



Shell Exploration & Production

September 18, 2009

Mr. Jeff Walker, Regional Supervisor Field Operations  
Minerals Management Service – Alaska Region  
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Re: MMS Request for Amendment to the Shell Offshore Inc., 2010 Outer Continental Shelf  
Exploration Plan, Camden Bay, Beaufort Sea, Alaska

Dear Mr. Walker:

Shell Offshore Inc. (Shell) is responding to a request from the Minerals Management Service (MMS), dated September 4, 2009 for amendment of information on air emissions to satisfy 30 CFR 250-218 and 30 CFR 250.303. Please find the enclosed information

If you have questions or comments about this notice, please contact me at 770-3700 or at [Susan.Childs@Shell.com](mailto:Susan.Childs@Shell.com).

Sincerely yours,

Susan Childs  
Regulatory Affairs Manager, Alaska Venture

Attachment:

- *2010 Outer Continental Shelf Exploration Plan – Camden Bay – Amended Air Emissions Information*

cc:

Don Perrin, Alaska Department of Natural Resources  
Administrative Record  
Project File

**RECEIVED**  
Anchorage, Alaska

SEP 18 2009

REGIONAL SUPERVISOR  
FIELD OPERATIONS  
MINERALS MANAGEMENT SERVICE

## SECTION 7.0 AIR EMISSIONS INFORMATION

### a) Projected Emissions

Prevention of Significant Deterioration (PSD) permitting rules (40 CFR Section 52.21) apply to new major sources or major modifications of existing major sources. The *Discoverer* operating by itself would not be subject to the PSD permit path, but rules that apply to Outer Continental Shelf activities require emissions from the icebreakers and other support vessels to be included in the total project emissions when determining PSD applicability. When emissions from support vessels are included, total exploration activity emissions exceed applicability thresholds and trigger the PSD permit process. The PSD permit path requires installation of Best Available Control Technology on emission units on the *Discoverer*, extensive air quality modeling analyses, and public involvement.

Total Annual Emissions: Total annual potential emissions from sources on the *Discoverer* and support vessel sources are provided in Table 7.0-1 as required by 30 CFR 250.218(1)(ii). These emissions are based on a maximum 168-day drilling season. The actual 2010 drilling window from July 1 to October 31 is approximately 122 days, therefore for 2010 the 168 days used for projected air emissions is a worst-case calculation.

Emissions over the Duration of the Exploration Activities: Because the exploration activities planned in this EP would be conducted during 2010 only, the total annual emissions presented in Table 7.0-1 are also the projected emissions that would be generated over the duration of the EP, which are required under 30 CFR 250.218(1)(iii).

Projected Peak Hourly Emissions: The projected peak hourly emissions from sources on the *Discoverer* and support vessel sources are provided in Table 7.0-2 as required by 30 CFR 250.218(1)(i) are listed in Table 7.0-2.

Frequency and Duration of Emissions: Footnotes to Table 7.0-2 define the frequency and duration of the listed emission sources as required under 30 CFR 250.218(1)(iv).

Total of All Emissions: As required under 30 CFR 250.218(1)(v), the total of all emissions are presented in the bottom row of Table 7.0-1.

Basis for Calculations as Required Under 30 CFR 250.218(2): Total annual emissions by pollutant for the *Discoverer* sources and for the associated vessels, are provided in Table 7.0-1. These projected total annual emissions are based on a maximum 168-day drilling season. The actual 2010 drilling window from July 1 to October 31 is approximately 122 days, therefore the 168-days used for projected air emissions is a worst case calculation. Emissions for all emission units associated with the *Discoverer* are estimated as PTEs, which are the emissions assuming continuous operation at maximum rated capacity for the entire 168-day drilling season per year, unless limited by owner-requested restriction. Engine size and rating are provided in Table 7.0-1. Proposed owner-requested restrictions are provided in Table 7.0-3. These restrictions and the following text summarize the basis for the calculation of the emissions.

The emissions for the ice management fleet propulsion engines are estimated for operation at 80 percent engine capacity for 38 percent of the 168-day season. *Discoverer* emissions are estimated without the propulsion engines operating (drilling and propulsion are exclusive). The emergency and backup engines are only used during emergencies and maintenance of paired engines. Fuel quality for the vessels will have a sulfur content equal to or less than 0.19 weight percent. Fuel quality for the *Discoverer* will have a sulfur content equal to or less than 0.0015 weight percent. Table 7.0-3 lists the proposed owner requested restrictions and provides the basis for how emissions were calculated. Table 7.0-4 provides a list of the emission sources, their ratings and maximum fuel consumption.

