Shell Offshore Inc.
3601 C Street, Suite 1000
Anchorage, AK 99503

March 22, 2010

Shell Beaufort Sea OCS Air Permit
EPA Region 10
1200 6th Ave. , Ste 900, AWT-107
Seattle, WA 98101

Re: Comments on Proposed OCS PSD Permit #R10OCS/PSD-AK-2010-01
Frontier Discoverer Drillship/Beaufort Sea Exploration Drilling Program

Dear EPA,

Shell Offshore Inc. provides the attached comments on EPA's February 17, 2010 proposed PSD Permit to Construct for Shell's Beaufort Sea Exploration Drilling Program.

The attachment presents Shell's comments in the order in which the affected conditions appear in the proposed permit. To facilitate EPA's response, a note at the end of each comment identifies whether Shell made the same or similar comment on the proposed Chukchi permit. Where relevant, the note specifies the submission in which Shell made the comment.

Sincerely,

Susan Childs

Attachment

cc: Lance Tolson
Keith Craik
Nicole St Amand
Rick Fox
Mark Schindler – Octane LLC
Rodger Steen – Air Sciences Inc.
Eric Hansen – ENVIRON International Corporation
Jeffrey Walker - Minerals Management Service

Comments on Proposed OCS PSD Permit No. R10OCS/PSD-AK-2010-01
Shell Offshore Inc.
Beaufort Sea Exploration Drilling Program

1. Proposed Definition of "OCS Source"

Shell urges EPA to adopt Option 2 (proposed permit page 12) as the alternative used to define when the Discoverer is an OCS Source.[1] As a matter of law, the Discoverer should be considered an OCS Source only when it is stabilized and ready to proceed with drilling activities. This definition, rather than Option 1, under which the Discoverer would be an OCS source when even one anchor is emplaced, is required by the definition of "OCS Source" in 40 C.F.R. 55.2:

> 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: . . . 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.

The referenced section 4(a)(1) of OCSLA states:

> The Constitution and laws and civil and political jurisdiction of the United States are hereby extended to the subsoil and seabed of the outer Continental Shelf *and to all artificial islands, and all installations and other devices permanently or temporarily attached to the seabed, which may be erected thereon for the purpose of exploring for, 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, to the same extent as if the outer Continental Shelf were an area of exclusive Federal jurisdiction located within a State.

43 U.S.C. 1333(a)(1) (emphasis added). As interpreted by the federal courts, section 4(a)(1) covers "any artificial island, installation, or other device if (a) it is permanently or

[1] Option 2: For the purpose of this permit, the Discoverer is an "OCS Source" between the time the Discoverer is declared by the Discoverer's on-site company representative to be secure and stable in a position to commence exploratory activity at the drill site until the Discoverer's on-site company representative declares that, due to retrieval of anchors or disconnection of its anchors, it is not longer sufficiently stable to conduct exploratory activity at the drill site, as documented by the records maintained pursuant to Condition B.2.2.

temporarily attached to the seabed of the OCS, and (b) it has been erected on the seabed of the OCS, and (c) its presence on the OCS is to explore for, develop, or produce resources from the OCS." *See, e.g., Diamond Offshore Company v. A&B Builders, Inc.*, 302 F.3d 531, 541 (5th Cir. 2002). Under this analysis, a jack-up rig that has been jacked-up on the OCS is within this definition, because it is literally both "attached" and "erected." *DeMette v. Falcon Drilling Co., Inc*., 280 F.3d 492, 498 (5th Cir. 2002).

In *Diamond Offshore*, the Court of Appeals noted, in denying summary judgment to plaintiff (a welder injured by drilling mud on the *Ocean Concorde* submersible) who contended the vessel had become an OCSLA "situs" by the time he was injured, that:

> After the *Ocean Concorde* was towed to its ultimate location, it would then be anchored to the seabed. The evidence does not indicate whether [plaintiff] was welding . . . during towing or while the *Ocean Concorde* was attached to the seabed by its anchors. . . . Since there is no evidence that the *Ocean Concorde* was connected to the ocean floor by its anchors or through its drilling mechanism, and there is no evidence of any other contact with the seabed, the second requirement that the *Ocean Concorde* was "erected" on the OCS at the time of [plaintiff's] alleged injury is clearly not satisfied.

302 F.3d at 541. Thus, it is clear from the Fifth Circuit's analysis that a drilling vessel does not become an OCS facility unless and until it is "erected" on the seabed and ready and able to explore for resources. This is consistent with OCSLA section 4(a)(1)'s requirement that a facility or installation be both "attached" to the OCS and "erected" on the OCS for the purpose of drilling before it is subject to the jurisdictional provisions of OCSLA.

The Discoverer will not be "erected" and ready to drill until it is correctly located and stabilized. Shell cannot begin the drilling process until the Discoverer is moored under tension and its central turret system, around which the vessel rotates to face wind and ice, has been stabilized and the Discoverer's on-site company representative declares the vessel to be secure and stable and ready for drilling personnel to commence drilling operations.[2]

The transition to OCS source status under this definition will be clearly documented. The drilling contractor must complete an International Association of Drilling Contractors (IADC) form to document changes in the status of the Discoverer. When the vessel is believed to be stable and on location, the drilling contractor will indicate on the form that the vessel's status has changed from "rig up" to "operations." However, initial

---

[2] A detailed description of the procedure for sequentially setting and tensioning the Discoverer's anchors to make it ready for drilling is provided in pp. 38-40 of Shell's Jan. 18, 2010 revised permit application.

completion of the IADC form does not mean that the vessel is ready to drill. Shell's representative will examine data from instruments that measure the vessel's stability and its location and then, if the Discoverer is stable and correctly located, will sign off on the IADC form (which is then archived and available for later review).

