UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
SEATTLE, WASHINGTON

TECHNICAL SUPPORT DOCUMENT
REVIEW OF SHELL'S
AMBIENT AIR QUALITY IMPACT ANALYSIS
FOR THE KULLUK OCS PERMIT APPLICATION
PERMIT NO. R10OCS030000

July 18, 2011

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A. Introduction

This Technical Support Document (TSD) provides the U.S. EPA Region 10's (Region 10's) findings regarding the ambient air quality analysis submitted by Shell Offshore Incorporated (Shell) for the Shell Beaufort Sea Alaska Exploratory Drilling Program using the Kulluk Conical Drilling Unit (Kulluk). Shell submitted this analysis in support of their February 28, 2011 Outer Continental Shelf Permit Application, as revised on May 4, 2011 (Martin 05/04/11), June 22, 2011 (Winges 06/22/11), and July 13, 2011 (Rudy 07/13/11). For the reasons described below, Shell's analysis adequately shows that operating the Kulluk and associated support vessels within the requested constraints will not cause or contribute to violations of the National Ambient Air Quality Standards (NAAQS).

B. Background

Shell is planning to use the Kulluk to conduct exploratory drilling within select lease blocks on the Outer Continental Shelf (OCS) in the Beaufort Sea. Drilling would occur for up to 120 days during each July through November drilling season. The drilling season will likely include both open water and broken ice conditions. The locations and Shell's plan of operation are fully described in Region 10's Statement of Basis (SOB) accompanying the draft permit.

C. Regulatory Overview

The application requirements are fully described in the SOB. In summary, Shell's proposal is subject to the air quality permitting requirements under the OCS provisions of Title 40, Code of Federal Regulations (CFR), Part 55. Under these regulations, the applicable requirements depend on the source's relative location to shore. OCS sources located within 25 miles of a State's seaward boundary are subject to the Federal, and to the State and local requirements of the Corresponding Onshore Area (COA) which have been incorporated into EPA's OCS regulations at 40 CFR Part 55 (Part 55). OCS sources located beyond 25 miles of a State's seaward boundary are subject to only Federal requirements – i.e., COA requirements do not apply. In Shell's case, the State of Alaska is the designated COA and the air quality permitting requirements of the Alaska Department of Environmental Conservation (ADEC) which have been incorporated into 40 CFR Part 55 apply. See 40 CFR § 55.15, Appendix A.

Shell requested that Region 10 impose emission limits to avoid the Prevention of Significant Deterioration (PSD) construction permit requirements for operation on lease blocks that are both within and beyond 25 miles of Alaska's seaward boundary. For operations within 25 miles of Alaska's seaward boundary, Shell submitted a minor permit application pursuant to the COA's minor permit program in Title 18 of the Alaska Administrative Code (AAC), Chapter 50. For operations beyond 25 miles of Alaska's seaward boundary, Shell submitted a Title V operating permit application under 40 CFR Part 71 (Part 71). Shell is also requesting that Region 10 issue a Title V operating permit under the COA regulations for continued operation within 25 miles of the seaward boundary. The ambient demonstration obligations for these various classifications are summarized below in Table 1 and are described in more detail in the following subsections.

Table 1: Ambient Demonstration Obligations by Permit Classification

Permit Classification	Air Pollutant						
	NO_2	SO_2	PM-10	PM-2.5	CO	O_3	Pb
18 AAC 50.502(c)(1)	X		X				
18 AAC 50.502(c)(2)(A)	X	X	X				
Part 70/71 (Title V)	X	X	X	X	X	X	X

C.1 Modeling Obligations under the COA's Minor Permit Program

Shell's request for an Owner Requested Limit (ORL) to avoid PSD classification would trigger the COA rules in ADEC's minor permit requirements in 18 AAC 50.508(5)[1]. Applications classified under this provision are not required to include an ambient air demonstration. However, Shell's proposal would also trigger additional minor permit classifications under the COA regulations, which have air quality demonstration requirements. These additional classifications are:

- 18 AAC 50.502(c)(1)(A) for a new stationary source with a potential to emit greater than 15 tons per year (tpy) of particulate matter with an aerodynamic diameter of less than 10 microns (PM-10);
- 18 AAC 50.502(c)(1)(B) for a new stationary source with a potential to emit greater than 40 tpy of nitrogen oxides (NOx); and
- 18 AAC 50.502(c)(2)(A) for relocating a portable oil and gas operation.

Per 18 AAC 50.540(c)(2)(A), applicants subject to 18 AAC 50.502(c)(1) must show that the proposed potential emissions from the stationary source will not violate the ambient air quality standards established for the triggered pollutants. In Shell's case, they would need to demonstrate compliance with the PM-10 ambient air quality standard and the nitrogen dioxide (NO_2) ambient air quality standard. SO_2 modeling would not be required under this provision, but it would be required under 18 AAC 50.540(c)(2)(B). Under this latter provision, applicants subject to 18 AAC 50.502(c)(2)(A) – i.e., portable oil and gas operations – must demonstrate compliance with the NO_2, PM-10, and SO_2 ambient air quality standards.

The COA rules establish a minor permit threshold and subsequent ambient demonstration requirement for lead (potential emissions that exceed 0.6 tpy) and for carbon monoxide (CO) – if the source emits at least 100 tpy and is located within 10 kilometers (km) of a CO nonattainment area. Shell's proposal does not trigger either of these additional minor permit classifications. Therefore, lead (Pb) and CO modeling would not be required under the COA's minor permit program.

The COA rules do not include minor permit thresholds or ambient demonstration requirements for ozone, particulate matter with an aerodynamic diameter of less than 2.5 microns (PM-2.5), or the two pollutants with state-only ambient air quality standards: ammonia (NH_3) and reduced sulfur compounds. Therefore, minor permit applicants have no regulatory obligation to

[1] References to a particular regulation in the AAC are intended to refer to the versions of the regulations that have been incorporated into Part 55.

demonstrate compliance with the ozone, PM-2.5, NH_3 and reduced sulfur ambient air quality standards. Likewise the rules do not require minor permit applicants to demonstrate compliance with the "maximum allowable increases" (also known as PSD increments), or conduct any type of visibility impact analysis.

Shell provided an ambient demonstration for all pollutants triggered under the COA's minor permit program (NO_2, SO_2 and PM-10). While not required, they also submitted an ambient demonstration for the State of Alaska's NH_3 air quality standard.

C.2 Modeling Obligations under 40 CFR Part 71

As specified in 40 CFR § 55.13(f)(2), the requirements of Part 71 apply to OCS sources located beyond 25 miles of state's seaward boundaries. Since the potential to emit (PTE) for the project is greater than 100 tpy for several criteria pollutants, the Kulluk is classified as a Title V major source under Part 71.

Part 71 includes as "applicable requirements", "any national ambient air quality standard or increment or visibility requirement under part C of Title I of the Clean Air Act (Act), but only as it would apply to temporary sources permitted pursuant to section 504(e) of the Act." 40 CFR § 71.2. As discussed in the SOB, EPA believes the best interpretation of these provisions is that the NAAQS are applicable requirements for all Title V temporary sources, but that increment and visibility are applicable requirements only if such sources would otherwise be subject to PSD.

Part 71 does not specify how a Title V temporary source must demonstrate compliance with the NAAQS. In the absence of regulations or guidance setting out the requirements for a demonstration that the terms and conditions of a Title V permit for a Title V temporary source will assure compliance with NAAQS at all authorized locations of operation, Region 10 believes that following the regulations and guidance for conducting an air quality analysis with respect to the NAAQS under the PSD program is an appropriate approach. See 40 CFR Part 51, Appendix W.

The modeling analysis Shell submitted under the minor permit is consistent with PSD modeling requirements. Therefore, Shell's minor permit analysis meets the PSD NAAQS demonstration requirements for the pollutants triggered under the minor permit program. For the CO and PM-2.5 NAAQS, Shell submitted ambient demonstrations following the PSD demonstration requirements. Shell did not provide a modeling analysis for the Pb and ozone NAAQS.

Shell's decision to not provide a modeling analysis for Pb and ozone NAAQS is reasonable and supportable. It is reasonable because diesel-fired combustion units do not typically release substantive quantities of Pb and ozone-precursor emissions (volatile organic compounds or VOCs), and diesel fuel tanks do not emit large quantities of VOCs. Also, ensuring emissions of other pollutants, especially NO_2 and PM-2.5, do not cause or contribute to a violation of the NAAQS will provide similar assurance for Pb and ozone-precursor emissions for this type of source. Shell's decision is supportable because Pb and VOC emissions are below PSD significant emission rates for both pollutants. Shell's quantitative demonstration that they are complying with the NO_2 and PM-2.5 NAAQS is therefore sufficient for qualitatively

demonstrating compliance with the Pb and ozone NAAQS. Additional information regarding ozone may be found in Section H of this TSD.

C.3 Modeling Obligations under 40 CFR Part 70

Shell's request for a Title V permit for continued operation within 25 miles of the seaward boundary did not trigger any ambient demonstration obligations not already triggered under the COA's minor permit program or Part 71.

C.4 Additional Discussion of Regulatory Obligations

For simplicity purposes, Region 10 intends to issue a single OCS permit that fulfills all three permitting mechanisms. This TSD therefore addresses Region 10's review of all ambient demonstration obligations, without further reference to the specific permit mechanism (e.g., COA minor permit program vs. Title V permit obligations).

D. Modeling Approach

A dispersion model is a computer simulation that uses mathematical equations to predict air pollution concentrations based on weather, topography, source characteristics and emissions data. Each of these aspects must be represented with numerical values that characterize the given features of the particular application and location.

Region 10 evaluated Shell's modeling analysis under the guidance established in 40 CFR Part 51, Appendix W, *Guideline on Air Quality Models* (Appendix W). The use of Appendix W for modeling analysis is required under the minor permit program, per 18 AAC 50.215(b). As discussed above, Region 10 believes it is appropriate to use Appendix W for assessing criteria pollutant modeling assessments required under Title V for Title V temporary sources. 40 CFR Part 51, Appendix W, Section 1.0(a).

D.1 Air Quality Model

As stated in Section 3.1 of Appendix W, EPA has developed models suitable for regulatory application. When a single model is found to perform better than others, it is recommended for application as a preferred model and listed in Appendix A of Appendix W. Shell employed the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) system of programs to estimate their ambient impacts (EPA 2002).

Shell and Region10 started discussing refined modeling options for the Arctic marine environment in June 2010. The initial discussion focused on two preferred models for near-field applications: (1) the Offshore and Coastal Dispersion (OCD) model (DiCristofaro et al. 1989) and AERMOD, and (2) a non-guideline over water version of CALPUFF (BOEMRE 2006). Shell and Region 10 ultimately selected AERMOD after examining the capabilities of each model (EPA 04/01/11).

The AERMOD Modeling System consists of three basic modules: AERMAP (which is used to process terrain data and develop elevations for the receptor grid/sources), AERMET (which is used to process the meteorological data), and the AERMOD dispersion model (which is used to

estimate the ambient concentrations). There are also several additional components used to process data or develop the parameters needed by these modules.

Shell used the version of AERMOD that was current when the Kulluk application was submitted on February 28, 2011 (version 09292). EPA has subsequently released two updates to AERMOD (version 11059 and version 11103), but these updates do not alter the validity of Shell's analysis. EPA released AERMOD version 11059 to correct several errors associated with use of the "Volume" source option – which was not used by Shell – and to introduce new features to better format the results for comparison to the 1-hour NO_2/SO_2 standards and the PM-2.5 standards. While these new features would have been "handy" to have for the Shell analysis, the lack of these features do not in any way detract from the accuracy of Shell's analysis. EPA released AERMOD version 11103 to correct an error in certain applications of the features introduced in version 11059, and to introduce additional internal checks for certain types of data files. None of these changes call into question the validity of Shell's analysis.

Shell used AERMET to process the meteorological data during periods of broken ice, and a non-Guideline model, the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm (Fairall et al. 2003), to process the meteorological data during open water conditions. The meteorological data used to run AERMOD, along with Shell's approach for processing the meteorological data, is discussed in more detail in Section E of this TSD. Shell did not need to use AERMAP for this analysis since the Beaufort Sea is assumed to be flat.

D.2 Urban/Rural Area Determination

Shell did not utilize the AERMOD option to incorporate the effects of increased surface heating from an urban area. Shell's approach is appropriate since there are no urban areas in the Beaufort Sea.

D.3 Operating Scenarios

Shell's proposed project consists of positioning the Kulluk within one of the lease blocks, setting anchors to stabilize the vessel, and drilling into the seafloor. A support fleet will patrol at a distance to break ice, transfer supplies and personnel, and provide assistance in case of any oil spillage.

D.3.1 General Discussion

According to Shell, the drilling of an exploratory well can take up to 30 days. The drilling process consists of the following three activities: 1) drilling of the "mud-line cellar" (MLC), 2) drilling of the well, and 3) casing, logging, and cementing. With a 30-day drilling cycle, Shell could theoretically complete up to four exploratory wells within a 120 day period.

The relative location of each well is currently unknown. Part of the decision regarding the location for subsequent wells will depend on what Shell learns from a previous drilling. The relative locations could be close enough for the project to have overlapping impacts on an annual average basis. Shell accounted for this potential overlap of plumes by assuming all four wells are drilled at the same location. This is a conservative assumption since it maximizes the effects of plume overlap. In reality, the drilling of four wells at the same location, and the corresponding overlap of plumes, would not occur.

Shell commits to operate the Kulluk incinerator for no more than 12 hours per day, and the emergency generator for no more than two hours per every 30 days. For modeling purposes, Shell assumed the incinerator operates between 8 a.m. and 8 p.m. They assumed the emergency generator operates for only two hours once every 30 days, but the two hours were assumed to occur during the worst-case emissions – the MLC phase of operation.

D.3.2 Associated Fleet

Vessels servicing or associated with an OCS source are included in the source's "potential to emit" (PTE) calculations when operating within 25 miles of the source. 40 CFR § 55.2. Shell therefore included the service vessels, or associated fleet, in their ambient analysis. The associated fleet consists of a primary ice management vessel, a secondary ice management vessel – which also serves as the anchor handler – one oil spill response (OSR) vessel, four oil spill work boats, and resupply vessels/barges.

The resupply vessel(s) will move in and out of the 25-mile radius as needed. Transit takes approximately 4-hours. When loading/off-loading the Kulluk, the resupply vessel will operate in "dynamic positioning" (DP) mode, which means that it will maintain position with its propulsion engines.[2] For its modeling analysis, Shell assumed resupply would occur once every five days, and that each DP mode would last 24-hours. Shell did not include the transit mode in the modeling analysis since that would not occur concurrently with the DP mode and the DP mode provides the worst-case scenario (on both an emission rate and length of operation basis).

Shell assumed the ice management vessels are operating at their maximum rate during the broken ice periods (i.e., the "AERMET" periods). During the open water ("COARE") periods, Shell initially assumed that the ice management vessels are beyond the 25-mile radius. Region 10 questioned this assumption since the application also indicated that Shell wanted to use the "secondary" ice management vessel as an anchor handler during the open water periods. Shell therefore revised their analysis by assuming that both ice management vessels are operating at maximum load during the open water periods (Ruddy 07/13/11). This is a conservative approach since Shell does not intend to operate the primary ice management vessel within the 25-mile radius during open water periods, plus there should not be a need to operate the anchor handler under full load conditions during this period. The revised impacts are only marginally larger than what Shell previously found.

D.3.3 Scenario Management

Shell incorporated the 120-day limit in their modeling of NO_2, SO_2, PM-10 and PM-2.5 impacts. To ensure the modeled results were not underestimated by their selection of when the 120-day period would occur, Shell modeled two 120-day periods: an "early season" period (July 1 through October 28th); and a "late-season" (August 3rd through November 30th). Shell then took the higher of the two impacts for comparison to the air quality standards.

[2] Shell noted that the resupply vessel could be a tug and barge. In this case, the barge – which has no emissions – would be moored to the Kulluk during loading/off-loading, and the tug would only be present to move the barge in and out of the 25-mile radius. However, these emissions would be less than the resupply vessel in DP mode – which was modeled as a worst-case scenario.

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

Shell used the full five month (153-day) meteorological period when modeling their CO and NH_3 impacts. They also used the worst-case emissions for each unit and assumed all units are operating concurrently. This is a conservative and therefore acceptable approach.

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 the impact during non-drilling periods will be zero.

D.4 Emission Unit Inventory and Location

Shell included all of the combustion-related emission units listed in their OCS minor/Title V permit applications in their modeling analysis. The list of modeled emission units is repeated below in Table 2 for convenience purposes. Table 2 also provides the assumed rating and shows whether Shell characterized the emission unit as a point source or as an area source. It also provides the tag that Shell used to identify each emission unit in the modeling files.

There are a number of different vessels that Shell could use to meet their various support needs. Shell treated the associated fleet as generic vessels in order to maintain operational flexibility.

Shell characterized the resupply vessel in DP mode as a point source since it will maintain its position relative to the Kulluk during the loading/off-loading process. Shell characterized all other vessels as area sources, since their duties require transient operation. The relative location of the vessels is shown in Figure 1 and described in Section 3.3.3 of their application. In summary, Shell assumed the ice management vessels would operate throughout a pie-shaped area upwind of the Kulluk, and the OSR vessels would operate throughout a 2 km by 2 km area downwind of the Kulluk. The ice management "pie" was 5 km long and 40-degrees wide. Since Shell used hourly input files for their NO_2, SO_2, PM-10, and PM-2.5 analysis, they were able to change the cardinal coordinates of these area sources on an hourly basis, in order to keep the area sources in-line with the wind direction. For the CO and NH_3 analysis, Shell aligned the area sources in the predominate upwind/downwind direction and held them in this same position for the entire 153-day period.

Varying the orientation of the associated fleet with the prevailing wind direction provides a conservative impact analysis as 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.

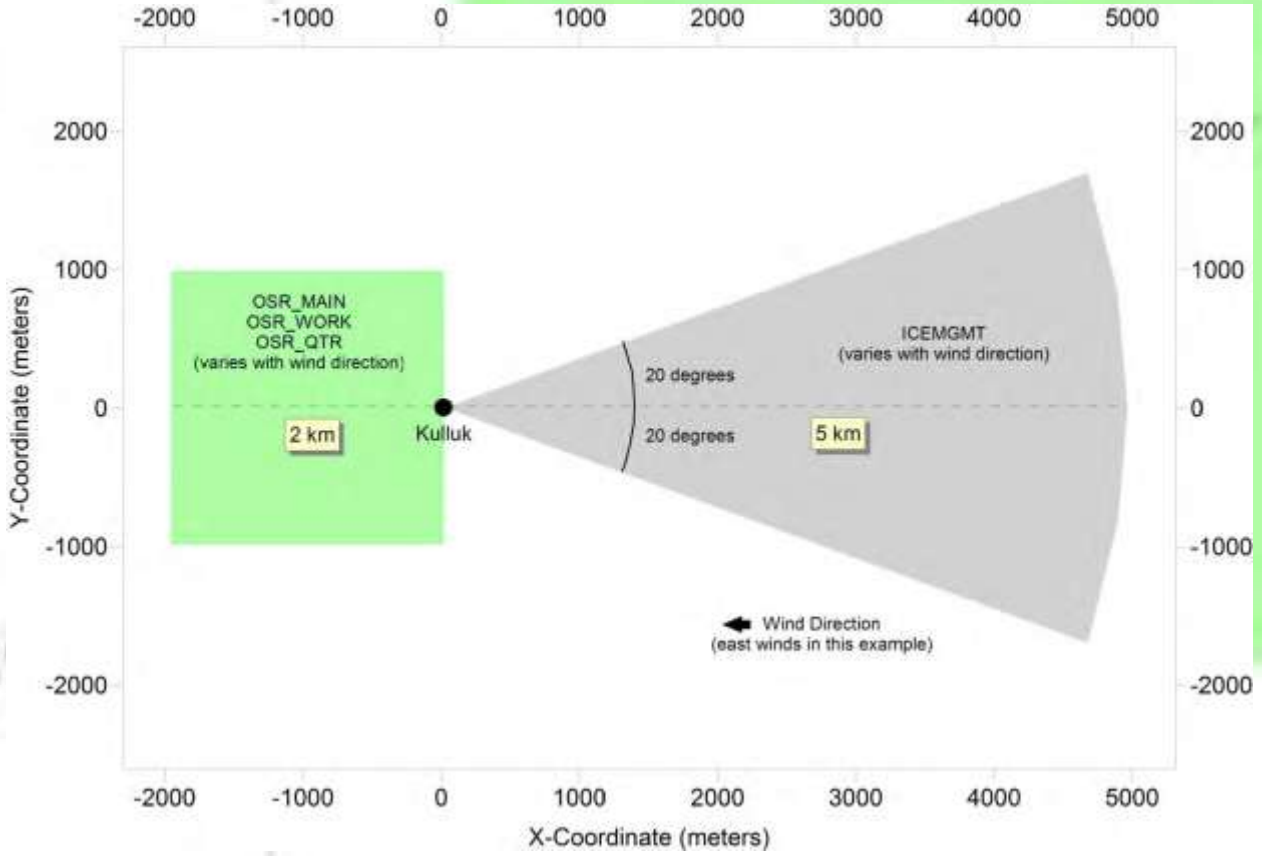
Shell used a local Cartesian coordinate system for designating all emission unit locations. They used the drill hole as the origin (0, 0 point) of their coordinate system.

Table 2: Emission Unit Location

Emission Unit		Rated Capacity	Source Type	Location	
Description	**Model ID**			**x (m)**	**y (m)**
Kulluk [a]					
Generators	MAINENGS	8,500 hp [b]	Point	-38.2	2.8
MLC Hydraulic Power Unit (HPU)	MLCHPU_A	750 hp	Point	11.0	36.4
MLC Hydraulic Power Unit (HPU)	MLCHPU_B	750 hp	Point	11.0	36.4
Air Compressor (port)	AIRCMP_A	750 hp	Point	-36.8	12.0
Air Compressor (starboard)	AIRCMP_B	750 hp	Point	25.1	-32.2
Crane	CRANE_A	400 hp	Point	-28.3	28.3
Crane	CRANE_B	400 hp	Point	30.1	27.9
Crane	CRANE_C	400 hp	Point	29.7	-29.7
Heaters & Boilers	HEATBOIL	6 MMBtu/hr	Point	-38.5	-5.3
Incinerator	INCIN_K	276 lb/hr	Point	11.7	-32.9
Seldom Used Units (typical operations)	SELDOML	0.79 gal/hr	Point	-2.1	38.9
Seldom Used Units (Em. Gen. – exercising)	SELDOMH	38.5 gal/hr	Point	-2.1	38.9
Associated Fleet [c]					
Resupply Ship (DP Mode)	RESUP_DP	12,000 hp	Point	87.7	81.5
Ice Management/Anchor Handler [d]	ICEMGMT	64,400 hp	Areapoly	Varies Hourly	
Main OSR Ship	OSR_MAIN	3,487 hp	Areapoly	Varies Hourly	
OSR Work Boats	OSR_WORK	23 gal/hr	Areapoly	Varies Hourly	

a. Kulluk emission units. Shell used a single location for the generator engines and the HPU engines. This approach makes for a conservative analysis since it overlaps the impacts.
b. Shell subsequently noted that they may replace the existing generator sets with new generator sets that have a total rated capacity of 10,400 hp. The modeled emission limits would still apply. This change does not alter the conclusions made in this TSD.
c. The rated capacity for the associated fleet is the total propulsion and generation capacity. The support vessels may also have miscellaneous heaters, small incinerators, and seldom used engines.
d. The 64,400 hp capacity for the Ice Management/Anchor Handler is the *total* propulsion/generation capacity between two generic 32,200 hp vessels.

Figure 1: Relative Location of the Associated Fleet for Modeling Purposes



D.5 Modeled Emission Rates

As previously discussed, Shell incorporated the various levels of operation during a 30-day drilling sequence in their NO_2, SO_2, PM-10 and PM-2.5 analysis. Therefore, the modeled emission rate varied on an hourly/daily basis for these pollutants. For example, Shell assumed the Kulluk HPU and air compressor emission units are emitting during the five days of MLC operation, but not during the remaining 25 days of the drilling sequence.

When the units are operating, Shell used the same basic emission rates as used in their permit applicability analysis (i.e., the emission units have the same level of operation and post-combustion controls as described in Attachment A of their permit application). The NO_2, SO_2, PM-10, and PM-2.5 gram per second (g/s) emission rates used by Shell in the modeling analysis are provided below in Table 3 through Table 5, for each modeled emission unit.[3] Table 3 provides the modeled emission rates during the MLC phase. Table 4 provides the rates during the drilling phase. Table 5 provides the rates during the cementing/logging phase. The equivalent pound per hour (lb/hr) value for each unit/pollutant is also provided in each of these

[3] Emissions for an area source are actually entered into AERMOD as a gram per second per square meter value (i.e., the g/s emission rated divided by the source area). Region 10 converted the modeled g/s/m^2 values into g/s values, in order to provide a consistent format.

tables. Shell used the maximum CO and NH_3 emission rate from any of the three scenarios in their CO and NH_3 analysis. The maximum g/s and lb/hr CO and NH_3 emission rates are provided in Table 6.

Shell stated that the seldom used units have highly intermittent use, but need to be exercised on an infrequent scheduled cycle. With one exception, Shell estimated the expected weekly/monthly fuel consumption for these intermittent units and then used the equivalent hourly fuel consumption to estimate the g/s emission rates needed for modeling purposes. Shell then assumed these seldom used units are constantly operating at this emission rate. The exception pertains to the Kulluk emergency generator, which is substantially larger than the other seldom used units. With respect to 1-hour NO_2, the use of maximum allowable emissions for intermittent emergency generators may result in modeled impacts that are substantially higher than realistic impacts (EPA 3/01/11). The guidance provides that in certain circumstances it may be appropriate to exclude emergency generators from compliance demonstrations. In this case, Shell included the emergency generator with the assumption that it would operate for only 2 hours during the 30-day cycle. Shell further assumed the emissions would occur during the MLC phase (which has the largest emissions of the three phases), in order to provide a worst-case analysis. Shell's approach for characterizing the various intermittent emission units is reasonable and in the emergency generator case, conservative, since they could have excluded the emergency generator from the 1-hour NO_2 analysis.