Table 7.0-1 Total annual emissions\*

Unit ID	Rating		Max fuel consumpt. (MMBtu/yr)	Fuel Use gal/yr	Maximum Emissions (ton/yr)					
					PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	CO	VOC
<i>Frontier Discoverer</i>										
FD-1	1,325	Hp	27,878	209,457	0.40	0.40	1.56	0.0222	0.56	0.07
FD-2	1,325	Hp	27,878	209,457	0.40	0.40	1.56	0.0222	0.56	0.07
FD-3	1,325	Hp	27,878	209,457	0.40	0.40	1.56	0.0222	0.56	0.07
FD-4	1,325	Hp	27,878	209,457	0.40	0.40	1.56	0.0222	0.56	0.07
FD-5	1,325	Hp	27,878	209,457	0.40	0.40	1.56	0.0222	0.56	0.07
FD-6	1,325	Hp	27,878	209,457	0.40	0.40	1.56	0.0222	0.56	0.07
FD-7	7,200	Hp	0	0	0.00	0.00	0.00	0.00	0.00	0.00
FD-8	131	Hp	44	331	0.0153	0.0153	0.0782	0.0000351	0.043	0.00806
FD-9	540	Hp	5,413	40,673	0.13	0.13	2.69	0.00432	2.35	2.69
FD-10	540	Hp	5,413	40,673	0.13	0.13	2.69	0.00432	2.35	2.69
FD-11	540	Hp	0	0	0.00	0.00	0.00	0.00	0.00	0.00
FD-12	250	Hp	2,951	22,169	0.08	0.08	4.09	0.00235	0.12	0.06
FD-13	250	Hp	2,951	22,169	0.08	0.08	4.09	0.00235	0.12	0.06
FD-14	365	Hp	4,181	31,412	0.03	0.03	4.68	0.00333	0.10	0.03
FD-15	365	Hp	4,181	31,412	0.03	0.03	4.68	0.00333	0.10	0.03
FD-16	335	Hp	2,931	22,022	0.12	0.12	4.85	0.00234	0.27	0.08
FD-17	335	Hp	2,931	22,022	0.12	0.12	4.85	0.00234	0.27	0.08
FD-18	147	Hp	1,286	9,664	0.05	0.05	2.13	0.00103	0.12	0.04
FD-19	128	Hp	0	0	0.00	0.00	0.00	0.00	0.00	0.00
FD-20	36	Kw	0	0	0.00	0.00	0.00	0.00	0.00	0.00
FD-21	7.97	MMBtu/hr	32,135	241,439	0.38	0.38	3.23	0.0256	1.24	0.02
FD-22	7.97	MMBtu/hr	32,135	241,439	0.38	0.38	3.23	0.0256	1.24	0.02
FD-23	276	lb/hr			0.10	0.09	0.06	0.03	0.39	0.04
FD-31	Resupply Ship - docked		196	1,474	0.03	0.03	0.43	0.02	0.09	0.03
Discoverer total while drilling			264,019	1,983,644	4.06	4.05	51.15	0.26	12.17	6.31
			<b>Max fuel</b>		<b>Maximum Emissions</b>					

