Petitioner’s Exhibit 4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
SEATTLE, WASHINGTON

STATEMENT OF BASIS

For Air Quality Control Minor Permit No. R10OCS-AK-07-02
Approval to Construct

Shell Offshore Inc.
The Frontier Discoverer Drilling Unit

OUTER CONTINENTAL SHELF EXPLORATION ACTIVITY

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ABBREVIATIONS/ACRONYMS

AAC .....Alaska Administrative Code
ACMP.....Alaska Coastal Management Program
ADEC.....Alaska Department of Environmental Conservation
AS.....Alaska Statutes
ASTM.....American Society of Testing and Materials
CEMS.....Continuous Emission Monitoring System
C.F.R. .....Code of Federal Regulations
EPA .....Environmental Protection Agency
Discoverer .....Discoverer Drilling Unit
MACT .....Maximum Achievable Control Technology
NA .....Not Applicable
NAICS .....North American Industry Classification System
NESHAPS .....National Emission Standards for Hazardous Air Pollutants
NSPS .....New Source Performance Standards
ORL.....Owner Requested Limit
PS .....Performance specification
PSD.....Prevention of Significant Deterioration
PTE.....Potential to Emit
RM.....Reference Method
SIC.....Standard Industrial Classification
SN.....Serial Number
SOB .....Statement of Basis
TAR.....Technical Analysis Report

Units and Measures

bhp.....brake horsepower or boiler horsepower[1]
gr./dscf.....grains per dry standard cubic feet (1 pound = 7,000 grains)
dscf .....dry standard cubic foot
gph.....gallons per hour
kW .....kiloWatts
kW-e .....kiloWatts electric[2]
lbs .....pounds
mmBtu.....million British thermal units
ppm.....parts per million
ppmv.....parts per million by volume
tph.....tons per hour
tpy.....tons per year
wt%.....weight percent

Pollutants

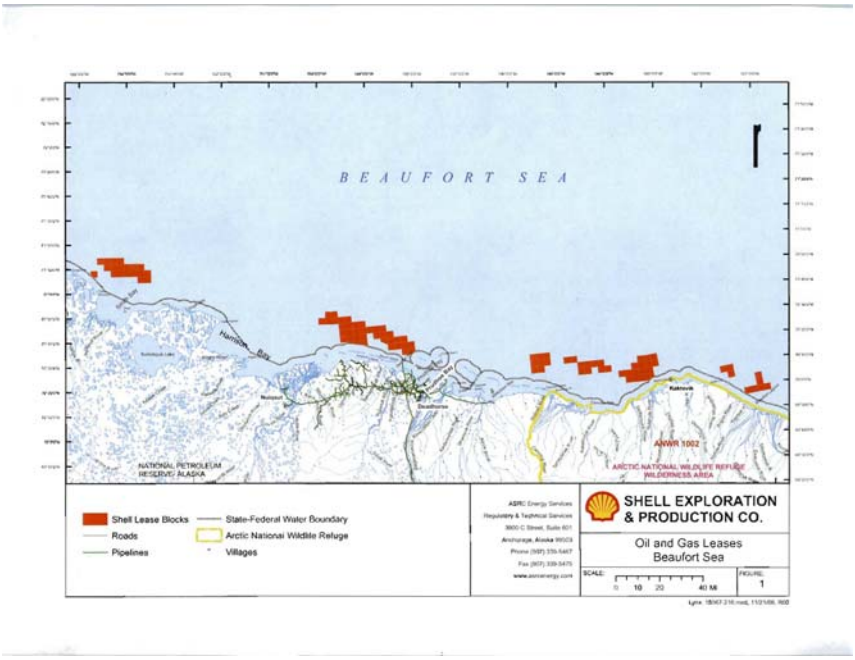
CO .....Carbon Monoxide
HAPS.....Hazardous Air Pollutants
H_2S .....Hydrogen Sulfide
NO_X .....Oxides of Nitrogen
NO_2.....Nitrogen Dioxide
NO .....Nitric Oxide
PM-10.....Particulate Matter with an aerodynamic diameter less than 10 microns
SO_2 .....Sulfur Dioxide
VOC .....Volatile Organic Compound

[1] For boilers: One boiler horsepower = 33,472 Btu-fuel per horsepower-hour divided by the boiler's efficiency. For engines: approximately 7,000 Btu-fuel per brake horsepower-hour is required for an average diesel internal combustion engine.
[2] kW-e refers to rated generator electrical output rather than engine output.

1.0 Introduction

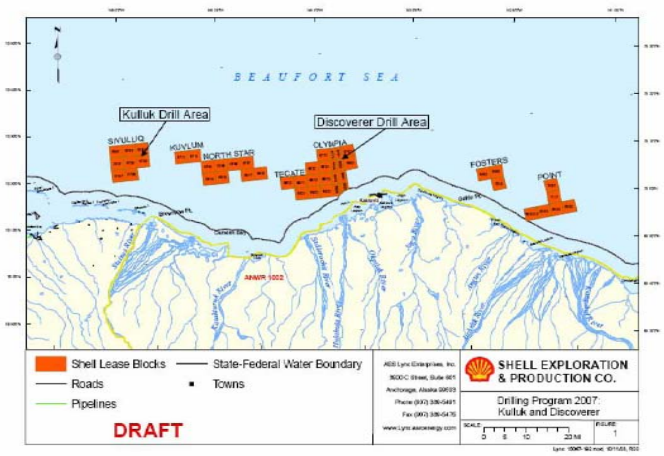
This Statement of Basis (SOB) provides the United States Environmental Protection Agency (EPA's) technical basis for the terms and conditions of Minor Permit No. R10OCS-AK-07-02. Minor Permit R10OCS-AK-07-02 authorizes Shell Offshore Inc. (Shell) to mobilize, operate, and demobilize the Frontier Discoverer Drilling Unit (Discoverer) at a drill site authorized by the United States Minerals Management Service (MMS) in the Beaufort Sea outer continental shelf (OCS). *See Figure 1.* It is important to recognize that the Discoverer is also inherently a vessel. Minor Permit No. R10OCS-AK-07-02 also authorizes Shell to utilize vessels in support of the Discoverer within 25 miles of a drill site.

