination of whether $PM_{2.5}$ precursor emissions from the project are significant, but has instead accounted for the possibility of the formation of secondary $PM_{2.5}$ through this non-modeling assessment as provided in the March 23, 2010 $PM_{2.5}$ Guidance Memo. Note that EPA's final regulations for the "Implementation of the New Source Review (NSR) Program for Particulate Matter Less than 2.5 Micrometers ($PM_{2.5}$)" (73 FR 28321, May 16, 2008), indicate that VOC and NH_3 emissions are presumed not to contribute to secondary formation of $PM_{2.5}$.

on this assessment, Region 10 believes that the $PM_{2.5}$ NAAQS will be protected when accounting for secondary precursors from the Discoverer and the Associated Fleet and that it is not appropriate or necessary to use a photochemical model to further evaluate secondary $PM_{2.5}$ formation in this permitting action.

Additionally, the 2011 Revised Draft Permits continue to include a post-construction requirement to install and operate a Federal Reference Method (FRM) sampler in addition to a Federal Equivalent Method (FEM) continuous sampler. An FRM is a manual sampler that pulls air through a filter for 24 hours (midnight to midnight). The filter is then weighed in a lab and a $PM_{2.5}$ concentration is calculated based on the mass increase of the filter and the volume of air drawn through it. Use of a manual sampler will allow the filter to be analyzed for the chemical speciation of $PM_{2.5}$ constituents such as sulfates, nitrates, organics, sea salt and metals. With this information, Region 10, Shell and the public will be better able to evaluate the significance of secondary formation of $PM_{2.5}$ in the North Slope region.

5.7.4 Other Pollutants and Averaging Periods

Because Shell modified certain operations from the 2010 Permits to address the 1-hour NO_2 NAAQS and requested to make other operational changes, an additional analysis of other averaging periods was warranted. As discussed above, many of the additional operational limits and restrictions have lowered emissions from the 2010 Permits, especially on an annual basis. The one large difference (increase in emissions) from the 2010 Permits is Shell's request to have the option of using the dynamically positioned (DP) mode for the Supply Ship, where motive power is required to keep the Supply Ship in position next to the Discoverer, in addition to the previously permitted option of attaching the Supply Ship to the Discoverer during resupply activities.

To address the Supply Ship emissions, Region 10 requested that Shell provide an additional demonstration that these new Supply Ship emissions in the DP mode, in conjunction with the existing emissions sources, would not violate any NAAQS or exceed any applicable increment. On May 19, 2011, Shell submitted an AERMOD analysis that included the remaining pollutants and averaging periods (annual NO_2, 24-hour an annual $PM_{2.5}$, 24-hour PM_{10}, 3-hour, 24-hour, and annual SO_2, and CO). The analysis followed similar procedures for source characterizations, ambient air boundary, and other assumptions as was applied in the 1-hour analysis for NO_2 and SO_2 as described above.

Region 10 has reviewed this additional analysis and finds that it satisfies the modeling requirements of Appendix W and the demonstration shows no NAAQS will be violated with the additional operational scenario. Region 10 believes this analysis is much more representative of potential impacts from Shell's operations than the prior screening analysis using SCREEN3 that was relied on in the 2010 Permits, because representative meteorological data and realistic emissions scenarios are now being used. Tables 11and 12 provide a summary of the modeled impacts for all the various pollutants and averaging times in the Beaufort and Chukchi Seas, respectively. Also note that, due to the overall reductions from Shell's operations as compared to the 2010 Permits, the additional modeling conducted by Shell also demonstrates that increments will not be exceeded.

With respect to ozone, as discussed in the Statements of Basis for the 2010 Permits, ozone is inherently a regional pollutant. Given the low level of ozone precursor emissions from Shell's exploration operations in comparison to regional emissions of ozone precursors, the fact that there are no other stationary sources in the more immediate regional vicinity of Shell's operations in the Chukchi Sea that contribute ozone precursors to the airshed, and the levels of the maximum 1-hour and 8-hour ozone levels measured on the North Slope, Region 10 concluded that the contribution of the ozone precursor emissions from Shell's exploration operations to the formation of ozone in the region was expected to be small and that emissions from Shell's exploration operations would not cause or contribute to a violation of the NAAQS for ozone. Region 10 reviewed the updated and more recent emissions and background monitoring data for ozone, and believes no further evaluation is needed for the ozone standard. The 2009 and 2010 ozone data for Wainwright and Point Lay show that the 1-hour and 8-hour levels are less than 34% and 54% of the NAAQS, respectively. The past monitoring data in the Prudhoe Bay area (CCP and A Pad) showed 1-hour and 8-hour ozone levels that were both less than 50% of the respective NAAQS. In addition, ozone precursor emissions (NO_X and VOC) have decreased substantially in comparison to those permitted under the 2010 Permits.