Table 3: Modeled Emission Rates – MLC Phase

Emission Unit		NOx		PM-2.5		PM-10		SO_2	
Description	Model ID	g/s	lb/hr	g/s	lb/hr	g/s	lb/hr	g/s	lb/hr
Generators	MAINENGS	2.395	19.0	0.374	2.97	0.374	2.97	6.80E-02	0.54
MLC HPU	MLCHPU_A	2.330	18.5	0.093	0.74	0.093	0.74	7.06E-03	5.6E-02
MLC HPU	MLCHPU_B	2.330	18.5	0.093	0.74	0.093	0.74	7.06E-03	5.6E-02
Air Comp (port)	AIRCMP_A	1.864	14.8	0.039	0.31	0.039	0.31	7.06E-03	5.6E-02
Air Comp (starboard)	AIRCMP_B	1.864	14.8	0.039	0.31	0.039	0.31	7.06E-03	5.6E-02
Crane	CRANE_A	0.149	1.18	0.006	0.05	0.006	0.05	4.52E-04	3.6E-03
Crane	CRANE_B	0.149	1.18	0.006	0.05	0.006	0.05	4.52E-04	3.6E-03
Crane	CRANE_C	0.149	1.18	0.006	0.05	0.006	0.05	4.52E-04	3.6E-03
Heaters & Boilers	HEATBOIL	0.115	0.91	0.019	0.15	0.019	0.15	8.06E-03	6.4E-02
Incinerator	INCIN_K	0.052	0.41	0.243	1.93	0.285	2.26	0.04	0.32
Seldom (no gen)	SELDOML	0.046	0.37	0.004	0.03	0.004	0.03	1.39E-04	1.1E-03
Seldom (Em. Gen)	SELDOMH	2.242	17.8	0.179	1.42	0.179	1.42	6.79E-03	5.4E-02
Resupply Ship (DP Mode)	RESUP_DP	9.32	74.0	0.39	3.10	0.39	3.10	0.04	0.32
Ice Management	ICEMGMT	21.88	174	3.68	29.2	3.72	29.6	0.68	5.41
OSR Vessel	OSR_MAIN	5.476	43.5	0.339	2.69	0.358	2.84	0.040	0.32
OSR Work Boats	OSR_WORK	1.313	10.4	0.105	0.83	0.105	0.83	3.98E-03	3.2E-02

Table 4: Modeled Emission Rates – Drilling Phase

Emission Unit		NOx		PM-2.5		PM-10		SO_2	
Description	Model ID	g/s	lb/hr	g/s	lb/hr	g/s	lb/hr	g/s	lb/hr
Generators	MAINENGS	2.395	19.0	0.374	2.97	0.374	2.97	6.80E-02	0.54
MLC HPU	MLCHPU_A	0	0	0	0	0	0	0	0
MLC HPU	MLCHPU_B	0	0	0	0	0	0	0	0
Air Comp (port)	AIRCMP_A	0	0	0	0	0	0	0	0
Air Comp (starboard)	AIRCMP_B	0	0	0	0	0	0	0	0
Crane	CRANE_A	0.149	1.18	0.006	0.05	0.006	0.05	4.52E-04	3.6E-03
Crane	CRANE_B	0.149	1.18	0.006	0.05	0.006	0.05	4.52E-04	3.6E-03
Crane	CRANE_C	0.149	1.18	0.006	0.05	0.006	0.05	4.52E-04	3.6E-03
Heaters & Boilers	HEATBOIL	0.115	0.91	0.019	0.15	0.019	0.15	8.06E-03	6.4E-02
Incinerator	INCIN_K	0.052	0.41	0.243	1.93	0.285	2.26	0.04	0.32
Seldom (no gen)	SELDOML	0.046	0.37	0.004	0.03	0.004	0.03	1.39E-04	1.1E-03
Seldom (Em. Gen)	SELDOMH	2.242	17.8	0.179	1.42	0.179	1.42	6.79E-03	5.4E-02
Resupply Ship (DP Mode)	RESUP_DP	9.32	74.0	0.39	3.10	0.39	3.10	0.04	0.32
Ice Management	ICEMGMT	21.88	174	3.68	29.2	3.72	29.6	0.68	5.41
OSR Vessel	OSR_MAIN	5.476	43.5	0.339	2.69	0.358	2.84	0.040	0.32
OSR Work Boats	OSR_WORK	1.313	10.4	0.105	0.83	0.105	0.83	3.98E-03	3.2E-02

Table 5: Modeled Emission Rates – Cementing/Logging Phase

Emission Unit		NOx		PM-2.5		PM-10		SO_2	
Description	Model ID	g/s	lb/hr	g/s	lb/hr	g/s	lb/hr	g/s	lb/hr
Generators	MAINENGS	1.690	13.4	0.264	2.10	0.264	2.10	4.80E-02	0.38
MLC HPU	MLCHPU_A	0	0	0	0	0	0	0	0
MLC HPU	MLCHPU_B	0	0	0	0	0	0	0	0
Air Comp (port)	AIRCMP_A	0	0	0	0	0	0	0	0
Air Comp (starboard)	AIRCMP_B	0	0	0	0	0	0	0	0
Crane	CRANE_A	0.249	1.98	0.010	0.08	0.010	0.08	7.53E-04	6.06E-03
Crane	CRANE_B	0.249	1.98	0.010	0.08	0.010	0.08	7.53E-04	6.06E-03
Crane	CRANE_C	0.249	1.98	0.010	0.08	0.010	0.08	7.53E-04	6.06E-03
Heaters & Boilers	HEATBOIL	0.115	0.91	0.019	0.15	0.019	0.15	8.06E-03	6.4E-02
Incinerator	INCIN_K	0.052	0.41	0.243	1.93	0.285	2.26	0.04	0.32
Seldom (no gen)	SELDOML	0.046	0.37	0.004	0.03	0.004	0.03	1.39E-04	1.1E-03
Seldom (Em. Gen)	SELDOMH	2.242	17.8	0.179	1.42	0.179	1.42	6.79E-03	5.4E-02
Resupply Ship (DP Mode)	RESUP_DP	9.32	74.0	0.39	3.10	0.39	3.10	0.04	0.32
Ice Management	ICEMGMT	21.88	174	3.68	29.2	3.72	29.6	0.68	5.41
OSR Vessel	OSR_MAIN	5.476	43.5	0.339	2.69	0.358	2.84	0.040	0.32
OSR Work Boats	OSR_WORK	1.313	10.4	0.105	0.83	0.105	0.83	3.98E-03	3.2E-02

Table 6: Modeled CO and NH_3 Emission Rates

Emission Unit		CO		NH_3	
Description	Model ID	g/s	lb/hr	g/s	lb/hr
Generators	MAINENGS	1.08	8.6	0.09	0.71
MLC HPU	MLCHPU_A	0.13	1.0	0	0
MLC HPU	MLCHPU_B	0.13	1.0	0	0
Air Comp (port)	AIRCMP_A	0.11	0.9	0	0
Air Comp (starboard)	AIRCMP_B	0.11	0.9	0	0
Crane	CRANE_A	0.01	0.1	0	0
Crane	CRANE_B	0.01	0.1	0	0
Crane	CRANE_C	0.01	0.1	0	0
Heaters & Boilers	HEATBOIL	0.03	0.2	0	0
Incinerator	INCIN_K	5.22	41.4	0	0
Seldom (no gen)	SELDOML	0.012	0.1	0	0
Seldom (Em. Gen)	SELDOMH	0.605	4.8	0	0
Resupply Ship (DP Mode)	RESUP_DP	2.81	22.3	0	0
Ice Management	ICEMGMT	15.61	123.9	0.40	0.79
OSR Vessel	OSR_MAIN	4.00	31.7	0	0
OSR Work Boats	OSR_WORK	0.35	2.8	0	0

D.6 Emission Unit Characterization

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. The release parameters needed for modeling point sources include stack height, stack gas exit temperature, stack gas exit velocity and inside stack diameter. Modeling polynomial area sources with buoyant exhaust characteristics requires a description of the polynomial (i.e, the corner coordinates), the release height and the initial vertical spread of the exhaust plume (sigma-z). The unit-specific values used by Shell for the point source parameters are listed in Table 3-4 of their application and are repeated in Table 7 for convenience. The values used by Shell are reasonable.

As noted in Section D.4, Shell may replace the existing generator sets with new units. This may lead to some variation in the stack parameters, but not to a degree that calls into question the validity of their analysis. Shell assumed the main generator stacks are collocated, which added a larger degree of conservatism in the modeled impacts than what little change may occur due to small variations in stack parameters.

The presence of non-vertical stacks or stacks with rain caps requires special handling in an AERMOD analysis. Shell assumed all of the point sources (see Table 7) have vertical stacks without rain caps. According to Shell, they are currently modifying the existing Kulluk generator stacks in order to comply with this modeling assumption (Martin 03/28/11).

Shell noted that the resupply vessel is currently unspecified, and could also vary on a year-to-year basis. They also correctly noted that the largest sources do not always produce the largest

ambient impacts. The relatively poor dispersion that occurs from smaller sources with their shorter stacks and smaller exhaust flow rates can produce the maximum ambient impacts. Shell therefore conducted a sensitivity analysis of the largest expected resupply vessel (the 6,140 hp Harvey Spirit) and the smallest expected resupply vessel (the 1,700 hp Arctic Seal). Shell found that the Harvey Spirit produces the larger 1-hour NO_2 and 24-hour PM-2.5 impacts, by substantive margins. This same trend would also be expected for the other pollutants and averaging periods. Shell therefore used the Harvey Spirit parameters to develop the "generic" resupply vessel in their modeling analysis. Region 10 concurs with their approach and conclusion.

Table 7: Point Source Stack Parameters

Emission Unit		Release Height Above				
Description	Model ID	Main Deck (m)	Water (m)	Exhaust Temp (K)	Exit Velocity (m/s)	Stack Diameter (m)
Generators	MAINENGS	6.40	13.72	606	30.5	0.60
MLC HPU	MLCHPU_A	3.05	10.36	700	40.0	0.18
MLC HPU	MLCHPU_B	3.05	10.36	700	40.0	0.18
Air Comp (port)	AIRCMP_A	3.66	10.97	606	30.5	0.60
Air Comp (starboard)	AIRCMP_B	4.69	12.01	606	30.5	0.60
Crane	CRANE_A	16.99	24.31	672	20.1	0.25
Crane	CRANE_B	16.99	24.31	672	20.1	0.25
Crane	CRANE_C	16.99	24.31	672	20.1	0.25
Heaters & Boilers	HEATBOIL	6.4	13.72	366	16.1	0.15
Incinerator	INCIN_K	8.81	16.12	623	10.0	0.46
Seldom Used (typical ops)	SELDOML	5.76	13.08	700	40.0	0.18
Seldom Used (Em. Gen)	SELDOMH	5.76	13.08	700	40.0	0.18
Resupply Ship (DP Mode)	RESUP_DP	--	18.29	650	14.6	0.60

Shell conducted preliminary runs of the ice management/anchor handling fleet in order to determine the hourly plume heights and sigma z values as a function of the hourly meteorological conditions. Shell used this variable plume height/sigma z approach for their NO_2, SO_2, PM-10, and PM-2.5 analysis. They used a more conservative approach of just using the lowest predicted plume height and smallest sigma z in their CO and NH_3 analysis.

To do these calculations, Shell performed the preliminary run with a line of receptors along the centerline of the areapoly used for the ice management vessels and determined the worst case concentration at each receptor. Shell then took the corresponding plume heights and vertical dispersion coefficients for the receptor with the highest modeled concentrations. These plume heights and vertical dispersion coefficients then became the final modeled inputs for the ice management vessels in the full impact analysis. A similar approach was used to characterize the oil spill response fleet. The end result of this approach allows Shell to place emissions for the moving associated fleet in the area they generally work while providing a conservative impact analysis by using worst case dispersion characteristics for the portion of the associated fleet that

is modeled as an areapoly. Region 10 reviewed this approach and believes it provides a conservative estimate of modeled impacts while adequately characterizing a moving fleet of vessels.

D.7 NO_2 Modeling Technique

The NOx 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 Appendix W 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 (EPA 06/29/10).

Shell used the Plume Volume Molar Ratio Method (PVMRM) (Hanrahan 1999) to estimate their 1-hour and annual average NO_2 impacts. PVMRM is discussed in Section 5.1.j of Appendix W as a technique that EPA is currently testing to determine its suitability as a refined method. In the mean-time, PVMRM may be considered on a case-by-case basis as a non-regulatory-default option under the "detailed screening method" (Tier 3) provision of Section 5.2.4.d of Appendix W (EPA 06/29/10 and EPA 03/01/11).

PVMRM assumes NO will convert to NO_2 in the presence of O_3, based on the following basic chemical mechanism, known as titration:

$$NO + O_3 \rightarrow NO_2 + O_2 \qquad \text{(Eq. 1)}$$

PVMRM also assumes that the NO_2 already present in the exhaust plume remains as NO_2 in the atmosphere. A user of this technique must therefore know or assume the amount of NO_2 present in the exhaust gas, and the amount of O_3 present in the atmosphere. These data requirements, along with the procedural requirements for using PVMRM, are described in more detail below.

D.7.1 Procedural Requirements

As a non-regulatory-default option, use of this technique requires Regional Office approval. It is also subject to public comment. The Regional Modeling Contact for Region 10 approved Shell's use of PVMRM for the Kulluk analysis on May 8, 2011 (EPA 05/08/11). The public will be invited to comment on the use of PVMRM in the public notice which accompanies the draft Kulluk permit.

D.7.2 In-stack NO_2/NOx Ratio

The assumed NO_2-to-NOx in-stack ratio is a variable that must be set for each emission unit with NOx emissions. Source-specific data should be used when available. When source-specific data is not available, EPA recommends the use of 0.50 as a default in-stack ratio for purposes of modeling 1-hour NO_2 impacts (EPA 03/01/11). This value represents "a reasonable upper bound based on the available in-stack data." EPA has not provided a similar default ratio for purposes of modeling annual average NO_2 impacts.

Shell used the preferred approach of obtaining source-specific data, rather than the 0.5 default. Shell developed average ratios for general types of combustion units and post-combustion control combinations, based on numerous source tests of the existing emission units on the Discoverer Drillship and associated fleet. Reliance on these ratios is a reasonable approach given the similarity in emission units.

D.7.3 Ambient Ozone Data

Shell obtained hourly ozone data for 2009 from Barrow and Prudhoe Bay A Pad. (Data from 2010 was not available at the time they prepared their analysis.) Shell then created an hourly ozone data set for modeling purposes by selecting the maximum reading from either station on an hour-by-hour basis.

Using the maximum of the two sites allows for missing hours at either site. Use of the maximum ozone concentration also leads to increased conversion of NO to NO_2 (during those periods when the ambient NO concentration exceeds the ambient ozone concentration). Shell therefore used a reasonable approach for developing a representative ozone data set for modeling NO_2 concentrations over the Beaufort Sea.

Region 10 reviewed both of these datasets and found they were representative of likely ozone levels in the Beaufort Sea. In general the ozone readings at both sites were similar, varying only a few parts per billion (ppb) on an hourly basis. Hourly readings at Barrow were slightly higher on average than those at A pad.

D.8 PM-2.5 Modeling Technique

PM-2.5 is either directly emitted from a source (primary emissions) or formed through chemical reactions with pollutants already in the atmosphere (secondary formation). EPA promulgated AERMOD as an acceptable model for performing near-field analysis of primary pollutants (Appendix A to Appendix W of 40 CFR Part 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 lack of a comprehensive, near-field modeling tool, EPA issued modeling guidance in 2010 to give further direction on how to conduct an ambient impact analyses for PM-2.5 (EPA 02/26/10 and EPA 03/23/10). This guidance provides that, with appropriate selection of representative background ambient 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.

Shell used PM-2.5 ambient monitoring data from an onshore location (Deadhorse) that includes the impacts of secondary PM-2.5 from existing onshore sources. This onshore monitor is expected to have accounted for much of the secondary formation that will occur in the area (i.e. the monitor is exposed to secondary formation from existing regional emissions sources). Shell took the resulting 24-hour monitored background value and added the two-year average of the

maximum 24-hour modeled concentration (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 $PM_{2.5}$ concentration in the Beaufort of 33.9 $\mu g/m^3$ at the assumed ambient air boundary (500 meters from the Kulluk hull) and lower levels as the distance from the Kulluk increases. Additional details regarding the Deadhorse PM-2.5 data may also be found in Section F.3 of this TSD.

It is important to note that secondary formation of PM-2.5 will generally be low near the emission release point (here, the Kulluk), where the 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 Kulluk 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 Kulluk would be operating in a single drilling location for 3 years, when that scenario is unlikely to occur, further mitigate against the possibility that emissions to be authorized under the permits would 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 Sea and in potential transport areas where monitoring is performed, show low levels of PM-2.5, generally in the range of 2 $\mu g/m^3$. 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.

The use of Deadhorse ambient monitoring data without additional assessment of the possible secondary PM-2.5 impacts from the Kulluk and associated fleet is therefore appropriate. Emissions of the PM-2.5 precursor SO_2 from the Kulluk and associated fleet are 10 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 NOx from the Kulluk and associated fleet are considerably higher, at 240 tpy.[4] As a point of comparison, however, actual emissions of NOx from point sources in the North Slope oil and gas fields within the greater Prudhoe Bay/Deadhorse area are approximately 65,000 tpy, yet the total (not just secondary) PM-2.5 concentrations in Deadhorse are typically quite low. Given the amount of NOx emissions to be authorized under these

[4] 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)" (73FR 28321, May 16, 2008), indicate that VOC and NH_3 emissions are presumed not to contribute to secondary formation of PM-2.5.

permits in comparison to the NOx emissions in the North Slope area in general, it is unlikely that NOx emissions from the Kulluk and 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 modeling uses background PM-2.5 monitoring results that are expected to include secondary PM-2.5 formed from 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. Region 10 believes that the PM-2.5 NAAQS will be protected at all locations when accounting for secondary precursors from the Kulluk 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.

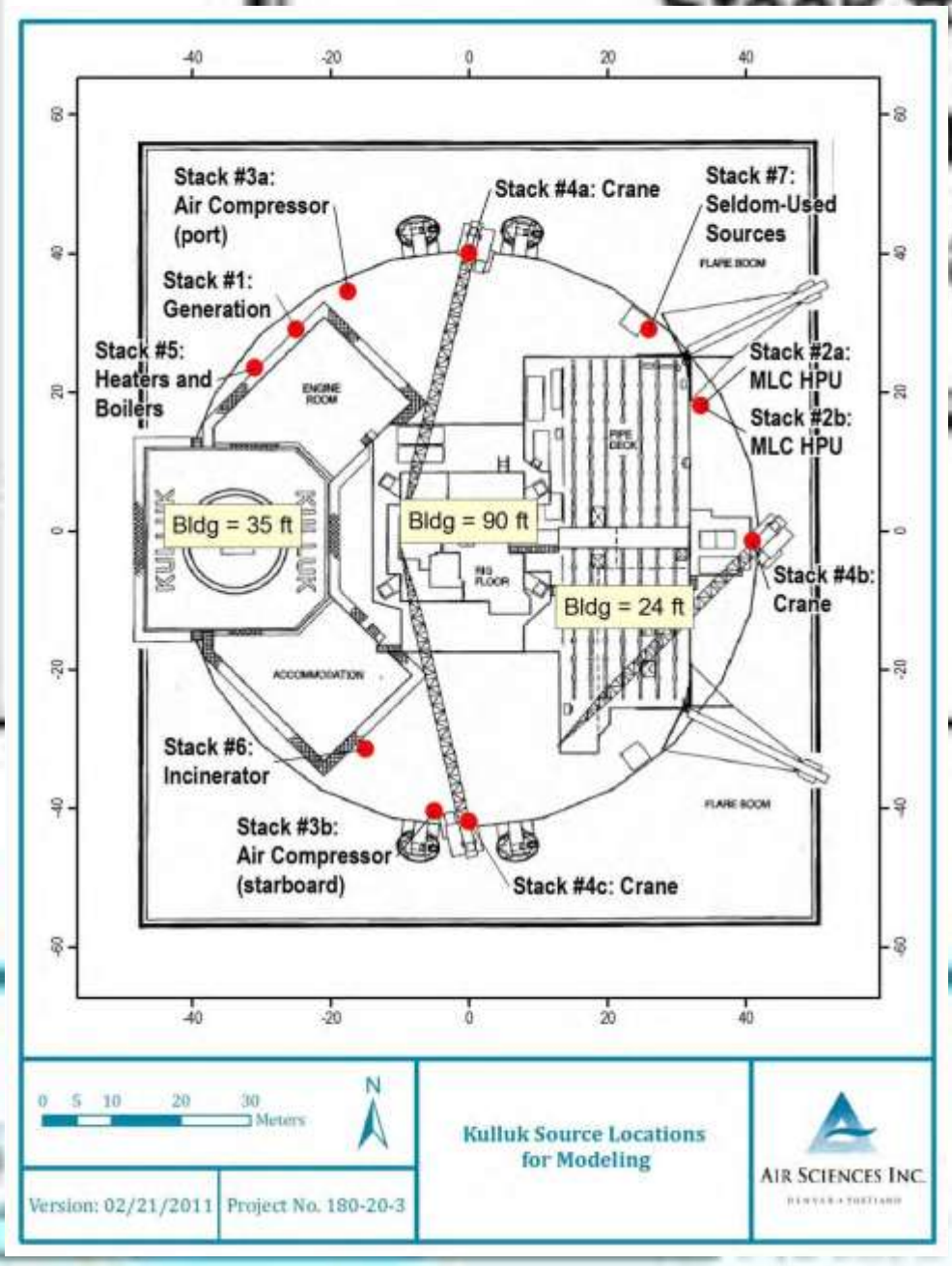
D.9 Building Downwash/Wake Effects

The Building Profile Input Program for PRIME (BPIPPRM) (EPA 4/21/04 User's Guide) calculates direction-specific building dimensions for input into AERMOD. These dimensions are used by the model to account for building downwash and wake effect which result from the effects of airflow around large structures near emission points.

The relative location of the Kulluk exhaust stacks and structures is shown in Figure 2. Shell input the stack location and height for each of the exhaust stacks above the water surface, along with the corner locations and structure height above the water surface of the Kulluk's main deck, the helicopter pad, the pipe deck and the derrick, and the resupply ship's structures into BPIPPRM. Shell used the current version of BPIPPRM – version 04274. Shell included the resulting direction-specific building dimensions in its AERMOD modeling analysis.

Region 10 used a proprietary 3-D visualization program to review Shell's characterization of the exhaust stacks and structure locations/heights. The images generated from Shell's BPIPPRM input file match the photos and figures of the Kulluk, as provided in Shell's permit application.

Figure 2: Kulluk Exhaust Stack and Structure Layout



D.10 Receptor Grid

Shell used the same local Cartesian coordinate system described in Section D.4 to define their modeling domain and receptor grid. Surface elevations were set to 0.0 meters to reflect the lack of terrain in an overwater setting. The grid does not have a defined origin because drilling will occur at multiple locations within the specified permitted lease blocks. Shell's modeling analysis assumed an ambient air boundary of 540 meters from the center of the Kulluk (500m from the hull) which is reflected in its receptor grid.

Figure 3 shows the receptor layout used in the modeling analysis. Shell used a 25 meter (m) spacing around the assumed ambient air boundary. Shell constructed the rest of the grid as follows:

- 100-m spacing out to 1 km from the center of the Kulluk;
- 250-m spacing from 1 km to 5 km from the center of the Kulluk.

Shell's grid has sufficient density and coverage for finding the maximum impacts.

Shell also included three "special interest" receptors to estimate the impacts in Nuiqsut, Deadhorse and Kaktovik. Shell placed these receptors in the same relative direction and distance as what would occur if Shell operated the Kulluk within the nearest corner of the nearest lease block to a given community. The location of these communities relative to Shell's lease blocks in shown in Figure 4.

Figure 3: Modeling Domain and Receptor Points

(The + in the figure represents the *Kulluk*)

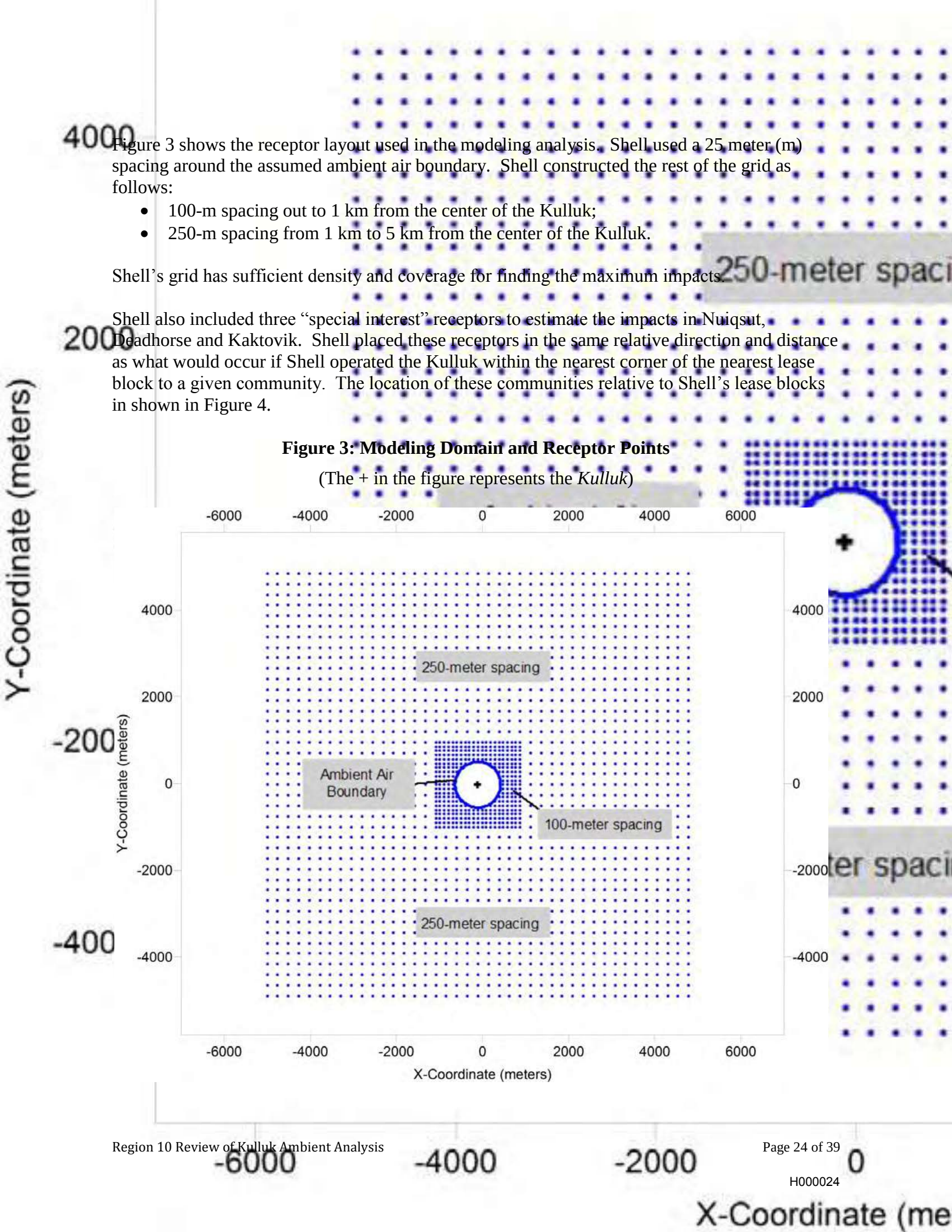
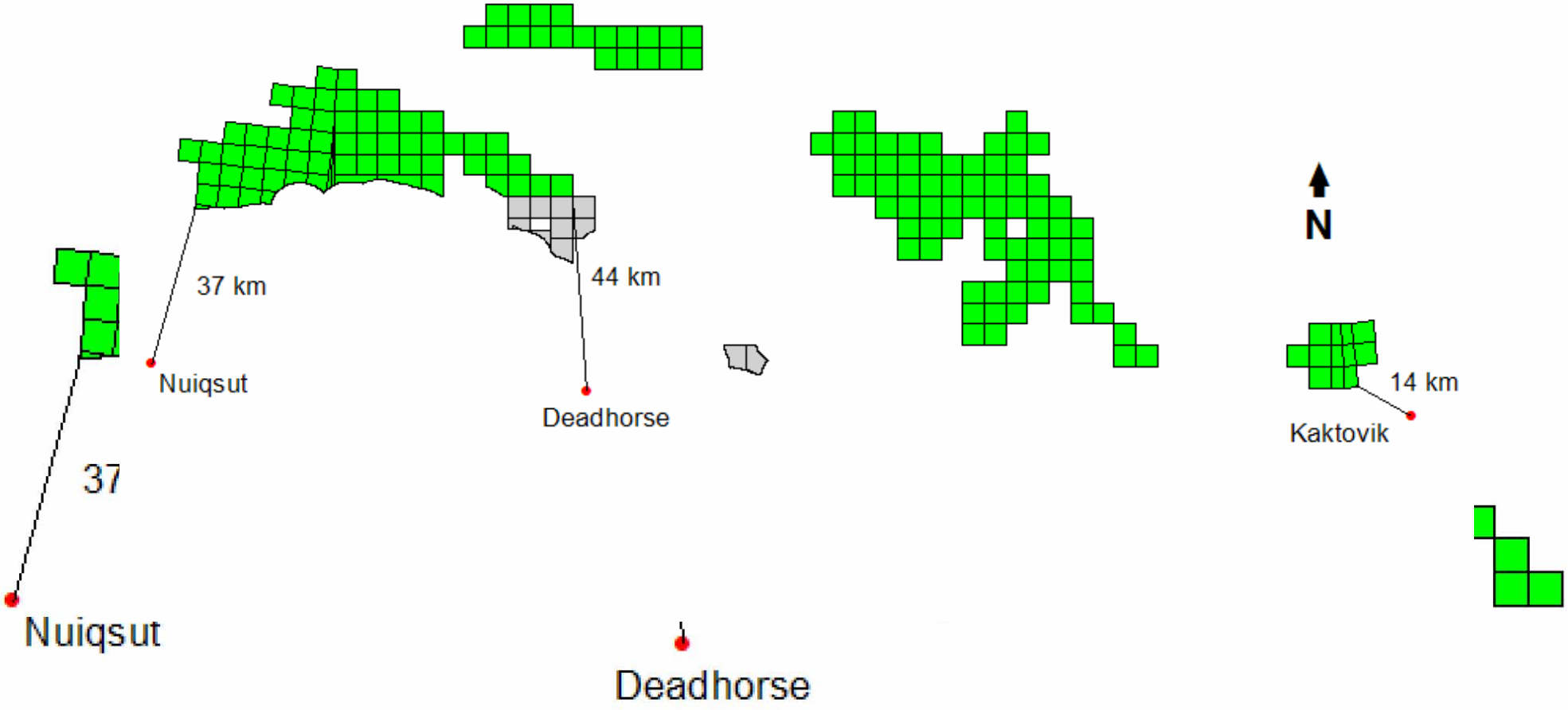


Figure 4: Map of Nearest Communities on the Beaufort Coast Relative to the Kulluk OCS Leases

Note: Shell dropped the gray-shaded lease blocks from permitting consideration in the Kulluk application.



D.11 Offsite Impacts

The impact from neighboring (off-site) sources must be accounted for in a cumulative impact assessment. Per 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.

Shell did not address potential off-site impacts in their February 2011 permit application. Region 10 therefore asked Shell to address this modeling deficiency in our March 18, 2011 incompleteness letter.