Figure 1



For the 2007 open water drilling season, Shell intends to conduct its exploration activity in the vicinity of Camden Bay. *See Figure 2.*

Figure 2



1.1 OCS Source Description

1.1.1 Emission Units

Pursuant to 40 CFR Part 55,

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

(1) Emits or has the potential to emit any air pollutant;

(2) Is regulated or authorized under the Outer Continental Shelf Lands Act ("OCSLA") (43 U.S.C. §1331 et seq.); and

(3) Is located on the OCS or in or on waters above the OCS.

This definition shall include vessels only when they are:

(1) Permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources 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.

In this case, the OCS source is the equipment identified in *Table 1* that generates air pollutant emissions while located at any drill site within a Beaufort Sea OCS lease block authorized by the MMS.

Table 1 – Discoverer Emission Units					
Unit ID	**Source Group[3]**	**Unit Description**	**Make/Model**	**Rating**	
FD-1	A1	Electrical Generator Engine	Caterpillar / D399	1,325	hp
FD-2	A1	Electrical Generator Engine	Caterpillar / D399	1,325	hp
FD-3	A1	Electrical Generator Engine	Caterpillar / D399	1,325	hp
FD-4	A1	Electrical Generator Engine	Caterpillar / D399	1,325	hp
FD-5	A1	Electrical Generator Engine	Caterpillar / D399	1,325	hp
FD-6	A1	Electrical Generator Engine	Caterpillar / D399	1,325	hp
FD-7[4]	A2	Propulsion Engine	Mitsubishi / 6UEC65	7,200	hp
FD-8	A3	Emergency Generator	Caterpillar / 3304	131	hp
FD-9	A3	Air Compressor Engine	Leased / Tier 2 or 3	500	hp
FD-10	A3	Air Compressor Engine	Leased / Tier 2 or 3	500	hp
FD-11	A3	Air Compressor Engine	Leased / Tier 2 or 3	500	hp
FD-12	A3	HPP Engine		250	hp
FD-13	A3	HPP Engine		250	hp
FD-14	A3	Port Deck Crane Engine	Caterpillar / D343	365	hp
FD-15	A3	Starboard Deck Crane Engine	Caterpillar / D343	365	hp
FD-16	A3	Cementing Unit Engine	Detroit / 8V-71N	335	hp
FD-17	A3	Cementing Unit Engine	Detroit / 8V-71N	335	hp
FD-18	A3	Logging Winch Engine	Detroit / 4-71N	128	hp
FD-19	A3	Logging Genset Engine	John Deere / 4024TF270	36	kW
FD-20	A4	Heat Boiler	Clayton / 200 Boiler HP	7.97	mmBtu/hr
FD-21	A4	Heat Boiler	Clayton / 200 Boiler HP	7.97	mmBtu/hr
FD-22	K	Incinerator	TeamTec / GS500C	276	lb/hr

[3] The Source Group for which an emissions unit is identified is used for the purpose of determining NO_X emissions pursuant to Condition 7.
[4] The propulsion engine is not employed when the Discoverer is attached to the seafloor. The propulsion engines are employed while the Discoverer is in transit. While in transit, the Discoverer is not subject to 40 CFR 55.

The OCS source could also include equipment listed in *Table 2* when the vessel is physically attached to the Discoverer at a drill site, and the emission unit is engaged in any activity not directly related to propulsion of a vessel.

Table 2 – Discoverer Support Vessels

Unit ID	Source Group[5]	Unit Description	Make/Model	Rating	
Kapitan Dranitsyn (icebreaker)					
KD-1	B1	Main Propulsion Engine	Wärtsilä / 9ZL	4,140	hp
KD-2	B1	Main Propulsion Engine	Wärtsilä / 9ZL	4,140	hp
KD-3	B1	Main Propulsion Engine	Wärtsilä / 9ZL	4,140	hp
KD-4	B1	Main Propulsion Engine	Wärtsilä / 9ZL	4,140	hp
KD-5	B1	Main Propulsion Engine	Wärtsilä / 9ZL	4,140	hp
KD-6	B1	Main Propulsion Engine	Wärtsilä / 9ZL	4,140	hp
KD-7	B2	Auxiliary Engine		1,050	hp
KD-8	B2	Auxiliary Engine		1,050	hp
KD-9	B2	Auxiliary Engine		1,050	hp
KD-10	B2	Auxiliary Engine		1,050	hp
KD-11	B2	Auxiliary Engine		1,050	hp
KD-12	B3	Compressor Engine		1,380	hp
KD-13	B3	Compressor Engine		1,380	hp
KD-14	B3	Emergency Generator Engine		438	hp
KD-15	B4	Heat Boiler		18	mmBtu/hr
KD-16	B4	Heat Boiler		18	mmBtu/hr
KD-17	K	Incinerator		70	kg/hr
Fennica/Nordica (icebreaker)					
FN-1	C1	Main Propulsion Engine	Wärtsilä / 16V32	7,884	hp
FN-2	C1	Main Propulsion Engine	Wärtsilä / 16V32	7,884	hp
FN-3	C1	Main Propulsion Engine	Wärtsilä / 12V32	5,913	hp

[5] The Source Group for which an emissions unit is identified is used for the purpose of determining NO_X emissions pursuant to Condition 7.