Table 8. Maximum Modeled Impacts in the Beaufort Sea

Air Pollutant	Averaging Period	Shell Only Impacts[1] (without background)	Background Concentration[2] (µg/m3)	Total Impact Including Background (µg/m^3)	NAAQS (µg/m^3)	Total impact as a % of NAAQS	PSD Class II Increment (µg/m^3)
NO_2	1-hour	72.3	9.3	81.6	188	43%	NA
	Annual	2.9	1.0	3.9	100	4%	25
$PM_{2.5}$	24-hour	12.2	6.0	18.2	35	52%	NA
	Annual	0.5	3.0	3.5	15	23%	NA
PM_{10}	24-hour	10.7	53.0	63.7	150	42%	30
SO_2	1-hour	22	13.0	35.0	196	18%	NA
	3-hour	13.4	11.0	24.4	1300	2%	512
	24-hour	5.9	4.0	9.9	365	3%	91
	Annual	1.2	2.0	3.2	80	4%	20
CO	1-hour	493.9	1742.0	2235.9	40000	6%	NA
	8-hour	352.8	1094.0	1446.8	10000	14%	NA

[1] Modeled Impacts from Tables 3 and 4 in Shell Technical Memorandum "AERMOD AIR QUALITY IMPACT ANALYSIS OF NO_2, SO_2, $PM_{2.5}$,PM_{10}, CO, AND NH_3 – DISCOVERER DRILLSHIP." May 19,2011

[2] Background concentrations from June 17 memo from Chris Hall titled "EPA's Determination of Appropriate Background Values for the Chukchi Sea and Beaufort Sea OCS Permits"

Table 9. Maximum Modeled Impacts in the Chukchi Sea

Air Pollutant	Averaging Period	Shell Only Impacts[1] (without background)	Background Concentration[2] (µg/m3)	Total Impact Including Background (µg/m^3)	NAAQS (µg/m^3)	Total impact as a % of NAAQS	PSD Class II Increment (µg/m^3)
NO_2	1-hour	160.8	13.2	174.0	188	93%	NA
	Annual	3.3	2.0	5.3	100	5%	25
$PM_{2.5}$	24-hour	12.4	11.0	23.4	35	67%	NA
	Annual	0.4	2.0	2.4	15	16%	NA
PM_{10}	24-hour	11.5	79.0	90.5	150	60%	30
SO_2	1-hour	17.3	23.0	40.3	196	21%	NA
	3-hour	13.6	14.0	27.6	1300	2%	512
	24-hour	8.1	5.0	13.1	365	4%	91
	Annual	1.4	0.4	1.8	80	2%	20
CO	1-hour	561.9	959.0	1520.9	40000	4%	NA
	8-hour	328.7	945.0	1273.7	10000	13%	NA

[1] Modeled Impacts from Tables 3 and 4 in Shell Technical Memorandum "AERMOD AIR QUALITY IMPACT ANALYSIS OF NO_2, SO_2, $PM_{2.5}$,PM_{10}, CO, AND NH_3 – DISCOVERER DRILLSHIP." May 19,2011

[2] Background concentrations from June 17 memo from Chris Hall titled "EPA's Determination of Appropriate Background Values for the Chukchi Sea and Beaufort Sea OCS Permits"

5.7.5 Offsite Impacts

The impact from neighboring (off-site) sources must be accounted for in a cumulative impact assessment. As provided in Section 8.2.3 of Appendix W, "all sources expected to cause a significant concentration gradient in the vicinity of the [applicant's source] should be explicitly modeled." The impact from other sources can be accounted for through ambient monitoring data.

A common long-term practice for selecting the "nearby" sources for explicit modeling was to follow a very prescriptive procedure in EPA's draft New Source Review Workshop Manual (Manual) (USEPA 1990). Under this approach, an off-site source located within the applicant's "significant impact area" (SIA) would need to be explicitly modeled. Sources located beyond the applicant's SIA, but with impacts inside of the SIA, would also be candidates for modeling. EPA recently clarified that "following such procedures in a literal and uncritical manner may in many cases result in cumulative impact assessments that are overly conservative." March 2011 NO_2 Modeling Guidance. Appendix W is consistent with the March 2011 NO_2 Modeling Guidance, stating that professional judgment is required for ascertaining which sources should be explicitly modeled and which sources can be represented through ambient monitoring data.

The BP Badami facility is the only regional source located within 50 kilometers of the Shell permitted lease blocks in either the Beaufort or Chukchi Seas. The BP Badami facility is located 37 kilometers from the nearest lease blocks on which Shell would be allowed to operate under

these permits in the Beaufort Sea. NO_2 and PM_{10} were the only pollutants for which the SIA extended to this distance. Because the distance to the BP Badami facility from Shell's exploratory operations is so great, it is not expected that emissions from the BP Badami facility would cause a significant concentration gradient in the vicinity of Shell's lease blocks. In addition, for NO_2, Badami monitoring data are being used as background monitoring data in the modeling analysis and should therefore reflect the impacts of this source. For PM_{10}, the CCP monitoring data were used. Prudhoe Bay has significantly more PM_{10} sources than any other area within 50km of the permitted lease blocks and this monitor should therefore represent a background value higher than any current neighboring source would cause. Based on this analysis, Region 10 has determined the one distant BP Badami facility is adequately represented in the ambient monitoring data for NO_2 and PM_{10}, would not cause a significant concentration gradient, and does not need to be explicitly included in the modeling runs.

5.8 Conclusion

Region 10 has reviewed and determined that the air quality monitoring data, meteorological measurements, model input and output files, and other related information submitted by Shell satisfy the requirements in Appendix W to make an adequate demonstration of compliance with the NAAQS and applicable increments. The AERMOD and AERMOD-COARE modeling predicted concentrations with conservatively representative background concentrations do not show a violation of any NAAQS. The revised analysis also demonstrates that the proposed Discoverer drilling program complies with the Alaska Ambient Air Quality Standards (AAAQS) and PSD increments.