		consumpt.	Fuel Use	(ton/yr)					
		(MMBtu/yr)	gal/yr	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	CO	VOC
<b>Ice Management Fleet – Generic</b>									
ICE Engines /									
Boiler		1,503,133	11,293,433	116.54	105.54	919.29	165.56	598.08	88.33
Incinerators	308 lb/hr			4.09	2.80	1.23	0.77	92.3	30.76
	<i>Ice Mnge Total</i>	<i>1,503,133</i>	<i>11,293,433</i>	<i>120.63</i>	<i>108.24</i>	<i>920.52</i>	<i>166.33</i>	<i>690.38</i>	<i>119.09</i>
<b>Resupply Ship - In Transit</b>		<i>1,421</i>	<i>10,677</i>	<i>0.32</i>	<i>0.26</i>	<i>4.24</i>	<i>0.16</i>	<i>0.56</i>	<i>0.10</i>
<b>OSR Fleet</b>									
OSR Main Ship ICE Propulsion Engines		48,018	360,773	1.06	1.06	84.90	4.85	4.55	6.17
OSR Main Ship ICE Generators		49,166	369,397	11.09	8.90	146.76	5.40	19.32	3.47
OSR Main Ship Incinerator				1.68	1.15	0.38	0.32	37.80	12.60
OSR Main Ship Total		84,970	638,400	2.5	1.85	172.38	0.38	39.14	13.59
OSR Work Boats Total		74,314	558,339	1.03	1.03	55.72	7.51	2.23	1.06
	<i>OSR Total</i>	<i>159,284</i>	<i>1,196,739</i>	<i>3.53</i>	<i>2.88</i>	<i>228.1</i>	<i>7.89</i>	<i>41.37</i>	<i>14.65</i>
<b>Total All Fleet</b>		<b>1,663,838</b>	<b>12,500,848</b>	<b>124</b>	<b>111</b>	<b>1,153</b>	<b>174</b>	<b>732</b>	<b>133</b>
<b>Total All</b>		<b>1,927,857</b>	<b>14,484,492</b>	<b>128</b>	<b>115</b>	<b>1,204</b>	<b>174</b>	<b>744</b>	<b>140</b>

Table 7.0-2. Projected peak hourly emissions in lb/hr for sources on or associated with the *Discoverer*.

Source	Description	Rating	Max Fuel Consumption (MMBtu/hr)	Maximum Emissions (lb/hr)							Notes
				PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	SO <sub>2</sub>	CO	VOC	Lead	
<i>Frontier Discoverer</i>											
FD-1	Generator Engine	1,325 hp	6.91	0.2	0.2	0.77	0.011	0.28	0.04	0.000201	2,3,4
FD-2	Generator Engine	1,325 hp	6.91	0.2	0.2	0.77	0.011	0.28	0.04	0.000201	2,3,4
FD-3	Generator Engine	1,325 hp	6.91	0.2	0.2	0.77	0.011	0.28	0.04	0.000201	2,3,4
FD-4	Generator Engine	1,325 hp	6.91	0.2	0.2	0.77	0.011	0.28	0.04	0.000201	2,3,4
FD-5	Generator Engine	1,325 hp	6.91	0.2	0.2	0.77	0.011	0.28	0.04	0.000201	2,3,4
FD-6	Generator Engine	1,325 hp	6.91	0.2	0.2	0.77	0.011	0.28	0.04	0.000201	2,3,4
FD-7	Propulsion Engine	7,200 hp	0	0	0	0	0	0	0	0	5,6
FD-8	Emergency Engine	131 hp	0.92	0.64	0.64	3.26	0.00146	1.79	0.34	0.0000266	7
FD-9	MLC Compressor	540 hp	3.58	0.18	0.18	3.55	0.00571	3.11	3.55	0.000104	8
FD-10	MLC Compressor	541 hp	3.58	0.18	0.18	3.55	0.00571	3.11	3.55	0.000104	8
FD-11	MLC Compressor	542 hp	3.58	0.18	0.18	3.55	0.00571	3.11	3.55	0.000104	8
FD-12	HPU Engine	250 hp	1.95	0.1	0.1	5.41	0.00311	0.16	0.08	0.0000566	9
FD-13	HPU Engine	250 hp	1.95	0.1	0.1	5.41	0.00311	0.16	0.08	0.0000566	9
FD-14	Port Deck Crane	365 hp	2.77	0.04	0.04	6.2	0.00441	0.13	0.04	0.0000802	9
FD-15	Starboard Deck Crane	365 hp	2.77	0.04	0.04	6.2	0.00441	0.13	0.04	0.0000802	9
FD-16	Cementing Unit	335 hp	2.62	0.21	0.21	8.66	0.00417	0.48	0.15	0.0000758	9
FD-17	Cementing Unit	335 hp	2.62	0.21	0.21	8.66	0.00417	0.48	0.15	0.0000758	9
FD-18	Cementing Unit	147 hp	1.15	0.09	0.09	3.8	0.00183	0.21	0.07	0.0000333	9
FD-19	Logging Winch	128 hp	1	0.08	0.08	3.31	0.00159	0.18	0.06	0.000029	9
FD-20	Logging Winch	36 kW	0.34	0.01	0.01	0.6	0.000537	0.04	0.06	0.00000976	9,10
FD-21	Heat Boiler	7.97 MMBtu/hr	7.97	0.19	0.19	1.6	0.0127	0.62	0.01	0.0000717	
FD-22	Heat Boiler	7.97 MMBtu/hr	7.97	0.19	0.19	1.6	0.0127	0.62	0.01	0.0000717	
FD-23	Incinerator	276 lb/hr		1.13	0.97	0.69	0.35	4.28	0.41	0.03	11
FD-31	Resupply Ship – docked		4.09	1.27	1.27	18.03	0.83	3.88	1.43	0.000119	
<i>Discoverer total while drilling</i>			<b>90.32</b>	<b>6.03</b>	<b>5.86</b>	<b>88.71</b>	<b>1.31</b>	<b>24.17</b>	<b>13.79</b>	<b>0.0317</b>	