Table 2 – Discoverer Support Vessels					
Unit ID	**Source Group[5]**	**Unit Description**	**Make/Model**	**Rating**	
FN-4	C1	Main Propulsion Engine	Wärtsilä / 12V32	5,913	hp
FN-5	C2	Auxiliary Engine		710	hp
FN-6	C2	Emergency Generator Engine		300	hp
FN-7	C3	Heat Boiler		4.44	mmBtu/hr
FN-8	C3	Heat Boiler		4.44	mmBtu/hr
FN-9	K	Incinerator		70	kg/hr
Jim Kilabuk (resupply vessel)					
JK-1	D	Main Propulsion Engine	EMD / V20 645	3,600	hp
JK-2	D	Main Propulsion Engine	EMD / V20 645	3,600	hp
JK-3	D	Electric Generator Engine	Caterpillar / D3406	292	hp
JK-4	D	Electric Generator Engine	Caterpillar / D3406	292	hp
JK-5	D	HPP Engine	Caterpillar / D343	300	hp
JK-6	D	Bow Thruster Engine	Caterpillar / D343	300	hp
Point Barrow Tug (Main Oil Spill Response Vehicle)					
PBT-1	E	Main Propulsion Engine		1,520	hp
PBT-2	E	Main Propulsion Engine		1,520	hp
PBT-3	E	Electrical Generator Engine		150	hp
PBT-4	E	Electrical Generator Engine		150	hp
PBT-5	E	Emergency Electrical Generator Engine		1,285	hp
Kvichak No. 1 47-foot Oil Spill Response Work Boat					
OSR47K1-1	E	Propulsion Engine		700	hp
Kvichak No. 2 47-foot Oil Spill Response Work Boat					
OSR47K2-1	E	Propulsion Engine		700	hp
Kvichak No. 3 34-foot Oil Spill Response Work Boat					
OSRK3-1	E	Propulsion Engine		300	hp
OSRK3-2	E	Propulsion Engine		300	hp
Kvichak No. 4 34-foot Oil Spill Response Work Boat					

Table 2 – Discoverer Support Vessels					
Unit ID	**Source Group[5]**	**Unit Description**	**Make/Model**	**Rating**	
OSRK4-1	E	Propulsion Engine		300	hp
OSRK4-2	E	Propulsion Engine		300	hp
Kvichak No. 5 34-foot Oil Spill Response Work Boat					
OSRK5-1	E	Propulsion Engine		300	hp
OSRK5-2	E	Propulsion Engine		300	hp
Kvichak No. 6 34-foot Oil Spill Response Work Boat					
OSRK6-1	E	Propulsion Engine		300	hp
OSRK6-2	E	Propulsion Engine		300	hp
Oil Spill Response Tug Boat for Supply Barge					
OSRT-1	E	Propulsion Engine		1,500	hp
OSRT-2	E	Propulsion Engine		1,500	hp

1.1.2 Classification of the Source as a Minor Source

The Discoverer and its support vessels are subject to the OCS regulations only when the Discoverer is attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom. This means that the OCS regulations do not apply while the Discoverer is in transit (it remains inherently a vessel), except when the Discoverer or any support vessel is in transit within 25 miles of the drill site. Emissions from the Discoverer and support vessels within a 25-mile radius of the drill site are considered in determining the Discoverer's potential to emit (PTE) as if the Discoverer were already located at the drill site. In that sense, it is the above activity at an OCS drill site that EPA is permitting, and not the Discoverer wherever it goes.[6] It is with this interpretation of the OCS regulations and the definition of OCS source that EPA assesses NSR applicability.

Pursuant to 18 AAC 50.040(h)(4)(B)(iii) of the State of Alaska Requirements Applicable to OCS Sources, December 3, 2005,

(4) *"building, structure, facility, or installation" has the meaning given in 40 C.F.R. 51.166(b) except that it includes a vessel*
(A) *that is anchored or otherwise permanently or temporarily stationed within a locale;*
(B) *upon which a stationary source or stationary sources are located; not including stationary sources engaged in propulsion of the vessel; and*

[6] EPA anticipates that the Discoverer will be on the Beaufort Sea OCS conducting exploration activity only a fraction of the year that is designated open-water drilling seaon.

(C) *that is used for an industrial process, excluding a tank vessel in the trade of transporting cargo; in this subparagraph, "industrial process" means the extraction of raw material or the physical or chemical transformation of raw material in either composition or character;*

40 CFR 51.166(b)(6) states,

(6) Building, structure, facility, or installation means all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control) except the activities of any vessel. Pollutant-emitting activities shall be considered as part of the same industrial grouping if they belong to the same Major Group (i.e., which have the same two-digit code) as described in the Standard Industrial Classification Manual, 1972, as amended by the 1977 Supplement (U.S. Government Printing Office stock numbers 4101–0066 and 003–005–00176–0, respectively).

In order to aggregate emissions of OCS sources together over the course of a 52-week period in determining classification of the source, the following three criteria must all be satisfied, the OCS sources together must share:

(1) a common owner or operater,
(2) the same SIC code, and
(3) the same contiguous or adjacent property.

As noted in *Figures 1 and 2*, Shell intends to conduct exploration activity at multiple drills sites. In addition to the Discoverer and its support vessels, Shell will be employing another drill ship, the Frontier Discoverer, and its support vessels. The Discoverer and Frontier Discoverer will have the opportunity to operate simultaneously on lease blocks currently held by Shell. All of this exploration activity is being undertaken by the same owner or operator, and the activity is classified under the same 2-digit SIC code; SIC Major Group 13 for Oil and Gas Extraction. What needs to be determined is the maximum distance between two OCS sources for which EPA still considers them to remain close enough in proximity so as to be considered contiguous or adjacent. We are determining that distance, in this case, to be 500 meters.