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) (EPA 10/90). 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" (EPA 03/11). Appendix W is consistent with this approach, stating that professional judgment is required for ascertaining which sources should be explicitly modeled and which sources can be represented through ambient monitoring data.

Shell and Region 10 discussed the possible options for assessing off-site impacts in an April 7, 2011 teleconference. Region 10 subsequently provided general guidance for Shell's consideration (EPA 4/14/11). Region 10 specifically noted that Shell may be able to limit the modeling of nearby sources by switching to ambient data that better accounts for the impacts from off-site sources.

Attachment B of Shell's May 4, 2011 submittal successfully showed that the impact from off-site sources could be accounted for through ambient monitoring data rather than modeling (Shell 05/04/11). The maximum project impacts occur near the Kulluk. Region 10 notes that this is a typical finding for sources with relatively short stacks and plumes subject to downwash. Additional information regarding the ambient data used to represent the off-site/background concentrations may be found in Section F of this TSD.

Shell did not include the Discoverer drilling program in their Kulluk analysis since they have agreed to not operate the Discoverer in the Beaufort Sea concurrently with the Kulluk. 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 operations that could potentially be in the Beaufort Sea. Region 10 intends to require all permitted operations to notify Region 10 regarding their anticipated drilling locations far in advance of each drilling season (6 months) so that Region 10 can evaluate whether there is a need for additional ambient analyses.

E. Meteorological Data/Processing

AERMOD requires hourly surface meteorological data to estimate plume dispersion. According to Appendix W, a minimum of one-year of site-specific data, or five years of representative National Weather Service (NWS) data should be used. When modeling with site-specific data, Appendix W states that additional years (up to five) should be used when available to account for year-to-year variation in meteorological conditions. AERMOD also requires a morning sounding from a representative upper air station.

Shell used July through November meteorological data from 2009 and 2010 for modeling most pollutants. The one exception regards the NO_2 analysis. In this case, Shell was unable to use the 2010 meteorological data since concurrent ozone data was not available at the time of the analysis (see NO_2 modeling discussion in Section D.7 of this TSD). Additional information regarding the meteorological data sets and Shell's processing of these data sets may be found below.

E.1 Meteorological Data Sets

Because the drilling season spans periods of both open water and ice, Shell needed several different meteorological data sets. Shell collected tower (surface) data at a small offshore island (Reindeer Island) during 2009 and 2010. The measured parameters included 10-meter wind speed/direction, air temperature, differential temperature between 10-meters and 2-meters, solar radiation, and pressure. Shell assumed the wind data adequately reflects marine boundary layer conditions without undue influence from the island since the island is small, there is little terrain relief, and the tower was located very close to the edge of the narrow island. Region 10 agrees with Shell's assessment of this location and considers the Reindeer Island data as site-specific for the Kulluk ambient impact assessment. Shell used concurrent upper air data from the nearest available source, the NWS station in Barrow, Alaska.

Region 10 reviewed the Reindeer Island meteorological data and determined that it meets the PSD quality assurance requirements. Shell filled in missing Reindeer Island data with Deadhorse NWS data.

In addition to the Reindeer Island surface data, Shell needed air-sea temperature difference data and overwater relative humidity data to run the COARE meteorological program during open water conditions. Shell deployed instrumented buoys during the open water periods in 2009 and 2010 to obtain the air-sea temperature and humidity data.

COARE provides most of the meteorological inputs required by AERMOD. However, COARE does not provide mixing height data. Shell therefore operated a thermal profiler at Endeavor Island (Endicott) during 2010 to develop the overwater mixing heights. Shell developed an empirical equation from the profiler data to derive the mixing heights during the open water periods in 2009 (when actual profiler data were not available). Additional details regarding Shell's processing of the meteorological data may be found in Appendix B and C of their permit application.

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. Diagnosed mixing heights using the Richardson number along with imposed restrictions on mixing heights were also reviewed by Region 10 and found to be representative for use in the Kulluk analysis.

E.2 Meteorological Pre-Processing

The meteorological data must be processed into a format that AERMOD recognizes. As previously discussed, Shell used two different meteorological pre-processors: one to process the meteorological data during broken ice conditions (AERMET), and the other to process the meteorological data during open water conditions (COARE). Shell defined the open water period as the time a buoy could be deployed (August 5 – October 13, 2009; and August 14 – October 10, 2010).[5]

E.2.1 COARE

As previously noted, COARE is a non-Guideline model. Use of this model therefore requires Regional Office approval. It is also subject to public comment. The Regional Modeling Contact for Region 10 approved Shell's use of COARE for the Kulluk analysis on May 8, 2011 (EPA 05/08/11). The public will also be invited to comment on the use of COARE in the public notice which will accompany the draft permit.

E.2.2 AERMET

Shell used the current version of AERMET (06341) at the time of the February 28, 2011 submittal. EPA has subsequently released a newer version (11059), but this release does not alter the validity of Shell's submittal.[6]

AERMET requires the area surrounding the meteorological tower be characterized in regards to the following three surface characteristics: noon-time albedo, Bowen ratio, and surface roughness length (EPA 11/04 AERMET). Additional guidance regarding the selection and processing of these values may be found in the *AERMOD Implementation Guide* (EPA 03/19/09).

Shell assumed the noon-time albedo is 0.8, the Bowen ratio is 2.0 and the surface roughness length is 0.001. These values are identical to the values previously approved by ADEC for winter conditions (i.e., ice conditions) on the Beaufort Sea (ADEC 2007).

F. Background Air Quality Data

Background monitoring data is used in conjunction with modeled predictions to determine if the combined impact complies with the NAAQS. The data should represent impacts from sources not specifically modeled; such as natural, area-wide, long-range transport and distant stationary sources.

[5] Once deployed, Shell left the buoys in the Beaufort Sea until they were destroyed by the pack-ice.

[6] The primary reason for EPA's recent release of a new version of AERMET is to provide applicants the ability to derive wind information from 1-minute, rather than hourly, NWS data. The use of 1-minute NWS data is not required, though, and this additional algorithm is non-applicable when using site-specific meteorological data.

Because there are no islands, platforms, or infrastructure in the Beaufort Sea 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 influenced by local sources that are not present in the vicinity of Shell's offshore operations.

Shell used ambient data collected at a number of on-shore monitoring stations for their background concentrations. They originally used the 2009 monitoring data that they collected near Badami for the background NO_2 and PM-2.5 concentrations. They later switched to data collected from the greater Prudhoe Bay area to better account for possible impacts from existing sources. The location of each background data set proposed by Shell is summarized below in Table 8.

Table 8: Location of Background Data Used by Shell

Air Pollutant	Data Location	Data Period
NO_2	Prudhoe Bay A Pad	2006, 2007, 2009
PM-2.5	Deadhorse	July 2010 – Nov 2010
PM-10	Prudhoe Bay CCP [a]	2006, 2007
SO_2	Endicott SDI [b]	July 2007 – Nov 2007 for short-term averages, Feb 2007 – Jan 2008 for annual average
CO	Endicott SDI [b]	Endicott (July 2007 – Nov 2007

[a] Shell identified the PM-10 data as "BPX Prudhoe Bay area." BPXA operates two ambient air monitoring stations within Prudhoe Bay. However, BPXA only collects PM-10 data at the "Central Compressor Plant" (CCP) site.

[b] Shell identified the SO_2 and CO data as "BPXA Liberty." This title actually refers to a project. BPXA collected the "Liberty" data set at the Endicott Satellite Development Island (SDI).

Region 10 considered the datasets presented by Shell and then conducted an independent evaluation of the available monitoring data to determine which datasets Region 10 believes are most representative of background values. Region 10 made this determination for both the offshore locations near the Shell lease blocks, as well as at the onshore communities where the air quality impact from the Kulluk and associated fleet is being evaluated. Region 10's findings are described in a June 23, 2011 memorandum, "EPA Region 10 Determination of Appropriate Background Values for the Chukchi Sea and Beaufort Sea OCS Permits." Table 9 summarizes the monitoring sites and the background values that Region 10 believes best represent offshore locations in the Beaufort Sea.[7] Each of the data sets used for the Kulluk offshore locations are discussed in more detail below.

[7] Table 6 of Region 10's June 23, 2011 memorandum incorrectly highlighted the CCP value for the annual average NO_2 concentration at offshore locations (19 $\mu g/m^3$). Region 10 intended to highlight the A Pad value (11 $\mu g/m^3$). While Shell can demonstrate compliance with the annual average NO_2 NAAQS using either value, Region 10 considers the CCP value to be an overly conservative estimate of the expected background concentration at the offshore lease blocks. Region 10 therefore used the A Pad value in this TSD.

Table 9: Background Values for Use with Modeled Impacts at Offshore Locations

Air Pollutant	Averaging Period	Concentration ($\mu g/m^3$)	Data Source
NO_2	1-hour	Varies by hour	A Pad
	Annual	11	
PM-2.5	24-hour	17	Deadhorse
	Annual	4	
PM-10	24-hour	53	CCP
SO_2	1-hour	29	CCP
	3-hour	29	
	24-hour	22	
	Annual	4	
CO	1-hour	1,742	SDI
	8-hour	1,094	

Table 10 summarizes the monitoring sites and background values that Region 10 believes are appropriate for evaluating impacts in the Kaktovik and Nuiqsut onshore communities. Region 10 used the offshore values presented in Table 9 to represent the background concentrations in Deadhorse.

Table 10: Background Values for Use with Modeled Impacts at Onshore Locations

Air Pollutant	Averaging Period	Katkovik		Nuiqsut	
		Concentration ($\mu g/m^3$)	Data Source	Concentration ($\mu g/m^3$)	Data Source
NO_2	1-hour	21	Badami	94	A Pad
	Annual	1		11	
PM-2.5	24-hour	6	Badami	17	DeadHorse
	Annual	3		4	
PM-10	24-hour	53	CCP	53	CCP
SO_2	1-hour	10	SDI	14	A Pad
	3-hour	11		180	
	24-hour	4		25	
	Annual	2		4	
CO	1-hour	1,742	SDI	1,742	SDI
	8-hour	1,094		1,094	

While ambient data is currently being collected in Nuiqsut, Region 10 instead used ambient data from Prudhoe Bay to represent the background values in Nuiqsut. Region 10 took this approach since the Nuiqsut data has not been submitted to Region 10 for review. The Prudhoe Bay data should also provide a more conservative estimate of the background values due to the close proximity of these monitoring stations to the oil and gas sources in Prudhoe Bay. Where available, Region 10 has used data from sites west of Prudhoe Bay for Nuiqsut and sites to the

east of Prudhoe Bay for Katktovik, with a preference for more recent data if more than one site has data for the same pollutant. As discussed above, the only reviewed PM-10 data is from the CCP site and so that data set was 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.

F.1 A Pad NO_2 Data

As previously noted, Shell switched from Badami data to Prudhoe Bay A Pad data to represent the NO_2 background concentrations at their offshore locations. As discussed in Section D.11, Region 10 agrees that this switch better accounts for the possible impacts from on-shore sources.

There are three years of recent PSD-quality NO_2 data available from A Pad (2006, 2007 and 2009). The 2008 NO_2 data is not PSD-quality, and therefore, should not be used for regulatory purposes (Enviroplan 2010a). The NO_2 data from the other years was reviewed by ADEC, who found them to be PSD-quality (ADEC 2008, ADEC 2009, Enviroplan 2010b). Shell used the maximum annual average NO_2 concentration between the three years of available data to represent the annual average NO_2 background concentration. The use of the maximum concentration is appropriate.

The 1-hour NO_2 NAAQS is based on an annual distribution of the daily maximum 1-hour value. Due to the probabilistic nature of this standard, applicants may use the monitored design value to represent the background concentration, rather than the maximum measured concentration (EPA 03/01/11). They may also use hourly values that represent the seasonal diurnal pattern of the ambient concentrations. In this case, applicants may add the multi-year average of the 98^{th} percentile of the available background concentrations by season and hour-of-day to the modeled concentration. In rare cases, the use of additional refinements, such as combining the background and modeled concentrations on an hour-by-hour basis may be warranted.

Shell originally paired the hourly background concentration and hourly modeled concentration on an hour-by-hour and day-by-day basis. Region 10 felt this approach was not adequately robust for purposes of this ambient demonstration, and instead asked Shell to use hourly background concentrations that reflect the diurnal profile of the NO_2 concentrations measured during the July through November drilling season.

Shell calculated a diurnal NO_2 profile based on a three-year average of the NO_2 concentrations measured in 2006, 2007 and 2009. They then combined the modeled concentrations with the background concentration on an hour-of-day basis to determine the total impact. The 98^{th} percentile of the maximum daily 1-hour total impact was then compared to the 1-hour NO_2 NAAQS.

F.2 CCP PM-10 and SO_2 Data

As with the NO_2 data, PM-10 and SO_2 data from the Prudhoe Bay area is warranted in order to best represent the possible impact from onshore sources at the offshore locations. The only PM-10 data set within Prudhoe is from the CCP. This is a conservative data set due to its close proximity (on the order of 100 meters) to two large Prudhoe Bay stationary sources: the Central Power Plant and Central Gas Facility.

There are three SO_2 data sets from the greater Prudhoe Bay area (CCP, A Pad and SDI). Shell used data from the SDI station in their application. Region 10 felt that either A Pad or CCP data was a better selection for representing potential impacts from onshore sources since these stations are located downwind of CCP and CGF. Of these data sets, the CCP set would typically provide the more conservative result due to its closer proximity to these stationary sources. The A Pad data sets also contained two anomalously high hourly values (336 $\mu g/m^3$ and 202 $\mu g/m^3$) that were an order of magnitude larger than the next highest value (20 $\mu g/m^3$). While Region 10 could have processed the A Pad data to determine a 1-hour SO_2 background concentration in the form of the 1-hour SO_2 standard, Region 10 instead took the simpler and more conservative approach of using the maximum value from CCP (29 $\mu g/m^3$). Region 10 also used the CCP data for the other SO_2 averaging periods for consistency purposes.

F.3 Deadhorse PM-2.5 Data

As previously noted, Shell originally used data measured near Badami to represent the expected PM-2.5 background concentration at their offshore locations. They latter switched data sets in order to better account for the potential impacts from existing onshore sources.

There are only two other complete PM-2.5 data sets from monitoring stations located along the Beaufort Sea: a data set from Nuiqsut and a data set from Deadhorse.[8] The Nuiqsut station was sited to measure regional impacts from the Kuparuk River Unit oilfield. The Deadhorse station (which is near Prudhoe Bay) only has data from 2010. The station was sited near gravel roads and pads in order to measure elevated concentrations for purposes of comparing the results between "Federal Reference Method" equipment and "Federal Equivalent Method" equipment.[9] While the Deadhorse data includes elevated fugitive dust impacts from the gravel roads and pads, it is nevertheless the more conservative data set for measuring impacts from existing North Slope stationary sources.

Shell used the Deadhorse data to represent the background PM-2.5 concentration within the Kulluk lease blocks. This is an acceptable data set due to its inclusion of both direct PM-2.5 emissions and potential secondary PM-2.5 impacts, as previously discussed in Section D.8 of this TSD. Region 10 reviewed the latest PM-2.5 monitoring data to ensure that the background values used in the ambient air analysis are representative of background values and to ensure the data being used followed the latest EPA modeling guidance. (EPA 06/23/11).

F.4 SDI CO Data

CO is not routinely measured within Prudhoe Bay due to its low ambient concentration in this region. The most recent data set was collected by BPXA at SDI. Shell and Region 10 used this data set to represent the background CO concentrations at both offshore and onshore locations.

[8] BP Exploration Alaska, Inc. (BPXA) has recently started collecting PM-2.5 data at their CCP monitoring station in Prudhoe Bay, but the dataset does not yet cover Shell's July through November exploratory drilling period.

[9] The Deadhorse station is located closer to a road than recommended in EPA's PSD monitoring guidance (CPAI 2009), and therefore, measures concentrations that are higher than what would typically be found. It was purposely placed at this worst-case location to counter the typical low PM-2.5 concentrations measured on the North Slope. Placement at this location allowed for higher concentrations to be measured, which was needed in order to accurately compare the two monitoring methods.

G. Results and Discussion

The maximum modeled NO_2, SO_2, PM-10, PM-2.5, and CO impacts, background concentrations, total impacts, and NAAQS are summarized below in Table 11. All of the total impacts are less than the NAAQS. The modeling results show that the emissions associated with the proposed permit are not expected to cause or contribute to a violation of the NAAQS. The maximum 8-hour NH_3 impact is 6.6 µg/m^3 which is well below the State of Alaska air quality standard of 2,100 µg/m^3.

Table 11: Modeled Impacts at the Location of Maximum Impact

Air Pollutant	Averaging Period	Shell Only Impacts (without background) (µg/m^3)	Background Concentration (µg/m^3)	Total Impact Including Background (µg/m^3)	NAAQS (µg/m^3)	Total Impact as a % of NAAQS
NO_2	1-hour	110.6	40.9	**151.5**	188	81%
	Annual	4.4	11	**15.4**	100	15%
PM-2.5	24-hour	17.0	17	**34.0**	35	97%
	Annual	1.0	4	**5.0**	15	33%
PM-10	24-hour	20.8	53	**73.8**	150	49%
SO_2	1-hour	14.0	29	**43.0**	196	22%
	3-hour	8.9	29	**37.9**	1,300	3%
	24-hour	2.8	22	**24.8**	365	7%
	Annual	0.2	4	**4.2**	80	5%
CO	1-hour	1,268	1,742	**3,010**	40,000	8%
	8-hour	712	1,094	**1,806**	10,000	18%

H. Ozone

This section provides additional information regarding ozone and why Region 10 believes it is appropriate not to require a quantitative assessment that includes modeling for this pollutant. Ozone is inherently a regional pollutant, the result of chemical reactions between emissions from many sources over a period of hours or days, and over a large area. Ozone is formed in the atmosphere through a chemical reaction that includes NOx, VOC, and CO in the presence of sunlight. The sources of these air pollutants are mainly combustion sources such as power plants, refineries, and automobiles.

EPA does not have a recommended modeling approach for assessing the impact of an individual source on ozone. Individual source impacts are generally within the range of "noise" of regional ozone models (i.e., imprecision in predicted concentration due to uncertainty in model inputs for emissions, chemistry, and meteorology). Section 5.2.1(a) of Appendix W reflects this understanding: "Simulation of ozone formation and transport is a highly complex and resource intensive exercise." Paragraph (c) states: "Choice of methods used to assess the impact of an individual source depends on the nature of the source and its emissions. Thus, model users

should consult with the Regional Office to determine the most suitable approach on a case-by-case basis." Under the Appendix W, Region 10 has considerable discretion in methods for assessing the ozone impact of individual sources. See In re: Prairie State Generating Company, 13 E.A.D. 1, PSD Appeal No. 05-05, slip op. at 133 (EAB 2006). In practice, it is very rare for EPA to require ozone modeling for individual sources.

The land area closest to Shell's exploration operations is part of the State of Alaska's Northern Alaska Intrastate Air Quality Control Region. See 40 CFR § 81.246. This region is designated as either attainment or unclassifiable for all criteria pollutants, including ozone. See 40 CFR § 81.301. Ozone precursor emissions from point sources in the North Slope oil and gas fields near Deadhorse contribute approximately 65,000 tpy of NOx and 1,100 tpy of VOC. Even so, the 8-hour ozone design concentration measured within Prudhoe Bay (A Pad) is 34 ppb, which is less than the 75 ppb NAAQS (EPA 06/23/11). Since the allowable NOx and VOC emissions from the Kulluk and associated fleet only a small fraction of this total amount (240 tpy of NOx and 40 tpy of VOC) and will occur away from the existing emissions, it is unlikely that this small increase in ozone precursor emissions would cause or contribute to a violation of the ozone NAAQS.

I. On Shore Impacts

Maximum impacts from the Kulluk's emissions are at the assumed ambient air boundary (500 meters from the Kulluk hull) and decline rapidly as the distance from the drill rig increases. The maximum predicted impacts in the local communities of Nuiqsut, Deadhorse and Kaktovik, which are respectively located approximately 37, 44, and 14 km from the closest leaseblocks, are shown in Table 12. The significant impact level (SIL) established under the PSD program is also shown.

As discussed above, although the PSD requirements for NAAQS demonstrations are not applicable to this analysis, they do serve as a useful guide. EPA has established Significant Impact Levels or SILs under the PSD program to characterize air quality impacts from sources that undergo PSD review. A SIL is a threshold level for the ambient concentration resulting from a source's emissions for a given pollutant and averaging period below which the source is considered too small to cause or contribute to a violation of the NAAQS.

As shown in Table 12, the Kulluk impacts are well below the SILs in all three communities. In many cases, the impacts are smaller by an order of magnitude or more. EPA is nevertheless providing the total impacts (Shell plus background) for comparison to the NAAQS in Table 13.

Table 12: Maximum Modeled Impacts at Nearest Communities (from Kulluk operations, excluding background concentrations)

Air Pollutant	Averaging Period	Kulluk Impacts (µg/m^3) at			SIL (µg/m^3)
		Nuiqsut	Deadhorse	Kaktovik	
NO_2	1-hour	0.04	0.02	0.3	**8**
	Annual	0.03	0.02	0.1	**1**
PM-2.5	24-hour	0.2	0.1	0.5	**1.2**
	Annual	0.004	0.004	0.01	**0.3**
PM-10	24-hour	0.3	0.2	0.5	**5**
SO_2	1-hour	0.4	0.5	0.7	**8**
	3-hour	0.2	0.2	0.3	**25**
	24-hour	0.05	0.03	0.1	**5**
	Annual	0.001	0.001	0.002	**1**
CO	1-hour	201	182	333	**2,000**
	8-hour	117	105	180	**500**

Table 13: Total Impacts at Nearest Communities (from Kulluk operations and including background concentrations)

Air Pollutant	Averaging Period	Total Impacts (µg/m^3) at			NAAQS (µg/m^3)
		Nuiqsut	Deadhorse	Kaktovik	
NO_2	1-hour	94	94	21	**188**
	Annual	11	11	1	**100**
PM-2.5	24-hour	17	17	7	**35**
	Annual	4	4	3	**15**
PM-10	24-hour	53	53	53	**150**
SO_2	1-hour	14	29	10	**196**
	3-hour	180	29	11	**1,300**
	24-hour	25	22	4	**365**
	Annual	4	4	2	**80**
CO	1-hour	1,943	1,924	2,075	**40,000**
	8-hour	1,211	1,199	1,274	**10,000**

J. Conclusions

Region 10 has reviewed and determined that the materials, air quality data, meteorological measurements, and model input and output files submitted by Shell satisfy the requirements in Appendix W to make adequate demonstration of compliance with the NAAQS. The AERMOD and AERMOD-COARE modeling predicted concentrations with representative background concentrations do not show a violation of any NAAQS. Shell has used the worst case emissions and has used worst case vessel emissions when more than one candidate vessel is available.

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 assumption of a fixed drilling location for the entire 120 day OCS period produces a conservative analysis (i.e., the predicted modeled impacts are larger than what would likely be realized with a moving ship with averaging over a longer period of time).

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

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
SEATTLE, WASHINGTON

STATEMENT OF BASIS
FOR DRAFT
OUTER CONTINENTAL SHELF
PERMIT TO CONSTRUCT AND TITLE V AIR QUALITY OPERATING
PERMIT NO. R10OCS030000

SHELL OFFSHORE INC.
CONICAL DRILLING UNIT KULLUK
BEAUFORT SEA EXPLORATION DRILLING PROGRAM

Date of Permit: July 22, 2011

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ASTM .....American Society of Testing and Materials
BOEMRE.....Bureau of Ocean Energy Management, Regulation and Enforcement
CAA .....Clean Air Act
CCV .....Closed Crankcase Ventilation
CFR.....Code of Federal Regulations
CH_4.....Methane
CO.....Carbon monoxide
CO_2.....Carbon Dioxide
CO_2e.....Carbon Dioxide Equivalent
COA .....Corresponding Onshore Area
DOI .....Department of Interior
EJ.....Environmental Justice
EPA.....United States Environmental Protection Agency
ESA.....Endangered Species Act
Fed. Reg .....Federal Register
GHG.....Greenhouse Gas or Greenhouse Gases
HAP.....Hazardous Air Pollutants
H_2S .....Hydrogen Sulfide
hp.....Horsepower
HPU.....Hydraulic Power Units
ICAS .....Inupiat Community of the North Slope
kW-e.....KiloWatts electric
lbs.....Pounds
MLC.....Mud Line Cellar
MMS .....Minerals Management Services (now BOEMRE)
MMBtu.....Million British thermal units
MSA.....Magnuson-Stevens Act
NA.....Not applicable
NAAQS.....National Ambient Air Quality Standards
NEPA .....National Environmental Policy Act
NESHAP .....National Emission Standards for Hazardous Air Pollutants
NHPA.....National Historic Preservation Act
NMFS.....National Marine Fisheries Service
NOAA.....National Oceanic and Atmospheric Administration
NO_X.....Oxides of nitrogen
NO_2 .....Nitrogen Dioxide
N_2O .....Nitrous Oxide
NSPS.....New Source Performance Standards
NSR.....New Source Review
OCS.....Outer continental shelf
OCSLA .....Outer Continental Shelf Lands Act
OSRV.....Oil spill response vessel
Part 55 .....40 CFR Part 55
$PM_{2.5}$ .....Particulate matter with an aerodynamic diameter less than 2.5 microns
PM_{10} .....Particulate matter with an aerodynamic diameter less than 10 microns
ppmv .....Parts per million by volume
PSD .....Prevention of Significant Deterioration
PTE .....Potential to Emit
SCR.....Selective Catalytic Reduction
SO_2 .....Sulfur Dioxide
tpy .....Tons per year
USCG.....United States Coast Guard
ULSD .....Ultra Low Sulfur Diesel
VOC .....Volatile organic compound
wt% .....Weight percent

1. INTRODUCTION, PROJECT DESCRIPTION, AND PUBLIC PARTICIPATION

1.1 Introduction

Shell Offshore Inc. (referred to hereinafter as Shell, facility, source, or permittee) proposes to operate the Kulluk conical drilling unit (Kulluk) and its associated fleet to conduct exploratory drilling on lease blocks located on the Outer Continental Shelf (OCS) in the Beaufort Sea off the North Slope of Alaska, as authorized by the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). The leased areas are part of Lease Sales 186, 202, and 195, and are within and beyond 25 miles of Alaska's seaward boundary.

The 1990 Clean Air Act (CAA or "the Act") amendments transferred authority for implementation of the CAA for sources subject to the Outer Continental Shelf Lands Act (OCSLA) from the Mineral Management Service (now BOEMRE) to the Environmental Protection Agency (EPA). Section 328 of the Act directed EPA to establish 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, Title I of the Act. EPA promulgated air quality regulations applicable to OCS Sources at Title 40 of the Code of Federal Regulations (CFR) Part 55 (Part 55).

The 1990 CAA amendments also established a comprehensive air quality permit program under the authority of Title V of the Act. EPA regulations implementing Title V are promulgated at 40 CFR Part 71 (for permits issued by EPA) and 40 CFR Part 70 (for permits issued by states). The Title V air quality operating permit, or Title V permit, is an enforceable compilation of all air pollution requirements that are applicable to an air emission source. A Title V permit is developed in a public process, sets forth enforceable terms, conditions, and limitations, and is valid for five years but may be renewed.

The operation of the Kulluk and associated fleet on and above the OCS is subject to Section 328 of the CAA, Part 55, and Alaska corresponding onshore area requirements. To comply with these requirements, which are discussed in more detail in Section 2 of this Statement of Basis (SOB), Shell submitted applications to EPA Region 10 (Region 10) for three permits to cover air pollution from its exploratory drilling operations on current OCS lease blocks in the Beaufort Sea: an OCS/Title V permit under Parts 55 and 71 for operations beyond 25 miles of Alaska's seaward boundary; a minor permit for air quality protection under 18 Alaska Administrative Code (AAC) 50.502 and for owner requested limitations under 18 AAC 50.508 to make Prevention of Significant Deterioration (PSD) review unnecessary for operations within 25 miles of Alaska's seaward boundary; and a Title V permit under 18 AAC 50.326 for operations within 25 miles of Alaska's seaward boundary. Shell requested that the three permits be consolidated into a single permit (hereinafter "OCS/Title V permit" or "draft permit").

In support of its permit application, Shell provided analyses that showed its pre-permit potential to emit (PTE) for carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen oxides (NO_X) would exceed the applicable major source threshold of 250 tons per year (tpy). In addition, the project's pre-permit PTE for greenhouse gas (GHG) emissions would exceed 100,000 tpy carbon dioxide equivalent (CO_2e), the threshold established in EPA's recent PSD "Tailoring Rule" defining when new sources of GHGs are subject to regulation for purposes of PSD. 75 Fed. Reg.