Similarly, when it is time to detach the Discoverer from the seabed at a drill site, Shell will cease all drilling activity and remove all physical connections through the drill stem to the seabed before any anchor can be removed. The change in status from operations to "rig down" will be documented in the IADC activity report and must be approved in writing by the Shell representative. This determination will document the timing of the change whereby the Discoverer would no longer be stable enough for drilling and therefore is no longer "erected" on the OCS for purposes of exploration.

By contrast, Option 1, under which "the Discoverer is an 'OCS Source' during all times between placement of the first anchor on the seabed to removal of the last anchor from the seabed at a drill site," is not a defensible or appropriate definition because it overlooks entirely the OCSLA requirement that the vessel be erected on seabed for the purpose of drilling. The Statement of Basis offers as a potential rationale for this option that:

> Once the Discoverer is attached by an anchor to the seabed at a drill site, the Discoverer is at that location for the purpose of exploring, developing or producing resources from the seabed and its activities are more closely aligned with the activities of a stationary source than of a vessel transiting the sea. Under this approach, connection of the Discoverer to the seabed by an anchor at the drill site would be considered both attachment to and erection on the seabed.

Statement of Basis at 24. However, under this definition, if the Discoverer arrived at the drill site and temporarily dropped an anchor for emergency reasons, e.g., to ride out a storm or avoid moving ice floes, or temporarily moved off the well location and anchored temporarily after suspension of drilling, the Discoverer would be considered an OCS source. This is clearly not a satisfactory test in light of the requirement that an OCS source be "erected" for the purpose of oil and gas exploration. With a single anchor down, the Discoverer remains mobile around the anchor location and is by definition not at a fixed location or stable and ready to drill. To define the vessel as an OCS source in that unstable and movable condition is not consistent with Congress' intent that an OCS source be functionally equivalent to a "fixed structure."[3]

---

[3] While the 1978 legislative amendments to section 4(a)(1) of the original OCS Act of 1953 substituted "installations and devices permanently or temporarily attached to the seabed" for the prior term "fixed structures" for purposes of OCSLA jurisdiction, the conference committee report made clear that "The

We note that, in issuing the proposed Kulluk minor source permit in June 2008, Region 10 rejected Shell's view that the Kulluk should be deemed an OCS source only when all anchors had been placed. Instead, Region 10 defined that drill ship as an OCS source "when it is attached to at least one anchor and that anchor is attached to the seabed." Response to Comments (June 18, 2008) at 13 (citing Supplemental Statement of Basis (Feb. 20, 2008) at 4-5). But Option 1 is neither supported nor compelled by that prior determination. Region 10's analysis of the issue in connection with the Kulluk permit was extremely rudimentary. Indeed, in the Kulluk permit process, EPA did not consider either in the SSOB or the RTC the definition of "OCS Source" in 40 C.F.R. 55.2, under which a vessel must be both attached and erected for the purpose of drilling before it is an OCS source. Nor did EPA there even consider the statutory limit on its jurisdiction, as set out section 4(a) of OCSLA, such that EPA can regulate only "installations and other devices permanently or temporarily attached to the seabed, which may be erected thereon for the purpose of exploring for, developing, or producing resources therefrom." 33 U.S.C. 1334(a)(1). As the more searching analysis presented herein confirms, a one-anchor-down test is contrary to EPA's regulations, to the plain language of OCSLA, and to Congress' intent in amending OCSLA in 1978.

Note: Shell made the same comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 8.

2. Discoverer generator compliance as a set of source units

Shell asks EPA to revise proposed **Condition C.4** (page 44) to limit emissions on an aggregate basis, rather than on an individual basis as currently proposed in Conditions C.4.1, C.4.2, and C.4.3. Shell's application intended the compliance conditions of the *Discoverer's* primary generators (FD-1 through 6) to be on an aggregate basis. The impact modeling assumes that all emissions are exhausted from a single stack, so it is immaterial to both emissions quantification and impact assessment that the emissions are limited on an aggregate basis.

Note: Shell made the same comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 4.

---

intent of the managers in amending section 4(a)of the 1953 OCS Act is technical and perfecting and is meant to restate and clarify and not change existing law." House Conference Report No. 95-1474, 95th Cong., 2d Sess. at 80, reprinted in 1978 U.S.C.C.A.N. 1674, 1679. Thus, Congress had in mind attachments to the seabed that are similar to fixed structures – not mere anchor lines and certainly not a single anchor line -- as triggers for the OCSLA jurisdiction that, in turn, creates EPA's regulatory authority under section 328 of the Clean Air Act.

3. Fuel flow metering

Proposed **Conditions F.7.1.1, G.9.1.1, H.8.1.1, I.8.1.1, J.6.1.1, O.11.4.1, P.13.4.1, and R.8.1.1** require fuel meters to be "located as close as practical to the fuel intake" of the subject unit. Given space constraints on board, locating meters close to the units may be difficult or impractical. Shell asks EPA to revise these conditions to instead require that the fuel meters be located so that there are no fuel inflows or outflows between the meter and the subject unit. This alternative should provide the same assurance of accurate fuel metering as the one proposed.