Ice Management Vessels											
	Internal Combustion Engines		372.8	57.69	52.19	1199.8	3	81.88	296.57	43.63	0.01073
	Incinerators			2.03	1.39	0.43		0.38	45.78	15.26	0.0322
<b>Ice management total</b>			<b>372.8</b>	<b>59.71</b>	<b>53.57</b>	<b>1200.4</b>	<b>4</b>	<b>82.26</b>	<b>342.36</b>	<b>58.89</b>	<b>0.0432</b>
Re-supply Ship – In Transit											
			44.41	20.04	16.07	265.11		9.75	34.89	6.26	0.00129
<b>Re-supply Ship – In Transit total</b>			<b>44.41</b>	<b>20.04</b>	<b>16.07</b>	<b>265.11</b>		<b>9.75</b>	<b>34.89</b>	<b>6.26</b>	<b>0.00129</b>
Oil Spill Response Vessels											
	Main Ship		83.29	2.85	2.26	353.1		0.29	21.76	8.11	0.0157
	Workboats		18.43	0.51	0.51	27.64		3.72	1.11	0.53	0.000534
<b>OSR vessels total</b>			<b>101.72</b>	<b>3.36</b>	<b>2.78</b>	<b>380.74</b>		<b>4.01</b>	<b>22.87</b>	<b>8.64</b>	<b>0.0163</b>
<b>Total All</b>			<b>6.925</b>	<b>89.14</b>	<b>78.29</b>	<b>1934.9</b>	<b>9</b>	<b>97.33</b>	<b>424.29</b>	<b>87.59</b>	<b>0.092</b>

Notes

ORR = owner requested restriction

- 1 All emissions are the maximum 1-hour values
- 2 Units FD-1-6 (Generator Engines) instantaneous capacity restriction applied
- 3 Units FD-1-6 (Generator Engines) SCR NOx control effectiveness applied
- 4 Units FD-1-6 (Generator Engines) Oxidation Catalyst reduction efficiencies applied
- 5 Not used during drilling
- 6 Any emissions from the propulsion engine associated with travel to and from drill sites (within 25 miles of the sites) will be negligible and are included in the ice management fleet allowance.
- 7 Unit FD-8 (Emergency Generator) operation assumed for 20 min/week. Ref: Wright, Alistair email to Anthony Wilson, 1/21/09.
- 8 Units FD-9-11 (MLC Compressors) are Tier 3 engines
- 9 Small engines (other than the Tier 3 engines) CDPF PM & CO reduction efficiencies applied
- 10 Unit FD-20 (Logging Winch) is a Tier 2 engine
- 11 Assume 2 incinerators rated at 154 lb/hr & 154 lb/hr

**b) Emissions Reduction Measures**

Shell offers the following emission reduction measures, 30 CFR 250.218(b), and restrictions on its operation for the purposes of limiting emissions and air quality impacts from the *Discoverer*:

- The primary generators on the *Discoverer* will be retrofitted with selective catalytic reduction devices to reduce nitrogen oxides emissions by over 90 percent, and with catalytic oxidation devices to reduce carbon monoxide, volatile organics and fine particulate matter by at least 50 percent.
- All remaining engines on the *Discoverer* will either be Tier 3 (low emissions) or will be retrofitted with catalytic oxidation filters to reduce carbon monoxide, volatile organics and fine particulate matter by at least 85 percent.
- Maximum sulfur content of diesel fuel combusted by the ice management and oil spill vessels will be limited to a maximum of 0.19 percent and to 15 parts per million on the *Discoverer*.
- Limiting the MLC compressors, Units FD-9 through FD-11, to 2 of the 3 while the *Discoverer* is occupying a drill site, and only using emergency equipment during emergencies.
- Limiting daily cementing, logging, and cranes to 30 percent of combined engine capacity
- The *Discoverer* may occupy drill sites, in aggregate, a maximum of 168 calendar days.