31,514 (June 3, 2010). As a major source operating on the OCS, Shell would be subject to the PSD requirements of Part C, Title I of the CAA.

In its permit application, however, Shell requested that its OCS/Title V permit contain federally enforceable restrictions that would limit its PTE of CO, SO_2, and NO_X to below PSD major source thresholds and its PTE for GHGs below the level at which GHGs become "subject to regulation" under the Tailoring Rule.[1] If finalized, the draft OCS/Title V permit will allow Shell to operate the Kulluk and Associated Fleet subject to the terms and conditions of the permit. Title V permits are issued for a duration of five years from the effective date of the permit.

This SOB describes the derivation of the permit conditions and the reasons for them, as well as the legal and factual basis for the permit conditions as provided in 40 CFR §§ 71.7(a)(5) and 71.11(b). The SOB addresses issues including the emitting processes associated with the operation of the Kulluk and associated fleet, air emissions, permitting history, the CAA statutory or regulatory provisions that relate to such operations, and steps taken to provide opportunities for public review of the permit. Note that it is the final OCS/Title V permit, not the SOB, which is legally enforceable. Any errors or omissions in the summaries provided herein do not excuse Shell from complying with the requirements of its OCS/Title V permit. Furthermore, the proposed exploratory drilling operations described in this SOB are also subject to oversight and approval by BOEMRE, including the issuance of a permit to drill.

Permit Application Chronology[2]: February 2011 to July 2011

Submission Date	Document Description
February 28, 2011	Kulluk operating permit applications with supplemental report
March 1, 2011	Revision to page one of supplemental report
March 7, 2011	Air quality impact modeling files
March 9, 2011	Meteorological files and COARE program
March 18, 2011	Additional air quality impact modeling files
March 28, 2011	Shell response to questions submitted by Region 10 on March 25, 2011
March 29, 2011	Revision to application forms and application appendices
April 7, 2011	Detailed Beaufort Sea lease map, description of mooring process, and sensitivity limits to mixing height
April 18, 2011	Draft pre-permitted potential to emit

[1] As explained in more detail in Sections 2 and 3 of the Statement of Basis, Shell's project is being permitted as a "synthetic minor" source, with federally enforcable limits restricting its PTE to below PSD major source thresholds, as well as its PTE for GHGs to below the threshold at which GHG's become subject to regulation under the Tailoring Rule.

[2] The Administrative Record also contains numerous emails and correspondence between Shell and its consultants and EPA clarifying various aspects of the application.

Submission Date	Document Description
April 19, 2011	Electronic copies of Kulluk impact analysis
April 22, 2011	Maps depicting lease blocks, monitoring methods matrix, allowable emission inventory, and summary of applicable regulations
April 27, 2011	Copy of check and fee filing form
April 29, 2011	Additional application information including nearby source/cumulative impact analysis, update to owner requested limits form, clarification on engine replacement, compliance monitoring plan and matrix, and summary of applicable regulations
May 4, 2011	Updates to air quality analysis, air quality impact modeling files, Tier 2 emission standards, and two missing pages for April 29, 2011 submission
May 5, 2011	Email explaining Attachment 5 of April 29, 2011 submission
May 6, 2011	Shell Discoverer Stack Test Reports
May 8, 2011	Shell Discoverer Associated Fleet Stack Test Reports
May 9, 2011	NSPS Subpart IIII applicability flow chart for MCL HPU engines and compressor engines
May 10, 2011	Kulluk application references
May 13, 2011	Draft example of Kulluk emission inventory
May 18, 2011	Withdrawal of request to employ existing main generators as emergency backup generators on Kulluk and clarification of engine replacement
May 19, 2011	Clarification of Shells engine replacement plan and drilling mud degassing methane emission calculations
May 21, 2011	Engine information
May 31, 2011	Seldom-used engines, cranes and shallow gas diverter system
June 16, 2011	Calculation of emission factors used for Kulluk permit application
June 22, 2011	Impact estimates with anchor handler in open water
June 29, 2011	Resubmission of complete permit application and supplemental information
July 5, 2011	Compilation of previously submitted application materials
July 7, 2011	Fuel Monitoring Information
July 13, 2011	Icebreaker No. 1 additional modeling results and files on hard drive
July 19, 2011	EPA application completeness determination

1.2 Project Description

The exploratory drilling program proposed by Shell will be conducted in the Beaufort Sea between July and November over a maximum of 120 days and is expected to start in July 2012. The drilling season generally occurs in the summer and fall of each year, during periods of open water, but it is likely that environmental conditions (ice and sea states) will limit drilling to less than 120 days. During the drilling season, Shell will have the flexibility to drill one or more wells, or parts of wells, in any of the lease blocks authorized under the terms of its OCS/Title V permit. The following lease blocks from Lease Sales 186, 195 and 202 are covered by the OCS/Title V permit:

OPD NR05-04 (Harrison Bay)

Lease Sale 186: 6369, 6370, 6419, 6420, 6421BC
Lease Sale 195: 6173, 6222, 6223, 6272, 6273, 6320,6321, 6322, 6323, 6371, 6372, 6373, 6374BC, 6424C, 6418, 6422B, 6423B, 6468, 6469B, 6518B, 6519A
Lease Sale 202: 6221, 6274, 6319, 6324, 6367, 6368, 6470, 6471

OPD NR06-03 (Beechey Point)

Lease Sale 186: 6352, 6402A, 6403B
Lease Sale 195: 6152, 6202, 6203, 6204, 6251A, 6301B, 6252, 6253, 6254, 6255, 6256, 6302, 6303, 6304, 6305, 6306, 6307, 6308, 6309, 6351AB, 6401C, 6353, 6354, 6355, 6356, 6358, 6359, 6360, 6404A, 6405B, 6406B, 6409B, 6410, 6411, 6412
Lease Sale 202: 6009, 6010, 6011, 6012, 6058, 6059, 6060, 6061, 6062, 6063, 6064, 6065, 6066, 6067, 6068, 6114, 6115, 6116, 6117, 6118, 6324

OPD NR06-04 (Flaxman Island)

Lease Sale 195: 6657, 6658, 6659, 6707, 6708, 6709, 6712, 6713, 6757, 6758, 6764, 6773, 6774, 6814, 6815, 6822, 6823, 6824, 6873, 6874
Lease Sale 202: 6251, 6252, 6259, 6301, 6302, 6303, 6304, 6305, 6308, 6309, 6310, 6351, 6352, 6353, 6354, 6355, 6356, 6357, 6358, 6359, 6401, 6402, 6403, 6404, 6405, 6406, 6407, 6408, 6409, 6410, 6453, 6454, 6455, 6456, 6457, 6458, 6459, 6460, 6461, 6504, 6505, 6506, 6508, 6510, 6511, 6512, 6554, 6555, 6558, 6559, 6560, 6561, 6562, 6609, 6610, 6611, 6612, 6660, 6662

OPD NR07-03 (Barter Island):

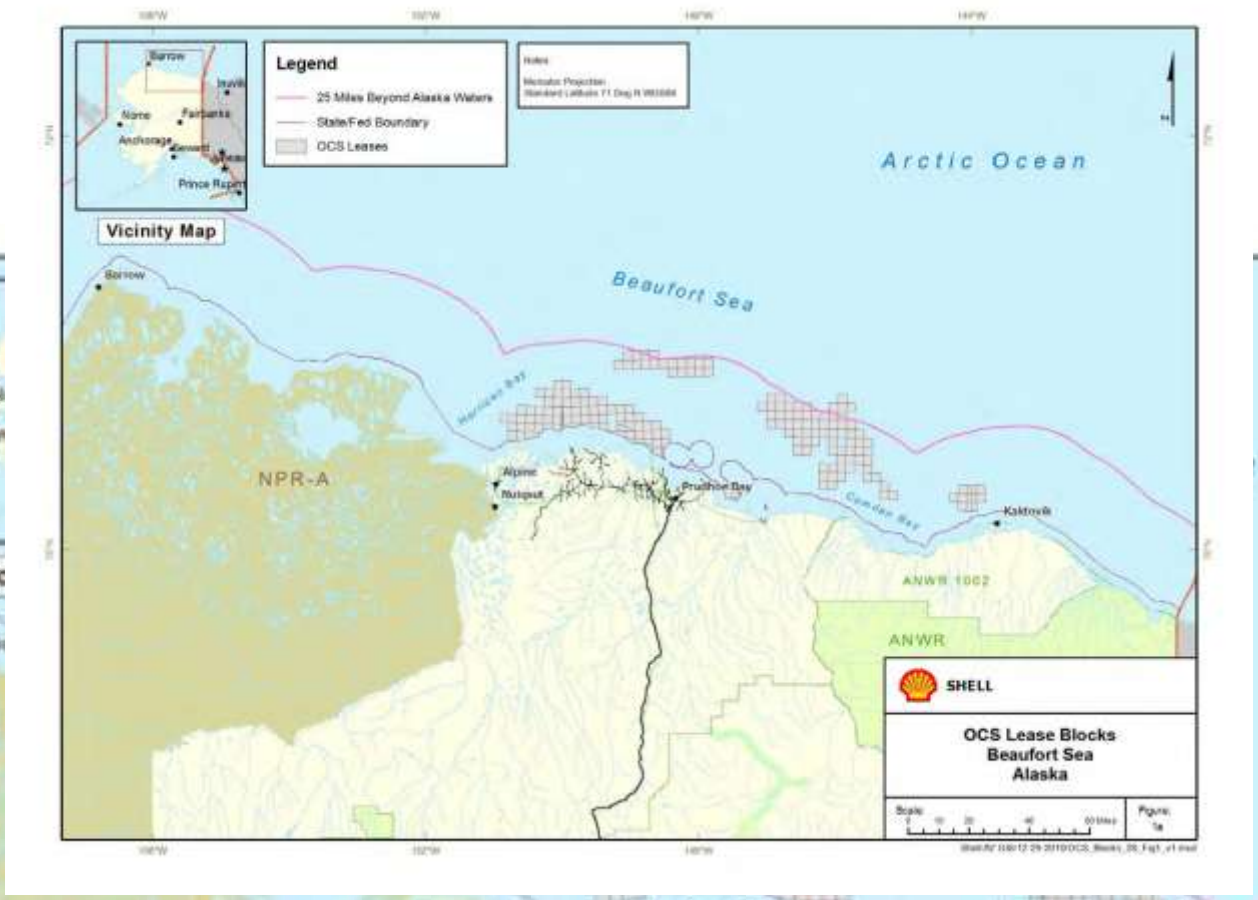
Lease Sale 195: 6751, 6752, 6801, 6802, 6851

The proposed permit would authorize the mobilization and operation of the Kulluk and its associated fleet to any lease block listed above at yet-to-be-determined drill sites in the Beaufort Sea OCS off the North Slope of Alaska for the purpose of conducting exploratory oil and gas drilling. While Shell has a working interest in most of these lease blocks, it does not have a working interest in all of them. The group of lease blocks authorized under this permit is located within 25 miles and beyond 25 miles from Alaska's seaward boundary. In some instances, lease blocks are both within and beyond 25 miles from Alaska's seaward boundary. For purpose of the SOB and the proposed permit, the portion of the OCS which is 25 miles or more from the State's seaward boundary is referred to as the "Outer OCS." The portion of the OCS that is within 25 miles of the State's seaward boundary is referred to as the "Inner OCS."

Figure 1-1 shows the location of all current leases in the Beaufort Sea, and Figure 1-2 shows the location of the subset of current leases within which Shell is not seeking EPA authorization to

use the Kulluk. Note the two contour lines in Figure 1-1 that run parallel to the coastline. One contour line is the state's seaward boundary which generally lies 3 miles from the coast. The other marks the border between the Inner and Outer OCS. As clearly illustrated in Figure 1-1, nearly all current OCS lease blocks lie within the Inner OCS.

Figure 1-1: Current Beaufort Sea OCS Lease Blocks



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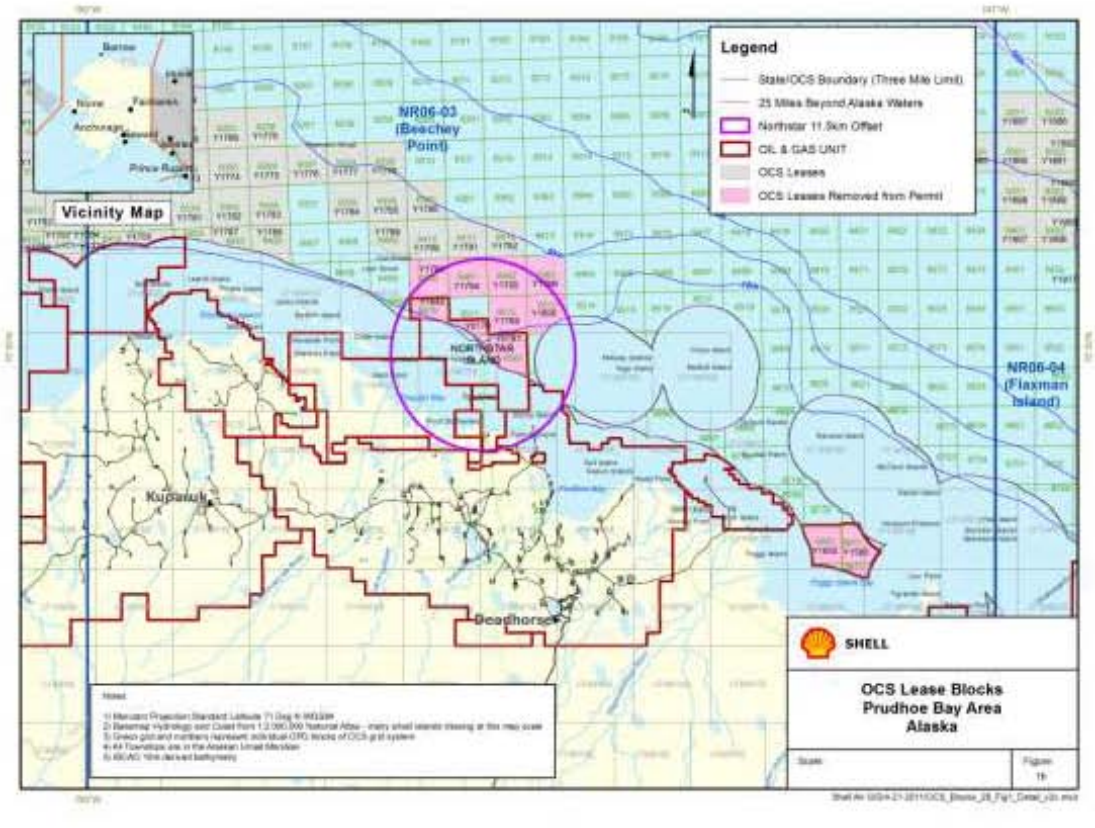
To get a relative sense of scale of the two figures, note that Figure 1-1 displays the 400-mile northern Alaska coastline between Barrow (to the west) and Canada (to the east). Figure 1-2 presents a vicinity map of the Prudhoe Bay area which lies roughly midway between Barrow and the Canadian border. Shell has elected not to request authorization to use the Kulluk in current lease blocks in the vicinity of Northstar Island. A few lease blocks in Foggy Island Bay to the southwest of Northstar Island have also been removed from Shell's original February 28, 2011 authorization request. See purple-shaded lease blocks in Figure 1-2.

Figure 1-2: Current Beaufort Sea OCS Lease Blocks Within Which Shell is Not Seeking Authorization to Employ the Kulluk (purple-shaded lease blocks)



Shell Additional Application Information 04/29/11, Attachment A

The Kulluk is a conical drilling unit without its own propulsion power that is designed to operate in the arctic environment. The primary emission source on the Kulluk is internal combustion engines that consume diesel fuel. A waste incinerator along with boilers and heaters also emit pollution but to a far lesser extent. The largest diesel engines drive generators which generate electricity primarily to power drilling motors. Other diesel engines power other drilling-related equipment including hydraulic pumps, air compressors, cranes, and emergency equipment. All emission units on the Kulluk are identified in Table 1-1 and discussed in greater detail in Section 1.4 of this SOB. A photograph of the Kulluk is provided in Figure 1-3.

The Kulluk's operations will be supported by an associated fleet of vessels that includes a primary ice breaker, an anchor handler with the dual purpose of operating as a secondary ice breaker, an oil spill response vessel carrying and managing smaller work boats, and resupply vessels (such support vessels to be referred to hereinafter as the "Associated Fleet"). The vessels comprising the Associated Fleet will be described in more detail in Section 1.4 of this SOB.

Figure 1-3: Photograph of the Kulluk

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1.3 Public Participation

1.3.1 Opportunity for Public Comment

Title V permits issued to OCS sources operating within and beyond 25 miles of a state's seaward boundary are issued under Part 71 and are therefore subject to the procedural requirements of Part 71. See 40 CFR § 71.4(d).

Region 10 is seeking public comment on the draft permit. The public comment period runs from July 22, 2011 to September 6, 2011. All written comments must be postmarked by no later than September 6, 2011.

If you believe any condition of this draft permit is inappropriate or that Region 10's decision to prepare a draft permit is inappropriate, you must comment on the draft 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 administrative record for this permit or consist of state or federal statutes or regulations, EPA documents of general applicability, or other generally available referenced materials. See 40 CFR § 124.13.

Written comments may be submitted by mail or email. Oral comments may be submitted during the public hearings in Barrow and Anchorage, Alaska. 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 permit.

Send comments on the draft permit to:

Email: R10ocsairpermits@epa.gov
Fax: 206-553-0110
Mail: Kulluk Beaufort Air Permit
EPA Region 10
1200 6th Ave, Ste. 900, AWT-107
Seattle, WA 98101

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.

1.3.2 Public Hearing and Informational Meetings

Region 10 is holding an informational meeting and public hearing on the draft permit as follows:

Barrow
August 23, 2011
Informational Meeting 5:00 pm – 6:30 pm
Public Hearing 7:00 pm – 9:00 pm
Inupiat Heritage Center
Barrow, Alaska

Anchorage
August 26, 2011
Public Hearing 6:00 pm – 7:30pm
Loussac Library
Anchorage, Alaska

The purpose of the public hearing is to receive public comments on the draft permit for Shell's operation of the Kulluk and Associated Fleet on the Beaufort Sea OCS. For more information about the hearing, contact Suzanne Skadowski, EPA Region 10 Community Involvement, at 206-553-6689 or skadowski.suzanne@epa.gov.

1.3.3 Administrative Record

The record for this draft permit includes Shell's application, including addendums and supplemental information; the SOB; the Environmental Justice Analysis; the Technical Support Document Review of Shell's Ambient Air Quality Impact Analysis attached to the SOB (Region

10 Technical Analysis); the additional documents and information submitted by Shell; and other materials relied on by Region 10 in issuance of the draft permit.

The permit record for this draft permit is available at EPA Region 10, 1200 6th Ave, Seattle, Washington, 9:00 am – 4:00 pm, Monday-Friday. To request a copy of or to review these materials, contact Suzanne Skadowski as described above.

The draft OCS/Title V Permit, SOB, Environmental Justice Analysis, the Region 10 Technical Analysis, and the key supplemental materials submitted by Shell are available online at:

EPA Region 10 web site: www.yosemite.epa.gov/R10/airpage.nsf/Permits/kullukap

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
Wainwright City Office, 1217 Airport Road, Wainwright, Alaska, 907-763-2815
Atqasuk City Office, 5010 Ekosik Street, Atqasuk, Alaska, 907-633-6811
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

For more information about the informational meeting, the public hearing or the draft permit, to request a copy of the draft 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.

1.4 Source Description

The following section describes the individual emission units that comprise the Kulluk and Associated Fleet.

Kulluk

While the Kulluk is attached to the seabed and exploring for oil and gas, the Kulluk will use a variety of pollutant-emitting equipment to support drilling operations. The emission units permitted on the Kulluk are listed in Table 1-1. The "K" that appears at the beginning of each emission unit ID signifies that the unit is located on the Kulluk.

Shell has identified groupings of emission units based upon the function each group serves. Shell is not requesting authorization to install specific makes and models of engines. Rather, Shell is requesting authorization to install groupings of engines categorized by known function. This permit allows operation of any emission unit that fits within the description presented in Table 1-1 and that operates in compliance with the terms of the permit. The ratings presented in Table 1-1 are approximations and do not limit Shell from installing larger equipment. As noted in Table 1-1, most of the emission units on the Kulluk are internal combustion engines. As noted earlier, the Kulluk is also equipped with boilers or heaters and an incinerator. All fuel-burning equipment will combust only diesel fuel with a sulfur content of less than 0.01 percent by weight.

Table 1-1: Kulluk Emission Units

Emission Unit ID	Description	Approximate Aggregate Rating[3]
K-1A – 1D	Electricity Generation Engines	10,352 hp
K-2A – 2Z	MLC HPU Engines	1,500 hp
K-3A – 3Z	MLC Air Compressor Engines	1,500 hp
K-4A – 4C	Deck Crane Engines	1,200 hp
K-5A – 5Z	Heaters and Boilers	6 MMBtu/hr
K-6	Emergency Generator Engine	1,047 hp
K-7A – 7D: Seldom-Used Sources		1,650 hp
K-7A	Remote-Operated-Vehicle Engine	300 hp
K-7B	Emergency Anchor Lifting Crane Engine	300 hp
K-7C	Emergency Diver Compressor Engine	300 hp
K-7D1 – 7D5	Emergency Lifeboat Propulsion Engines	750 hp
K-8	Incinerator	276 lb/hr
K-9	Fuel Tanks	423,469 gallons
K-10	Drilling Mud System	NA
K-11	Shallow Gas Diverter System[4]	NA

Emission units with ID beginning with "K-1" are engines that generate electricity to support well drilling activity. Region 10 makes reference to the first four letters of the alphabet, "A" through "D" as Shell intends to install and operate up to four 2011 model year engines with combined 10,352 horsepower output.

Emission units with ID beginning with "K-2" are engines associated with hydraulic power units (HPU) that are employed to construct the Mud Line Cellar (MLC). These engines are portable and are not permanent fixtures on the Kulluk. To provide flexibility in the number of MLC HPU engines Shell intends to employ, EPA makes reference to the entire alphabet "A" through "Z" when identifying the potential span of emission units to serve the MLC HPU function. Shell predicts that the aggregate rating for the MCL HPU engines will be approximately 1,500 horsepower output.

Emission units with ID beginning with "K-3" are engines associated with air compressors that are employed to construct the MLC. These engines are portable and are not permanent fixtures on the Kulluk. To provide flexibility in the number of MLC air compressor engines Shell intends to employ, EPA makes reference to the entire alphabet "A" through "Z" when identifying the potential span of emission units to serve the MLC air compressor function. Shell predicts that the aggregate rating for the MLC compressor engines will be approximately 1,500 horsepower output.

[3] This permit does not limit the permittee to the specific rating listed. Permit conditions may limit operations to less than rated capacity.
[4] Permit conditions prohibit the shallow gas diverter system from emitting any air pollutants.

Emission units with ID beginning with "K-4" are existing engines associated with the three deck cranes that are employed to move equipment and supplies around on the deck of the Kulluk. EPA makes reference to these three engines as "A", "B" and "C." The aggregate rating of the deck crane engines is approximately 1,200 horsepower output.

Emission units with ID beginning with "K-5" are boilers and heaters. To provide flexibility in the number of boilers and heaters Shell intends to employ, EPA makes reference to the entire alphabet "A" through "Z" when identifying the potential span of emission units to serve the boiler and heater function. Shell predicts that the aggregate rating for boilers and heaters will be approximately 6 MMBtu per hour heat input.

Unit K-6 is an emergency generator engine. Shell is in the process of replacing the existing emergency generator engine with a 2011 model year engine. The new engine's rating is 1,047 horsepower output.

Emission units with ID beginning with "K-7" are seldom-used engines. These engines include one remote-operated vehicle engine "A", one emergency anchor lifting crane engine "B", one emergency diver compressor engine "C" and up to five emergency lifeboat propulsion engines "D1" through "D5". These engines are portable and are not permanent fixtures on the Kulluk. The aggregate rating of these seldom-used engines is 1,650 horsepower output.

Unit K-8 is a waste incinerator. Shell predicts that the incinerator will have a maximum waste feed rate of 276 pounds per hour.

Unit K-9 represents three diesel fuel tanks. The three storage tanks have aggregate capacity of 423,469 gallons. Unit K-10 represents the drilling mud system. Unit K-11 represents a shallow gas diverter system. This system will only be activated in the event of an emergency.

Associated Fleet

Shell identified the types of vessels in the Associated Fleet that will support the Kulluk, and the groupings of emission units on each vessel based upon the function each group serves. Shell is not requesting authorization to install specific makes and models of engines, but is instead requesting authorization to install groupings of engines categorized by known function. This permit allows operation of any emission unit that fits within the description presented in Table 1-2 and that operates in compliance with the terms of the permit. The ratings presented in Table 1-2 are approximations and do not limit Shell from installing larger equipment. Most of the equipment consists of internal combustion engines. All fuel-burning equipment will consume only diesel fuel with a sulfur content of less than 0.01 percent by weight.

Table 1-2: Associated Fleet Emission Units

Emission Unit ID	Description	Approximate Aggregate Rating[5]
Icebreaker No. 1 (IB1)		
IB1-1A – 1Z	Propulsion Engines and Generator Engines	32,200 hp
IB1-2A – 2Z	Heaters and Boilers	10 MMBtu/hr
IB1-3A – 3Z	Seldom-Used Sources	Various
IB1-4	Incinerator	154 lb/hr
Icebreaker No. 2 - Anchor Handler (IB2)		
IB2-1A – 1Z	Propulsion Engines and Generator Engines	32,200 hp
IB2-2A – 2Z	Heaters and Boilers	10 MMBtu/hr
IB2-3A – 3Z	Seldom-Used Sources	Various
IB2-4	Incinerator	154 lb/hr
Resupply Vessel/Barge and Tug (RV/BT)[6,7]		
RV/BT-1A – 1Z	Propulsion Engines and Generator Engines	12,000 hp[8]
RV/BT-2A – 2Z	Seldom-Used Sources	Various
Oil Spill Response Vessel (OSRV)		
OSRV-1A – 1Z	Propulsion Engines and Generator Engines	3,500 hp
OSRV-2A – 2Z	Seldom-Used Sources	Various
OSRV-3	Incinerator	125 lb/hr
OSRV Work Boats (OSRV WB)[7]		
OSRV WB-1A – 1Z	Propulsion Engines and Generator Engines	600 hp[8]

Up to two icebreakers will be deployed. The "IB1" and "IB2" that appear at the beginning of each emission unit ID signify that the unit is located on that particular vessel. One of the icebreakers will also serve as an anchor handler and general utility vessel. Shell has identified four categories of emissions units on each icebreaker. Within the first category, an unidentified number of propulsion engines and generator engines "1A" through "1Z" will have an estimated aggregate capacity of 32,200 horsepower output. Within the second category, an unidentified number of heaters and boilers "2A" through "2Z" will have an estimated aggregate capacity of 10 MMBtu per hour heat input. Within the third category, an unidentified number of seldom-used sources "3A" through "3Z" will have an unidentified aggregate horsepower output. Only one unit, an incinerator, comprises the fourth category of emission unit for each icebreaker. The incinerator on each icebreaker will have an estimated maximum feed rate of 154 pounds per hour.

Multiple resupply vessels/barge and tug combinations will be deployed to resupply the Kulluk and to remove waste. The "RV/BT" that appears at the beginning of each emission unit ID signifies that the unit is located on a resupply vessel/barge and tug combination. Shell has

[5] This permit does not limit the permittee to the specific rating listed. Permit conditions may limit operations to less than rated capacity.
[6] Resupply vessels include, but are not limited to, resupply ships and barge and tugboat combinations.
[7] Multiple different RV/BT and OSRV WB may be employed over the course of a single drilling season.
[8] The rating for RV/BT and OSRV WB propulsion engines and generator engines listed in the table reflects approximate aggregate rating for an individual vessel, not for all RV/BT and OSRV WB combined.

identified two categories of emission units on each RV/BT. An unidentified number of propulsion engines and generator engines "1A" through "1Z" will have an estimated aggregate capacity of 12,000 horsepower output. An unidentified number of seldom-used sources "2A" through "2Z" will have an unidentified aggregate horsepower output.

One oil spill response vessel will be deployed as a contingency measure. It will engage in routine oil spill response exercises. The "OSRV" that appears at the beginning of each emission unit ID signifies that the unit is located on the oil spill response vessel. Shell has identified three categories of emission units on the OSRV. Within the first category, an unidentified number of propulsion engines and generator engines "1A" through "1Z" will have an estimated aggregate capacity of 3,500 horsepower output. Within the second category, an unidentified number of seldom-used sources "2A" through "2Z" will have an unidentified aggregate horsepower output. Only one unit, an incinerator, comprises the third category. It will have an estimated maximum feed rate of 125 pounds per hour.