Second, proposed **Conditions F.7.1, G.9.1, H.8.1, I.8.1, J.6.1, O.11.4, P.13.4, and R.8.1** impose aggregate fuel consumption limits, yet require separate fuel flow meters for each separate unit. With an aggregate limit, there is no compliance value gained by having separate meters for each source. Shell therefore asks EPA to add the phrase "or the combined set" to each fuel flow meter condition, such that they read: "Equip each of the units [specify units] or the combined set, with a diesel fuel flow meter."

Note: Shell made the same comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 6.

4. Stack testing of crane emissions is unnecessary

Proposed **Condition H.7** (pages 55-56) requires stack testing of both crane engines for NOx, CO, PM, VOC and visible emissions. Shell requests that these testing requirements be deleted because the tests would provide little meaningful information. Furthermore, these tests are particularly difficult to conduct for the cranes because of their location and the transient nature of their loads. The emission factors provided by the manufacturer (Caterpillar) and used in the application are sufficient to define a maximum for the crane engine emissions. The Caterpillar 343 specifications, provided in the application, contain the manufacturer's statement: "The nominal values of NO_x, CO, HC, and PM [in the emission factor tables] have been multiplied by 1.2, 1.8, 2.0, and 1.5 respectively to take into account measurement and engine variability. Thus the Caterpillar estimates already are higher than average expected engine emissions by 20 percent for CO, and 100 percent for PM. When the engines are maintained according to manufacturer's recommendations, as required in permit condition B.12, their emissions should be well below these engine specification estimates and these manufacturer's listed emission factors are appropriately conservative estimates of the crane emissions. Testing is unnecessary because it is highly likely the testing will show emissions below these specification estimates.

The crane engines are mounted on girder pedestals 10 meters above the deck so that it is particularly difficult to access the engines and accordingly the testing carries safety risk for the testers. More importantly, the cranes operate only very intermittently while lifting and depositing loads. There is no simple way to provide a constant load to these engines, needed for stack testing, without disassembling them, which changes their operating configuration, which in turn could change the emissions during the stack test. Doing so also carries a safety risk, as the units are not designed to operate in this manner.

Note: Shell made a similar comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 2.

5. Revisions to supply ship operational limits

Proposed **Condition L** (page 67) imposes operational limits when the supply ship is attached to the Discoverer. The condition – in its entirety – should therefore explicitly apply only when the supply ship is attached to the Discoverer. As drafted, however, only Condition L.1 specifically states that it applies only when the supply ship is attached to the Discoverer. The other requirements in Condition L, particularly L.2 and L.3, must also clearly apply only when the supply ship is attached to the Discoverer. Shell asks EPA to revise Condition L to make each requirement apply only when the supply ship is attached to the Discoverer.

Shell understands the requirement to limit operations, but asks that the limits be revised. Shell contracts the use of the supply ships on a short-term basis and wishes to increase the range of acceptable supply ship generator sizes (Table 4 of proposed permit) while continuing to meet proposed permit limits. Shell proposes to restrict the supply ship to a total of 7,784 hp from the propulsion and utility generator IC engines (the sum of the engine capacities listed in Table 4) – excluding any emergency generators (they would not be subject to the limits) – while also restricting the propulsion power to no more than 7,200 hp (also listed in Table 4). In this way, the generators capacity can be greater than 584 hp, if propulsion engine horsepower is reduced correspondingly below 7,200 hp. The emissions and thus the ambient impacts during transit to and from the Discoverer will be the same as or less than already demonstrated because the gross power limit will not change. The emergency generator will be less than 200 kW capacity, and Shell accepts the restriction on the emergency generator that it not be exercised while within 25 miles of the Discoverer.

Regarding the supply ship status when tied to the Discoverer and defined as part of the OCS source, Shell asks for the 12-hour time restriction (Condition L.1.1) and the generator capacity limit of 292 hp (Condition L.1.2) to be replaced by an equivalent energy consumption restriction equivalent of 3,504 hp-hr (292 hp x 12 hours). Using the assigned supply ship IC engine heat rate of 7,000 Btu per hp-hr, and fuel heat value of 133,098 Btu per gallon, compliance with this energy restriction can be tracked through fuel usage and will be limited to approximately 184 gallons per day when part of the OCS source.

In this way, the daily maximum emissions from the supply ship while part of the OCS source will not change, nor will the 24-hour impacts. With the change in limit from 12 hours to an energy production of 3504 hp-hrs per day, it is possible to produce the associated emissions in a period of 8 hours or less, which would increase the eight-hour and one-hour CO emissions and impacts**.** Shell's January 2010 permit application identifies maximum 1-hour and 8-hour concentrations of 612 and 358 $\mu g/m^3$, respectively, for the scenario that includes a supply ship at the Discoverer. Given a 40,000 $\mu g/m^3$ one-hour CO standard, the predicted concentration could be increased 12-fold (all emissions occurring in one hour) and still be less than 20 percent of the ambient standard. Similarly, given a 10,000 $\mu g/m^3$ eight-hour CO standard, the predicted concentration could easily be increase by 50 percent (all generator emissions in an 8-hour period) without threatening the ambient standard. Thus, possible increase in CO emissions from the supply ship while attached to the Discoverer will not threaten the CO NAAQS.