**c) Processes, Equipment, Fuels, and Combustibles**

Per 30 CFR 250.218(c), the following summarize equipment, fuels, and combustibles associated with the project. Emission units on the *Discoverer* are primarily associated with the generation of electricity, compressed air, and hydraulic energy to support drilling. All others are secondary and related to general purpose heating, transfer of materials about the deck, pumping of cement, incineration of (primarily) domestic waste, and other small emission sources. All emission units on the *Discoverer* will use diesel with sulfur content at or below 15 ppm. All emission sources aboard the *Discoverer* are listed in Table 7.0-4.

**TABLE 7.0-3 PROPOSED OWNER-REQUESTED RESTRICTIONS**

Compliance Condition	Restriction	How Calculated	How Documented
<b>Operational Restrictions</b>			
Season maximum drilling duration	168 days/season	168 days/season x 24 hr/day =	4,032 hrs
MLC compressors maximum use per season	63 days/season	63 day/season x 24 hr/day x 2 engines x 540 hp/engine x 0.007 mBTU/hp-hr x 7.5 gal/mBTU=	81,346 gal/season
HPU's maximum use per season	63 days/season	63 day/season x 24 hr/day x 2 engines x 250 hp/engine x 0.007 mBTU/hp-hr x 7.5 gal/mBTU=	44,338 gal/season
Generator combined production maximum	71%	0.71 x 6 engines x 1325 hp x kW/1.340hp=	4,212 kW
Incinerator maximum use	1,525 Lb trash/day		
Discoverer incinerator PM <sub>2.5</sub> limits	7 Lb/ton		
Discoverer incinerator PM <sub>10</sub> limits	8.2 Lb/ton		
Discoverer incinerator SO <sub>2</sub> limits	2.5 Lb/ton		
Cementing & Logging units combined maximum	30% Per day (of cementing)	30% x (335 hp x 2 engines +147hp) x 0.007 mBTU/hp-hr x 24 hr/day x 7.5 gal/mBTU =	345 gal/day
Crane units combined maximum	63 days/season	Max Fuel Consumption	62,824 gal/season
Sulfur content on all stationary source engines on drilling vessel	0.0015% by weight		
Sulfur content on all ships except the Discoverer	0.19% by weight		
Ice management fleet fuel restriction while < 25 miles from drill site	1,699 tons NOx/season	Fuel Consumption (gallons) X stack test emission factor	
Anchor handler fuel restriction while < 25 miles from drill site	850 tons NOx/season	Fuel Consumption (gallons) X stack test determined Nox emission factor	