In the Chukchi Sea, modeled 1-hour NO_2 impacts at the location of maximum modeled impact are very close to the applicable NAAQS. These impacts are partially due to the conservative assumptions used by Shell in its modeling analysis. For example, the movement of the drilling ship will decrease short-term impacts of all pollutants, especially in the near field where high modeled concentrations occur, if averaging were performed over multiple years. The combination of only one or two years of meteorological data for some pollutants and the assumption of a fixed drilling location for the entire 120 day operating period produces a conservative analysis (i.e., the predicted modeled impacts are larger than what would likely be realized with a ship operating at several locations with averaging over a longer period of time).

Finally, modeled impacts generally decrease as the distance from the 500 meter ambient air boundary increases, and in general there is a rapid decrease in concentrations as the distance from the Discoverer increases. Modeled impacts at all on-shore locations in both seas are well below the NAAQS.

6 OTHER REQUIREMENTS

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

As explained in the Statements of Basis for the 2010 Permits, Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies, in consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and/or the U.S. Fish and Wildlife Service (U.S. FWS) (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 C.F.R §§ 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 C.F.R § 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 C.F.R § 402.07.

The BOEMRE, formerly Minerals Management Service (MMS), is the lead agency for ESA Section 7 compliance for Shell's oil exploration activities in the Arctic and has consulted with the Services regarding Shell's activities in the Beaufort Sea and Chukchi Sea. In fulfilling our ESA obligations for this permitting action, Region 10 reviewed the ESA consultation documents prepared by MMS and the biological opinions (BOs) issued by the Services upon conclusion of their inter-agency ESA consultations regarding impacts from exploratory drilling on threatened and endangered (T&E) species and designated critical habitats for listed species. The following list summarizes the primary documents we reviewed.

- U.S. FWS March 27, 2007, Biological Opinion for Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Associated Seismic Surveys and Exploratory Drilling.
- Programmatic Biological Opinion for Polar Bears on Chukchi Sea Incidental Take Regulations, Fairbanks Fish and Wildlife Field Office, June 3, 2008.
- National Marine Fisheries Service's (NMFS) revised Biological Opinion for Federal oil and gas leasing and exploration by the Minerals Management Service (MMS) within the Alaskan Beaufort and Chukchi Seas, July 17, 2008.
- Incidental Take Regulations (ITR) for oil and gas exploration activities in the Chukchi Sea. 73 Fed. Reg. 33212 (June 11, 2008).
- Biological Opinion for Beaufort and Chukchi Sea Program Area Lease Sales and Associated Seismic Surveys and Exploratory Drilling on September 3, 2009.
- Incidental Take Regulations for oil and gas exploration activities in the Beaufort Sea. 71 FR 43925 (August 2, 2006).
- Proposed Incidental Take Regulations for oil and gas exploration activities in the Beaufort Sea. 76 FR 13454 (March 11, 2011).

Since the prior consultations and BOs address the same type of regulatory drilling activities authorized by the air permits that Region 10 is issuing to Shell, Region 10 relied in part on those conclusions. Region 10 also gathered additional information regarding potential impacts of emissions of air pollutants on the threatened and endangered species in the Chukchi Sea Lease Sale 193 Area and the leases in Camden Bay. Prior to issuing the 2010 Permits, based upon the best available data, Region 10 determined that the issuance of these CAA permits to Shell 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. As explained in greater detail in the Statements of Basis for the 2010 Permits, FWS and NOAA concurred in writing with our determination.

Region 10 understands that BOEMRE is in continued consultation with the Services regarding Shell's Revised OCS Exploration Plan for Camden Bay[21] and the Revised Exploration Plan for the Chukchi Sea.[22] The Services may update or revise the Biological Opinions as appropriate to reflect additional or revised information regarding the company's exploratory operations information.

In fulfilling Region 10's ESA obligations for this permitting action, we intend to rely on these consultations while also conducting additional compliance activities, if any, necessary to address any Region 10-permitted activities not covered in these consultations. Region 10 has begun discussions with the Services regarding our current permitting action and potential impacts on protected species. Any final air permits that we may issue in this action will, as appropriate, include additional conditions that may be identified during the ESA process.

As in the 2010 Permits, these proposed OCS/PSD permits include a statement that the permit does not relieve Shell of the responsibility to comply fully with any other requirements under federal law. Therefore, these permits do not relieve Shell of its obligation to obtain an annual Letter of Authorization (LOA) and incidental harassment authorization, as appropriate, from the Services in accordance with the ITR and section 101 (a)(5) of the Marine Mammal Protection Act (MMPA).

6.1.1 Essential Fish Habitat Requirements of Magnuson-Stevens Act

As explained in the Statements of Basis for the 2010 Permits, Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NOAA National Marine Fisheries Service (NMFS) with respect to any action authorized, funded, or undertaken by the agency that may adversely affect any essential fish habitat (EFH) identified under the MSA. 16 U.S.C. § 1855(b)(2).

[21] **2012 Outer Continental Shelf Lease Camden Bay Exploration Plan, and associated Oil Discharge Prevention and Contingency Plan (ODPCP)**, May 4, 2011.

[22] **Revised Outer Continental Shelf Lease Exploration Plan and associated** Oil Discharge Prevention and Contingency Plan **(ODPCP)**, Chukchi Sea, Alaska, May 12, 2011.