Note: Shell made a similar comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 7 (that comment did not include the request in the first paragraph above here for Condition L to clarify that all of its requirements apply only when the supply ship is attached to the Discoverer).

6. Hull 247 propulsion engines are also used for other vessel loads

Proposed **Condition P.1.2** (page 74) limits the Hull 247 generator engines to 0 hp. In fact, the Hull 247 propulsion engines will consist of both direct drive engines and generators. Furthermore, some of the propulsion generator engine power will be used to power the ship utilities. Thus, Shell asks EPA to revise the condition to recognize this combined duty of the propulsion generator engines. For example:

> "The total capacity of all ***utility*** generator engines on Icebreaker #2 shall not exceed 2,336 hp for the Tor Viking. ***There will be no utility generation, separate from the propulsion engines, for Hull 247;***"

Note: Shell made the same comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 3.

7. Generator efficiency increase for Hull 247 anchor handler

Proposed **Condition P.5** (page 76) assumes mechanical to electrical conversion efficiency of 92 percent for the generators on board Hull 247. As shown on Attachment A, however, these generators have mechanical to electrical conversion efficiency of 95 percent. Shell requests that this higher efficiency be used to calculate the energy production allowance in Conditions P.5.2 and P.5.4.

Note: Shell made the same comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 5.

8. Stack testing of small sources with known emission rates is unnecessary

Stack testing is generally needed only when the uncertainty in emissions is large, e.g., for large emission units, even with well defined manufacturer-specified emissions by model; or when uncertainty is high from smaller units. In the case of the Discoverer, Shell agrees that it is appropriate to test the Discoverer generator engines, ice management fleet and Nanuq propulsion engines, and ice management fleet generator engines because they are large (>1,000 hp). A maximum of two of each model will be sufficient to define the emissions from each engine model type. Shell also believes that it is appropriate to test the incinerators (on the Discoverer and ice management fleet), because even though they are small, the feedstock composition is uncertain and therefore the emissions are uncertain. However, the remainder of the engines are under 600 hp and potentials to emit (PTE) are under 12 tons per year for all pollutants. Furthermore, their emission rates have been defined in the application as "conservative," and by proposed Condition B.12, these emission units will be maintained according to manufacturer's recommendations, so stack testing would reasonably be expected to confirm that the emission are below the application-provided values. Examples of conservatism in emission estimates includes the use of Tier 2 and Tier 3 emission limits for FD-9, 10, 11, 19, and 20, which are the maximum allowable emission rates for the engine class. Actual emissions will be below these limits. Another example is the use of maximum emission factors from a series of stack tests for a particular model of engine for FD-12, 13, 16, 17, and 18. Actual emissions can reasonably be expected to be lower for a properly maintained unit of the same model.

Furthermore, all engines will be fueled by ultra low sulfur diesel (ULSD), which is a highly refined fuel that minimizes particulate emissions.

Shell believes that there is no need to test the boilers because the combustion process of boilers is simple, the emission rates are well defined and emissions rates determined from stack testing are already provided by the manufacturers. These well-defined emission rates are used in the application materials. PTE from each boiler is low at under 3 tons per year per pollutant. Furthermore, they will be fueled by ULSD, which is a highly refined fuel and tends to minimize particulate emissions.

The proposed permit also requires testing of the same emission units on the ice management fleet in multiple years. Shell believes that this is not necessary. With proper maintenance, and a definition of the emissions from testing of two of the same model units, the initial tests will be valid for the duration of Shell's operations.

Stack testing of emission units on vessels and in international waters is difficult, carries safety risks, and is extremely time-consuming and expensive. It should only be required when the need is justified. Shell believes that the plan stated above is appropriate and reasonable for demonstration of compliance and asks that the testing beyond this plan be removed from the permit.

Note: Shell made the same comment on the proposed Chukchi permit in comments dated February 1, 2010, Item 3.

9. Background $PM_{2.5}$ Concentrations

Shell has established an ambient air quality monitoring station at Badami near the coast of the Beaufort Sea. The Badami location is remote from the majority of the oil exploration and production areas of the North Slope. In the January 2010 permit application, Shell asserted that the data collected at Badami are a conservative representation of background concentrations in the Beaufort Sea ambient air.

The station was established and began collecting PM2.5 data in mid-August of 2009. It has been collecting data since that time. The proposed Shell exploration program in the Beaufort Sea will not commence until July 1 and will not extend past the end of December. Thus the majority of the period from July 1 through December has been monitored for PM2.5 concentration at the Badami station. Only the period from July 1 through August 19 is not included in the Badami ambient monitoring period.

Examination of historical monitoring data for the Beaufort Sea coastal area reveals that the period from July through mid-August is not typically a high particulate concentration period. Figure 1 is a plot of 1999 historical PM10 data collected at the Badami site. Data collected in the period from July 1 through August 19 has been highlighted in red. As the data clearly show, the July 1 – August 19 period is not the highest concentration period during the year.