Shell proposes to aggregate emissions generated by the Discoverer and its support vessels across multiple Discoverer drill sites if the emissions are generated within the same 52-week period, and the drill sites are located within 500 meters of one another. Shell also proposes to aggregate emissions generated by the Discoverer and its support vessels with emissions from the Frontier Discoverer and its support vessels if the emissions are generated within the same 52-week period, and the drill sites are located within 500 meters of one another.

In order to measure the distance between two sources, one must determine the exterior boundary of each source. Shell proposes that the geographic extent of the drill site is the hull of the OCS source. EPA believes that Shell's approach provides for an allowable interpretation of the source under the Act. Shell's approach is consistent with a "common sense notion of plant" as established in *Alabama Power*. Shell's approach appears to be a logical outcome of applying recent EPA guidance developed specifically to instruct permitting authorities on how to determine the extent of the source in oil and gas fields.[7] Thus, EPA is proposing incorporate Shell's approach in our permit action establishing synthetic minor limits on the OCS source at a drill site to avoid major source classification.

The 500-meter threshold beyond which emissions are not aggregated from a drill site does not interfere with the methodology prescribed by Congress to aggregate support vessel emissions with the corresponding OCS source. Although Congress prescribes that emissions from support vessels within 25 miles of the OCS source drill site be aggregated for purposes of determining PTE, Congress never intended support vessels to be a part of an OCS source unless physically attached.

Pursuant to 40 CFR Part 55,

Potential emissions means the maximum emissions of a pollutant from an OCS source operating at its design capacity. Any physical or operational limitation on the capacity of a 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 a limit on the design capacity of the source if the limitation is federally enforceable. Pursuant to section 328 of the Act, emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source, and while enroute to or from the source when within 25 miles of the source, and shall be included in the "potential to emit" for an OCS source. This definition does not alter or affect the use of this term for any other purposes under §§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 and 55.14 of this part.

The statutory definition of "OCS source" and EPA's definition of PTE in the OCS regulations do not directly address the extent to which activity at an OCS drill site is to be aggregated with activity at another OCS drill site. This is a decision left to the individual permitting authority on a case-by-case basis. We are making a preliminary decision here.

Based upon Shell's request to limit its NO_X and SO_2 (See Section 4 of the document) emissions resulting from OCS source exploration activity located within 500 meters of one another, EPA concludes that it is appropriate to issue a minor permit to Shell for the Discoverer. If Shell constructs and operates the Discoverer in accordance with the synthetic minor emission limits in the resultant minor permit, Shell is not required to obtain a Prevention of Significant Deterioration permit.

[7] January 12, 2007 EPA Memorandum entitled, "Source Determinations for Oil and Gas Industries"

Rather than issuing a separate permit to Shell for every drill site that it may explore utilizing the equipment described in its application, EPA is issuing a single permit so as to minimize the administrative burden associated with issuing multiple permits. The single resultant permit for a drill site in a Shell Beaufort Sea lease block captures all applicable requirements regardless of the exact location of the actual drill site.

1.2 Application Summary

1.2.1 Why Is a Permit Needed?

Shell is required to obtain a minor permit for air quality protection pursuant to 18 AAC 50.502(c)(2)(A) of the State of Alaska Requirements Applicable to OCS Sources, December 3, 2005, given that the Discoverer is a portable oil and gas operation as defined at 18 AAC 990(124). Shell is also required to obtain a minor permit for air quality protection pursuant to 18 AAC 50.502(c)(1)(B) of the State of Alaska Requirements Applicable to OCS Sources, December 3, 2005, given that the Discoverer has a potential to emit greater than 40 tons per year NO_X.

Shell is required to obtain a permit to operate pursuant to 18 AAC 50.300(2) of the Alaska Implementation Plan given that the Discoverer and its support vessels have a combined fuel burning equipment rating of 100 mmBtu per hour or more.

1.2.2 What Did the Applicant Submit?

December 29, 2006. Shell submits its initial application to EPA. The application was deemed complete by EPA on February 2, 2007 given that the December 2006 submittal satisfied the requirements of 18 AAC 50.300(b) of the Alaska Implementation Plan and 18 AAC 50.540(c) and (j) of the State of Alaska Requirements Applicable to OCS Sources, December 3, 2005. The application included, but was not limited to, an ambient impact analysis utilizing SCREEN3 to demonstrate compliance with NO_2, SO_2, and PM_{10} NAAQS and an owner-requested limits for NO_X and SO_2 to avoid PSD.

February 7, 2007. Shell submits additional information related to its owner-requested NO_X limit.

March 26, 2007. Shell formally submits additional information related to the following items: (1) revised list of source units, (2) inclusion of particulate matter emission controls for some engines, (3) decreased maximum SO_2 content of the diesel fuel consumed by the small engines on the drill vessels, (4) establishment of the ambient boundary at the edge of the drill vessels, (5) revised demonstration of synthetic minor status to include load-based emission estimation, and (6) owner-requested limit of a minimum 500 meters distance between any two drill sites in any one year.

1.3 EPA Findings

Based upon a review of the original application and supplemental materials, EPA finds that:

1. EPA is required to assess emission fees upon Shell for operations under this permit.

2. Construction and operation of the Discoverer and its support vessels will not cause or contribute to a NO_2, SO_2, or PM_{10} NAAQS violation.

3. Shell is capable of complying with the permit's 245 tons-per-year owner-requested NO_X and SO_2 emission limits necessary to avoid PSD review.

4. EPA has drafted permit conditions that are adequate for determining weekly compliance with the 245 tons-per-year NO_X and SO_2 emission limit. .

5. By limiting NO_X and SO_2 emissions to less than 245 tons per year, emissions of all regulated NSR pollutants will remain less than 250 tons per year.

6. Construction and operation of the Discoverer will not result in a violation of the 0.05 gr/dscf particulate matter standard applicable to combustion sources.