OSRV work boats will reside upon the OSRV and will be launched routinely to participate in oil spill response exercises. The "OSRV WB" that appears at the beginning of each emission unit ID signifies that the unit is located on an OSRV workboat. Shell has identified the propulsion engines and generator engines "1A" through "1Z" as the sole category of emission units on these vessels. The aggregate rating per vessel is approximately 600 horsepower output assuming, for example, that each OSRV WB is equipped with two 300-horsepower propulsion engines.

2. REGULATORY APPLICABILITY

2.1 The Outer Continental Shelf (OCS)

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.

Section 328 and Part 55 distinguish between OCS sources located within 25 miles of a state's seaward boundaries referred to as the "Inner OCS" and those located beyond 25 miles of a state's seaward boundaries referred to as the "Outer OCS". CAA § 328(a)(1); 40 CFR § 55.3(b) and (c). In this case, Shell is seeking a permit for exploratory drilling that will be conducted on both the Inner and Outer OCS.

40 CFR § 55.13 generally sets forth the federal requirements that apply to OCS sources on the Outer OCS. These sources 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 if there is 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 as implemented in Part 71. See 40 CFR § 55.13(a), (c), (d)(2), (e), and (f)(2), respectively. The applicability of these requirements to Shell's exploration drilling program is discussed in Sections 2.2 to 2.6 below.

The OCS regulations also contain provisions relating to monitoring, reporting, inspections, compliance, and enforcement. See 40 CFR §§ 55.8 and 55.9. Section 55.8(a) and (b) authorize Region 10 to require monitoring, reporting, and inspections for OCS sources, and provide that all

monitoring, reporting, inspection, and compliance requirements of the CAA apply to OCS sources. These provisions, along with the provisions of the applicable substantive programs, provide authority for the monitoring, recordkeeping, reporting and other compliance assurance measures included in this draft OCS/Title V permit.

Section 328 of the CAA provides that requirements for sources located within the Inner OCS be the same as would be applicable if the sources were located in the corresponding onshore area (COA). 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 in Appendix A to Part 55. For permit conditions that apply in the Inner and Outer OCS and cite to the COA regulations and federal requirements, the COA regulations provide authority only for the condition as it applies to the Inner OCS. The COA requirements are incorporated by reference in 40 CFR § 55.14 and listed in Appendix A.

On February 8, 2011, EPA proposed a consistency update to approve the incorporation of Alaska onshore requirements into 40 CFR 55.14. 76 Fed. Reg. 7,518. These requirements were proposed in response to the receipt of a Notice of Intent on December 10, 2010 from Shell. On June 27, 2011, EPA finalized the consistency update. 76 Fed. Reg. 37,274. EPA 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.

2.1.1 The "OCS Source"

Section 328 of the CAA establishes requirements to control air pollution from "OCS sources." Defining when the Kulluk becomes an "OCS source" therefore determines when CAA § 328 applies to and regulates air pollution from the Kulluk. This question is of primary importance because the later in time a vessel becomes an OCS source and the sooner it ceases to be an OCS source, the more limited the time during which potential emissions from both the Kulluk and its Associated Fleet will be included under the synthetic minor limits in the permit and in the air quality analysis. Based on an evaluation of the 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 Kulluk be considered an OCS source at all times that it is attached to the seabed at a drill site by at least one anchor.

2.1.2 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 emissions 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 <u>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</u>…

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 thereon 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."

2.1.3 The Kulluk's Anchoring Process at a Drill Site

The Kulluk is a conical drilling platform without its own propulsion power. With the start of each drilling season authorized in the draft permit, the Kulluk will be towed by an anchor handler to a selected drilling location. When it reaches the drilling location, the Kulluk will drop and secure its ship anchor. When the anchor is secure, the anchor handler will release the tow cable and the Kulluk will be held in position above the drilling location by its ship anchor. The anchor handler will then move to the leeward side of the Kulluk, extend the first stabilization anchor cable, connect the high holding power anchor and lower it to the seabed. The anchor handler will deploy each stabilization anchor in a pre-determined sequence, and in this manner all 12 of the Kulluk's main stabilizing anchors will be connected to the seabed. Once all of the stabilization anchors are in place, they will be sequentially adjusted to the appropriate tension for drilling activity. No other vessels are involved in the anchoring procedure.

When vacating a drill site, the retrieval of the stabilization anchors is a reversal of the placement process. The Kulluk's ship anchor is the final anchor to be lifted from the seabed. The retrieval of the ship anchor will occur after the Kulluk is connected to the anchor handler to be towed from the drilling location.

2.1.4 Region 10's Proposed Determination of When the Kulluk Becomes an OCS Source

Region 10 proposes to consider the Kulluk an OCS source, subject to Clean Air Act § 328 requirements, from the time it is attached to the seabed by a single anchor at a drill site, which will first occur when the Kulluk's ship anchor is secured at a drill site, until the last anchor is detached from 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. 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:[9]

> 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).

In this context, Region 10 believes (1) that that the Kulluk is "attached to the seabed" when it is attached to the seabed by at least one anchor, and (2) that the Kulluk is "erected [on the seabed]" when that attachment occurs at the location where the Kulluk 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. 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 Kulluk 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 Kulluk is a drillship. Although the phrasing "used for the purpose of" could indicate a requirement that the Kulluk 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. First, 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 mud line cellars or drilling for oil. Its attachment to

[9] 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.

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.[10]

In sum, based on the analysis discussed above, Region 10 proposes to consider the Kulluk 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 Kulluk 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 determination of when the Kulluk is considered an OCS source on permits terms and conditions and emissions is discussed in Section 3.1 below.

2.2 "Potential to Emit"

A source's potential to emit or "PTE" is defined as the maximum capacity of the 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.[11] See 40 CFR §§ 52.21(b)(4) and 55.2. As discussed above and in more detail below, the applicability of several CAA major source programs, including PSD and Title V, depends on whether the source's PTE will exceed certain thresholds.

[10] 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 Minerals Management Service, now 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)).

[11] EPA requires that PTE limits be either federally enforceable or legally and practicably enforceable. Subsequent references in this SOB to "enforceable" PTE or synthetic minor limits means that the limit must be either federally enforceable or legally and practicably enforceable.

For OCS sources, the definition of "potential emissions" in Part 55 explains which emissions from vessels associated with the OCS source are included in the PTE of the OCS source, providing that:

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

40 CFR § 55.2 (definition of "potential emissions").

Thus, emissions from vessels servicing or associated with an OCS source that are within 25 miles are considered in determining the PTE or "potential emissions" of the OCS source. Emissions from such associated vessels are therefore included as direct emissions from the OCS source in determining whether the OCS source is a "major" source under CAA programs, including PSD and Title V. Emissions from such vessels are also considered in determining whether emissions from the OCS source cause or contribute to a violation of the National Ambient Air Quality Standards (NAAQS).[12] See Order Denying Review in Part and Remanding Permits, Shell Gulf of Mexico, Inc and Shell Offshore, Inc., Frontier Discoverer Drilling Units, OCS Appeal Nos. 10-01 through 10-04, Slip. Op. 38 (December 30, 2010)("the Region's decision to impose Permit conditions to control the Associated Fleet's emissions to comply with the NAAQS and PSD increment, but not to apply BACT to the Associated Fleet, is not a clearly erroneous application of section 328 and the CAA's PSD requirements").

2.3 Prevention of Significant Deterioration of Air Quality (PSD) Applicability

Under 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 § 55.21. The objective of the PSD program is to prevent significant adverse environmental impact from air emissions by a proposed new or modified major source. Under the PSD regulations, a stationary source is "major" if, among other things, it emits or has the potential to emit 100 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 source if it emits or has the potential to emit 250 tpy or more of a regulated NSR pollutant. 40 CFR § 52.21(b)(1). Recently effective regulations provide that a new major source subject to PSD will also be subject to PSD for GHGs if it will emit or have the potential to emit 75,000 tpy CO_2e or more of GHGs, or, even if it is not otherwise subject to PSD, 100,000 CO_2e tpy or more of GHGs,

[12] Section 109 of the CAA requires EPA to promulgate regulations establishing National Ambient Air Quality Standards or "NAAQS" for those air pollutants (criteria pollutants) for which air quality criteria have been issued pursuant to Section 108 of the CAA. EPA has set NAAQS for six criteria pollutants: SO_2, particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (as NO_x), CO, ozone (precursors NO_x and volitile organic compounds (VOC)), and lead. 40 CFR Part 50.

provided that the source also has a PTE that is at or above the CAA mass-based major source thresholds. See 75 Fed. Reg. 31,514 (June 3, 2010).

As discussed below, based on Shell's request, Region 10 has included enforceable limits in this draft OCS/Title V permit such that Shell's PTE will remain below the PSD major source thresholds and therefore not be subject to PSD.

2.4 Title V Applicability and Authority to Create Limits on PTE

The Part 71 rules implementing the Title V permitting program apply to an OCS source if the source meets the definition of a "Part 71 source." See 40 CFR §§ 55.13(f)(2); 71.2 (definition of Part 71 source); 71.4(d). A Part 71 source includes any "major source," which in turn includes a source with a PTE of 100 tons per year or more of any air pollutant subject to regulation under the CAA and any source with a PTE of 10 tpy or more of any hazardous air pollutants (HAP) or 25 tpy of all HAP combined. 40 CFR §§ 55.13(f)(2); 71.2 (definition of major source). The purpose of the Title V permit is to collect and impose upon a source in a single permit all "applicable requirements" that apply to the source as well as monitoring, recordkeeping, reporting and other conditions necessary to ensure compliance with such applicable requirements. See CAA §§ 502(a) and 504(a). As discussed below, because the PTE for the Shell project is greater than 100 tpy for several criteria pollutants, it is classified as a major source under Part 71 and Title V. See 40 CFR § 71.2 (definition of major source).

EPA's rules applying to sources of air pollution on the Outer OCS (40 CFR Part 55) do not include provisions requiring construction permits for minor sources. Because of this, Shell has applied for its OCS/Title V air quality operating permit in advance of construction so that it can obtain enforceable permit limits on its PTE that will restrict its emissions to below the PSD major source thresholds.

Title V of the CAA and Part 71 provide authority to create limits in a Title V permit that restrict a source's PTE so that the source can operate without additional requirements, such as PSD, that would otherwise be necessary in the absence of such synthetic minor limits. See CAA § 504(a)("Each permit shall include enforceable emission limitations…and such other conditions as are necessary to assure compliance with applicable requirements [of the Act]…"); see also, CAA § 304(f) (defining the term "emission limitation, standard of performance or emission standard" for purposes of the citizen suit provision to include "any other standard, limitation, or schedule established under any permit issued pursuant to subchapter V [Title V], any permit term or condition, and any requirement to obtain a permit as a condition of operations.").

Moreover, two provisions of Part 71 recognize that Title V permits can be used to limit PTE. 40 CFR § 71.6(b) provides that all terms and conditions in a Part 71 permit, "including any provisions designed to limit a source's potential to emit, are enforceable by the Administrator and citizens under the Act." Part 71 provisions for permit modifications similarly recognize the authority to establish such limits by stating that minor permit modifications cannot involve a change to a permit term or condition that a source has assumed to avoid applicable requirements to which the source would otherwise be subject. See 40 CFR § 71.7(e)(1)(i)(A)(4)(i). The Environmental Appeals Board (EAB) has specifically acknowledged that "Title V permits (and other permits as well) may function as vehicles for establishing such PTE limits, potentially allowing a source to avoid more burdensome permitting requirements for 'major sources' by instead qualifying as a 'synthetic minor' source for purposes of some other regulatory

programs." In re Peabody Western Coal Company, 12 EAD 22, 31 (EAB Feb. 18, 2000)(upholding a Region's decision to deny a request to establish a limit on PTE in a Part 71 permit because of concerns regarding the practicable enforceability of such a limit in a case involving large quantities of fugitive emissions).

Region 10 is relying on this authority to include in Shell's OCS/Title V permit synthetic minor permit limits that will limit the source's PTE to below the thresholds that would make it subject to PSD permitting.

2.5 The PTE of the OCS Source

In determining the PTE for Shell's Beaufort Sea exploration drilling program, Region 10 included the potential emissions from the Kulluk while operating as an OCS source, as well as the potential emissions from the Associated Fleet – the icebreakers, oil spill response vessel and work boats, and the resupply vessel/barge and tug combination, when operating within 25 miles of the Kulluk while it is an OCS source.

In order to determine which pollutants require enforceable limits in order to reduce PTE to below PSD major source thresholds, it is necessary to calculate the "pre-permitted" PTE for the project. Once calculation of the pre-permitted PTE has identified the pollutants for which the source would be a major PSD source without a Title V or COA minor permit, enforceable permit conditions can be developed limiting the PTE of the OCS source to below PSD major source thresholds.

Table 2-1 lists the pre-permitted PTE as well as the permitted PTE for the regulated NSR pollutants CO, NO_X and SO_2. Table 2-1 also lists the pre-permitted PTE for GHGs. For these pollutants, Shell has requested that Region 10 include enforceable limits to reduce emissions to less than PSD major source thresholds. The reductions shown between the pre-permitted PTE and the permitted PTE reflect the impact of federally enforceable limits imposed in the permit to demonstrate compliance with the NAAQS and, as stated above, to lower the PTE to below PSD major source thresholds. See April 29, 2011 letter from Shell to Region 10 in the administrative record supporting this permitting action for detailed emissions calculations used to determine both pre-permitted PTE and permitted PTE.[13]

Table 2-1: Potential to Emit Key Pollutants

Air Pollutant	Pre-Permitted PTE (tpy)	Permitted PTE (tpy)
Carbon Monoxide (CO)	855	200
Nitrogen Oxides (NO_X)	2,339	240
Sulfur Dioxide (SO_2)	833	10
Greenhouse Gases (GHG)	141,487	80,000

[13] See May 10, 2011 correspondence for updated emission factor references provided by Shell.

Because exploration drilling programs are not included in the list of source categories subject to a 100-tpy PSD applicability threshold, the requirements of the PSD program apply if the project PTE is at least 250 tpy of a regulated NSR pollutant. PSD review also applies if GHG PTE is at least 100,000 tpy. From the pre-permitted PTE shown in Table 2-1, it is evident that Shell's Beaufort Sea exploration drilling program would be a major PSD source for CO, SO_2, NO_X and GHG because each would exceed the major source thresholds if federally enforceable limits were not imposed via the permit. Therefore, based on the pre-permitted PTE of the Shell project, federally enforceable limits for CO, SO_2, NO_X, and GHGs must be included in the OCS/Title V permit in order for Shell's OCS source to qualify as a "synthetic minor" not subject to PSD.

Shell has estimated its emissions of hazardous air pollutants (HAP) from its Beaufort Sea exploration drilling program at 3.4 tpy for all HAP combined. See April 29, 2011 letter from Shell to Region 10 in the administrative record for detailed HAP emissions calculations. Based upon these calculations, the project is an area source of HAP, rather than a major source of HAP.

2.6 Other Standards and Requirements Applicable to the OCS Source

As discussed above, OCS sources located beyond 25 miles of a state's seaward boundaries are subject to the NSPS in 40 CFR Part 60; the PSD program in 40 CFR § 52.21 if the OCS source is also a PSD major stationary source or if there is a major modification to a PSD 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 and Part 71. See 40 CFR § 55.13(a), (c), (d)(2), (e), and (f)(2), respectively. See also 40 CFR § 71.4(d).

Part 55 makes the requirements of Part 71 applicable to this OCS source. See 40 CFR § 55.13(f). Part 71 requires a Title V permit to address all "applicable requirements" as that term is defined in 40 CFR Part 71.2. The following subsections of this Section discuss the categories of Title V "applicable requirements" for the Shell exploratory operations, as well as other requirements that must be included in the OCS/Title V permit.

2.6.1 Part 55 Requirements as Applicable Requirements

Standards and requirements to control air pollution from OCS sources under Section 328 of the CAA are included in the definition of applicable requirement in 40 CFR § 71.2 and apply to the source as provided in Part 55. Accordingly, all requirements of Part 55 applicable to the OCS source have been included in the draft OCS/Title V permit and are discussed in Section 3, this includes the COA requirements incorporated by reference in 40 CFR § 55.14.

2.6.2 NAAQS as Applicable Requirements for Title V Temporary Sources

Region 10 interprets the CAA and EPA regulations to require that a temporary source seeking a Title V permit demonstrate that it will not cause or contribute to a violation of the NAAQS at all locations where it is authorized to operate. Section 504(e) of the CAA authorizes a Title V permitting authority to issue a single permit authorizing emissions from similar operations by the same source owner at multiple temporary locations, provided that the permit includes conditions that will assure compliance with all applicable requirements at all locations. EPA regulations at 40 CFR § 71.6(e) provide that a "temporary source" is any source that moves at least once during the term of a Title V permit. The application submitted by Shell requests authorization to

conduct exploratory drilling at multiple temporary locations during the term of the permit, and the project is therefore a temporary source under Title V.

Section 504(e) further provides that requirements applicable to Title V temporary sources include, but are not limited to, "ambient standards and compliance with any applicable increment or visibility requirements under Part C" of Title I of the Act. In turn, implementing regulations at 40 CFR § 71.2 define "applicable requirements" as including "(13) any national ambient air quality standard [NAAQS] or increment or visibility requirements under Part C, Title I of the Act, but only as it would apply to temporary sources permitted pursuant to section 504(e) of the Act." EPA included the same language in 40 CFR § 70.2. When EPA adopted its Part 70 regulations, the Agency interpreted Section 504(e) of the Act to make compliance with the NAAQS an applicable requirement for temporary sources. 57 Fed. Reg. 32550, 32276 (July 21, 1992) ("Under the Act, NAAQS implementation is a requirement imposed on States in the SIP; it is not imposed directly on a source. In its final rule, EPA clarifies that the NAAQS and the increment and visibility requirements under part C of title I of the Act are applicable requirements for temporary sources only."). Based on this prior interpretation by EPA, Region 10 reads the definition of "applicable requirement" in 40 CFR 71.2 to mean that compliance with the NAAQS is an applicable requirement for all Title V temporary sources and therefore this source.

The definition of "applicable requirement" in 40 CFR 71.2 says that the NAAQS, increment, and visibility requirements are applicable requirements "only as it would apply to temporary sources permitted pursuant to Section 504(e) of the Act." Section 504(e) of the CAA identifies applicable requirements for temporary sources as including "ambient standards and compliance with any applicable increment or visibility requirements under part C." Region 10 interprets these provisions to mean that NAAQS are applicable requirements for all Title V temporary sources, but that increment and visibility requirements are applicable requirements only if such sources would otherwise be subject to PSD. Because the language in section 504(e) of the Clean Air Act uses the term "applicable" before "increment or visibility requirements under part C," Region 10 interprets Section 504(e) to only make increment and visibility requirements "applicable requirements" for a temporary source when they would otherwise be "applicable" to a new major stationary source or major modification to an existing major stationary source in a permit required under Part C of the Act. Because the permittee is taking limits such that the source will not be a new major stationary source subject to PSD, the increment and visibility requirements under 40 CFR § 52.21 and Part C of the Act are not "applicable" in this instance.

Thus, the NAAQS are considered "applicable requirements" for the Kulluk and the OCS/Title V permit must contain terms and conditions that ensure compliance with the NAAQS at all relevant locations. The application submitted by Shell includes an analysis of the air quality impacts of the emissions from its exploratory operations on the NAAQS. The air quality analysis generally follows the regulations and guidance applicable to air quality analyses supporting permits issued under the PSD program. Part 71 does not describe how a Title V temporary source should demonstrate compliance with the NAAQS. In the absence of regulations or guidance setting out the requirements for a demonstration that the terms and conditions of a Title V permit for a temporary source will assure compliance with NAAQS at all authorized locations or operation, Region 10 believes that following the regulations and guidance for conducting an air quality analysis with respect to NAAQS under the PSD program is an appropriate approach. *See* 40 CFR Part 52, Appendix W ("Industry and control agencies have long expressed a need for

consistency in the application of air quality models for regulatory purposes . . . The *Guideline* provides a common basis for estimating the air quality concentrations of criteria pollutants used in assessing control strategies and developing emission limits.")

While EPA recognizes that temporary sources must demonstrate compliance with the NAAQS at all authorized locations, in the context of OCS permits, there remains some uncertainty as to whether Section 328 of the CAA should be read by EPA to require such a showing for areas of ambient air over the OCS or solely on land. EPA is therefore currently assessing how to apply the NAAQS to OCS sources beyond 25 miles of a state's seaward boundary on the Outer OCS. And, for sources located within 25 miles of a state seaward boundary on the Inner OCS, 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." Under any readings of these provisions, Region 10 believes that the permit applicant has made a sufficient showing to meet this applicable requirement. As discussed in more detail in Section 4 below, Region 10 reviewed and analyzed Shell's application and air quality analysis and concluded that it demonstrates that the emissions impact from its exploratory operations, when operating in compliance with the terms and conditions of the draft OCS/Title V permit, will not cause or contribute to a violation of any NAAQS at any location in the ambient air over any point on the OCS or within the state seaward boundary.[14] Therefore, resolving the point of compliance questions is not necessary for this permitting action.

As also discussed below in Section 3, the draft OCS/Title V permit includes emission limits, operating restrictions, and associated monitoring, recordkeeping, and reporting requirements to ensure emissions authorized under the permit will not cause or contribute to a violation of any NAAQS.

2.6.3 New Source Performance Standards as Applicable Requirements

Standards promulgated under Section 111 of the CAA are "applicable requirements" under 40 CFR § 71.2 and Section 111 standards promulgated under 40 CFR Part 60 (Part 60) apply to OCS sources as provided in 40 CFR § 55.13(c). Specific NSPS subparts in Part 60 apply to a source based on the source category, equipment capacity, and the date when the equipment commenced construction or modification. All emission units operating on the Kulluk are potentially subject to NSPS regulations because each is an emission unit on an OCS source. The application submitted by Shell provides that the Kulluk will contain emission units in four NSPS source categories: stationary compression-ignition internal combustion engines, boilers, incinerators, and fuel tanks. The requirements of applicable NSPS subparts for stationary compression-ignition internal combustion engines and incinerators are discussed in Section 3 of the SOB.

NSPS Subparts K, Ka, and Kb: 40 CFR Part 60, Subparts K, Ka, and Kb apply to petroleum liquids tanks as follows: K applies to tanks with capacity greater than 40,000 gallons that commenced construction or modification between March 8, 1974 and May 19, 1978; Ka applies to tanks with capacity greater than 40,000 gallons that commenced construction or modification

[14] As discussed in more detail below, the draft OCS/Title V permit includes a condition that supports excluding the area within 500 meters of the hull of the Kulluk from ambient air.

after May 18, 1978 and before July 23, 1984; Kb applies to tanks with capacity greater than 75 cubic meters (19,813 gallons) that commenced construction, reconstruction or modification after July 23, 1984.

EPA does not know whether the tanks on the Kulluk are newer than 1984. However, the fuel stored in the tanks is the diesel used to fuel the emission units on board the Kulluk, and diesel fuel has a very low vapor pressure. They will therefore be exempted from the provisions of NSPS Kb as provided in 40 CFR § 60.110b(b) because the Reid vapor pressure of diesel fuel is less than 3.5 kPa. A representative range for the Reid vapor pressure of diesel fuel is available from AP-42, Chapter 7, Table 7.1-2. Consequently, the permit contains no conditions regarding operation of these tanks. Note that the tanks will have very low emissions – about 7 lbs of VOC per year.

NSPS Dc: 40 CFR Part 60, Subpart Dc, applies to boilers with a capacity of at least 10 MMBtu/hr. Based upon the information Shell provided to Region 10, there are no boilers on the Kulluk with a heat input capacity exceeding 10 MMBtu/hr. Therefore, the Kulluk boilers are not subject to NSPS Subpart Dc.

2.6.4 National Emission Standards for Hazardous Air Pollutants (NESHAP) as Applicable Requirements

NESHAP and other Section 112 standards are "applicable requirements" under 40 CFR § 71.2. Pursuant to 40 CFR § 55.13(e), such standards apply to OCS sources if rationally related to the attainment and maintenance of federal or state ambient air quality standards or the requirements of Part C of Title I of the Act. All emission units operating on the Kulluk are potentially subject to NESHAP regulations because each is an emission unit on an OCS source.

No source categories on board the Kulluk or Associated Fleet are currently regulated by NESHAPs promulgated at 40 CFR Part 61. Consequently, the emission units on the Kulluk are not subject to the requirements of Part 61.

The application submitted by Shell provides that the Kulluk will contain emission units in two source categories subject to NESHAP standards for area sources promulgated under 40 CFR Part 63: stationary reciprocating internal combustion engines and boilers. The applicability of specific NESHAP subparts to these emission units is discussed in Section 3 of the SOB.

2.6.5 Monitoring, Recordkeeping, and Reporting

As discussed above, 40 CFR § 55.8(a) authorizes Region 10 to require monitoring, reporting, and inspections for OCS sources, and 40 CFR § 55.8(b) provides that all monitoring, reporting, inspection, and compliance requirements of the CAA apply to OCS sources. In addition, Part 71 requires all Title V permits to contain monitoring, recordkeeping, and reporting to assure compliance with all Title V permit terms and conditions. See 40 C.F.R. §§ 71.6(a)(3)(i)(B) and 71.6(c)(1).

Accordingly, Region 10 has included in the draft OCS/Title V permit monitoring, recordkeeping, and reporting to assure compliance with all permit terms and conditions based on the following authority. As required by 40 C.F.R. § 55.8(b) and 40 C.F.R. § 71.6(a)(3)(i)(A), Region 10 has included in the OCS/Title V permit the monitoring requirements contained in all applicable requirements. Where the applicable requirement contains no periodic monitoring, Region 10 has included periodic monitoring sufficient to yield reliable data from the relevant time period that

are representative of the source's compliance with the permit as provided in 40 C.F.R. § 71.6(a)(3)(i)(B). See also 40 CFR § 55.8(a). Finally, where there is some periodic monitoring in the applicable requirement, but that monitoring is not sufficient to assure compliance with permit terms and conditions, Region 10 has supplemented that monitoring to assure such compliance, as required by 40 C.F.R. § 71.6(c)(1) and 40 CFR § 55.8(a). Region 10 has also included all applicable and other appropriate recordkeeping and reporting requirements.

3. PERMIT TERMS AND CONDITIONS

3.1 Overview

The permittee intends to implement its Beaufort Sea exploration drilling program through the use of the Kulluk and the Associated Fleet. The permittee has applied for a COA minor permit and an OCS/Title V permit containing limitations necessary to ensure that the project emissions are reduced to below PSD thresholds. This section of the SOB describes the permit terms Region 10 considers necessary to ensure the project remains a minor source, not subject to PSD, as well as to ensure that the project does not cause or contribute to a violation of any NAAQS and complies with all other applicable requirements.

3.2 Generally Applicable Requirements

This section describes the permit conditions that apply generally to the Kulluk and the Associated Fleet and generally relate to permit administration or enforcement.

Condition A.1 requires the permittee to construct and operate the OCS source and the Associated Fleet in accordance with its application and supporting materials and in accordance with the final permit, and to submit supplementary or corrected information discovered to have been omitted from the permit application, as provided in 40 CFR §§ 55.6(a)(4)(i) and 71.5(b).

Condition A.2 requires that when two or more provisions apply to the same emission unit or activity, the permittee must comply with both, as provided in 40 CFR § 71.6(a)(1) and 18 AAC 50.326(a).

Condition A.3 specifies the enforcement authority for violation of OCS, COA and Part 71 regulations and this permit, as provided in 40 CFR §§ 55.9(a)-(b) and 71.6(a)(6)(i), and specifies other provisions governing compliance with permit terms and conditions as well as applicable requirements that apply to Title V sources pursuant to 40 CFR §§ 55.9(a)-(b), 71.5(c)(8)(iii)(A-B), 71.6(a)(6)(ii) and 71.6(c)(3). Operation in violation of a permit term or condition is not authorized under this permit.

Condition A.4 makes clear that, except with respect to the extent of the Title V permit shield with respect to Clean Air Act requirements included and specifically identified in the permit as provided in 40 CFR § 71.6(f)(1)(i), the permit does not relieve the permittee of the responsibility to comply fully with all other requirements of federal law. See 40 CFR §§ 55.6(a)(4)(iii) and 71.6(f)(3)(i-iv). The permittee is required to obtain approval from other agencies before it is authorized to begin exploratory drilling in the Beaufort Sea. Condition A.4 makes clear the permittee's obligation to satisfy all other federal requirements prior to commencing operation under this CAA permit.

Condition A.5 requires the permittee to notify all owners, operators and contractors of the source of the requirements of the permit, as provided in 40 CFR § 55.6(a)(4)(iv).

Condition A.6 addresses the expiration of the permit and the ramifications if the permittee does or does not renew its permit. It is important to note that, if the permittee does not submit a complete and timely renewal application, the permittee's right to operate is terminated. The expiration date of the permit is listed on the top right-hand corner of the front page of the permit. This condition includes terms generally applicable to Title V sources pursuant to 40 CFR §§ 71.5(a)(1)(iii), 71.5(a)(2), 71.5(c)(5), 71.6(a)(11), 71.7(b), &1.7(c)(1), 71.7(c)(1)(ii) and 71.7(c)(3).