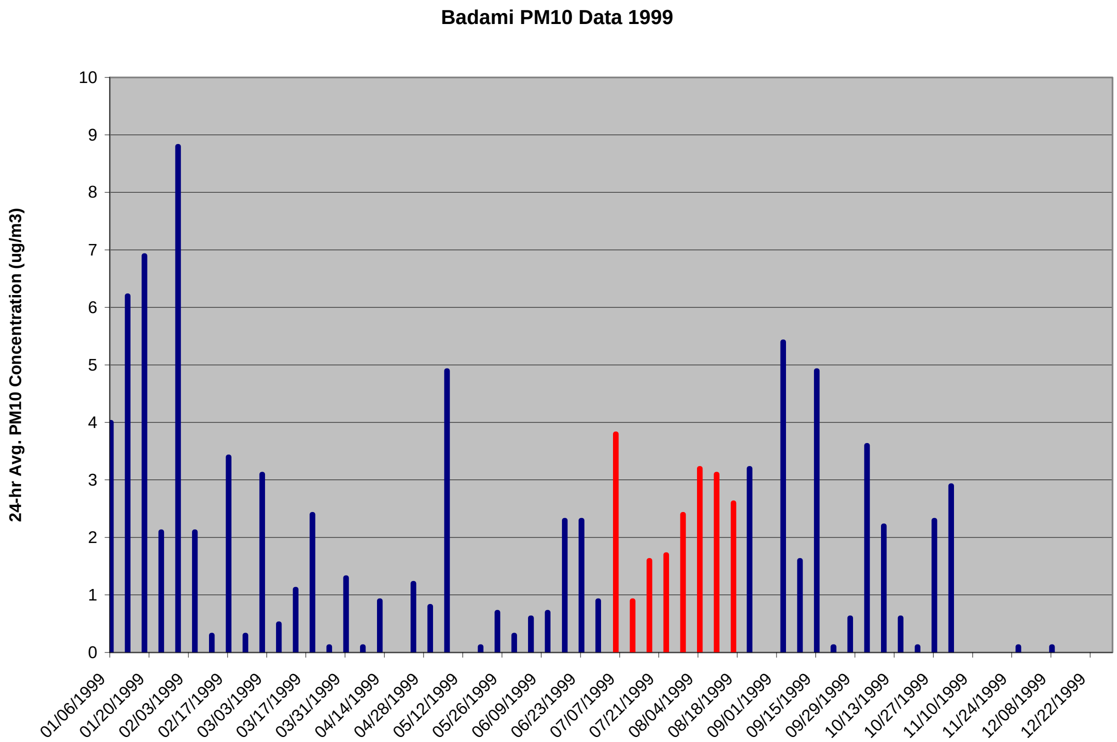


Figure 1. Historical PM10 Data Collected at Badami

Similarly, data collected in 2006-2007 at the Central Compressor Plant in Prudhoe Bay by BP, shown in Figure 2, depict the same pattern. Again, the period in question has been highlighted in red. Consistent with the historical observations at Badami, the July 1 – August 19 period is definitely not representative of peak particulate concentrations.

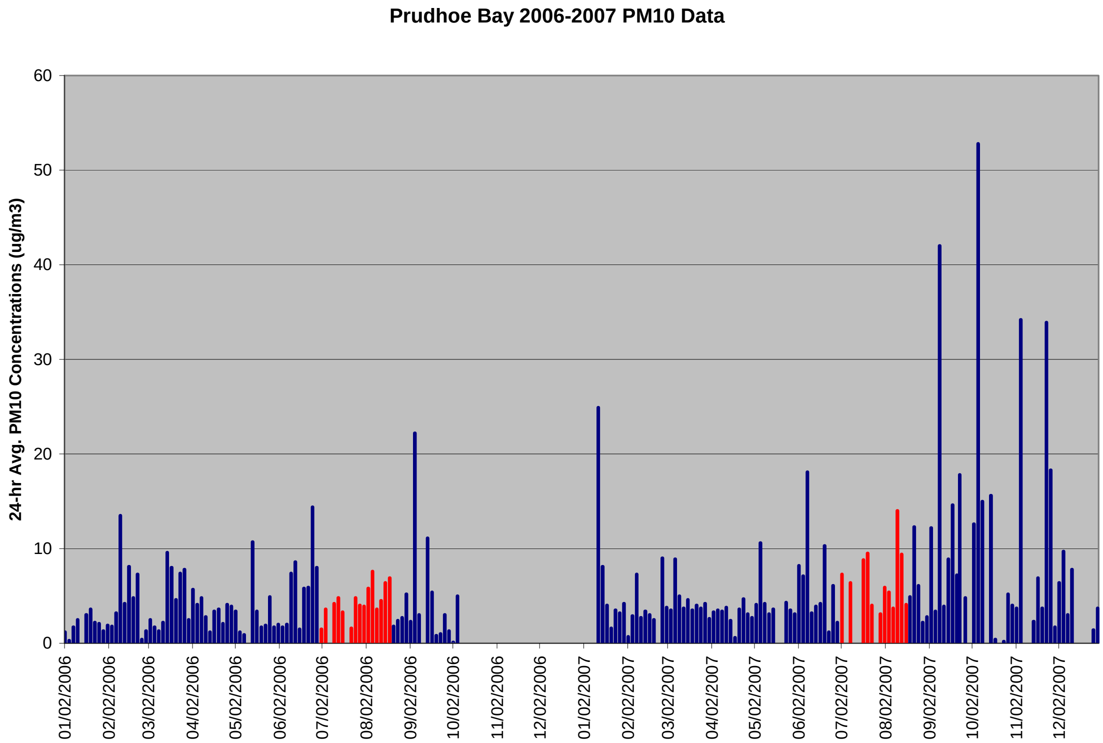


Figure 2. Historical PM10 Data Collected in Prudhoe Bay

The conclusion is drawn that for the Beaufort Sea area, the July 1 – August 19 period would be expected to have lower concentrations that the period later in the fall. Thus the ambient monitoring that has been performed by Shell is reflective of peak particulate concentrations.