BOEMRE is the lead federal agency for authorizing oil and gas exploration activities on the Alaska OCS, including the Chukchi and the Beaufort Seas. In accordance with the MSA, BOEMRE consults on essential fish habitat at the oil and gas lease sale stage and consulted with NMFS in connection with its Arctic Multiple-Sale Draft Environmental Impact Statement. The BOEMRE and NMFS also consulted regarding the associated effects of oil and gas exploration activities on EFH in the Beaufort and Chukchi Seas. Since 2009, three species have been designated - saffron cod, Arctic cod, and Opillio crab. The BOEMRE and NMFS continue to consult regarding the associated effects of oil and gas exploration on EFH in the Beaufort and Chukchi Seas on a project-by-project basis.

As in the 2010 Permits, in fulfilling our MSA obligations for this permitting action, we intend to rely on the consultations between BOEMRE and NMFS while also conducting additional compliance activities, if any, necessary to address any Region 10-permitted activities that may adversely affect any EFH identified under the MSA. Any final air permits that Region 10 may issue in this action will, as appropriate, include additional conditions that may be identified during the MSA process.

6.2 National Historic Preservation Act

See Section 6.2 of Statements of Basis for the 2010 Permits.

6.3 Coastal Zone Management

See Section 6.3 of the Statements of Basis for the 2010 Permits.

6.4 Executive Order 12898 – Environmental Justice

In the environmental justice analysis supporting issuance of the 2010 Permits, Region 10 determined that issuance of the 2010 Permits would not have a disproportionately high or adverse human health or environmental effects on minority or low-income populations. Region 10 based this decision on the fact that the 2010 Permits would not interfere with attainment or maintenance of the NAAQS that were in effect at the time of issuance of the 2010 Permits and the fact that the NAAQS are health based standards set at levels designed to protect public health, including sensitive individuals, with an adequate margin of safety. As discussed above, the Board remanded the 2010 Permits to Region 10 based in part on the Board's finding that Region 10's analysis of environmental justice issues relating to the 2010 Permits was deficient with respect to consideration of the new 1-hour NO_2 NAAQS that had been promulgated, but was not yet effective, at time of issuance of the 2010 Permits.

Region 10 has prepared a Supplemental Environmental Justice Analysis to supplement the analysis conducted to support the 2010 Permits. A copy of the supplemental analysis is in the record for this action and is summarized here. Region 10's Supplemental Environmental Justice Analysis focuses particularly on the available information regarding the impact of the 2011 Revised Draft Permits on NO_2 levels in the area with respect to the new1-hour NO_2 standard, as well as available information with respect to the new 1-hour SO_2 standard that has been

promulgated and gone into effect since issuance of the 2010 Permits. It also considers ambient air quality data that have been collected since issuance of the 2010 Permits and the impact of secondary $PM_{2.5}$ emissions on compliance with the NAAQS. It is important to note that the extent of an Environmental Justice Analysis will vary according to the unique circumstances of each case. The scope of the analysis conducted in this case was shaped by the fact that Region 10's previous Environmental Justice Analysis was the subject of a remand by the Board, the communities' unique use of a broad geographic area for subsistence activities, and the other unique characteristics of the potentially affected communities.

As discussed in more detail below, based on available information, Region 10 concludes that the activities proposed to be authorized under the permits will not have disproportionately high and adverse human health or environmental effects with respect to these air pollutants on minority or low-income populations residing in the North Slope, including coastal communities closest to the proposed operations. In reaching this conclusion, Region 10 considered the impact on communities while engaging in subsistence activities in areas where such activities are regularly conducted.

6.4.1 Environmental Justice in PSD Permitting

Executive Order 12898 entitled "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations" states in relevant part that "each Federal agency shall make achieving Environmental Justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Section 1-101 of Exec. Order 12898, 59 Fed. Reg. 7629, (Feb. 16, 1994). "Federal agencies are required to implement this order consistent with, and to the extent permitted by, existing law." Id. at 7632. Based on this Executive Order, the EAB has held that environmental justice issues must be considered in connection with the issuance of federal PSD permits issued by EPA Regional Offices. See, e.g., In re Prairie State Generating Company, 13 E.A.D. 1, 123 (EAB 2006). The EAB reinforced the importance of completing an adequate environmental justice analysis in its recent opinion remanding the 2010 Permits to Region 10. See Remand Order I Slip Op. 63-81. As the EAB recently observed, for purposes of the Executive Order on Environmental Justice, "compliance with the NAAQS is emblematic of achieving a level of public health protection that, based on the level of protection afforded by the NAAQS, demonstrates that minority or low-income populations will not experience disproportionately high and adverse human health or environmental effects due to exposure to relevant criteria pollutants." Remand Order I Slip Op. 73. This is because the NAAQS are health-based standards, designed to protect public health with an adequate margin of safety, including sensitive populations such as children, the elderly, and asthmatics and is supported by the fact that "[t]he Agency sets the NAAQS using technical and scientific expertise, ensuring that the primary NAAQS protects the public health with an adequate margin of safety." Remand Order I Slip Op. 73. The studies assessed by EPA in setting NAAQS and the integration of the scientific evidence presented therein have undergone extensive critical review by EPA, the Clean Air Scientific Advisory Committee (CASAC), and the public. When setting the NAAQS, "[t]he Administrator's final decisions draw upon scientific information and analysis related to health effects, population exposures, and risks; judgments about the appropriate response to the range of uncertainties that are inherent in

scientific evidence and analyses; and comment received from CASAC and the public." Id. at 6483.