Condition A.7 contains provisions for modification, revocation, reopening and reissuance and termination of the permit pursuant to 40 CFR §§ 71.6(a)(6)(iii), 71.7(f) and 71.6(a)(8).

Condition A.8 clarifies that the specification of a reference test method does not preclude the use of other credible evidence for the purpose of establishing whether or not the permittee is in compliance with a particular requirement. This is consistent with Region 10's interpretation of the Clean Air Act requirements. See 40 CFR §§ 52.12(c), 60.11(g), 61.12(e), and 62 Fed. Reg. 8314 (February 24, 1997).

Condition A.9 includes EPA's inspection authority for Title V sources pursuant to 40 CFR § 71.6(c)(2).

Condition A.10 includes the general recordkeeping requirements for Title V sources, including a record retention requirement of five years pursuant to 40 CFR § 71.6(a)(3)(ii)(A-B).

Condition A.11 specifies the Region 10 address to which information under the permit must be submitted.

Condition A.12 requires the certification of all documents submitted under the permit as required by 40 CFR §§ 71.5(d), 71.6(c)(1) and 71.9(h)(2).

Conditions A.13 and A.14 contain standard language regarding severability of permit conditions and property rights that are applicable to Title V sources pursuant to 40 CFR §71.6(a)(5) and 71.6(a)(6)(iv).

Condition A.15 contains standard language regarding the obligation of the permittee to respond to information requests from Region 10, pursuant to 40 CFR §71.6(a)(6)(v) and 71.5(a)(3).

Condition A.16 contains standard language governing emergency situations at Title V sources, pursuant to 40 CFR §§ 71.6(g)(1) - (5).

Condition A.17 contains standard language regarding deviation reports for Title V sources pursuant to 40 CFR §§ 71.6(a)(3)(i)(B), 71.6(a)(3)(iii)(B) and 71.6(a)(3)(iii)(C).

Conditions A.18 applies on the Inner OCS and requires the permittee to comply with applicable excess emission and permit deviation reporting requirement in 18 AAC 50.235(a)(2) and 18 AAC 50.240 except as provided in Condition A.19. The State of Alaska adopted this condition as Standard Permit Condition III (revised as of August 20, 2008) and Standard Permit Condition IV (revised as of August 20, 2008) under 18 AAC 50.346(b) as part of the construction permit program and these condition are included in State construction permits.

The permittee is required to notify EPA when emissions or operations deviate from the requirements of the permit. This condition satisfies two State of Alaska regulations related to excess emissions: the technology-based emission standard regulation and the excess emission regulation. Although there are some differences between the regulations, Condition A.18 satisfies the requirement of each regulation.

The reports themselves and the other monitoring records required under this permit provide monitoring of whether the Permittee has complied with the condition. Please note that there may be additional federally required excess emission reporting requirements.

Condition A.19 includes provisions requiring semi-annual monitoring reporting (called an "operating report" in the permit) and an annual compliance certification report as required by 40 CFR §§ 71.6(a)(3)(iii)(A) and 71.6(c)(5). The annual compliance certification is required to be submitted along with the semi-annual monitoring report due February 28 given that the corresponding operating period coincides with the drilling season. Given that the drilling season ends no later than November 30, the permittee is provided 90 days from the termination of drilling activity to compile and submit this report.

Condition A.20 contains standard language regarding off permit changes at Title V sources pursuant to 40 CFR §71.6(a)(12).

Condition A.21 contains standard language regarding emissions trading and operational flexibility at Title V sources pursuant to 40 CFR § 71.6(a)(13)(i).

Condition A.22 ensures compliance with the applicable fee requirement in 18 AAC 50.400 – 50.405. This condition requires the permittee, owner, or operator to pay administration fees as set out in regulation. Paying administration fees is required as part of obtaining and holding a permit for operation on the Inner OCS.

Conditions A.23 and A.24 apply on the Inner OCS and implements the applicable requirements in 18 AAC 50.410 – 50.420. The regulations require all permits to include due dates for the payment of fees and the method the permittee may use to re-compute assessable emissions.

The State of Alaska adopted this condition as Standard Permit Condition I (revised as of August 25, 2004) under 18 AAC 50.346(b) and the condition is included in State construction permits. The default assessable emissions are generally potential emissions of each air pollutant in excess of 10 tpy authorized by the permit. Assessable emissions are defined as the quantity of each air pollutant for which emission fees are assessed.

This condition allows the permittee to calculate actual annual assessable emissions based on previous actual annual emissions. Assessable emissions are based on each air pollutant. Therefore, fees based on actual emissions shall be paid on any pollutant emitted whether or not the permit contains any limitation of that pollutant.

This condition specifies that, unless otherwise approved by EPA, calculations for assessable emission based on actual emissions use the most recent previous calendar year's emissions. Since each current year's assessable emission are based on the previous year, the EPA will not give refunds or make additional billings at the end of the current year if the estimated emissions and current year actual emissions do not match.

Condition A.25 contains standard language regarding Part 71 fees for Title V sources pursuant to 40 CFR § 71.9.

Condition A.26.1 applies on the Inner OCS and requires the Permittee to conduct source tests requested by EPA. The State of Alaska adopted this condition under 18 AAC 50.345(k) as part of its construction permit program standard permit condition and the condition is included in State construction permits. This condition ensures compliance with the applicable regulation in 18 AAC 50.220(a).

Conditions A.26.2 through A.26.4 apply within the Inner OCS and implements the applicable requirements in 18 AAC 50.220(b) and apply because the permittee is required to conduct source tests as set out in Conditions A.28.2 through A.28.4. These conditions supplement the specific monitoring requirements stated elsewhere in the permit.

Condition A.26.5 applies on the Inner OCS and implements the applicable requirements in 18 AAC 50.345(a) and applies when the source exhaust is observed for visible emissions. As provided in 18 AAC 50.345(a) the requirement for test plans, notifications and reports do not apply to visible emissions observations by smoke readers, except in connection with required particulate matter testing.

Condition A.26.6 applies on the Inner OCS and implements the applicable requirements in 18 AAC 50.345(l) – (o) and applies because the permittee is required to conduct source tests by this permit. Standard Conditions 18 AAC 50.345(l) – (o) are incorporated through this condition.

Condition A.26.7 applies on the Inner OCS and requires the permittee to reduce particulate matter data in accordance with 18 AAC 50.220(f). It applies when the permittee tests for compliance with the PM standard in 18 AAC 50.050 or 50.055. This condition incorporates a regulatory requirement for PM source tests. This condition supplements specific monitoring requirements stated elsewhere in the proposed permit.

3.3 COA Source-Wide Requirements

Conditions B.1 – B.4: Conditions B.1 through B.4 apply on the Inner OCS and implements the applicable requirements in 18 AAC 50.055(a). 18 AAC 50.055(a) applies to the operation of fuel-burning equipment and industrial processes. Units K-1A through K-7D5 in Table 1 of the permit are fuel-burning equipment and industrial processes. The State of Alaska adopted this condition as a Standard Permit Condition IX (revised as of August 20, 2008) under 18 AAC 50.346(c) as part of the construction permit program and this condition is included in State construction permits. Condition B.1 prohibits the permittee from causing or allowing visible emissions in excess of the applicable standard in 18 AAC 50.055(a)(1). The permittee must monitor, record and report emissions in accordance with Conditions B.2 through B.4 of this permit.

Condition B.2.2 has slightly modified the State's Standard Permit Condition in this permit by removing the part of the Standard Permit Condition which requires semiannual method 9 observations. Shell stated in the permit application that the Beaufort Sea drilling season will be July 1 through November 30 annually. Given the length of the drilling season (five months) EPA determined that the permittee would not be able to conduct the semiannual Method 9 observations contemplated in the State's Standard Permit Conditions.

Liquid fuel-fired burning equipment

For liquid fired fuel-burning equipment Units K-1A through K-7D5, the MR&R requirements in the State's Standard Permit Condition IX.

Monitoring: In general, the visible emissions shall be observed by a Method 9 Plan or Smoke/No Smoke Plan as detailed in Condition B.2. Corrective actions such as maintenance procedures and either more frequent or less frequent testing may be required depending on the results of the observations.

Recordkeeping: The permittee is required to record the results of all visible emission observations and record any actions taken to reduce visible emissions.

Reporting: The permittee is required to report: 1) emissions in excess of the federal and state visible emission standard and 2) deviations from permit conditions. The permittee is required to include copies of the results of all visible emission observations with the OCS operating report.

Condition B.5 – B.9: Conditions B.5 through B.9 apply on the Inner OCS and implements the applicable requirements in 18 AAC 50.055(b). This requirement applies to operation of all industrial processes and fuel burning equipment in Alaska. The State of Alaska adopted this condition as a Standard Permit Condition IX (revised as of August 20, 2008) under 18 AAC 50.346(c) as part of the construction permit program and this condition is included in State construction permits. Units K-1A through K-7D5 of Table 1 are fuel burning equipment and industrial processes.

Condition B.5 prohibits emissions in excess of the state PM (also called grain loading) standard applicable to fuel-burning equipment and industrial processes. The Permittee must establish by actual visual observations that can be supplemented by other means, such as a defined Stationary Source Operation and Maintenance Program, that the stationary source is in continuous compliance with the State's emission standards for visible emissions and particulate matter.

These conditions detail a stepwise process for monitoring compliance with the State's visible emissions and particulate matter standards for liquid and gas fired sources. Equipment types covered by these conditions are internal combustion engines, turbines, heaters, boilers, and flares. Initial monitoring frequency schedules are established along with subsequent reductions or increases in frequency depending on the results of the self-monitoring program.

Reasonable action thresholds are established in these conditions that require the Permittee to progressively address potential visible emission problems from sources either through maintenance programs and/or more rigorous tests that will quantify whether a specific emission standard has been exceeded.

Monitoring recording and reporting requirements are listed in Conditions B.6 through B.9. The permittee must establish actual visible observation which can be supplemented by other means to demonstrate that the emission unit is in continuous compliance with the State’s emission standards for PM.

Condition B.10 – B.12: Conditions B.10 through B.12 apply on the Inner OCS and require the permittee to comply with the sulfur compound emission standard for all fuel-burning equipment and industrial processes. This requirement applies to operation of all industrial processes and fuel burning equipment in Alaska. The State of Alaska adopted Conditions B.17 and B.19 as a Standard Permit Condition XI (revised as of August 25, 2004) under 18 AAC 50.346(c) as part of the construction permit program. In addition Standard Permit Condition XII (August 25, 2004) was adopted under 18 AAC 50.345(c). As a result, these standard permit conditions are included in State construction permits. Units K-1A through K-7D5 of Table 1 are fuel-burning equipment and industrial processes.

The 0.01 percent by weight limitation on sulfur in the No. 2 diesel fuel assures compliance with the COA's 500 ppm SO_2 stack gas standard based on the following calculations:

C_d = (1 lb S/10,000 lb fuel) x (2 lb SO_2/lb S) x (385 dscf SO_2/64 lb SO_2) x (1 lb fuel/19,571 Btu)x(Btu/0.00919 dscf)

= $6.7x10^{-6}$ dscf SO_2/dscf exit gas = 6.7 ppm

The permittee may not cause or allow the affected equipment to violate this standard. Conditions B.11 and B.12 contain the COA Regulations for recordkeeping and reporting requirements to ensure compliance with the Sulfur Compound Emission Standard.

Condition B.13: Condition B.13 applies on the Inner OCS and ensures compliance with the applicable visible emission requirements in 18 AAC 50.055(a). This condition prohibits the permittee from causing or allowing visible emissions in excess of the applicable standard in 18 AAC 50.055(a)(1).

The permittee must monitor, record, and report emissions in accordance with Condition B.2 through B.44 of this permit.

Condition B.14: Condition B.14 applies on the Inner OCS and ensures compliance with the applicable requirement in 18 AAC 50.346(b)(5) and applies to all emission units except those subject to federal emission standards, those subject to continuous emission parametric monitoring, and for insignificant emission units. This condition requires the permittee to comply with good air pollution control practices for all sources.

Maintaining and operating equipment in good working order is fundamental to preventing unnecessary or excess emissions. The State of Alaska adopted this condition as a Standard Permit Condition II (revised as of August 25, 2004) under 18 AAC 50.346(b) as part of the construction permit program and this Standard Permit Condition included in State construction permits. The State condition is based on the assumption that good maintenance is performed. Without appropriate maintenance, equipment can deteriorate more quickly than with appropriate maintenance.

The permittee is required to keep maintenance records to show that proper maintenance procedures were followed and to make the records available to the EPA. The EPA may use these records as a trigger for requesting source testing if the records show that maintenance had been deferred. EPA also has authority under Section 114 of the CAA to require source testing at any time to determine compliance with CAA requirements.

Condition B.15: Condition B.15 applies on the Inner OCS and implements the applicable requirement in 18 AC 50.110. Air Pollution Prohibited requirements apply to the stationary source because the stationary source will have emissions. The State of Alaska adopted this condition as a Standard Permit Condition II (revised as of August 25, 2004) under 18 AAC 50.346(a) as part of the construction permit program and is included in State construction permits.

The condition prohibits the permittee from causing any emission which is injurious to human health or welfare, animal or plan life, or property, or which would unreasonably interfere with the enjoyment of life or property. While the other permit conditions and emission limitations should ensure compliance with this condition, unforeseen emission impacts can cause violations of this standard. These violations would go undetected except for complaints from affected

persons. Therefore, to monitor compliance, the permittee must monitor and respond to complaints.

The permittee is required to report any complaints and injurious emissions. The permittee must keep a record of the date, time, and nature of all complaints received and summary of the investigation and corrective actions undertaken for these complaints and to submit copies of these records upon request by EPA.

The EPA will determine whether the necessary actions were taken. No corrective actions are necessary if the complaint is frivolous or there is not a violation of 18 AAC 50.110; however this condition is intended to prevent the permittee from prejudging that complaints are invalid.

Condition B.16: Condition B.16 states that nothing in this permit relieves the permittee from the requirement to obtain a minor permit for modifications that are subject to 18 AAC Article 5 Minor Permits. This permit term is particularly relevant as the permittee considers changes to the Kulluk or Associated Fleet. Before making changes to emission units on the Kulluk or Associated Fleet, Condition C.4 of the permit requires Shell to conduct and submit a modeling analysis to support changes to the emissions units on the Kulluk and Associated Fleet. Such changes may also trigger the requirement to obtain from EPA a permit to construct. Condition B.16 emphasizes that the permittee's compliance with Condition C.4 does not relieve Shell of its obligation to obtain a minor permit for such changes, if applicable.

Source-Wide Notifications

Condition C.1: The permittee has requested authorization to operate the Kulluk at multiple drill site locations on its lease holdings in lease sales 186, 195 and 202 of the Beaufort Sea under a single permit that restricts all such operations to below PSD major source thresholds. This condition requires the permittee to notify and provide to Region 10 by April 1 each year a list of proposed drill locations and the expected date that the Kulluk will become an OCS source. This allows EPA to confirm that the Kulluk will be operating at a location addressed by the permit and dictates which permit conditions will apply because some conditions only apply on the Inner OCS.

Condition C.2: Total operation as an OCS source under the permit is limited to 120 days per drilling season. This condition requires the permittee to notify Region 10 of the actual beginning and end of each drilling season. This provision provides information that EPA uses to enforce the limitations on the length of the drilling season and the number of days of drilling.

Condition C.3: As discussed above, the Associated Fleet vessels and the emission units thereon that the permittee will use as allowed under this permit will be leased and have therefore not been identified to Region 10. For the Kulluk, Shell has not identified specific make and models or serial numbers for the permitted equipment along with other emission unit characteristics. Condition C.3 requires this information to be sent to Region 10 by April 1 each year. This will allow Region 10 enough time to ensure the equipment is adequately addressed by the permit.

Condition C.4: NAAQS are applicable requirements for Title V temporary sources, such as the Kulluk Drill Rig and the Associated Fleet. This condition requires the permittee to establish via a replicable modeling analysis that emissions from the Kulluk and Associated Fleet, as actually configured in each year of operation, do not cause or contribute to a violation of the NAAQS. This condition reflects the fact that the permittee does not own the Associated Fleet vessels, and

therefore does not have specific information on the equipment and precise configurations that will be operated from year to year. Shell has also indicated that emission units on the Kulluk could change from year to year. Region 10 has relied on the information and details submitted supporting this initial permitting action to establish permit terms and conditions ensuring that under the proposed configuration the source will not cause or contribute to a violation of any NAAQS.

The emission units on the Kulluk and Associated Fleet that are actually used in each year must comply with all of the conditions and limitations in this permit, including the Synthetic Minor PTE Limits (condition D.4), the Operational Restrictions to Protect the NAAQS (condition D.5), and the Emission Limits to Protect the NAAQS (condition D.6). However, different configurations of emission units as well as their stack characteristics (height, diameter, location relative to structures) can change the modeled impact even if emissions are the same. This condition assures compliance with the NAAQS, an applicable requirement, if the equipment or vessels in any drilling season differ from the equipment or vessels described in the permit application. Requiring subsequent modeling analyses to be conducted in an identical manner, reflecting only specific equipment or configuration changes, to establish that any future configuration satisfying this requirement would have been approvable at the time of issuance of this permit, is using a protocol based on sound scientific principles to provide reproducible results with the same inputs. The permit contains conditions to assure that the results of the protocol are recorded (by requiring the modeling analysis and results to be submitted to EPA before the drilling season) and will be used for determining whether the NAAQS will be met for the configuration used during each drilling season.

Note that any changes to the project must also be evaluated under applicable new source review programs and for compliance with title V permit modification requirements. Nothing in this condition or otherwise in this permit exempts modifications at this source from applicable new source review requirements.

3.4 Source-Wide Emission Limits & Operational Restrictions

Condition D.1: This condition specifies the frequency (weekly or monthly) for calculating and summing emissions of specified pollutants and averaging times. Pollutants with hourly or daily limits are calculated weekly; pollutants with monthly-rolling limits are calculated monthly. Specific calculations are required in other conditions in the permit that use the results to determine compliance with emission limits, including the synthetic minor PTE limits in Permit Condition D.4 and the NAAQS-based emission limits in Permit Condition D.6. The calculated emissions also will form the basis for paying emission-based fees. This condition also clarifies which emission factor to use for groups of emissions units and how to convert tracked operating hours to fuel usage data used in compliance calculations.

Condition D.2: This condition contains tables that specify the emission factors[15] that are required to be used for purposes of the permit for calculating emissions under and compliance with the emission limits and other terms and conditions in the permit. These emission factors apply until an alternative test-derived emission factor has been developed pursuant to Condition D.2 of the permit.

[15] See July 20, 2011 EPA memorandum entitled, "Derivation of Emission Factors in Tables D.2.1 and D.2.2 of Draft Permit to Shell for Operation of Conical Drilling Unit Kulluk in Beaufort Sea."

Condition D.3.1 and D.3.2: These conditions limit the annual duration of the permittee's exploration operations in the Beaufort Sea. The permittee's drilling season will largely be limited by sea ice conditions. Some variability can be expected from year to year. However, the permittee may begin drilling on July 1 and must cease operations as an OCS source by November 30 of each year. The permittee has specifically requested that the permit impose an annual limit of 120 days of operation as an OCS source. This condition limits the drilling season to the period between July 1 and November 30 of each year, which is referred to as the "drilling season" in the permit, and limits the number of days of operation as an OCS source to 120 calendar days each drilling season. This is not a continuous 120 day period but an aggregation of all time operating as an OCS source during a given drilling season. In addition, for each drill site,

Conditions D.3.3, D.3.4 and D.3.5 are necessary for ambient air quality protection. The conditions restrict the duration of time Shell can perform certain higher-emitting activities utilizing equipment on the Kulluk. The permittee shall not conduct any Drilling Activity in excess of 1,632 hours within a drilling season. Drilling Activity includes MLC Drilling Activity and Well Drilling Activity. Well Drilling Activity is defined as any time when the top drive is engaged and turning the conventional rotary bit. MLC Drilling Activity is defined as any time when any MLC HPU engine or MLC air compressor engine is operating. MLC Drilling Activity is expected to generate the most air pollution. The permittee shall not conduct any MLC Drilling Activity in excess of 480 hours.

Condition D.3.6 requires the permittee to document the exact location of the Kulluk when drilling, the lease block where drilling is occurring, and the duration of the Kulluk as an OCS source at that site.

Conditions D3.7 and D3.8 require monitoring and recording to document compliance with Conditions D 3.4 and D3.5.

Condition D.3.9 also clarifies that time recorded as an OCS source must include time spent drilling relief wells.

Condition D.4: This condition imposes synthetic minor limits (tons per "year") to ensure that the source's emissions remain below the levels that would make it a PSD major source and subject to PSD permitting. Only pollutants that would otherwise (without the permit) be potentially emitted at rates above the PSD thresholds must be limited; this condition limits NOx, CO, SO2 and GHG emissions below the PSD tons per "year" thresholds in this condition. The ton per "year" period is either a 12 month rolled monthly or a 365 day period rolled daily depending on how confident EPA is in the compliance techniques employed. EPA prefers shorter rolling compliance periods for pollutants that are harder to measure or confirm.

SO2 emissions are limited using an emission limit as well as fuel and fuel sulfur content limits. The permit requires compliance with the SO2 limit to be determined by measuring the total amount of fuel burned and confirming the total amount of fuel burned using nearly continuous measurements and confirming the total amount of sulfur in the fuel burned. Confidence that this technique will ensure continuous compliance is high, therefore "yearly" emissions are required to be summed only monthly.

GHG emissions are limited using an emission limit as well as a fuel limit. Compliance with the GHG emission limit is determined by measuring the total amount of fuel burned and calculating

the emission using measured fuel and emission factors. The combination of fuel and incineration limits as well as the fact that the emission factors are expected to be relatively consistent results in good confidence in the overall compliance technique and therefore "yearly" emissions are required to be summed only monthly.

CO and NOx emissions are limited using emission limits. Compliance with the CO and NOx emission limits is determined by multiplying measured fuel by periodically confirmed emissions factors. Because EPA expects the emission factors to be more variable, the "yearly" emissions are summed on a daily frequency.

For compliance techniques that rely on emission factors, the permit includes default emission factors that can be used until unit-specific emission factors are determined through testing (see Condition E.2). The testing protocol required by the permit results in conservatively high emission unit-specific emission factors, which help to assure compliance. The permit also includes specific monitoring requirements for fuel usage in engines and boilers and waste feed rates to the incinerators so limits on operational parameters can be confirmed. A cap has been set on the capacity of the incinerators. Permit-required monitoring of the SCR and oxidation catalyst control devices will help assure the devices are operating correctly and achieving the emissions reductions expected. In fact, when monitoring indicates that the SCR or oxidation catalyst units are not operating correctly, the permittee must use emissions factor that assume no control devices exist – basically "uncontrolled" emissions that are 10 times the controlled emissions from an SCR unit and 5 times the controlled emissions from an oxidation catalyst.

The limits are generally not applied to individual emission units in this permit due to the need for operational flexibility. Exploration operations such this one experience highly variable operations (well to well and season to season) due to natural elements (e.g. weather, the sea and the remoteness of the area) and the exploratory nature of the operation – that is exploration of the unknown. Given the need for flexibility, the remoteness of the operation and mix of pollutants and emission units, EPA believes that the pollutant- and emission unit-specific compliance techniques in this permit are warranted.

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). The Kulluk and Associated Fleet emit three of the six GHGs (CO_2, N_2O, and CH_4). The permit requires the use of 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.

A small amount of CH_4 may be emitted by the Drilling Mud System (K-10). 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 Kulluk. These gases are typically released as fugitive emissions when the mud is processed for reuse on the Kulluk or stored and shipped away; however, some of the emissions pass through a vent. Although fugitive emissions are not counted towards PSD applicability for exploratory drill rigs (see 40 CFR §

52.21(b)(1)(iii)), the permittee has agreed to count all of these methane emissions under the PTE limit for GHGs.

Based on past drilling experience, the permittee has estimated that approximately 399 pounds of methane per month could be released from the circulated mud. To account for this potential methane release while determining compliance with the GHG PTE limit, the permit assumes 4 tons per month of CO_2e emissions (399 pounds CH_4 per month multiplied by CH_4 global warming potential) will be released from the drilling mud and reduces the amount of GHGs that can be emitted from other operations.

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

- A GHG 12-month rolling limit of 80,000 tpy CO_2e;
- A total aggregate 12-month rolling limit for fuel combusted of 7,011,023 gallons[16];
- A total aggregate daily waste-combusting capacity limit of 13,704 pounds.

It was necessary to assume a certain amount of waste is incerated each day in order to calculate the season-long diesel fuel allowance for combustion equipment in aggregate. The daily waste-combusting capacity was calculated by summing the approximate capacities for incinerators on the Kulluk and Associated Fleet while considering operating limits proposed by this permit. EPA is proposed to limit operation of the Kulluk incinerator to 12 hours per day. Here is the calculation:

$$13{,}704 \text{ lb /day} = (276 \text{ lb/day})(12 \text{ hours/day}) + (154 \text{ lb/day})(24 \text{ hr/day}) + (154 \text{ lb/day})(24 \text{ hr/day}) + (125 \text{ lb/day})(24 \text{ hr/day})$$

For determining compliance with the 80,000 tpy CO_2e limitation, GHG emission calculations for many units will be based upon fuel usage. For certain units not expected to contribute significantly to overall emissions and for whom daily operation monitoring may be a challenge, emission calculations will be based upon the assumption that the unit is operating at maximum rated capacity. Examples of such units include incinerators and heaters/boilers.

Condition D.4.9 prohibits Shell from operating the Kulluk in the Beaufort Sea within the same drilling season as the Noble Discoverer drilling vessel. With this condition, the scope of emissions generating activity occurring in time and space that could be considered part of the source under the CAA does not extend beyond the Kulluk.

Conditions D.5 and D.6: These conditions include provisions necessary to ensure that the project does not cause or contribute to a violation of any NAAQS under authorized operational scenarios. As discussed in Section 2 above, for a Title V temporary source, the NAAQS are an applicable requirement and the Title V permit must include terms and conditions to ensure compliance with the NAAQS at all locations. See 40 CFR §§ 71.2 (definition of applicable requirement), 71.6(a)(1), and 71.6(e). Specific to just the Inner OCS, COA 18 AAC 50.544(c)(1) requires this permit to construct to contain terms and conditions necessary to protect the short and long-term SO_2 standards, the 24-hr PM_{10} standard and the annual NO_2 standard. The air

[16] See July 20, 2011 EPA memorandum entitled , "Calculation of No. 2 Diesel Fuel Usage Restriction for Condition D.4.6 in Draft Permit to Shell for Operation of Conical Drilling Unit Kulluk in Beaufort Sea."

quality modeling analysis submitted as part of the permit application demonstrated initial compliance with the NAAQS. The air quality impact analysis is discussed in Section 4. Emission limitations and operational restrictions have been included to ensure compliance with the hourly NO_2 and the 24-hour PM_{10} and $PM_{2.5}$ NAAQS. These conditions convert key assumptions that were made by the permittee in the modeling analysis into enforceable permit conditions.

The air quality analysis submitted by the permittee modeled emissions from the Kulluk beginning 500 meters from the hull of the Kulluk and assumes that the Coast Guard will impose a safety zone of this distance around the Kulluk to exclude the public from the area in which the main operations will be conducted.[17] Region 10 will include in the permit a requirement that the permittee 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. To implement this provision, the draft permit also requires that the permittee 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 Kulluk. Region 10 has included these provisions in Condition D.5.1, consistent with the permittee's demonstration that emissions from their exploratory operations will not cause or contribute to a violation of the NAAQS in any location that constitutes ambient air. Thus, the permittee's application demonstrates that it complies with the NAAQS at all authorized locations, regardless of EPA's ultimate decision about the point of compliance.[18]

Conditions D.5.2 through D.5.5 include specific operational restrictions inherent in the modeling analysis conducted by the permittee. These conditions include limits on hour of operation for specific equipment, duration and frequency of certain activities, and a requirement that certain stacks be vertical uncapped stacks. For example, the permit places a restriction on the number of times a vessel can operate in dynamic positioning mode while resupplying (including removing waste) the Kulluk over the course of a drill season. The permit also restricts the duration of such events to 24 hours. Region 10 is relying on vessel tracking data required to be collected via modern global positioning system technology under Condition F.1.3 and has included recordkeeping requirements.