Note: This comment is unique to the proposed Beaufort Sea permit.

10. Adequacy of the impact model (ISC-PRIME)

In Statement of Basis Section 1.4.1, EPA asks for comments on the use of the non-guideline ISC3-PRIME modeling system to predict air pollutant concentrations in connection with issuance of the proposed permit. Either of two levels of modeling sophistication (screening and refined modeling) may be used to demonstrate compliance with ambient standards and guidelines. The purpose of a screening modeling technique is to apply a simple and conservative screening procedure to determine whether a source poses a potential threat to air quality, thus eliminating the need for more detailed data collection and modeling for those sources that clearly will not cause or contribute to ambient concentrations in excess of either the National Ambient Air Quality Standards (NAAQS) or the allowable prevention of significant deterioration (PSD) concentration increments (Section 2.2 of EPA's Guideline on Air Quality Models in 40 CFR 51, Appendix W). At the screening level, a model is run using a predefined range of meteorological conditions to identify the condition which produces highest hourly concentration at the relevant point of impact in relation to the proposed source, regardless of how frequently that worst-case condition may actually occur. This ceiling concentration is then scaled by conservative persistence factors to estimate maximum concentrations at other time scales, such as 24-hour and annual averages. A large degree of conservatism is incorporated into screening modeling to provide assurance that maximum concentrations will not be underestimated. Because the impacts derived from a screening approach are conservative, the screening analysis is used when actual meteorological data are not available at a project site.

In a refined modeling analysis, actual meteorological data representative of the project location would be used to characterize the actual range of dispersion meteorology and thus more accurately estimate the project impact on all averaging times. Thus, screening model approaches are designed to produce higher concentration impacts than refined modeling approaches (Section 2.2 of EPA's Guideline on Air Quality Models in 40 CFR 51, Appendix W).

The ISC-PRIME model is a U.S. EPA-approved, alternative model (http://www.epa.gov/scram001/dispersion_alt.htm) which can be run with screening meteorological data. Currently, SCREEN3 (screening version of the ISC model) is the screening model in the Guideline on Air Quality Models.[4] However, SCREEN3 is limited to only one source and it only considers receptors directly downwind of a source. Alternatively, the ISC-PRIME model is available and is a multiple-source model, which offers a screening mode using the same meteorological data as SCREEN3. ISC-PRIME incorporates improved plume rise and building downwash algorithms (i.e., PRIME algorithms), resolves impacts in a three-dimensional receptor grid, and it allows for consideration of the actual spatial distribution of sources (rather than a single source like SCREEN3). Since this project involves multiple sources, some of which are substantially affected by building wake effects, ISC-PRIME is more appropriate than SCREEN3. To insure conservatism of the predictions, the longer term impact estimates for ISC-PRIME were developed using upper bound persistence factors reported from the EPA's screening procedures guidance.[5] For example, the recommended 24-hour persistence factor to convert from hourly to 24-hour average concentrations is 0.4±0.2. For this analysis the upper bound value of 0.6 was used, effectively increasing the 24-hour impacts by 50 percent over those factors normally used in screening analyses.

[4] 40 CFR 51, Appendix W: Federal Register / Vol. 70, No. 216 / Wednesday, November 9, 2005 / Rules and Regulations, Pg. 68221.

[5] EPA's Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised (EPA-454/R-92-019, October 1992) document.

In addition to this dispersion model conservatism, the emissions inputs to the model are set at maximum for all emission units, a scenario that will rarely if ever occur. Drilling projects need a high degree of flexibility to work with unknown drilling circumstances and it is rare that any of the emission units will operate at maximum rate for any significant length of time. Even if under some unknown and rare circumstance all were to operate simultaneously at maximum, it would be highly unlikely that this would occur simultaneously with lowest-dispersion meteorology (also a rare event) to combine and cause maximum impacts. Thus the impacts predicted by this screening analysis are likely to be well above actual maximum impacts from the project.

Note: Shell made the same comment on the proposed Chukchi permit in comments dated October 20, 2009, Item 1.

ATTACHMENT A

Hull 247 Generator Specifications

LAFAYETTE POWER SYSTEMS
Generator Specifications

Spec. No: 4P8.1-2700 Model: 4P8.1-2700

*********** Specifications ***********

Poles	4
Excitation:	PMG
Pitch:	0.667
Connection:	Wye
Max Overspeed (60 sec)	125%
Number of Bearings	Two
Number of Leads	Six
Number of Terminals	Four

*********** Ratings ***********

Power	1700 EkW
K.V.A.	2125
P.f.	0.8
Voltage-L.L.	4,160 V
Voltage-L.N.	2402 V
Current-L.L.	295 A
Frequency	60 Hz
Speed	1800 RPM

*********** Efficiency and Heat Dissipation ***********

(As per NEMA and IEC at 95°C)

Load PU	Kilowatts	Efficiency	Heat Rejection	
0.25	425.0	92.1%	124421	BTU/hr
0.50	850.0	95.2%	146271	BTU/hr
0.75	1275.0	96.0%	181316	BTU/hr
1.00	1700.0	96.2%	229189	BTU/hr

******** Temperature & Insulation Data ********

Ambient Temperature	50 °C
Temperature Rise	90 °C
Insulation Class	F (155 °C)
Insulation Resistance (as shipped)	100 Megaohms (at 40 °C)

*********** Fault Currents ***********

Instantaneous 3-Ø symmetrical fault current	2949 Amps
Instantaneous L-N symmetrical fault current	3403 Amps
Instantaneous L-L symmetrical fault current	2221 Amps

*********** Exciter Armature Data ***********

(at full load, 0.8 p.f.)