7. Issuance of minor permits to Shell is not required to be preceeded by an Alaska Coastal Manangement Program consistency review.

1.4 Permit History

Permit History – None. This is new source construction.

1.5 Emissions Summary/Assessable Emissions

The maximum expected emissions from the Discoverer and its supply vessels while exploring one drill site, considering owner requested limits, is as follows:

Pollutant	Potential to Emit (tons)	Assessable Emissions (tons)
NO_X	245	245
SO_2	17.7	17.7
PM/PM_{10}	7.0	0 (<10)
CO	47.9	81.8
VOC	11.8	11.8
TOTAL		323

Based upon information provided by Shell in the original application and February 7, 2007 supplemental, approximately 95% of the NO_X emissions is generated by Discoverer main drilling engines and propulsion engines on icebreakers.

2.0 Ambient Air Quality Impact Analysis

Shell conducted an ambient air quality impact analysis pursuant to ADEC Regulation 18 AAC 50.540(c)(2)(B). The regulation states that a minor source permit application must include a SO_2, NO_2 and PM_{10} analysis for portable oil and gas operations. The purpose of the analysis is to demonstrate if the potential emissions impact from the new stationary source will comply with NAAQS.

Compliance with the NAAQS is demonstrated by taking the sum of the emissions impact (or predicted concentration) and background air quality concentration, and comparing the total to the specific air pollutant standard. In general, concentrations are estimated by applying an appropriate EPA air quality dispersion model. Background air quality concentrations are measured data and can be obtained from a local air agency. The measured data should be representative of the area in which the stationary source is proposing to construct and operate.

2.1 Modeling Methodology

The ISC-PRIME Model (USEPA 2004a) was used with screening meteorology from the SCREEN3 Model (USEPA 1992) and building information generated from the Building Profile Input Program for PRIME (BPIP-PRIM) (USEPA 2004b) to calculate worst case concentration impacts resulting from Shell's drilling activities in the OCS. The fifty-four (54) hours of meteorology from SCREEN3 were incremented every five degrees with a net result of 3888 hours of meteorology. BPIP-PRIM was executed for each point source and its nearby buildings and structures to assess the effects of building wake induced downwash.

While the ISC-PRIME Model is not a guideline model, it is an alternative model which can be approved by USEPA Region 10 for application on a case-by-case basis. In this particular application, USEPA Region 10 approved its use in order to capture the predicted concentrations in the wake region of the buildings and structures (USEPA 2007).

The following paragraphs summarizes the assumptions and options used with ISC-PRIME and employed by Shell to meet the regulation requirements. A more complete description of the modeling methodology is contained in the revised AQIA (Shell 2007).

2.1.1 Urban/Rural Area Determination

The exploratory drilling activities will occur in the OCS of the Beaufort Sea. Since the activities will occur over a large body of water (i.e., greater than 3 kilometers), the area is considered rural for dispersion purposes (Auer 1978).

2.1.2 Ambient Air Definition

Ambient air for each activity begins at, and extends outward from the drill rig or vessel. There is no exclusion zone or physical barrier to prevent the public from approaching up to the edge of the activity.

2.1.3 Good Engineering Practice (GEP Stack Height)

The BPIP-PRIM Program was used to determine if an exhaust plume from an emission unit would be affected by a nearby structure or building. Parameters from eight exhaust stacks and five structures were input into BPIP-PRIM to make this determination. The output from the program identified all emission units were of insufficient height and if constructed, may be affected by a wake generated from a nearby structure or building.

2.1.4 Meteorology

Worst case meteorology found in the SCREEN3 Model was used in the ISC-PRIME Model to predict the highest concentration impact. In the SCREEN3 Model, the meteorology consisted of fifty-four (54) hours of wind speed and stability combinations and a downwind wind direction. For use in ISC-PRIME, an external file was generated with the SCREEN3 meteorology including specific wind directions. Essentially, the file contained the SCREEN3 meteorological data combinations with wind directions incremented every five degrees from five degrees to 360 degrees. This resulted in 3888 hours of meteorology.

The SCREEN3 model default ambient temperature of 293 K was also used with the wind direction, wind speed and stability combinations. A more representative ambient temperature of 262 K for example, could have been used and would have likely resulted in less conservative concentration predictions.

2.1.5 Receptors and Terrain Elevations

A Cartesian coordinate system with an origin at (0, 0) m was used to define the modeling domain. Receptor points were spaced every 10-meters around the drill rig, 25-m within 1-km of the rig, and 50-m from 1-km to 6-km. The receptor total was 19534 points. All drilling activities were located inside this modeling domain.

Terrain elevation was set to zero.

2.1.6 Emission Sources

Exploratory drilling activities consist of a drill rig and several support vessels. A list of the emission sources/units and its maximum hourly potential emission rates are presented in Table 2-1. For the Shell Discoverer drill rig, a single stack was used to represent the two main engines, the two air compressors, the two HPP engines and the three deck cranes. Emissions from hot water heater and boiler were combined and emitted through the boiler stack.

Table 2-1 Maximum Hourly Emission Rates

Source	Stack ID.	Description	Air Pollutant Emission Rate		
			SO_2 (g/sec)	NO_x (g/sec)	PM_{10} (g/sec)
Shell Discoverer	1	Main Engines (2)	1.090	11.100	0.500
	2	Air Compressors (2)	0.194	0.829	0.042
	3	HPP engines(2)	0.097	1.950	0.139
	4	Crane Engines (3)	0.198	3.980	0.283
	5	Boiler (1)/Water Heater (1)	0.010	0.053	0.009
	6	Logging Winch (1)	0.027	0.547	0.039
	7	Incinerator (1)	0.043	0.052	0.121
Vladimir Ignatjuk	8	Primary Icebreaker	4.790	74.500	1.400
Fennica/Nordica	9	Secondary Icebreaker	4.380	65.900	1.420
Oil Response Ships	10		2.400	25.500	0.778
Jim Kilabuk	11	Resupply	0.363	5.730	0.111

(number of emission units)
The ice breakers were combined and modeled as an area source.