The NAAQS protection limits in Condition D.6 include emission limits on specific emission units or groups of specific emission units (including whole vessels) that reflect emission rates used in the modeling analysis conducted in support of the permit application (discussed in more detail in Section 4 and Appendix A of this SOB). Although the permit allows some flexibility in the selection of vessels and equipment as part of its operations, the vessels and equipment selected must comply with the emission limits and operations restrictions in the permit. For example, Condition D.6.1.1 and D.6.1.2 limit emissions from the Kulluk electric generation

[17] See Shell Permit Application 02/28/11, page 44 of Appendix F

[18] 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.

engines. While Condition D.6.1.1 specifies the emission limit applicable to the engines while they generate electricity to support well drilling activity, Condition 6.1.2 limits engine emissions at all other times. Engine emissions are greater during well drilling activity given the demand on the generators for additional power. The need for additional power correlates to the engines operating at higher loads and thus consuming additional diesel fuel. The frequency and duration of the well drilling activity and associated emissions must be limited so as to protect the NAAQS as discussed previously in this SOB for Conditions D.3.3 to D.3.5 of the proposed permit.

The hourly emission limits for NO_X and daily emission limits for PM_{10} and $PM_{2.5}$ in Conditions D.6.1 through D.6.12 reflect the emission rates employed in the modeling analysis. The permittee calculated these emission rates by summing the rates for each emission unit, group of emission units, or vessel, depending on which approach was appropriate considering the modeling approach used by the permittee in its permit application. For example, emissions from the Kulluk electric generation engines were modeled together as one point source given that their emissions will be exhausted to a common stack. It is appropriate for EPA to limit emissions from this group of engines collectively as one. For the MLC air compressor engines, however, it is not appropriate to limit their emissions collectively on those occasions when these portable units are not co-located. The permittee assumed two groups of these engines would be located on opposite sides of the Kulluk. To ensure consistency with the modeling analysis, half of the emissions are assigned to one group and half of the emissions to the other. Contrast the MLC air compressor modeling approach with that for the Associated Fleet. Because emissions from the icebreakers were modeled as a single area source (to represent movement of vessels) as opposed to a stationary point source, it is appropriate to simply limit total emissions from both vessels.

The emission limits in Condition D.6.1 through D.6.12 rely on the monitoring, recordkeeping, and reporting requirements in Conditions D.13 through D.15 to document compliance under the authority of 40 CFR §§ 71.6(a)(3), 71.6(c)(1) and 55.8(a). Compliance with the NO_X emission limits will be determined through use of emission factors (lb/unit) and recorded hourly operation rates (units/hour) for a particular emission unit or group of emission units. For engines and boilers or heaters, the permittee is generally required to measure the gallons of diesel fuel consumed (gal/hr) and multiply the measured value by the appropriate emission factor (lb/gal) in order to determine emissions. Compliance with the $PM_{2.5}$ and PM_{10} is determined in the same manner except that the operating rate of the emission unit or group of emission units is measured over the course of an entire day, not just an hour.

In lieu of monitoring fuel flow, the permittee may elect to measure an emission unit's operating time over the course of an averaging period so long as, for purposes of calculating emissions, the unit is assumed to have been operating at maximum capacity. In the case of boilers, heaters and incinerators (with the exception of the Kulluk incinerator that is limited to operating just 12 hours per day), the permittee may simply assume the emission unit is operating at maximum capacity each hour over the course of the entire drilling season. This may be attractive for the permittee for those units that were modeled as if operating at maximum capacity each day.

For engines employing an oxidation catalyst, determining the correct $PM_{2.5}$ and PM_{10} emission factor will be based upon whether the monitoring data required to be collected pursuant to Condition F.2 of the permit indicates the oxidation catalyst is functioning properly. For engines employing a selective catalytic reduction (SCR) unit, determining the correct NO_X emission factor to employ will be based upon whether the monitoring data collected pursuant to Condition

F.3 of the proposed permit indicates the SCR unit functioning properly. For incinerators, determining the correct $PM_{2.5}$ and PM_{10} emission factor will be based upon whether the monitoring data required to be collected pursuant to Condition F.2.5 indicates that the incinerator is being operated in manner consistent with how it operated during the emission-factor derivation testing.

Condition D.7: This condition prohibits the permittee from flow testing wells, flaring gas, storing liquid hydrocarbons recovered during well testing, allowing vessels associated with this project to approach within 25 miles of the Kulluk unless it is listed in Table 2 of the permit, and emitting NSR regulated pollutant or GHG from the shallow gas diverter system. Emissions from these activities have not been estimated or analyzed, so this condition prohibits them.

Condition D.8: All of the emissions estimates are based on the equipment and control equipment being operated using good practices. Consequently, this condition requires the use of good air pollution control practices for minimizing emissions and is based on language in the general provisions of the NSPS and NESHAP (see 40 CFR §§ 60.11(e) and 63.6(e)) under the authority of 40 CFR §§ 71.6(a)(1) and 71.6(a)(3)(i).

Condition D.9: In its application materials, the permittee did not address crankcase ventilation emissions from the internal combustion engines to be used on the Kulluk and Associated Fleet vessels. Because these emissions of particulate matter were not included in the emission inventory or the modeling to demonstrate compliance with the NAAQS, Region 10 has required under this condition that these emission units be equipped with closed crankcase ventilation (CCV), which routes any crankcase ventilation emissions back to the engine intake under negative pressure.

Condition D.10: The permittee assumed that each main engine on the Kulluk and each propulsion and electric generation engine on the icebreakers would be controlled for NO_X by a SCR system and that the SCR system would reduce NO_X emissions by approximately 90%. The analyses in support of this permit action were based on the SCR units being fully operational at any time that the engine(s) they serve are running. This condition includes these assumptions as conditions of the permit.

Condition D.11: The permittee assumed that several engines on the Kulluk and each propulsion and electric generation engine on the icebreakers would be controlled for PM_{10} and $PM_{2.5}$ by an oxidation catalyst system and that the catalyst system would reduce PM_{10} and $PM_{2.5}$ emissions by approximately 50%. The analyses in support of this permit action were based on the catalyst units being fully operational at any time that the engine(s) they serve are running. This condition includes these assumptions as conditions of the permit.

3.5 Source-Wide Testing Conditions

Condition E.1: This condition contains general testing requirements under the authority of 40 CFR §§ 71.6(a)(3) and 71.6(c)(1) related to how the stack tests must be conducted. It also contains a requirement to submit a test plan in advance of testing, procedures for approval of an alternative to or a deviation from a reference test method and time extensions. This condition requires all monitoring required by the permit to be performed and recorded during each test. The monitoring data is often used to confirm the validity of the tests and can form the basis for additional monitoring set points such as minimum temperature. For example, incinerator exit temperatures and SCR catalyst inlet temperatures are measured during the tests and used to

minimum values for monitoring – see Permit Conditions E.2.6 and E.3.7. Unless these requirements conflict with specific testing conditions in the permit, all sources testing done to comply with this permit should meet these general conditions.

Condition E.2: Because the Kulluk, Associated Fleet vessels, and all associated emission units to be used by the permittee are not specified or known at this time, many generic emission factors have been used to calculate the estimated emissions from this project. The permittee relied on a combination of emission testing of similar units, manufacturer's emissions data and literature, including AP-42. These sources of emissions information are generally considered to be less reliable and accurate than unit-specific testing data. Because of the inherent uncertainty of the project approach taken by the permittee, Region 10 has generally addressed this by basing emission limits on the estimated rates included in the permittee's permit application materials, and requiring thorough source testing in order to obtain unit-specific test data. Region 10 is therefore requiring that many units be tested prior to the first drilling seasons (as well as ongoing periodic testing), and that emissions data collected during these performance tests be used to derive emission factors which will be more accurate than the generic factors used by the permittee to support its permit application. This condition contains the required procedure for testing specific emission units to derive equipment-specific emission factors. The derivation of the emission factors is through an approved replicable procedure or ARM as provided for in 40 CFR § 71.2 and 40 CFR § 71.6(a)(1).

An important element of this condition is the selection of worst case emission factors for each emission unit or group of emission units tested. Testing engines at three loads will produce emission factors for each load. The permittee is required to use the highest of the three emission factors for determining ongoing compliance with emission limits in the permit for all operating loads during actual operation. This allows the permittee to avoid continuous engine load monitoring and provides additional confidence that the engine is complying with the emission limits in the permit. When a single emission factor will be used to represent a group of emission units, the highest emission factor of all the emission units in the group will be used for demonstrating compliance. This allows the permittee to monitor fuel to the group of engines in one place and provides yet another level of confidence that the group will be complying with the emission limits in the permit.

To support testing each engine at various operating loads, instrumentation is necessary to monitor the percentage of rated capacity that each engine is operating at during each test run. Because the specific engines and related ancillary equipment will be leased for this project and therefore are unknown at this time, Condition E.2 requires electrical power output monitoring devices be installed during the test. To account for possible variation in the specific equipment used, provisions are included to allow an alternative method of load measurement based on written approval by Region 10. This condition also requires the monitoring and recording of fuel injection timing while testing engines. This information is useful for establishing the conditions under which the engines were tested.

The condition separates the testing instructions between those for engines and those for testing incinerators. This condition also requires the testing to be completed by May 1 and reported to EPA by June 15. The results will be available to be used for compliance determinations during the drilling season that begins 15 days later (July 1) for each year that testing is performed. The

permittee is required to use the test-derived emission factor for all emission calculations and compliance determinations required under the permit.

Condition E.3: This condition specifies which emission units and pollutants must be tested to develop emission factors for ensuring compliance with synthetic minor and NAAQS-based emission limits. The permittee is required to test many emission units before the first two drilling seasons. The frequency, beginning in the third year, is then set based upon how variable the results are. EPA's goal is to determine representative emission factors for compliance use. Once relatively consistent (in two consecutive test years) emission factors have been identified, the frequency can be reduced but not discontinued. The less frequent testing is still necessary to indicate whether conditions and emission factors are changing over time.

Emission units that are less emitting, less variable in operations and emissions and used less frequently are required to be tested less frequently or not at all. EPA believes it is reasonable to focus emission testing resources where the results will most likely impact compliance decisions.

The tested pollutants include CO and NOx (two pollutants for which synthetic minor limits are needed) and PM10 and PM2.5 (which, along with NOx, are limited by the permit for NAAQS protection purposes). NO2 will be also measured simultaneously with NOx so the NO2 ratios assumed for use in the ambient air quality impact analysis can be verified. Visible emission testing is also required for additional unit performance feedback. Average incinerator exit and SCR inlet temperatures will be documented for use in compliance monitoring.

3.6 Source-Wide Monitoring & Recordkeeping Conditions

Condition F.1: This condition requires the permittee to use a modern global positioning system on the Kulluk and all vessels in the Associated Fleet (except work boats) to track the movement and location of these vessels in order to implement permit conditions limiting the movement and location of certain vessels in the Associated Fleet. This includes requirements based on the inclusion of emissions of Associated Fleet vessels as emissions of the OCS source when Associated Fleet vessels are within 25 miles of the OCS source. Workboats are not required to be individually tracked because they never travel far from the vessel the workboats are stored on.

Condition F.2.1: This condition first requires that all monitoring equipment and systems necessary to perform the monitoring required by this permit (e.g. temperature, fuel flow, etc) are installed, calibrated, maintained and operated. This condition also includes specifications for fuel flow meters required by the permit. These provisions ensure that the meters meet appropriate accuracy specifications and that their installation is appropriate to provide the necessary data. Fuel monitoring requirements for smaller and seldom used emission units are also specified. An option for using operating time in place of fuel monitoring is included and operating time tracking is included here where appropriate. The measured operating time is converted to fuel usage by conservatively assuming that the monitored unit is operating at its maximum capacity – something few emission units do all of the time. The permit also includes requirements for monitoring the sulfur content of fuel for the Kulluk and the Associated Fleet.

Incinerator exit temperature monitoring is also required by this condition and expected to be kept above the minimum value established during emission testing. The permit condition clarifies when a reportable temperature deviation occurs.

Condition F.3: Region 10 has included additional parametric monitoring requirements to ensure the SCR pollution control systems required on the large engines on the Kulluk and the icebreakers are operating properly and achieving the anticipated pollutant reductions. Region 10 believes that the SCR 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 the SCR emission control systems, the permit requires monitoring and recording of the inlet temperature. The permit also requires monitoring and recording of the urea flow to the SCR unit. To ensure each catalyst is still active, the permit requires weekly measurements of NO_X concentrations downstream of the SCR units with a portable monitoring device. Comparing the weekly NO_X 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 SCR monitoring systems.

Condition F.4: Region 10 has included additional parametric monitoring requirements to ensure the oxidation catalyst pollution control systems required on most engines on the Kulluk and the large engines on the icebreakers are operating properly and achieving the anticipated pollutant reductions. Region 10 believes that the oxidation catalyst will be effective if the inlet temperature to each system is high enough and the catalysts are still active. To ensure the continuing performance of these add-on control systems, on-going monitoring is required. For the oxidation catalyst control system, the permit requires monitoring and recording of the inlet temperature. To ensure each catalyst is still active, the permit requires weekly measurements of CO concentrations downstream of the oxidation catalyst with a portable monitoring device. Comparing the weekly CO measurements against values measured during previous stack testing is expected to provide a reasonable assurance that the catalyst is still active. The permittee is also required to develop a monitoring plan to ensure proper installation and operation of the oxidation catalyst monitoring systems.

3.7 NESHAP and NSPS Conditions

Condition G.1: As discussed in Section 2 above, applicable NSPS Part 60 standards apply to OCS sources and must be included in the Title V permit for the OCS source as applicable requirements. See 40 CFR §§ 55.13(c)); 71.2. Condition G.1 includes the applicable requirements from 40 CFR Part 60, Subpart IIII (NSPS IIII) as they apply to the electric generation engines (Units K-1A – 1D), MLC HPU engines (Units K-2A – K-2Z), MLC air compressor engines (Units K-3A – 3Z) and the emergency generator engine (Unit K-6) on the Kulluk. NSPS IIII applies to stationary compression-ignition internal combustion (IC) engines, with the earliest applicability date being for units that were modified, or reconstructed after July 11, 2005, and the applicability date for newly manufactured engines that are not fire-pump engines being April 1, 2006.

This condition requires that engines on the Kulluk identified above be engines that are subject to 40 CFR 60, Subpart IIII based on their per cylinder displacement and model year. In other words, the permittee cannot install older engines that are not subject to Subpart IIII.

EPA recently amended NSPS IIII in June 2011 to require owners and operators to purchase diesel fuel that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel. See 76 Fed. Reg. 37954. Owners and operators will no longer be required to ensure that the purchased diesel

fuel meets the specifications of 40 CFR 80.510(b) as it enters the engine. The proposed permit conditions reflect the requirements that will become effective August 28, 2011 as final decisionmaking on this proposed permitting action will occur after August 28.

As also discussed above, applicable NESHAPs promulgated under Section 112 of the CAA apply to OCS sources and must be included in Title V permits as applicable requirements if rationally related to the attainment and maintenance of federal and state ambient air quality standards or the requirements of Part C of Title I of the CAA. See 40 C.F.R. §§ 55.13(e) and 71.2. 40 C.F.R. Part 63, Subpart ZZZZ (NESHAP ZZZZ) applies to compression-ignition internal combustion engines (RICE), such as those that will be on the Kulluk. Region 10 has determined that NESHAP ZZZZ is rationally related to attainment of the NAAQS because NESHAP ZZZZ relies, in part, upon affected sources' compliance with NSPS IIII to achieve compliance with NESHAP ZZZZ. See 40 CFR § 63.6590(c). In effect, NESHAP ZZZZ requires compliance with NSPS IIII, which in turn are standards of performance designed to control pollutants for which federal ambient air quality standards have been promulgated (the NAAQS), as well as to control other pollutants.

The permittee has agreed to install new engines for certain functions on the Kulluk as identified above. The permit requires installation of these new engines that are subject to NSPS Subpart IIII. As provided in 40 CFR §63.6590(c), these engines will be compression-ignition stationary RICE located at an area source. Therefore, these emission units comply with Subpart ZZZZ by meeting the requirements of 40 C.F.R. Part 60, Subpart IIII, for compression-ignition engines and no additional Subpart ZZZZ provisions apply. See 40 CFR § 63.6590(c).

Condition G.2: As noted above, the Kulluk is an area source for HAP and NESHAP ZZZZ applies on the OCS as it is rationally related to attainment of the NAAQS. Units K-7A, K-7B, K-7C and K-7D1 – 7D5 are assumed to be existing sources as Shell did not identify any of these emission units as being subject to NSPS Subpart IIII. Unit K-7A is a non-emergency compression-ignition engine with rating less than 300 horsepower output. The other "K-7" group of engines are emergency compression-ignition engines with individual ratings less than 500 horsepower output. Given this information and the applicability structure of NESHAP ZZZZ, each of these existing units is subject to the same or similar NESHAP ZZZZ requirements. Compliance is required by May 3, 2013 pursuant to 40 CFR 63.6595(a).

Among the various NESHAP ZZZZ requirements that apply to each engine, note that the permittee is required to change the engine oil and oil filter at a frequency determined by engine function (emergency or non-emergency) and whether the permittee conducts an oil sample and analysis program. The permittee is also required to inspect the engine air cleaner, hoses and belts most likely at a frequency of once each year. No monitoring, recordkeeping, and reporting in addition to that required by NESHAP ZZZZ was considered necessary to provide a reasonable assurance of compliance with the applicable requirement for these emission units.

Condition G.3: As noted above, the Kulluk is an area source for HAP and NESHAP ZZZZ applies on the OCS as it is rationally related to attainment of the NAAQS. Units K-4A through K-4C are assumed to be existing sources as Shell did not identify any of these emission units as being subject to NSPS Subpart IIII. Units K-4A – 4C are subject to the NESHAP ZZZZ requirements for existing non-emergency compression ignition engines with power output

exceeding 300 horsepower but less than 500 horsepower, and compliance is required by May 3, 2013 pursuant to 40 CFR 63.6595(a).

Among the various NESHAP ZZZZ requirements that apply to each engine is the requirement to install either a closed crankcase ventilation system or an open one with a filtered exhaust. The permittee is also required to reduce HAP emissions from the exhaust such that CO (surrogate) emissions are reduced by 70 percent or do not exceed 49 ppmvd at 15 percent O_2. The permittee is required to conduct an emissions test to determine compliance. The permittee is also prohibited from having any of these engines consume diesel fuel with a sulfur content of greater than 15 ppm by weight, in-use. Additional monitoring, recordkeeping, and reporting was considered necessary to provide a reasonable assurance of compliance with respect to the in-use diesel fuel sulfur-content limitation.

Condition G.4: The boilers and heaters on the Kulluk are subject an area source Maximum Achievable Control Technology standard: NESHAP, 40 CFR Part 63, Subpart JJJJJJ. This MACT applies to boilers at industrial, commercial, and institutional area sources of HAPs. The rule includes limited applicable requirements for all oil-fired boilers (including diesels) regardless of size and age. Region 10 has determined that Subpart JJJJJ is rationally related to attainment of the NAAQS because compliance with the rule results in reductions of filterable PM, SO_2, and VOC in addition to reductions of HAP. See 76 Fed. Reg. 15554, 15579-80 (March 23, 2011).

The heaters/boilers on the Kulluk have a combined rating of approximately 6 MMBtu/hr heat input, and are therefore subject to applicable requirements of Subpart JJJJJJ, consisting primarily of a periodic tune-up and associated monitoring, recordkeeping, and reporting. These applicable requirements are included in Condition G.4. No monitoring, recordkeeping, and reporting in addition to that required by Subpart JJJJJJ was considered necessary to provide a reasonable assurance of compliance with the applicable requirement for these emission units, a periodic tune-up.

Condition G.5: The incinerator on the Kulluk is subject to a New Source Performance Standard: 40 CFR Part 60, Subpart CCCC. This requirement applies to commercial and solid waste incinerators (CISWI) constructed after November 30, 1999. Although the exact date of manufacture of the incinerator that will be on-board the Kulluk is unknown at this time, it is likely the incinerator will have been constructed after that date, meet the definition of a CISWI, and be subject to the substantive requirements of Subpart CCCC unless it qualifies for one of the exemptions in 40 CFR § 60.2020. Shell has submitted an initial notification and exemption request to Region 10 on the grounds that the incinerator will burn more than 30 percent municipal solid waste and refuse derived fuel and have the capacity to burn less than 35 tons per day of municipal solid waste and refuse derived fuel. See 40 CFR§ 60.2020(c)(2). This exemption requires a subject source to maintain records as provided in the exemption in order to continue to qualify for the exemption. Region 10 has included in the permit a requirement to submit to Region 10 with the seasonal notification required under Condition G.5 a claim for operation under the exemption of 40 CFR § 60.2020(c)(2). Region 10 has also included in the permit provisions to implement this exemption, by requiring monitoring, recordkeeping, and reporting requirements to assure compliance with this exemption.

Note that EPA amended NSPS Subpart CCCC on March 21, 2011 to eliminate this exemption. See 76 Fed. Reg. 15704. On May 18, 2011, however, EPA stayed the effectiveness of the amendments until the proceedings for judicial review of these rules are completed or the EPA completes its reconsideration of the rules, whichever is earlier. The permit will be amended, as necessary, to reflect the outcome of the NSPS Subpart CCCC rule review consistent with the Title V program's permit reopening provisions as provided in Condition A.7.

4. AIR QUALITY ANALYSIS

As discussed in Section 2 above, Shell's permit applications triggered several COA and Title V requirements to assess the expected air quality impacts from the Kulluk and Associated Fleet and demonstrate that project emissions do not cause or contribute to a violation of the NAAQS. The details regarding these requirements are found in Appendix A (Region 10 Technical Support Document Review of Shell's Air Quality Analysis). To address these requirements, Shell submitted an ambient air quality analysis in support of their Kulluk permit application.

Region 10 has reviewed Shell's submittal and determined that Shell's analysis adequately shows that operating the Kulluk and Associated Fleet within the requested constraints will not cause or contribute to violations of the NAAQS. Region 10's assessment of Shell's analysis is fully described in Appendix A and is summarized below.

Region 10 evaluated Shell's modeling analysis under the guidance established in 40 CFR Part 51, Appendix W, *Guideline on Air Quality Models* (Appendix W). Shell used the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) system of programs to estimate most of their ambient impacts. Region 10 used qualitative assessments to evaluate the ozone and lead impacts.

The AERMOD Modeling System consists of various modules. Shell used the AERMET component to process their meteorological data during periods of broken ice, and a non-Guideline model, the Coupled Ocean-Atmospheric Response Experiment (COARE) bulk flux algorithm to process the meteorological data during open water periods. Shell also used the Plume Volume Molar Ratio Method (PVMRM) to estimate their nitrogen dioxide (NO_2) impacts. The COARE and PVMRM algorithms have not been approved by EPA for general use, but have been approved by Region 10 under the case-by-case alternative modeling provisions of Appendix W. Region 10 therefore specifically requests public comment on the suitability of these modeling algorithms for this permitting action.

The maximum modeled NO_2, SO_2, PM_{10}, $PM_{2.5}$, and CO impacts, background concentrations, total impacts, and NAAQS are summarized below in Table 4-1. The maximum impacts occur within 500 meters of the Kulluk and rapidly decrease as the distance from the Kulluk increases. All of the total impacts are less than the NAAQS at all locations that constitute ambient air. See Section 3.4 Conditions D.5 and D.6 of the SOB.

Table 4-1: Modeled Impacts at the Location of Maximum Impact

Air Pollutant	Averaging Period	Shell Only Impacts (without background) ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Impact Including Background ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Total Impact as a % of NAAQS
NO_2	1-hour	110.6	40.9	**151.5**	188	81%
	Annual	4.4	11	**15.4**	100	15%
$PM_{2.5}$	24-hour	17.0	17	**34**	35	97%
	Annual	1.0	4	**5.0**	15	33%
PM_{10}	24-hour	20.8	53	**73.8**	150	49%
SO_2	1-hour	14.0	29	**43.0**	196	22%
	3-hour	8.9	29	**37.9**	1,300	3%
	24-hour	2.8	22	**24.8**	365	7%
	Annual	0.2	4	**4.2**	80	5%
CO	1-hour	1,268	1,742	**3,010**	40,000	8%
	8-hour	712	1,094	**1,806**	10,000	18%

The total 24-hour $PM_{2.5}$ impact at the location of maximum modeled impact is very close to the applicable NAAQS. This is partially due to the conservative assumptions used by Shell in its modeling analysis. For example, the 24-hour $PM_{2.5}$ NAAQS is based on a three-year average of the 98th percentile of the 24-hour concentrations. For modeling purposes, Shell assumed the Kulluk never relocates during the entire drilling season and returns to the same location each successive drilling season. This assumption produces the largest possible predicted impact, but overstates what would really occur under the more likely scenario of periodically relocating the Kulluk. In addition, the background concentration is a very conservative estimate of expected concentrations offshore in the vicinity of Shell's operations and includes days during which the measured background concentrations onshore were likely influenced by local dust. Average background concentrations of $PM_{2.5}$ are much lower, at approximately 2 $\mu g/m^3$.

The total impact (Kulluk and Associated Fleet plus background) in the local communities of Nuiqsut, Deadhorse and Kaktovik, which are located approximately 37, 44, and 14 km, respectively, from the closest Kulluk lease blocks, are shown in Table 4-2.

Table 4-2: Total Impacts at Nearest Communities (from Kulluk operations and including background concentrations)

Air Pollutant	Averaging Period	Total Impacts ($\mu g/m^3$) at			NAAQS ($\mu g/m^3$)
		Nuiqsut	Deadhorse	Kaktovik	
NO_2	1-hour	94	94	21	**188**
	Annual	11	11	1	**100**
$PM_{2.5}$	24-hour	17	17	7	**35**
	Annual	4	4	3	**15**
PM_{10}	24-hour	53	53	53	**150**
SO_2	1-hour	14	29	10	**196**

Air Pollutant	Averaging Period	Total Impacts (µg/m^3) at			NAAQS (µg/m^3)
		Nuiqsut	Deadhorse	Kaktovik	
	3-hour	180	29	11	**1,300**
	24-hour	25	22	4	**365**
	Annual	4	4	2	**80**
CO	1-hour	1,943	1,924	2,075	**40,000**
	8-hour	1,211	1,199	1,274	**10,000**

In all cases, background concentrations comprise the majority of total impacts at all onshore locations. A more detailed discussion of background data is provided in Appendix A.

5. OTHER REQUIREMENTS

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

Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies, in consultation with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) 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 CFR §§ 402.13, 402.14. The federal agency is also required to confer with the Services on any action which is likely to jeopardize the continued existence of a species proposed for listing as threatened or endangered or which will result in the destruction or adverse modification of critical habitat proposed to be designated for such species. 16 U.S.C. §1536(a)(4); see also 50 CFR § 402.10. Further, the ESA regulations provide that where more than one federal agency is involved in an action, the consultation requirements may be fulfilled by a designated lead agency on behalf of itself and the other involved agencies. 50 CFR § 402.07.

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. In fulfilling its ESA obligations for this permitting action to date, Region 10 reviewed the ESA consultation documents prepared by BOEMRE and the biological opinions (BOs) issued by the Services resulting from the inter-agency ESA consultations regarding impacts from exploratory drilling on threatened and endangered species and designated critical habitats for listed species. The following list summarizes the primary documents reviewed by Region 10.

- Fish and Wildlife Service's Endangered Species Act, Section 7 Biological Opinion for Beaufort and Chukchi Sea Program Area lease sales and associated seismic surveys and exploratory drilling, September 3, 2009
- National Marine Fisheries Service's revised Biological Opinion for Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska; and Authorization of Small Takes Under the Marine Mammal Protection Act, July 17, 2008

- National Marine Fisheries Service's Biological Opinion for Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska; and Authorization of Small Takes Under the Marine Mammal Protection Act, June 16, 2006
- Mineral Management Service's Environmental Assessment, Shell Offshore, Inc. 2010 Outer Continental Shelf Lease Exploration Plan, Camden Bay Alaska, October 2009
- Fish and Wildlife Service's Programmatic Biological Opinion for Polar Bears on Beaufort Sea Incidental Take Regulations, June 23, 2008
- Proposed Threatened and Not Warranted Status for Subspecies and Distinct Population Segments of the Bearded Seal, 75 Fed. Reg. 77496 (December 10, 2010)
- Proposed Threatened Status for Subspecies of the Ringed Seal, 75 Fed. Reg. 77476 (December 10, 2010)
- Designation of Critical Habitat for the Polar Bear in the United States, 75 Fed. Reg. 76086 (December 7, 2010)

Since the BOs above addressed the same drilling activities associated with the draft OCS/Title V permit, EPA relied on those consultations and the protections mandated by BOEMRE as a result. EPA also conducted a review of any additional information regarding potential impacts of air emissions from the drilling activities on threatened and endangered species and designated critical habitat. Based upon the best available data, EPA determined that the issuance of a CAA permit to Shell for exploratory drilling was not likely to cause any adverse effects on proposed or listed species or designated critical habitat beyond those already identified, considered and addressed in the consultations between BOEMRE and the Services.