Voltage	119.0	V
Current	77.0	A

*********** Time Constants ***********

OC Transient - Direct Axis	**T'DO**	5.177 Sec
SC Transient - Direct Axis	**T'D**	0.414 Sec
OC Subtransient - Direct Axis	**T"DO**	0.052 Sec
SC Subtransient - Direct Axis	**T"D**	0.042 Sec
OC Subtransient - Quadrature Axis	**T"QO**	0.026 Sec
SC Subtransient - Quadrature Axis	**T"Q**	0.005 Sec
Armature SC	**TA**	0.036 Sec

*********** Resistances ***********

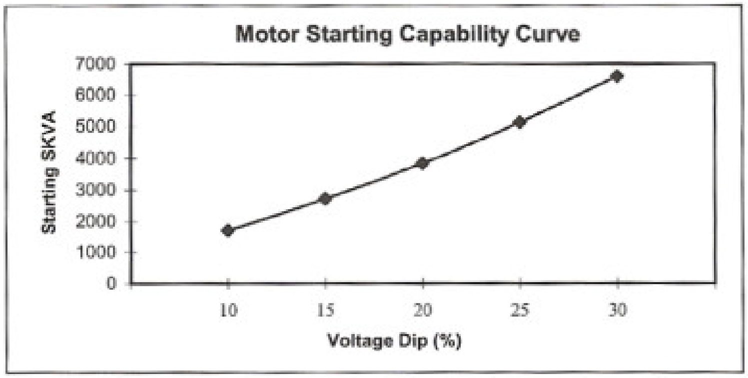
Base Impedence	8.144 ohms
Stator (at 25 °C)	0.036 ohms
Field (at 25 °C)	1.07 ohms
Zero Sequence R0	0.11 ohms
Positive Sequence R1	0.04 ohms
Short Circuit Ratio	0.65

*********** Reactances ***********

		Saturated		Unsaturated	
		Per Unit	**Ohms**	**Per Unit**	**Ohms**
Subtransient - Direct Axis	**X"D**	0.100	0.8	0.120	1.0
Subtransient - Quadrature Axis	**X"Q**	0.160	1.3	0.190	1.5
Transient - Direct Axis	**X'D**	0.120	1.0	0.140	1.1
Transient Quadrature Axis	**X'Q**	0.690	5.6	0.910	7.4
Synchronous - Direct Axis	**XD**	1.550	12.6	2.110	17.2
Synchronous - Quadrature Axis	**XQ**	0.690	5.6	0.910	7.4
Negetive Sequence	**X2**	0.130	1.1	0.150	1.2
Zero Sequence	**X0**	0.030	0.2	0.030	0.2

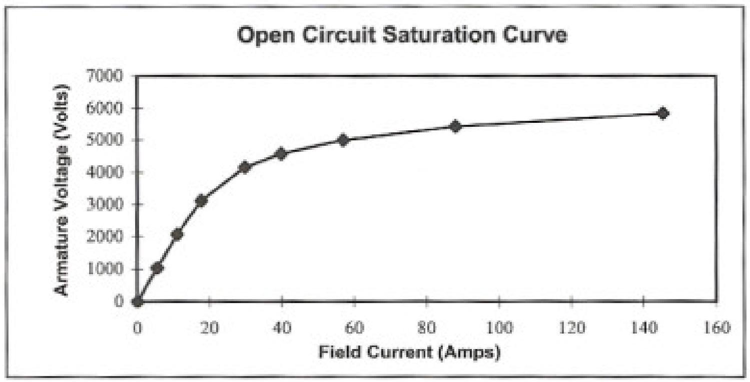
****** Motor Starting Capability Data ******

Voltage Dip (%)	Starting SKVA
10	1714
15	2722
20	3856
25	5141
30	6610



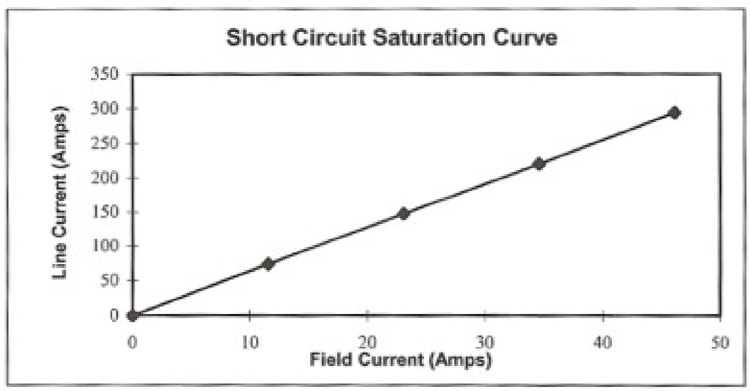
******* Open Circuit Saturation Data *******