**TABLE 7.0-3 PROPOSED OWNER-REQUESTED RESTRICTIONS**

Ice management fleet capacity hourly PM <sub>2.5</sub> restriction	84.4	Lb/hr	(Propulsion engine power (kW) capacity (80% of design rating) X PM <sub>2.5</sub> emission factor (lb/kWh)) + (boiler design rate (btu/hr) X PM <sub>2.5</sub> emission factor (lb/btu)) X 24 hrs + incinerator capacity (lb/hr) X PM <sub>2.5</sub> emission factor (lb PM <sub>2.5</sub> /lb waste)	Propulsion emission factor by stack test, boiler and incinerator emission factors from the Air Permit Application. Compliance calculated prior to startup
Anchor handler capacity hourly PM <sub>2.5</sub> restriction	42.2	Lb/hr	(Propulsion engine power (kW) capacity (80% of design rating) X PM <sub>2.5</sub> emission factor (lb/kWh)) + (boiler design rate (btu/hr) X PM <sub>2.5</sub> emission factor (lb/btu)) X 24 hrs + incinerator capacity (lb/hr) X PM <sub>2.5</sub> emission factor (lb PM <sub>2.5</sub> /lb waste)	Propulsion emission factor by stack test, boiler and incinerator emission factors from the Air Permit Application. Compliance calculated prior to startup
Ice management fleet capacity hourly PM <sub>10</sub> restriction	96.0	Lb/hr	(Propulsion engine power (kW) capacity (80% of design rating) X PM <sub>10</sub> emission factor (lb/kWh)) + (boiler design rate (btu/hr) X PM <sub>10</sub> emission factor (lb/btu)) X 24 hrs + incinerator capacity (lb/hr) X PM <sub>10</sub> emission factor (lb PM <sub>10</sub> /lb waste)	Propulsion emission factor by stack test, boiler and incinerator emission factors from the Air Permit Application. Compliance calculated prior to startup
Anchor handler capacity hourly PM <sub>10</sub> restriction	48.0	Lb/hr	(Propulsion engine power (kW) capacity (80% of design rating) X PM <sub>10</sub> emission factor (lb/kWh)) + (boiler design rate (btu/hr) X PM <sub>10</sub> emission factor (lb/btu)) X 24 hrs + incinerator capacity (lb/hr) X PM <sub>10</sub> emission factor (lb PM <sub>10</sub> /lb waste)	Propulsion emission factor by stack test, boiler and incinerator emission factors from the Air Permit Application. Compliance calculated prior to startup
Resupply ship while docked limited to	12	hr/day		
Resupply ship while docked generation limited to 1 engine	100%			Demonstrated by by energy monitoring (kw-hr)
OSR Main Ship propulsion limited to equivalent of 1 engine at:	50%		1 engine x 2710 hp x 50% x kW/1.340 hp x 24 hr/day ="	Demonstrated by energy monitoring of two engines output combined (kw-hr per day) with accuracy of +/- 5 % of 1011 kW or +/- 51 kW.
OSR Main Ship generation limited to 1 engine, electrical switch allows only 1 generator to operate at a time:	100%			
Nanuq propulsion engines limited to	25%			Demonstrated by by energy monitoring (kw-hr)
Nanuq generators engines limited to	50%			Demonstrated by by energy monitoring (kw-hr)

TABLE 7.0-3 PROPOSED OWNER-REQUESTED RESTRICTIONS

Compliance Condition	Restriction		Comment			How Documented
Generator SCR NOx control effectiveness	.5	g/kW-hr	50-100% of capacity	CEM		D.E.C. Marine AB letter, October 9, 2008, initial stack test and CEM
Generator Oxidation Catalyst CO reduction efficiency	80%		50-100% of capacity			D.E.C. Marine AB letter, October 9, 2008, and initial stack test
Generator Oxidation Catalyst VOC, HAPs, Formaldehyde reduction efficiency	70%		50-100% of capacity			D.E.C. Marine AB letter, October 9, 2008
Generator Oxidation Catalyst PM <sub>10</sub> reduction efficiency	50%					D.E.C. Marine AB email, February 9, 2009
Small engines (other than Tier 3 engines) Catalytic Diesel Particulate Filter (CDPF) CO, VOC, HAPs, Formaldehyde reduction efficiency	90%					CleanAIR CDPF guarantee
Small engines CDPF PM reduction efficiency	85%					California Air Resource Board Currently verified, January 2009, CleanAIR Systems PERMIT

Table 7.0-4 Description of *Discoverer* emission units

Unit ID	Unit Description	Make/Model	Rating	Max fuel consumption (mBtu/hr)
FD-1	Generator engine	Cat / D399	1,325 hp	6.91
FD-2	Generator engine	Cat / D399	1,325 hp	6.91
FD-3	Generator engine	Cat / D399	1,325 hp	6.91
FD-4	Generator engine	Cat / D399	1,325 hp	6.91
FD-5	Generator engine	Cat / D399	1,325 hp	6.91
FD-6	Generator engine	Cat / D399	1,325 hp	6.91
FD-7	Propulsion engine <sup>1</sup>	MI / 6UEC65	7,200 hp	0
FD-8	Emergency generator <sup>2</sup>	Caterpillar / 3304	131 hp	0.92
FD-9	MLC compressor	Tier 2	540 hp	3.58
FD-10	MLC compressor	Tier 2	540 hp	3.58
FD-11	MLC compressor <sup>3</sup>	Tier 2	540 hp	3.58
FD-12	HPP engine	Detroit/8V71	250 hp	1.95
FD-13	HPP engine	Detroit/8V71	250 hp	1.95
FD-14	Port deck crane	Cat / D343	365 hp	2.77
FD-15	Starboard deck crane	Cat / D343	365 hp	2.77
FD-16	Cementing unit	Detroit / 8V-71N	335 hp	2.62
FD-17	Cementing unit	Detroit / 8V-71N	335 hp	2.62
FD-18	Cementing unit	GM 3-71	147 hp	1.15
FD-19	Logging winch <sup>4</sup>	Detroit / 4-71N	128 hp	1.0
FD-20	Logging winch <sup>4</sup>	4024TF270	36 kW	.34
FD-21	Heat boiler	Clayton 200 Boiler	7.97 mBtu/hr	7.97
FD-22	Heat boiler	Clayton 200 Boiler	7.97 mBtu/hr	7.97
FD-23	Incinerator	TeamTec/GS500C	276 lb/hr	-