Region 10 communicated with the services concerning CAA permitting on the OCS in letters dated September 4, 2009 and March 1, 2010. These communications concerned Region 10's issuance of a CAA permit for Shell to construct and operate the Discoverer drillship and its Associated Fleet on its lease blocks the Beaufort and Chukchi Seas. The draft OCS/Title V permit for Shell's Kulluk drilling unit and Associated Fleet involves operations similar to the Discoverer drillship. The Services concurred in writing with Region 10's determination in letters dated September 23, 2009, October 26, 2009, March 30, 2010 and April 5, 2010.

BOEMRE is in ongoing consultation with the Services regarding Shell's Revised OCS Exploration Plan for Camden Bay, which will address the Kulluk operations as well as the final designation of polar bear critical habitat and the proposed listing of the bearded and ringed seals.[19]

In fulfilling its ESA obligations for this permitting action, Region 10 intends to rely, as appropriate, on the foundational and supplemental BOEMRE-Services determinations. Region 10 is once again completing additional evaluation work on the potential impacts of air emissions and is working to obtain the Services' concurrence with its findings. Any final air permits that Region 10 may issue in this action will, as appropriate, include additional conditions that may be developed as a result of the updated ESA process.

5.1.1 Essential Fish Habitat of Magnuson-Stevens Act

[19] *2012 Outer Continental Shelf Lease Camden Bay Exploration Plan*, and associated *Oil Discharge Prevention and Contingency Plan* (ODPCP), May 4, 2011

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), and implementing regulations at 50 CFR § 600.920. For activities that may have an adverse effect on EFH, agencies must provide NMFS with a written assessment of those effects unless the agency determines that the action would not adversely affect EFH. 40 C.F.R. § 600.920(e)(1).

BOEMRE is the lead federal agency for authorizing oil and gas exploration activities on the Alaskan OCS, including the Beaufort Sea. 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 Lease Sales 186, 195, and 202 in the Beaufort Sea. BOEMRE received NMFS' comments on the Draft Environmental Impact Statement for the Lease Sales in a letter dated September 6, 2002. In this letter NMFS stated that no additional EFH consultation was required but the need for additional EFH consultation should be determined as specific projects are proposed.

In August 2009, EFH was designated for three species – saffron cod, Arctic cod, and Opilio crab. The most recent EFH consultation for OCS exploration in Beaufort Sea was conducted concurrently with the preparation and public review of the Arctic Multiple-Sale Draft Environmental Impact Statement. BOEMRE received NMFS' conservation recommendations in a letter dated June 26, 2009.

BOEMRE is currently updating its Environmental Assessment for Shell's Revised Camden Bay Outer Continental Shelf Lease Exploration Plan. This Environmental Assessment will include EFH consultation, as necessary, to address the effects of Shell's proposed exploration drilling project in the Beaufort Sea on EFH.

In fulfilling MSA obligations for this permitting action, Region 10 intends to rely on the consultations between BOEMRE and NMFS while also conducting additional compliance activities to address the potential effect of levels of air pollution authorized by the draft OCS/Title V permit on 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.

5.2 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties and provide the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. Under the ACHP's implementing regulations at 36 C.F.R. Part 800, section 106 is implemented through a process involving consultation between federal agencies and the relevant state and/or tribal historic preservation officials, with opportunities for direct involvement by the ACHP in certain circumstances as well as opportunities for public input and involvement of other interested parties.

The goals of the procedural requirements of the section 106 consultation are to identify historic properties potentially affected by the undertaking, assess the potential effects of the undertaking on historic properties, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. If more than one federal agency is involved in an undertaking, some or all of the agencies may designate a lead federal agency for this analysis. The lead federal agency then

acts on behalf of itself and the other agencies, fulfilling their responsibilities under the statute. Section 106 requires the lead agency to consult with the relevant parties on actions with the potential to affect historic properties.

As the lead federal agency, BOEMRE conducted Section 106 consultations with the Alaska State Historic Preservation Officer (SHPO) in conjunction with the Beaufort Sea Multiple-Sale Environmental Impact Statement and the Arctic Multiple-Sale Draft Environmental Impact Statement. BOEMRE concluded that the lease sales would have no effect on known offshore historic resources. The SHPO concurred with BOEMRE's conclusion on September 24, 2008. Following Shell's submission of its 2010 Camden Bay Exploration Plan, BOEMRE conducted a review of site-specific data and determined that there are no historic properties at Shell's proposed exploration drilling locations. The SHPO concurred with this determination on October 2, 2009. In fulfilling its NHPA obligations for this permitting action Region 10 is relying on BOEMRE's consultations.

5.3 Coastal Zone Management

The Alaska Coastal Management Program (ACMP), authorized by the State of Alaska's 1977 Alaska Coastal Management Act, is designed to protect Alaska's rich and diverse coastal resources to ensure a healthy and vibrant coast that sustains long-term economic and environmental productivity. The ACMP requires that certain projects that will be conducted in Alaska's coastal zone be reviewed by coastal resource management professionals and found consistent with the statewide standards of the ACMP.

Pursuant to Title 11 of the Alaska Administrative Code at 11AAC 110.400 (b)(5), projects requiring the following EPA permits must undergo an ACMP consistency review:

A. permit required under 33 U.S.C. 1342 (Clean Water Act), authorizing discharge of pollutants into navigable waters;

B. permit required under 33 U.S.C. 1345 (Clean Water Act), authorizing disposal of sewage sludge;

C. permit under 40 C.F.R. Part 63 for new sources or for modification of existing sources, or a waiver of compliance allowing extensions of time to meet air quality standards under 42 U.S.C. 7412 (CAA); or

D. air quality exemption granted under 40 C.F.R. 60.14 or 40 C.F.R. 64.2 for stationary sources.

The OCS/Title V permit at issue in this action does not appear on the list. Thus, issuance of this Title V permit is not required to be preceded by an ACMP consistency review.

5.4 Executive Order 12898 – Environmental Justice

As discussed in more detail below, based on available information, Region 10 concludes that the activities proposed to be authorized under the OCS/Title V permit 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. The basis for this conclusion is summarized below and is

set forth in more detail in the Environmental Justice Analysis, which is included in the administrative record for this permit action.

It is important to note that the extent of an Environmental Justice Analysis will vary according to the unique circumstances of each case. The permit at issue here are is a OCS/Title V permit for a Title V temporary source that must assure compliance with the NAAQS and that also establishes limits on the PTE of the source so as to avoid PSD review, as well as a minor source construction permit under the COA regulations. The scope of the analysis conducted in this case is shaped by the type of permit at issue, the fact that Region 10 has received several OCS permit applications for operation in the OCS off the North Slope of Alaska, and the unique characteristics of the potentially affected communities, including the importance of subsistence activities to their lifestyle and cultural identity.

5.4.1 Environmental Justice in Air 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.

The Title V operating permit program does not generally impose new substantive air quality control requirements. Rather, the Title V operating permit program is generally a vehicle for ensuring that existing air quality control requirements are appropriately applied to facility emission units and that compliance with these requirements is assured. Accordingly, the primary means of addressing environmental justice issues in the Title V program is through increased public participation and review by permitting agencies, and conditions to assure compliance with applicable requirements. As discussed above, the OCS/Title V permit at issue in this case is unusual in that it requires the source, as a Title V temporary source, to meet the NAAQS and also establishes limits on PTE. Region 10 has considered environmental justice concerns in this permitting action, where possible, in the context of assuring compliance with requirements applicable to the source, in particular assuring compliance with the NAAQS as a Title V temporary source and establishing PSD avoidance limits.

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." Id. 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." Id. 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." 75 Fed. Reg. 6481, 6438 (Feb. 9, 2010).

5.4.2 Northern Iñupiat Communities

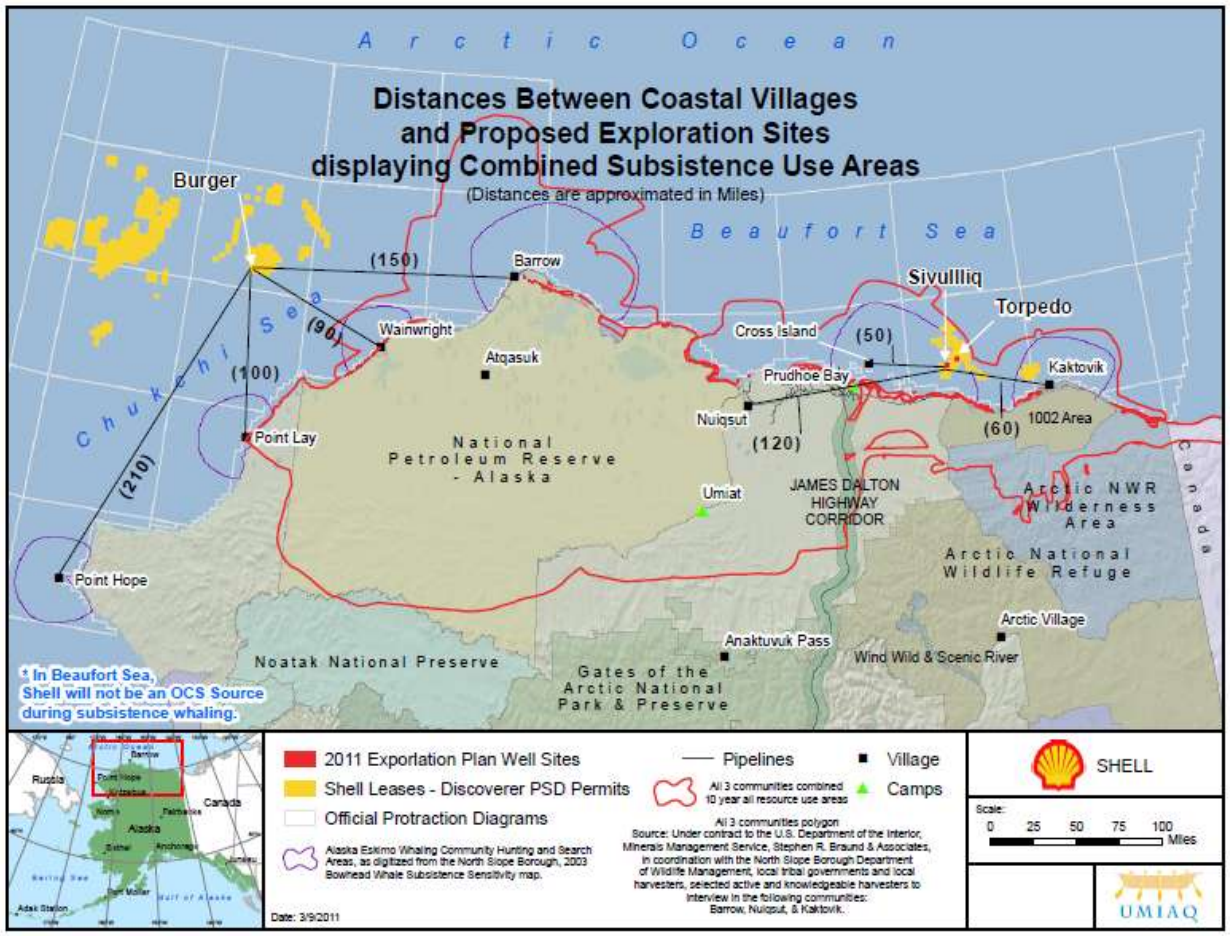
The North Slope is bordered by the Arctic Ocean to the north and the Brooks Mountain Range to the south. In all it encompasses approximately 89,000 square miles of northern Alaska. The incorporated villages of the North Slope Borough (NSB) include Point Hope, Point Lay, Wainwright, Atqasuk, Barrow, Nuiqsut, 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 Beaufort Sea, the nearest towns or villages to Shell's exploratory operations are Kaktovik, Deadhorse, and Nuiqsut, which are located 14, 44, and 37 kilometers (8, 27, and 22 miles), respectively, from the closest lease block in the Beaufort Sea at which Shell will be authorized to operate under the OCS/Title V permit.

As discussed in more detail in the 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.[20] 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.[21] Subsistence activities also play an important cultural role.[22] Residents report traveling long distances offshore to hunt for bowhead whale and conduct other subsistence activities, up to 35 miles from Kaktovik and 60 miles from Nuiqsut.[23] Figure 5-1 depicts the location of subsistence activities in the Beaufort Sea. Shell has committed to halt drilling operations in the Camden Bay area around the end of August of each year for the Nuiqsut and Kaktovik subsistence bowhead whale hunt.

[20] 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.
[21] 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.
[22] 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."
[23] Stephen R. Braund & Associates. Report of Traditional Knowledge Workshops – Point Lay, Barrow, Nuiqsut, and Kaktovik. Chukchi and Beaufort Seas National Pollutant Discharge Elimination System Exploration General Permits Reissuance. 2011.

Figure 5-1: Subsistence Use Areas Mapped Over Exploration Sites



The 2009 Alaska Native Health Status Report issued by the Alaska Native Tribal Health Consortium provides an overview of health conditions in this region.[24] Between 2004 and 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).[25]

As discussed below, EPA has identified people with respiratory problems to be potentially at greater risk of experiencing adverse health effects from exposure to some pollutants, including NO_2 and SO_2. This was taken into consideration when setting the new NAAQS standards for the 1-hour NO_2 and SO_2 NAAQS. EPA also noted in particular that the prevalence and severity of

[24] 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*

[25] 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*

asthma is higher among certain ethnic or racial groups such as Alaskan Natives. 75 Fed. Reg. 6482 (February 9, 2010) and 75 Fed. Reg. 35527 (June 22, 2010).

5.4.3 Community Outreach

Oil and gas operations in the Beaufort Sea 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 OCS/Title V permit. 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. Region 10 held early information meetings in Kaktovik and Barrow the week of June 13, 2011, regarding several OCS permit applications that have been submitted to Region 10, including the Kulluk application. 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.

In addition, Region 10 is holding a comment period on the draft OCS/Title V permit and, in anticipation of a significant degree of public interest in the draft permit, 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 hearing or during the public comment period prior to taking final action on the permit. Region 10 specifically solicits public comment on its Environmental Justice Analysis.

Note that the draft permit requires Shell to have a plan for communicating to the North Slope communities on the Beaufort Sea 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.

5.4.4 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 OCS/Title V permit would have disproportionately high and adverse human health or environmental effects on Alaska's Northern Iñupiat communities along the Beaufort Sea living and engaging in subsistence activities, including in areas closest to the activities proposed to be permitted.

As discussed in more detail in Section 4 above and in Region 10's Technical Analysis, Shell used the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) system to model the impacts of the emissions proposed to be authorized under the permit. Region 10 has reviewed Shell's analysis and, as discussed above, concluded that it is consistent with EPA OCS and Title V permitting requirements. Modeled concentrations at communities along the Beaufort Sea, including the impact of emissions from Shell's proposed Discoverer operations, indicate compliance with all NAAQS, with values well below the NAAQS for all pollutants and averaging periods.

The pollutants and averaging periods closest to the NAAQS are 1-hour NO_2 emissions, 24-hour PM_{10} and $PM_{2.5}$ emissions and annual $PM_{2.5}$ emission. At Kaktovik, located 14 km (8 miles) from the closest lease block, the total maximum modeled concentrations (considering background concentrations) are—as a percentage of the NAAQS—11% for the 1-hour NO_2 NAAQS, 20% for the 24-hour $PM_{2.5}$ NAAQS, 35% for the 24-hour PM_{10} NAAQS, and 20% for the annual $PM_{2.5}$ NAAQS. At Nuiqsut, located 37 km (33 miles) from the closest lease block, the total maximum modeled concentrations are, 50% for the 1-hour NO_2 standard, 48% for the 24-hour $PM_{2.5}$ standard, 35% for the 24-hour PM_{10} standard, and 26% for the annual $PM_{2.5}$ NAAQS. It should be noted that a majority of the total impacts are a result of background concentrations.

The total maximum modeled concentrations demonstrate that the NAAQS will be attained at all locations beyond the 500 meter ambient air boundary and will be below the standard in the Beaufort Sea North Slope communities and in the areas where the communities conduct subsistence activities.

5.4.5 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 draft OCS/Title V permit 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 Kulluk. 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.

5.5 Executive Order 13175 – Tribal Consultation

Executive Order 13175, issued on November 9, 2000 and entitled "Consultation and Coordination with Indian Tribal Governments," requires federal agencies to have an accountable process to assure meaningful and timely input by tribal officials in the development of policies that have tribal implications. 65 Fed. Reg. 67249

EPA's recently issued "EPA Policy on Consultation and Coordination with Indian Tribes" (May 4, 2011) and Region 10's tribal consultation procedures call for consultation based on the potential to affect a tribal community or its subsistence resources.

As discussed above in Section 4 and Section 5.4, Region 10 expects minimal impacts from air emissions under the Kulluk draft permit at all on-shore locations. However, given the geographic proximity of the Kulluk's operations to on-shore communities along the Beaufort Sea (approximately 14 kilometers or 8 miles from the closest lease block to Kaktovik), as well as the proximity between the Kulluk's operations and off-shore areas where subsistence activities are conducted in the Beaufort Sea, Region 10 determined it is appropriate to consult with the Inupiat Community of the Arctic Slope (ICAS), the Native Village of Nuiqsut, and the Native Village of Kaktovik on the Kulluk draft permit. Accordingly, on June 7, 2011, Region 10 sent letters to

these tribal entities offering tribal consultation on the Kulluk draft permit for exploratory activities in the Beaufort Sea. ICAS has already requested consultation on pending OCS air permit applications for operations in both the Chukchi and Beaufort Seas, including the Kulluk draft permit and Region 10 intends to consult with ICAS on these proposed permitting actions. Consistent with EPA's tribal consultation policy, Region 10 will attempt to honor consultation requests from federally recognized tribal governments.

Region 10 has taken a number of affirmative steps to provide tribal entities and communities along the Beaufort Sea with information regarding the Kulluk draft permit and the permittee's proposed operations, as well as to ensure tribal entities and communities are aware of the opportunity to comment on this draft permit. In accordance with Region 10's May 2009 "North Slope Communications Protocol: Communications Guidelines to Support Meaningful Involvement of the North Slope Communities in EPA Decision-Making," a regional policy for early community and tribal involvement, Region 10 held informational meetings in Barrow and Kaktovik on June 15-17, 2011 on upcoming OCS air permitting actions in the Chukchi and Beaufort Seas. This included Region 10's plan to propose for public comment in the summer of 2011 a draft OCS/Title V permit for the permittee's proposed operations for the Kulluk in the Beaufort Sea. 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 these early informational meetings.

Region 10 will also notify tribal entities and communities along the Beaufort and Chukchi Seas of the opportunity to provide public comment on this draft OCS/Title V permit during the public comment period and to attend and provide testimony during the scheduled public hearing.

5.6 National Environmental Policy Act

The National Environmental Policy Act (NEPA) establishes a national environmental policy and goals for the protection, maintenance, and enhancement of the environment. NEPA includes a process for implementing these goals by federal agencies when they undertake major federal actions. The NEPA process involves an assessment of the environmental effects of a proposed action and alternatives. For projects that have the potential for significant environmental effects or that are environmentally controversial, a detailed statement called an Environmental Impact Statement (EIS) is prepared.

Section 7(c) of the Energy Supply and Environmental Coordination Act of 1974 specifically exempts actions under the CAA, including issuance of Title V permits, from the requirements of NEPA. Region 10 is therefore not required to develop an EIS prior to issuance of this permit.

Appendix A

Technical Support Document Review of Shell's Ambient Air Quality Impact Analysis

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 6th Avenue, Suite 900
Seattle, WA 98101-3140

May 25, 2011

To:

North Slope Borough
Inupiat Community of the Arctic Slope
Alaska Eskimo Whaling Commission
Native Village of Barrow
City of Barrow
Native Village of Kaktovik
City of Kaktovik
Native Village of Nuiqsut
City of Nuiqsut
Native Village of Point Hope
City of Point Hope
Native Village of Point Lay
City of Point Lay
Wainwright Traditional Council
City of Wainwright

Re: Invitation to attend informational meetings on EPA air and water permits for oil and gas exploration

Dear Tribal Presidents, Mayors and Leaders:

The U.S. Environmental Protection Agency (EPA) is preparing to propose issuing several oil and gas exploration air and water permits in the coming months. Before issuance, we are inviting you to participate in informational meetings about the proposed permits in June. We also would like to know if you would like EPA to meet individually or together with your governments or organizations during this visit (including teleconference) or on another date via telephone.

Air Permits

EPA's air program is preparing to re-issue draft revised Shell *Discoverer* air permits for oil and gas exploration in the Beaufort Sea and Chukchi Sea that were remanded by EPA's Environmental Appeals Board in 2010. We are also preparing to propose issuing draft air permits for Shell *Kulluk* oil and gas exploration in the Beaufort Sea and for ConocoPhillips oil and gas exploration in the Chukchi Sea. We expect to propose the draft air permits for public comment in early July starting with the Shell *Discoverer* air permit.

Water Permits

EPA's water program is preparing to reissue the National Pollutant Discharge Elimination System (NPDES) general permits for oil and gas exploration in the Beaufort Sea and Chukchi Sea. We expect to propose the draft exploration general permits for public comment starting in September.

Before the public comment periods begin this summer and fall, EPA air and water program staff will be visiting Kaktovik and Barrow June 15-17 to share early information about the air and water permits. The informational meetings are intended to:

1. Describe each of the proposed exploration projects, the air permit process and permit schedules;
2. Give an overview of Ocean Discharge Criteria Evaluations for the exploration general permits;
3. Share potential differences between existing Arctic general permit and proposed exploration general permits;

4. Share the current schedule for reissuance of the exploration general permits;
5. Follow-up on Traditional Knowledge information collection for the exploration general permits;
6. Share future opportunities for public involvement in the air permits and the exploration general permits.

We invite you to these meetings and we look forward to working with you throughout our permitting process. EPA will hold informational meetings at the following dates and locations.

City	Location	Date	Time
Air Permits Public Informational Meetings			
Kaktovik	Kaktovik City Hall / Community Center Kaktovik City Hall / Community Center	June 15 June 15	11:30 am – 1:00 pm 5:30 pm – 9:30 pm
Air and Water Permits Public Informational Meetings			
Barrow	Inupiat Heritage Center	June 16	4:30 pm – 9:00 pm
Air and Water Permits Governmental Information Meetings*			
Barrow	Barrow High School Auditorium *Invitees: North Slope Borough, Inupiat Community of the Arctic Slope, Alaska Eskimo Whaling Commission, Native Villages, City governments	June 17	9:00 am – 12:00 pm

We look forward to seeing you at these informational meetings. Enclosed is EPA's *Arctic Permits Newsletter - Summer 2011* which summarizes information about the permits.

If you have any questions or concerns regarding this letter, please contact the project managers, Doug Hardesty (air permits) at 208-378-5759 or hardesty.doug@epa.gov and Hanh Shaw (water permits) at 206-553-0171 or shaw.hanh@epa.gov. If you have questions about the informational meetings, please contact Suzanne Skadowski at 206-553-6689 or skadowski.suzanne@epa.gov.

Sincerely,

for

Doug Hardesty
Project Manager
OCS air permits

Hanh Shaw
Team Lead
NPDES Permits Unit

Enclosure: *EPA Arctic Permits Newsletter - Summer 2011*

United States Environmental Protection Agency

Air Permits Proposed for Public Comment:

* Shell *Kulluk* Oil and Gas Exploration, Beaufort Sea, Alaska
* ConocoPhillips Oil and Gas Exploration, Chukchi Sea, Alaska

EPA Region 10 seeks public comment from July 22 to September 6, 2011 on draft Outer Continental Shelf (OCS) Title V Clean Air Act permits for Shell Offshore Inc., 3601C St., Ste. 1000, Anchorage, AK 99503 and ConocoPhillips Co., 700 G Street, Anchorage, AK 99510. The draft permits authorize air emissions from Shell oil and gas exploration drilling operations in the Beaufort Sea and ConocoPhillips oil and gas exploration drilling operations in the Chukchi Sea. Shell plans to operate the *Kulluk* drill rig and support fleet for exploration drilling beginning in 2012 on the Beaufort Sea OCS. ConocoPhillips plans to operate a jackup drill rig and support fleet for exploration drilling beginning in 2013 on the Chukchi Sea OCS. A Title V air quality operating permit (40 CFR Parts 70 and 71) is an enforceable compilation of all air pollution requirements that are applicable to an air emissions source. Title V permits set forth enforceable terms, conditions, and limitations, and are valid for five years but may be renewed. In their permit applications, Shell and ConocoPhillips each requested that their Title V permits contain federally enforceable restrictions that would limit their emission of regulated air pollutants to avoid the need for Prevention of Significant Deterioration program air permits. In addition, for Shell *Kulluk* operations within 25 miles of the Alaska seaward boundary, which are subject to Alaska corresponding onshore area requirements, Shell requested that the minor source air permit required under 18 Alaska Administrative Code 50.502 be incorporated into its Title V permit. The Shell *Kulluk* draft air permit is based on the Coupled Ocean Atmosphere Response Experiment Meteorological Modeling Algorithm and the Plume Volume Molar Ratio Method Nitrogen Dioxide Modeling Algorithm to predict air pollutant concentrations. These models have not been approved by EPA for general use, but have been approved under EPA guidelines case by case alternative modeling provisions. EPA Region 10 requests public comment on the suitability of these models for the Shell *Kulluk* permit. The ConocoPhillips draft air permit uses an EPA Guideline model. EPA air permits do not provide authorization to drill, they authorize air pollutant emissions, when and if drilling commences. The Bureau of Ocean Energy Management Regulation and Enforcement is the federal agency that provides authorization to drill.

COMMENT BY SEPTEMBER 6

Email: r10ocsairpermits@epa.gov
Re: Shell *Kulluk*
or ConocoPhillips

Mail: Shell *Kulluk* Air Permit
or ConocoPhillips Air Permit
EPA Region 10
1200 6th Ave
Ste. 900, AWT107
Seattle, WA 98101

Fax: 206-553-0110

PUBLIC HEARINGS

August 23, 2011	August 24, 2011	August 26, 2011
Shell *Kulluk* Air Permit Informational Meeting 5:00pm to 6:30pm **Public Hearing** 7:00pm to 9:00pm **Inupiat Heritage Center** **Barrow, Alaska** *Telephone participation available at NS Borough teleconference centers*	**ConocoPhillips Air Permit Informational Meeting** 5:00pm to 6:30pm **Public Hearing** 7:00pm to 9:00pm **Ilisagvik College** **Barrow, Alaska** *Telephone participation available at NS Borough teleconference centers*	**Shell *Kulluk* Air Permit Public Hearing** 6:00pm to 7:30pm **ConocoPhillips Air Permit Public Hearing** 8:00pm to 9:30pm **Loussac Public Library** **Anchorage, Alaska**

PUBLIC COMMENT The purpose of the public comment periods and public hearings are to receive comments on the draft air permits. Written and oral comments can be submitted at the public hearings in Barrow or Anchorage, Alaska and by mail or email. Oral comments can also be recorded on tape, disk, or digital audio and submitted by mail or email. North Slope communities outside of Barrow can participate in the Barrow public hearings by telephone at North Slope Borough teleconference centers. You may comment on the permits and must raise and submit all reasonably ascertainable issues and arguments supporting your position by the end of the comment period. Supporting documents must be included in full, not by reference, unless they are already in the permit records, or are state or federal statutes or regulations, EPA documents of general applicability, or other generally available referenced materials. Please identify if your comments relate to the Shell Kulluk permit, the ConocoPhillips permit, or both. **Comments must be postmarked or emailed to EPA Region 10 by September 6, 2011.**

PERMIT DOCUMENTS AVAILABLE The administrative record for each permit includes the permit application and supplemental application materials, the draft permit and statement of basis, and all other materials relied on by EPA. The administrative records are available for public review at EPA Region 10, 1200 6th Ave, Suite 900, Seattle, Washington, 9am to 5pm Mon. through Fri. (206 553 1200). The draft permits, statements of basis, and application materials are available at: **http://yosemite.epa.gov/R10/AIRPAGE.NSF/Permits/ocsap/** and will be available at these locations in Alaska: EPA Alaska Office, Federal Building, 222 West 7th Ave, Anchorage (907 271 5083); Barrow City Office, 2022 Ahkovak Street, Barrow (907 852 4050); Nuiqsut City Office, 2230 2nd Avenue, Nuiqsut (907 480 6727); Kaktovik City Office, 2051 Barter Avenue, Kaktovik (907 640 6313); Wainwright City Office, 1217 Airport Road, Wainwright (907 763 2815); Kali School Library, 1029 Ugrak Ave, Point Lay (907 833 2312); Point Hope City Office, 530 Natchiq Street, Point Hope (907 368 2537); Atqasuk City Office, 5010 Ekosik Street, Atqasuk (907 633 6811); Anaktuvuk Pass City Office, 3031 Main St, Anaktuvuk Pass (907 661 3612). **For more information about the public meetings and hearings, or to request copies of the permit documents, or to join the EPA arctic permits mailing list, please contact Suzanne Skadowski, 206 553 6689, skadowski.suzanne@epa.gov.**