Field Current (Amps)	Armature Voltage (Volts)
0.0	0
5.5	1040
11.1	2080
17.7	3120
29.8	4160
39.8	4576
57.0	4992
88.0	5408
145.4	5824



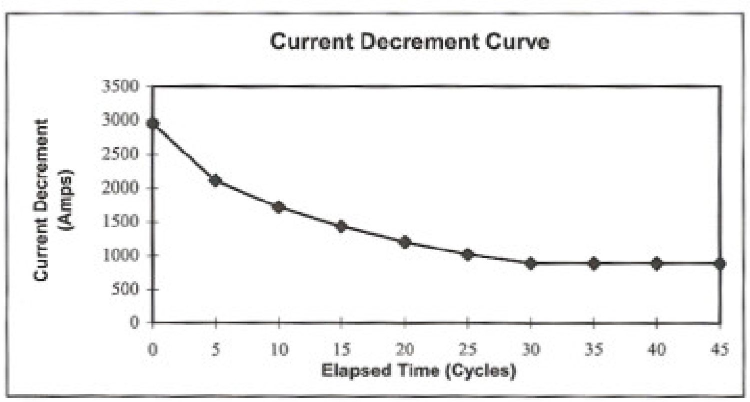
******* Short Circuit Saturation Data *******

Field Current (Amps)	Line Current (Amps)
0.0	0.0
11.5	73.7
23.1	147.5
34.6	221.2
46.1	294.9



******** Current Decrement Data ***********

Elapsed Time (Cycles)	Current Decrement (Amps)
0	2949
5	2114
10	1715
15	1431
20	1205
25	1019
30	885
35	885
40	885
45	885



10% higher
S/N 22322
as built Data

Kato Engineering/Leroy-Somer Generator Design Program

PREDICTED GENERATOR PERFORMANCE VALUES

4P8.1-2700 Tewac								
KW	**KVA**	**PF**	**TAMB**	**TRISE**	**POLES**	**RPM**	**SLOTS**	**HZ**
1870.	2337.5	0.8	50	90	4	1800	84	60
VOLTS-PH	**VOLTS-LL**	**AMPS-PH**	**AMPS-LN**	**BASE Z**	**025**	**026**	**PHASE/CONNECTION**	
2402	4160	324.4	324.4	7.403	420882	409977	3 PHASE WYE	

0.6667 PER UNIT PITCH

REACTANCES		SAT	UNSAT		HI POT VALUES	VOLTS	
SYNCHRONOUS					STATOR	9320	
DIRECT AXIS	Xd	170.3	232.3		ROTOR	1500	
QUADRATURE AXIS	Xq	76.4	99.6		EXCITER FIELD	1500	
TRANSIENT					EXCITER ARM	1500	
DIRECT AXIS	X'd	13.3	15.2				
QUADRATURE AXIS	X'q	76.4	99.6		MOTOR STARTING	0 P.F.	
SUBTRANSIENT						INRUSH	%VOLT
DIRECT AXIS	X"d	10.7	12.6		SKVA AT GENERATOR	SKVA	DIP
QUADRATURE AXIS	X"q	17.6	20.8		TERMINALS	1713.6	10
NEGATIVE SEQUENCE	X2	14.2	16.7			2721.7	15
ZERO SEQUENCE	X0	3.1	3.7			3855.7	20
LEAKAGE REACTANCE	XL	5.843	6.64			5140.9	25
						6609.8	30
RESISTANCES @ 25C -	RDCa	0.03575					
	RDCf	1.0669					

NL-FL VOLTAGE DIP AT RATED P.F. = 9.6%
USED XID= 15.2% FOR DIP CALCULATION.

TIME CONSTANTS (SECONDS)		
D-AXIS 3-PH S.C. TRANSIENT	T'd3	0.414
D-AXIS O.C. TRANSIENT	T'd0	5.177
D-AXIS 3-PH S.C. SUB-TRANS	T"d3	0.042
D-AXIS O.C. SUB-TRANS	T"d0	0.052
ARM CKT (ASYMMETRICAL S.C.)	TA	0.036

TRANSIENT TORQUES				KW		HEAT REJ
	TORQUE	MAX TORQUE		@0.8P.F.	%EFF	BTU/HR
CONDITION	P.U.	FT-LBS				
3-PH S.C.	9.3	85169	FL	1870.0	96.2	250307
L-L S.C.	10.4	95273	3/4L	1402.5	96.1	193215
			1/2L	935.0	95.5	151659
			1/4L	467.5	92.7	125507

EFFICIENCY CALCULATED AT 105.0C

SHORT CIRCUIT CURRENT	INSTANTANEOUS SYMMETRICAL FAULT CURRENT		INSTANTANEOUS ASYMMETRICAL FAULT CURRENT	
TYPE	P.U.	AMPS	P.U.	AMPS
3-PH	9.32	3024	16.15	5239
L-L	6.95	2255	12.04	3907
L-N	10.70	3470	18.53	6010

OVERSPEED: 2250.0 RPM FOR 1 MINUTE. MINIMUM 3 PHASE MOTORING POWER: 187.00 KW

	FULL LOAD	NO LOAD
SYNCH COEFF	3962KW/RAD	1960KW/RAD

DISPLACEMENT ANGLE: 29.1 DEGREES

BY ______________________