<sup>1</sup> Not used during drilling; any emissions are associated with travel to and from drill sites (within 25 miles of the drill sites) will be negligible and are included in the ice management fleet allowance

<sup>2</sup> Not used during drilling; small engines (other than Tier 3 engines) CDPF PM and CO reduction efficiencies applied

<sup>3</sup> Tier 3 engines

<sup>4</sup> Logging Winches operations are combined with the Cementing Units and small engines (other than Tier 3 engines) CDPF PM and CO reduction efficiencies applied

#### d) Distance to Shore 30 CFR 250.218(b)

Per requirements set forth in 30 CFR 250.218(b), distances from the drill sites to shore are as follows. The Sivulliq N drill site is situated on lease block No. 6658, approximately 16 mi (26 km) north of the mainland. The Torpedo H drill site location lies in Block 6610 approximately 22 mi (35 km) north of the mainland.

#### e) Non-exempt Drilling Vessels

As required by 30 CFR 250.218(e), the following describes how Shell's program complies with the requirements of 30 CFR 250.303. The drillship and associated support vessels are not exempt using

the exemption formula found at 30 CFR 250.303(d) except for VOC. Modeled concentrations exceed significance concentrations identified in 30 CFR 250.303(e) for all other pollutants. Because Shell is applying for a PSD permit from the EPA, BACT has been applied to all pollutants. The BACT is described in Shell's air permit application (Outer Continental Shelf Pre-Construction Air Permit Application Frontier Discoverer Beaufort Sea Exploration Drilling Program), prepared by ENVIRON and submitted to the EPA and MMS. Impacts are estimated using dispersion modeling procedures provided by EPA Region 10. Per EPA guidance, screening meteorological data were used. A copy of the data is attached.

#### f) Modeling Report

Results of the air emissions modeling can be found in the air permit application submitted to the EPA and located in Appendix D of this document. Table 7.0-5 displays the maximum estimated concentrations of NO<sub>2</sub>, PM<sub>2.5</sub>, PM<sub>10</sub> and SO<sub>2</sub> near the drillship. The concentrations do not exceed National Ambient Air Quality Standards, Alaska Ambient Air Quality Standards, and PSD increments.

Per requirements set forth in 30 CFR 250.218(f), information on air emissions modeling can be found in Shell's air permit application, which has been provided to MMS and is referenced above in (e).

**TABLE 7.0-5**  
**Summary of Maximum Estimated Concentrations**

Pollutant	Averaging Time	NAAQS/AAAQS <sup>1</sup> (µg/m <sup>3</sup> )	PSD Class II Increment (µg/m <sup>3</sup> )	Shell Screening Model Max. Impact No Background (µg/m <sup>3</sup> )	X Coordinate of Maximum Impact (in meters from center of the drillship)	Y Coordinate of Maximum Impact (in meters from center of the drillship)	Screening Model Max. Impact Plus Background (µg/m <sup>3</sup> )
Nitrogen Dioxide (NO <sub>2</sub> )	Annual	100	25	17.3	-80.8	0.6	28.6
Particulate Matter (PM <sub>2.5</sub> )	24-hour	35	NA	25.7	-80.8	0.6	30.7
	Annual	15	NA	1.6	-80.8	0.6	2.6
Particulate Matter (PM <sub>10</sub> )	24-hour	150	30	27.4	-80.8	0.6	35.3
	Annual	50	17	1.8	-80.8	0.6	3.6
Sulfur Dioxide (SO <sub>2</sub> )	3-hour	1,300	512	13.0	-3,196.5	-1154.4	293.7
	24-hour	365	91	6.5	-3,196.5	-1154.4	118.0
	Annual	80	20	0.5	-3,196.5	-1254.4	6.6