6.4.2 Northern Iñupiat Communities

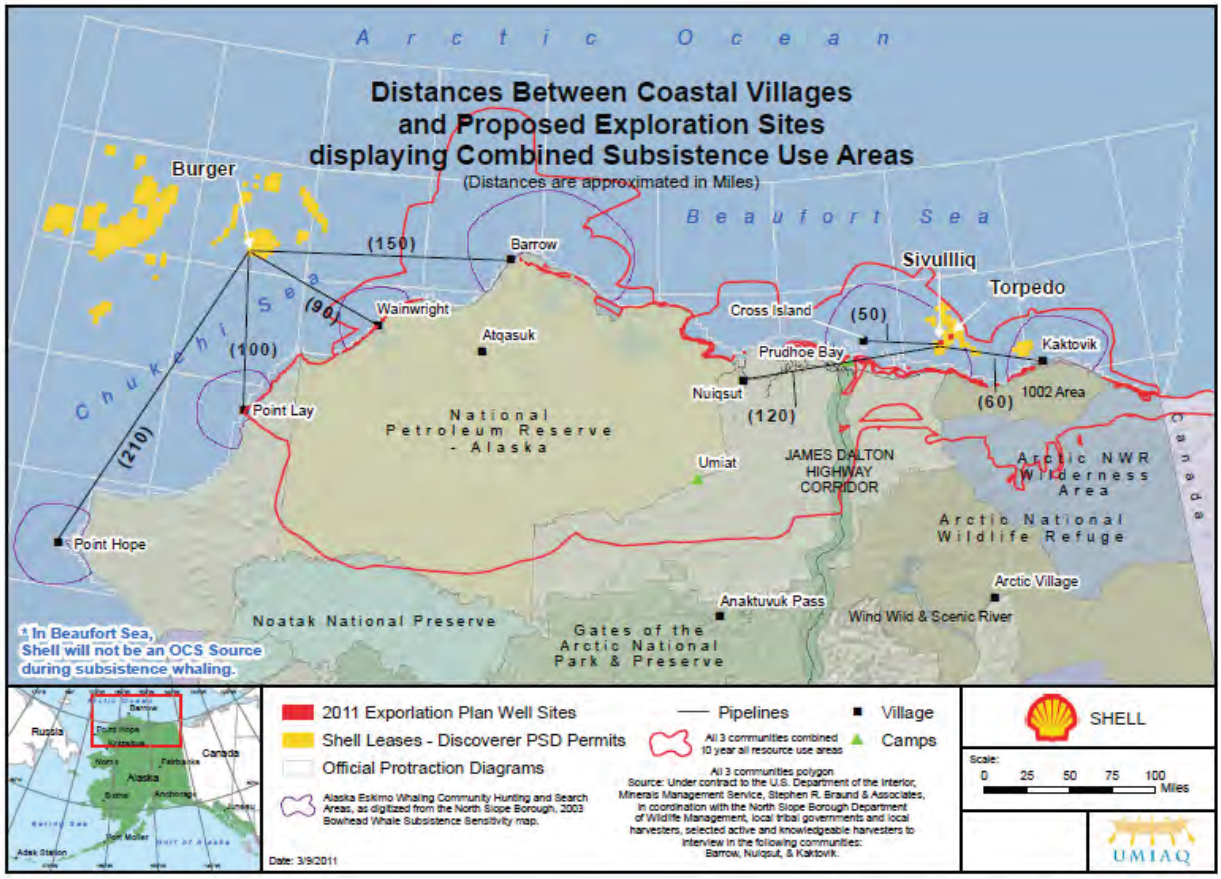
The North Slope is bordered by the Arctic Ocean to the north and the Brooks Mountain Range to the south. In all it encompasses approximately 89,000 square miles of northern Alaska. The incorporated villages of the North Slope Borough (NSB) include Point Hope, Point Lay, Wainwright, Atqasuk, Barrow, Nuiqsut, Kaktovik and Anaktuvuk Pass. These communities are situated completely above the Arctic Circle and are considered remote villages, with no roads between them.

Most of the communities are coastal villages located near the Chukchi and Beaufort Seas. In the Chukchi Sea, the nearest towns or villages to Shell's proposed operations are Point Lay and Wainwright, which are located 99 and 105 kilometers (61 and 65 miles), respectively, from the closest lease block in the Chukchi Sea. In the Beaufort Sea, the nearest towns or villages are Kaktovik, Deadhorse, and Nuiqsut, which are located 14, 84, and 193 kilometers (8, 52, and 120 miles), respectively, from the closest lease block in the Beaufort Sea.

As discussed in more detail in the Supplemental Environmental Justice Analysis, a review of demographic characteristics shows that the North Slope area has a significantly high percentage of Alaska Natives, who are considered a minority under Executive Order 12898. In addition, nearly half the people who reside in the North Slope speak a language other than English at home. Subsistence foods from traditional practices such as hunting (marine mammals, terrestrial and birds), fishing, and whaling are an important component of the Iñupiat diet.[23] In 2004, the Alaska Department of Fish and Game reported that over a 25 year period residents in the North Slope Borough harvested an average of 434 pounds of subsistence food per capita.[24] Subsistence activities also play an important cultural role.[25] Residents report traveling long distances offshore to hunt for bowhead whale and other subsistence activities. Figure 1 depicts Shell's lease block in the Chukchi and Beaufort Seas overlaid with an outline of onshore and offshore subsistence use areas.