2.1.7 Stack Locations and Stack Parameters

The location of the stacks and stack parameters appear in Table 2-2. The ice breakers, Stack ID Nos. 8 and 9, were modeled as an area sources. The location of these emission sources were configured by SOI such that the worst case concentration impact would be predicted by the model.

Table 2-2 Stack Parameters

Stack ID	Point Location			Stack Parameter			
	East (m)	North (m)	Elevation (m)	Height (m)	Temp. (K)	Vel. (m/sec)	Dia. (m)
1	154.1	55.2	0.0	17.40	498.00	63.300	0.35
2	83.0	47.0	0.0	13.11	700.00	40.000	0.21
3	83.0	50.0	0.0	13.11	700.00	40.000	0.18
4	114.6	44.0	0.0	18.29	672.00	20.100	0.25
5	154.3	52.2	0.0	17.40	366.00	7.300	0.46
6	106.6	43.5	0.0	7.70	711.00	53.000	0.10
7	154.0	58.0	0.0	17.40	623.00	10.000	0.46
8	1484.6	-643.8	0.0		523.00	41.500	0.32
9					573.00	36.000	0.27
10	300.0	200.0	0.0	15.24	700.00	40.000	0.18
11	131.0	76.0	0.0	15.24	700.00	40.000	0.18

Stack ID #8 and #9 were modeled as area sources. Release height= 60.9 m; X- and Y-dimension = 3000 m.

2.1.8 Operating Schedule

The exploratory drilling is expected to run 24 hours per day for a continuous 60 day period in a calendar year. To compute the annual average concentration impact, a conversion factor of 0.1644 (=60/365) was applied to calculated annual average concentration.

2.1.9 Background Air Quality

The 1999 SO_2, NO_2 and PM_{10} air quality measurements as shown in Table 2-3 from BP Badami were used to represent the air quality levels in the OCS. This data meets the representativeness criteria as set forth in USEPA ambient air modeling guidance (1987).

Table 2-3 Representative Back Air Quality

Air Pollutant	Averaging Period	Measured Background ($\mu g/m^3$)
Sulfur Dioxide	3-Hour	9.8
	24-hour	7.2
	Annual	2.6
Nitrogen Dioxide	Annual	3.0
PM_{10}	24-Hour	7.9
	Annual	1.8

2.1.10 Scaling Factors

Scaling factors as recommended by the USEPA (1992) were applied to the hourly concentrations predicted by ISC-PRIME to obtain the appropriate period concentration. The scaling factors are provided in Table 2-4.

Table 2-4 Scaling Factors

Averaging Time	Scaling Factor
3-Hour	0.90
8-Hour	0.70
24-Hour	0.40
Annual Average	0.08

2.2 Compliance with National Ambient Air Quality Standards

The maximum hourly concentration for each air pollutant predicted by ISC-PRIME were multiplied by the averaging period scaling factor shown in Table 2-4. For annual predictions, the scaled concentration was further multiplied by 0.1644 to account for only operating 60 days per year. The annual average NOx, was additionally multiplied by 0.75 to obtain an annual average NO_2 concentration (CFR 2006). The predicted concentrations from the Shell drilling activities are identified in the "Shell" column of Table 2-5. Furthermore, Table 2-5 shows the total air quality concentration impacts (Shell plus Existing) and its percent to the NAAQS.

Table 2-5 Comparison with NAAQS

Air Pollutant	Averaging Period	SOI ($\mu g/m^3$)	Existing ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent NAAQS
SO_2	3-Hour	219.7	9.8	229.5	1300	18
	24-Hour	97.6	7.2	104.8	365	29
	Annual	2.4	2.6	5.0	80	6
NO_2	Annual	22.7	3.0	25.7	100	26
PM_{10}	24-Hour	84.2	7.9	92.1	150	61
	Annual	2.1	1.8	3.9	50	8

Maximum 1-hour: SO_2 = 244.1 $\mu g/m^3$; NO_x = 3070.2 $\mu g/m^3$, and PM_{10} = 210.6 $\mu g/m^3$

2.3 Conclusions

Shell followed generally accepted modeling practices and procedures in the application of the alternative ISC-PRIME Model to obtain conservative concentration impacts. The results support the conclusion that the Shell exploratory drilling activities in the OCS is not expected to cause or contribute to a violation of the applicable SO2, NO_2 and PM_{10} NAAQS.

2.4 References

Auer, Jr., A.H. 1978. Correlation of Land Use and Cover with Meteorological Anomalies. Journal of Applied Meteorology, 17(5): 636-643.

CFR (Code of Federal Regulations). 2006. Title 40, Appendix W to Part 51- Guideline On Air Quality Models

Shell (Shell Offshore, Inc.). 2007. Air Quality Impact Evaluation - No Exclusion Zone. Shell Discoverer Beaufort Sea Exploratory Drilling Program. Project 180-15. February 19.

USEPA (U.S. Environmental Protection Agency). 2007. Email to Roger Steen, Air Sciences, Modeling of impacts using an alternate EPA model. 09 February.

USEPA. 2004a. ISC3 with PRIME Building Downwash - ISC3P, Version 04269. Office of Air Quality Planning and Standards, Research Triangle Park, NC. August 26.

USEPA. 2004b. User's Guide to the Building Profile Input Program, EPA-454/R-93-0389. Office of Air Quality Planning and Standards, Research Triangle Park, NC. April 21

USEPA. 1992. Screening Procedures for Estimating the Air Quality Impact of Stationary

Sources, Revised. Office of Air Quality Planning and Standards, Research Triangle Park, NC. October.