<sup>1</sup> National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards

**Attachment**  
**Screening Meteorological Data 2/13/09**  
**Shell Beaufort Sea Preconstruction Air Permit Application**

99999	01	99999	01					
1	5	213	270.0000	1.0000	261.1	1	320.	320.
1	5	214	270.0000	1.5000	261.1	1	480.	480.
1	5	215	270.0000	2.0000	261.1	1	640.	640.
1	5	216	270.0000	2.5000	261.1	1	800.	800.
1	5	217	270.0000	3.0000	261.1	1	960.	960.
1	5	218	270.0000	1.0000	261.1	2	320.	320.
1	5	219	270.0000	1.5000	261.1	2	480.	480.
1	5	220	270.0000	2.0000	261.1	2	640.	640.
1	5	221	270.0000	2.5000	261.1	2	800.	800.
1	5	222	270.0000	3.0000	261.1	2	960.	960.
1	5	223	270.0000	3.5000	261.1	2	1120.	1120.
1	5	224	270.0000	4.0000	261.1	2	1280.	1280.
1	5	3 1	270.0000	4.5000	261.1	2	1440.	1440.
1	5	3 2	270.0000	5.0000	261.1	2	1600.	1600.
1	5	3 3	270.0000	1.0000	261.1	3	320.	320.
1	5	3 4	270.0000	1.5000	261.1	3	480.	480.
1	5	3 5	270.0000	2.0000	261.1	3	640.	640.
1	5	3 6	270.0000	2.5000	261.1	3	800.	800.
1	5	3 7	270.0000	3.0000	261.1	3	960.	960.
1	5	3 8	270.0000	3.5000	261.1	3	1120.	1120.
1	5	3 9	270.0000	4.0000	261.1	3	1280.	1280.
1	5	310	270.0000	4.5000	261.1	3	1440.	1440.
1	5	311	270.0000	5.0000	261.1	3	1600.	1600.
1	5	312	270.0000	8.0000	261.1	3	2560.	2560.
1	5	313	270.0000	10.0000	261.1	3	3200.	3200.
1	5	314	270.0000	1.0000	261.1	4	320.	320.
1	5	315	270.0000	1.5000	261.1	4	480.	480.
1	5	316	270.0000	2.0000	261.1	4	640.	640.
1	5	317	270.0000	2.5000	261.1	4	800.	800.
1	5	318	270.0000	3.0000	261.1	4	960.	960.
1	5	319	270.0000	3.5000	261.1	4	1120.	1120.
1	5	320	270.0000	4.0000	261.1	4	1280.	1280.
1	5	321	270.0000	4.5000	261.1	4	1440.	1440.
1	5	322	270.0000	5.0000	261.1	4	1600.	1600.
1	5	323	270.0000	8.0000	261.1	4	2560.	2560.
1	5	324	270.0000	10.0000	261.1	4	3200.	3200.
1	5	4 1	270.0000	15.0000	261.1	4	4800.	4800.
1	5	4 2	270.0000	20.0000	261.1	4	6400.	6400.
1	5	4 3	270.0000	1.0000	261.1	5	10000.	10000.
1	5	4 4	270.0000	1.5000	261.1	5	10000.	10000.
1	5	4 5	270.0000	2.0000	261.1	5	10000.	10000.
1	5	4 6	270.0000	2.5000	261.1	5	10000.	10000.
1	5	4 7	270.0000	3.0000	261.1	5	10000.	10000.
1	5	4 8	270.0000	3.5000	261.1	5	10000.	10000.
1	5	4 9	270.0000	4.0000	261.1	5	10000.	10000.
1	5	410	270.0000	4.5000	261.1	5	10000.	10000.
1	5	411	270.0000	5.0000	261.1	5	10000.	10000.
1	5	412	270.0000	1.0000	261.1	6	10000.	10000.
1	5	413	270.0000	1.5000	261.1	6	10000.	10000.



1	5	414	270.0000	2.0000	261.1	6	10000.	10000.
1	5	415	270.0000	2.5000	261.1	6	10000.	10000.
1	5	416	270.0000	3.0000	261.1	6	10000.	10000.
1	5	417	270.0000	3.5000	261.1	6	10000.	10000.
1	5	418	270.0000	4.0000	261.1	6	10000.	10000.