Figure 1 Subsistence Use Areas Mapped Over Exploration Sites

[23] Wernham, Inupiat Health and Proposed Alaskan Oil Development: Results of the First Intergrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's Notrth Slope, 2007.
[24] Wolfe, R. J. 2004. Local traditions and subsistence: a synopsis of twenty-five years of research in Alaska. Technical Paper No. 284. Alaska Department of Fish and Game, Division of Subsistence. Juneau, Alaska.
[25] In the words of the Environmental Director of the Inupiat Community of the Arctic Slope (ICAS), speaking at the Environmental Justice Session held during the 2011 Alaska Forum on the Environment, "For thousands of years, our people have depended on a subsistence lifestyle for a large majority of our food, and also for our cultural and spiritual health. Through the subsistence hunt, we not only provide food for our families, but we also carry on the ancient traditions that have been passed down to us by our parents and grandparents. Our subsistence activities define who we are and bind us together as a community. We therefore depend on the land and sea for our survival and we hold the deepest and most profound respect for the natural resources that have sustained us for so many years. Our very survival as a people depends on our ability to safeguard and protect the resources that have provided for us for thousands of years."



The 2009 Alaska Native Health Status Report issued by the Alaska Native Tribal Health Consortium provides an overview of health conditions in this region.[26] Between 2004-2007, the leading causes of death among Alaskan Natives living in the North Slope region were cancer, heart disease, suicide, unintentional injury and chronic obstructive pulmonary disease (COPD). There is a higher incidence of outpatient visits for upper respiratory problems in the North Slope area than in the rest of Alaska. In fact, in 2006 diseases of the respiratory system were the leading cause for inpatient hospitalization at Samuel Simmons Memorial Hospital in Barrow. Respiratory issues range from the common cold (acute) to pneumonia (severe).[27]

As discussed below, EPA has identified people with respiratory problems to be potentially at greater risk of experiencing adverse health effects from NO_2 and SO_2. This was taken into consideration when setting the new NAAQS standards. 75 Fed. Reg. 6481 (February 9, 2010); 75 Fed. Reg. 35527 (June 22, 2010).

[26] Alaska Native Tribal Health Consortium: Alaska Native Epidemiology Center. Alaska Native Health Status Report 2009 http://www.anthc.org/chs/epicenter/upload/01_HSRintro.pdf

[27] Alaska Native Tribal Health Consortium: Alaska Native Epidemiology Center. Regional Health Profile: Arctic Slope, 2009. http://www.anthc.org/chs/epicenter/upload/Regional_Health_Profile_ASNA_1109.pdf

6.4.3 Community Outreach

Oil and gas operations in the Chukchi and Beaufort Seas are of great interest to the Northern Iñupiat communities. Region 10 has taken several measures to provide meaningful involvement for the communities of concern potentially impacted by the 2011 Revised Draft Permits. Recognizing the challenges and special considerations that are required in communicating with people in more than one culture for whom English is a second language, in May 2009, EPA issued the North Slope Communications Protocol establishing communications guidelines to specifically support meaningful involvement of North Slope communities in EPA decision-making. The goal of the protocol is to improve the agency's effectiveness in working with North Slope communities.

In an effort to engage the potentially affected communities at the beginning of the process, managers of Region 10's air and water programs conducted early outreach on air and water permitting in May 2009 in Kotzebue and Barrow. Region 10 also held meetings and conference calls to specifically solicit input on environmental justice concerns related to these permitting actions, as well as other potential OCS air permitting actions on the Chukchi and Beaufort Seas. In addition, Region 10 held public hearings and community meetings on the North Slope prior to finalizing the 2010 Permits. Consistent with the North Slope Communications Protocol, Region 10 made every effort to assist non-English speakers by having Inupiaq translators available at each meeting and hearing. In an effort to solicit tribal and public involvement at agency sponsored meetings and/ or outreach activities, Region 10 has sent out written communication reminders to its community contacts to encourage participation.

These efforts continue. An early information meeting regarding the 2011 Revised Draft Permits was held in Kaktovik and Barrow the week of June 13, 2011. The meetings were open to the public and invitations went to communities across the North Slope and a teleconference line was available for those not able to travel to the meeting. Region 10 is holding a comment period on the 2011 Revised Draft Permits and, in anticipation of a significant degree of public interest in the proposed permits, the agency is also scheduling a public hearing on the North Slope with a teleconference line available for other communities to call in. Region 10 will consider all comments received at the hearings or during the public comment period prior to taking final action on the 2011 Revised Draft Permits. Region 10 specifically solicits public comment on its Supplemental Environmental Justice Analysis.

Note that the draft permits require Shell to have a plan for communicating to the North Slope communities on a periodic basis regarding when exploration activities are expected to begin and end at a drill site, the location of the drill site, and applicable restrictions on activities in the vicinity of Shell's exploration operations.

6.4.4 Air Impacts of Proposed Operations

Region 10 has carefully considered the environmental justice impacts directly related to air quality from Shell's proposed operations, focusing on whether the issuance of the 2011 Revised Draft Permits would have disproportionately high and adverse human health or environmental effects on Alaska's northern Iñupiat communities along the Beaufort and Chukchi Seas living

and engaging in subsistence activities, including in areas closest to the activities proposed to be permitted.