USEPA. 1987. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/4-87-007. Office of Air Quality Planning and Standards, Research Triangle Park, NC. October.

3.0 Source Specific Emissions Standards

For each source subject to minor permitting, the applicant must show that the emissions units comply with the applicable emission standards.

EPA does not anticipate that support vessels will operate non-propulsion related fuel-burning equipment or an incinerator while attached to the Discoverer. If a support vessel were to operate non-propulsion related fuel-burning equipment or an incinerator while attached to the Discoverer, the equipment must comply with the applicable emission standards.

3.1 Visible Emissions

3.1.1 Incinerators

Visisble emissions, exluding condensed water vapor, from all fuel-fired and process equipment at an OCS source shall not exceed more than 20 percent averaged over any six consecutive minutes. EPA is requiring Shell to conduct visible observations to demonstrate compliance.

3.1.2 Industrial Process and Fuel-Burning Equipment

Visisble emissions, exluding condensed water vapor, from all fuel-fired and process equipment at an OCS source shall not exceed both (a) an opacity of 20 percent for more than three minutes in any one hour and (b) more than 20 percent averaged over any six consecutive minutes. EPA is requiring Shell to conduct visible observations to demonstrate compliance.

3.2 Particulate Matter

Discoverer emission units unrelated to propulsion are subject to a particulate matter standard of 0.05 grains per dry standard cubic foot of exhaust gas (gr/dscf) per 18 AAC 50.055(b)(1) of the State of Alaska Requirements Applicable to OCS Sources, December 5, 2005. Support vessel emission units, while the support vessel is physically attached to the Discoverer at a drill site, are also subject to this standard when the emission unit is engaged in any activity not directly related to propulsion of a vessel.

Shell has provided a demonstration to EPA indicating that all Discoverer emission units will comply with the standard. While most emission units can comply without installing post-combustion control and without utilizing low-sulfur diesel fuel, nine emission units (Units FD-8, FD-12, FD-13, FD-14, FD-15, FD-16, FD-17, FD-18, and FD-19) that must install post-combustion controls and must combust low-sulfur diesel fuel to comply. The permit requires that Shell employ these pollution control measures while operating these nine emission units.

See Appendix A of Shell's March 26, 2007 application addendum for the compliance demonstration for all units.

3.3 Sulfur Oxides

Industrial process or fuel-burning sources are subject to the sulfur compound emission standard. The standard, expressed as SO_2, is an exhaust concentration of less than 500 ppm, averaged over a period of three hours.

The State of Alaska Department of Environmental Conservation has previously calculated that emission units burning distillate fuel with less than 0.75 percent sulfur by weight will comply with the SO_2 emission standard of 500 ppm. See http://www.dec.state.ak.us/air/ap/docs/sulfliq.pdf . Discoverer and support vessel engines may combust only diesel fuel with a sulfur content of less than 0.19 percent by weight pursuant to an owner-requested limit.

4.0 Owner-Requested Limits Rendering Prevention of Significant Deterioration (PSD)Review Unnecessary

4.1 Nitrogen Oxides

As stated earlier in Section 1.5 of this document, approximately 95% of the NO_X emissions is generated by Discover main drilling engines and propulsion engines on icebreakers. The resultant permit contains adequate monitoring, recordkeeping and reporting to verify compliance with the synthetic minor limit. Shell is required to determine NO_X emissions weekly, and emissions from each emissions unit will be determined by employing emission factors. Shell has grouped emission units into categories, and certain categories emission units contribute more significantly to the emissions cap than others. Per source group, Shell will track emissions by either monitoring fuel usage once every 7 days or by monitoring an individual unit's load once every 15 minutes. For source groups contributing significant NO_X emissions, stack testing is required to determine a group-specific emissions factor. For those units employing post-combustion air pollution control technology, Shell is required to determine whether the control device is operating once every 15 minutes.

Here is an excerpt from Shell's March 26, 2007 supplemental:

The Drill vessels are to be permitted as synthetic minor sources and emissions of all the criteria pollutants on a per-drill-site basis will remain below 250 tons per year. Emissions from the drill vessel and associated vessels, including primarily two ice breakers are included in the calculation. Since the primary source units are diesel engines and the fuel will have sulfur content of 0.19 percent or less, it is the NOx emissions that will be the largest for this source, and by limiting the NOx emissions, all other emissions will remain well below 250 tpy. This demonstration is provided in Appendix B, page B-1 of the December 29, 2006 applications. So, tracking of emissions is limited to the NOx emissions and all source units (except the incinerators) will be tracked by a PEMS system based on fuel consumption or engine load. A constant emission from each incinerator is included, based on incinerator operation at capacity.

There will be three classes of source units for this NOx emission tracking system, the units with an assumed constant emission factor (EF) with load, the units with varying emission factors as a

function of load (EF[load]), and the incinerators with constant emissions. For the large sources (ice breaker propulsion and drill vessel drilling engines) each engine type is to be stack tested and the measured emission factors are used for estimation of NOx emissions. If SOI chooses to monitor engine load (Kw), the emissions will be determined by an emission factor as a function of load (lb NOx per Kw-hr). If SOI chooses to not monitor load, the emission factors are the maximum measured over the normal engine operating range. The maximum EF (lb NOx per gallon fuel) is used with fuel consumption (gallons) to estimate NOx emissions.

For the small sources, an emission factor (lb NOx per gal fuel) is assumed equal to either the manufacturer's or EPA's estimate (AP42) and emissions are estimated based on this factor and the fuel consumed. The small sources, including the incinerators, account for less than 10 % of the source emissions. In this way, SOI ensures that the estimated NOx emissions will be equal to or higher than actual NOx emissions. SOI also commits to remaining below 245 tons per year, which is 5 tons per year below the major source threshold, thereby allowing for an additional uncertainty in aggregated measurements of 2 percent.