As discussed above, two new NAAQS have come into effect since issuance of the 2010 Permits, a new 1-hour NAAQS for NO_2 and a new 1-hour SO_2 NAAQS. Exposure to NO_2 and SO_2 emissions above these levels has been linked to respiratory illnesses that lead to emergency room visits and hospital admissions, particularly in at-risk populations such as children, the elderly, and people with respiratory disease. In issuing the new 1-hour NO_2 and SO_2 NAAQS, EPA noted in particular that the prevalence and severity of asthma are higher among certain ethnic or racial groups such as Alaskan Natives. In these promulgations EPA specifically considered the exposure of sensitive subpopulations, including Alaskan Natives. 75 Fed. Reg. 6482 (February 9, 2010) 75 Fed. Reg. 35527 (June 22, 2010).

In response to the EAB Orders, Shell submitted a new air quality analysis of the anticipated air quality impacts of operations to be authorized under the 2011 Revised Draft Permits with respect to the new 1-hour NO_2 and SO_2 standards. As discussed in more detail in Section 5 above and in Region 10's Supplemental Air Quality Analysis, Shell used the AERMOD dispersion model with certain adjustments to account for application in a marine environment to model the impacts of the emissions proposed to be authorized under the permits. Region 10 has reviewed Shell's analysis and, as discussed above, concluded that it is consistent with EPA PSD permitting requirements.

For the background NO_2 values, Shell used monitoring data from the Badami oil fields in Deadhorse for the Beaufort Sea, and data from Wainwright for the Chukchi Sea. Results of the modeling indicate the maximum total impacts under the permits, including consideration of background air quality data, are 81.6 $\mu g/m^3$ in the Beaufort Sea and 174.0 $\mu g/m^3$ in the Chukchi Sea, in both cases less than the standard of 100 ppb (188 $\mu g/m^3$). The modeling is based on conservative assumptions, such as assuming the Discoverer will be located at a single drill site at the location closest to on-shore areas for the entire 120 days of operation each year, when in actuality, the Discoverer is likely to be operating at more than one drill site each season.

As discussed in Section 5 above, maximum impacts from the Discoverer and the Associated Fleet occur 500 meters from the hull of the Discover and decline rapidly from that point. Modeled impacts at communities along the Beaufort Sea are substantially lower. At Kaktovik, the modeled NO_2 concentration with the source in operation is 37.0 $\mu g/m^3$, while the modeled NO_2 concentration with the source in operation at Deadhorse and Nuiqsut is 98.9 $\mu g/m^3$. Note that, in the case of Deadhorse and Nuiqsut, which are more than 50 kilometers (31 miles) from the closest lease block, the impact and total NO_2 concentration is assumed to be the impact and concentration at 50 kilometers from the Discoverer in the direction of Deadhorse and Nuiqsut, because the model is designed to predict impacts to this distance. In actuality, 1-hour NO_2 emissions are expected to decline further beyond 50 kilometers and so 1-hour NO_2 emissions at Deadhorse are expected to be even lower and lower still at Nuiqsut, which is located more than 84 kilometers (52 miles) from the closest lease block. These modeled concentrations include monitored background concentrations of NO_2, which in all cases are a significant portion of the total concentration. For example, in Nuiqsut and Deadhorse, the modeled impact from Shell's

operations is just 4.9 $\mu g/m^3$ of NO_2 whereas 94 $\mu g/m^3$ of the total modeled concentration at those locations is background levels of NO_2.

Modeled concentrations at communities along the Chukchi Sea also indicate compliance with the 1-hour NO_2 NAAQS, with values well below the standard. At Point Lay, the maximum modeled concentration with the source in operation is 52.8$\mu g/m^3$, while at Wainwright it is 42.9 $\mu g/m^3$. Because both of these communities are more than 50 kilometers (31 miles) from the closest location at which the Discoverer will be operating in the Chukchi Sea, the modeled impacts from Shells operations are represented by modeled impacts 50 kilometers in the direction of the communities. Again, actual impacts will be even lower in those communities because the communities are further away than 50 kilometers and NO_2 values are expected to decline further with distance. Thus, the 1-hour NO_2 standard will be attained at all locations beyond the 500 meter boundary and will be well below the standard in the North Slope communities and in the areas where the communities conduct subsistence activities.

Shell has also submitted a new modeling analysis of the anticipated air quality impacts of operations with respect to the new 1-hour SO_2 NAAQS of 196 $\mu g/m^3$. As discussed in more detail in Section 5 above, even with the conservative modeling assumptions Shell used, the modeled impacts of 1-hour SO_2 NAAQS are expected to be minimal at all locations. This is because the 2011 Revised Draft Permits requires Shell to use ULSD in the Discoverer and the Associated Fleet. In the Beaufort Sea, the worst case modeled SO2 impact at the assumed ambient air boundary of 500 meters from the Discoverer is 35.0 $\mu g/m^3$, while the modeled concentration at Kaktovik with the source in operation is 12.9 $\mu g/m^3$ and at Deadhorse and Nuiqsut are 15.4 $\mu g/m^3$, less than 10% of the 196 $\mu g/m^3$ 1-hour SO_2 NAAQS. For the Chukchi Sea, worst case modeled concentrations (including background) are 40.3 $\mu g/m^3$, while at 50 kilometers the concentrations including background emissions in Point Lay and Wainwright are 16.2 $\mu g/m^3$ and 14.2 $\mu g/m^3$ respectively, less than 10% of the standard. Again, the modeled concentrations include the worst case monitored background concentration for the areas, which in all cases is a significant portion of the modeled concentrations for all areas. Thus, the 1-hour SO_2 standard will be attained at all locations beyond the 500 meter boundary and will be well below the standard in the North Slope communities and in the areas where the communities conduct subsistence activities.

As also discussed in Section 5 above, although there will be some increases in emissions from certain emission units as compared to the emissions under the 2010 Permits, overall emissions from the Discoverer and the Associated Fleet on an annual and hourly basis will be reduced by more than 50% for NO_X, PM_{10}, $PM_{2.5}$, CO, and VOC, with lesser but still substantial reductions of SO_2. The impact of the Discoverer and the Associated Fleet is therefore also expected to be substantially reduced under the 2011 Revised Draft Permits as compared to the 2010 Permits for all other NAAQS that were in effect at the time of issuance of the 2010 Permits.

Note that, as discussed above, the Board remanded for further consideration Region 10's conclusion that emissions of secondary $PM_{2.5}$ (that is, $PM_{2.5}$ formed by emissions condensing outside the stack or through chemical reactions with pollutants already in the atmosphere) were adequately accounted for in Region 10's air quality analysis for $PM_{2.5}$. Remand Order II at 14-19. As discussed in Section 5 above and the Supplemental Air Quality Analysis, Region 10 has

provided additional support for its conclusion. Region 10 therefore believes that the $PM_{2.5}$ standard will be met at all locations more than 500 meters from the Discoverer even when accounting for the possibility of the secondary formation of $PM_{2.5}$.

6.4.5 Conclusion

In summary, as indicated above, there is a significantly high population of Alaskan Natives in the North Slope, as well as a high population of individuals that speak a language other than English at home. These characteristics combined with the health profile of residents may increase vulnerability or sensitivity to air emissions as compared to the reference populations. Based on available information, Region 10 concludes that the activities proposed to be authorized under the 2011 Revised Draft Permits will not cause or contribute to air quality levels in excess of health-based standards for SO_2, CO, PM_{10}, $PM_{2.5,}$ Ozone or NO_2 beyond 500 meters of the center of the Discoverer. Region 10 therefore concludes that there will not be disproportionately high and adverse human health or environmental effects with respect to these air pollutants on minority or low-income populations residing in the North Slope. In reaching this conclusion, Region 10 considered the impact on communities while engaging in subsistence activities in areas where such activities are regularly conducted.

6.5 Executive Order 13175 – Tribal Consultation

Pursuant to Executive Order 13175 issued on November 9, 2000 and entitled "Consultation and Coordination with Indian Tribal Governments," federal agencies are required to have an accountable process to assure meaningful and timely input by tribal officials in the development of regulatory policies on matters that have tribal implications. 65 Fed. Reg. 67249 (November 9, 2000). In accordance with Region 10's May 2009 North Slope Communications Protocol, a regional policy for early community and tribal involvement, Region10 held an informal informational meeting in Barrow on May 29, 2009 to discuss the upcoming air permitting actions.

Prior to beginning the public comment period on the 2010 Permits, Region 10 sent letters to potentially interested tribal governments, offering government-to-government consultation opportunities on Region 10's proposed action to issue the 2010 Permits. As described in the Statement of Basis for the 2010 Permits, Region 10 held a government-to-government consultation meeting with the Inupiat Community of the Arctic Slope (ICAS) and Native Village of Point Hope and held informational meetings for the local communities prior to issuing the 2010 Permits. Region 10 also notified the potentially interested tribal governments of the opportunity to provide public comment on the draft permits during the public comment periods and to attend and provide testimony during the scheduled public hearings.

Like the recently issued "EPA Policy on Consultation and Coordination with Indian Tribes" (May 4, 2011), Region 10 tribal consultation procedures call for consultation based on the potential to affect the tribal community or their subsistence resources. As discussed above in Section 5 and Section 6.4, Region 10 expects minimal impacts from air emissions under the 2011 Revised Draft Permits at all on-shore locations. However, given the geographic proximity of the Discoverer's operations to on-shore communities along the Beaufort Sea (approximately 14

kilometers from the closest lease block to Kaktovik), as well as the proximity between the Discoverer's operations and off-shore areas where subsistence activities are conducted in the Beaufort Sea (see Figure 1 in Section 6.4 above), Region 10 determined it is appropriate to consult with ICAS, the Native Village of Nuiqsut, and the Native Village of Kaktovik. Accordingly, on June 7, 2011, Region 10 sent letters to these tribal entities offering tribal consultation on the 2011 Revised Draft Permit for exploratory activities in the Beaufort Sea. Region 10 will hold government-to-government tribal consultation meetings with the invited tribes that request consultation. Whenever possible, Region 10 will accommodate requests for consultation received any time during the permitting process.

In addition to notifying these tribal governments of the opportunity for government-to-government consultation, Region 10 will also notify tribal entities of the opportunity to provide public comment on the 2011 Revised Draft Permits during the public comment period and to attend and provide testimony during the scheduled public hearing. Region 10 sent out an invitation for informational meetings that were held in Barrow and Kaktovik on June 15-17, 2011. The meetings were open to the public and all North Slope entities (City Governments, Tribal Governments, the North Slope Borough, and the Alaska Eskimo Whaling Commission) received invitations to attend the early informational meetings.

6.6 National Environmental Policy Act

See Section 6.6 of the Statements of Basis for the 2010 Permits.