For stack testing purposes, there are to be three tests per engine type and they are to be at the low, middle, and high end of the normal operating ranges for the type of engine. For propulsion engines, the normal range is 35% to 80%. For the drilling generators it is 50 to 100 %. The propulsion ranges are estimates, developed from the ice breaker operators (and Corbett and Koehler, 2003, Updated Emission From Ocean Shipping, JGR, Vol 108, No. D20, Table 7). The drill generator range is estimated by the drillers.

In addition to Appendix B of the original application, information in Shell's February 7, 2007 supplemental is also useful in understanding why the monitoring proposed in the permit is adequate for tracking compliance with the synthetic minor emissions cap.

4.2 Sulfur Oxides

The permittee shall not combust any liquid fuel with sulfur content greater than 0.19 percent by weight in any emission unit on the Discover or a support vessel. Based upon calculations submitted by Shell, combusting diesel fuel with a sulfur content less than 0.19 percent by weight results in SO_2 emissions of only 17.7 tons per year. Monitoring and recordkeeping requirements have been incorporated into the permit so as to track compliance.

5.0 EPA Obligations

5.1 Endangered Species Act

Under section 7 of the ESA, a federal agency must consult with 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. 16 U.S.C. §1536(a). For species proposed to be listed as threatened or endangered, the federal agency is required to confer with the Services on any action which is likely to jeopardize the continued existence of the proposed species. 16 U.S.C. §1536(a)(4).

The MMS has fulfilled the federal government's Section 7 obligations prior to approving Shell's Exploration Plan on February 15, 2007.[8] MMS concluded and the Services concurred that Shell's exploratory drilling activity would not adversely affect bowhead whales, spectacled and Steller's eiders, Kittlitz's Murrelet, and polar bears (proposed for listing).

5.2 Essential Fish Habitat of Magnuson-Stevens Act

Essential fish habitat (EFH) is the waters and substrate (sediments, etc.) necessary for fish to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires a federal agency to consult with NOAA Fisheries when a proposed action "may adversely affect" (reduce quality and/or quantity of) EFH.

MMS has fulfilled the federal government's obligations to consult NOAA Fisheries regarding EFH prior to approving Shell's Exploration Plan on February 15, 2007.

5.3 National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 requires federal agencies to take into account the effects of their undertakings on historic properties. Historic properties are properties that are included in the National Register of Historic Places or that meet the criteria for the National Register. If so, the federal agency must identify the appropriate state historical preservation officer / tribal historical preservation officer to consult with during the process. It should also plan to involve the public, and identify other potential consulting parties.

The MMS fulfilled the federal government's obligations prior to approving Shell's Exploration Plan on February 15, 2007. The effects of Shell's exploratory drilling activity upon historic properties is documented in Sections III.B.3.d and IV.B.3.d of MMS's February 2007 Environmental Assessment of Shell's Exploration Plan.

5.4 Alaska Coastal Management Act

The Alaska Coastal Management Program (ACMP), authorized by the State of Alaska's 1977 Alaska Coastal Management Act, provides stewardship of 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 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;*

[8] http://www.mms.gov/alaska/ref/PublicInfo/Shell_BF/SOI_ep_approval.pdf

> *(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 (Clean Air Act); or*
> *(D) air quality exemption granted under 40 C.F.R. 60.14 or 40 C.F.R. 64.2 for stationary sources;*

The minor NSR permits requested by Shell do not appear on the list. Thus, issuance of these permits is not required to be preceded by an ACMP consistency review.[9]

5.5 Executive Order 12898 - Environmental Justice

Pursuant to Executive Order 12898 issued on February 11, 1994 and entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," federal agencies are required to identify and address disproportionately high and adverse human health or environmental effects of regulatory programs, policies, and activities on minority populations and low-income populations.[10]

The effects of Shell's exploratory drilling activity upon minority populations and low-income populations is documented in Sections III.B.3.d and IV.B.3.d of MMS's February 2007 Environmental Assessment of Shell's Exploration Plan.

5.6 Executive Order 13084 - Tribal Consultation

Pursuant to Executive Order 13084 issued on May 14, 1998 and entitled, "Consultation and Coordination With Indian Tribal Governments," federal agencies are required to have an effective process to permit elected officials and other representatives of Indian tribal governments to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities.[11]

As indicated on page 22 of MMS's February 2007 Environmental Assessment of Shell's Exploration Plan,

> *The MMS conducted government-to-government meetings related to the proposed project with the Native Village of Kaktovik on January 29, 2007, and the Native Village of Barrow and the Inupiat Community of the Arctic Slope on February 1, 2007; a scheduled meeting in Nuiqsut on January 30, 2007, was not held due to local circumstances.*

EPA issued letters to thirty tribal governments providing each with the opportunity to influence EPA decisionmaking in the context of government-to-government consultation. As of the

[9] The equivalent minor NSR permits issued pursuant to 18 AAC 50 by ADEC within 3 miles of the State's seaward boundary may require a consistency review.
http://www.touchngo.com/lglcntr/akstats/aac/title11/chapter110/section750.htm,
http://www.touchngo.com/lglcntr/akstats/aac/title11/chapter110/section010.htm,
http://www.alaskacoast.state.ak.us/Clawhome/abc/c.pdf
[10] http://www.epa.gov/Compliance/resources/policies/ej/exec_order_12898.pdf
[11] http://www.epa.gov/fedrgstr/eo/eo13084.htm

printing of this document, EPA has not yet conducted any meeting or conference call with tribal governments. EPA continues to try and schedule such meetings or conference calls prior to making a final decision on the applications.