Shell Exploration & Production

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United States Department of Interior
Bureau of Ocean Energy Management
Alaska OCS Region
Attn: David Johnston, Regional Supervisor
3801 Centerpoint Drive, Suite 500
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November 30, 2015

Re: **Shell Gulf of Mexico Inc. Revised Outer Continental Shelf Lease Exploration Plan**
Chukchi Sea 2015 Exploration Season – Seasonal Operating Report

Pursuant to Item No. 18 of the Conditional Approval issued by the Alaska Region of the Bureau of Ocean Energy Management (BOEM) on May 11, 2015 for the Shell Gulf of Mexico Inc. (Shell) Revised Outer Continental Shelf Lease Exploration Plan (EP) for the Chukchi Sea, Shell is submitting the following information to fulfill the requested items.

The information provided is consistent with the interpretations of the intent and purpose, as well as the corresponding definition and clarifications provided, of Condition 18 as documented by letter from Shell to BOEM on June 29, 2015.

- Item No. 18.a – Records of fuel purchases showing volume, sulfur content, and date of deliveries to each mobile offshore drilling unit (MODU) are provided in Attachment 1.
- Item No. 18.b – Records of each fuel delivery during the drilling season to individual support vessels and drilling units are provided in Attachment 2. Please note that fuel transfers may include fuel that was consumed inside and/or outside a 25-mile radius of a facility. All fuel deliveries to the *Transocean Polar Pioneer* and *Noble Discoverer* during the drilling season were made by fuel transfers between the fuel tanker, *Marika*, and the *Aiviq* support vessel.
- Item No. 18.c – Hours of operation per month or fuel consumption per month for each emission unit or emission unit group identified in the EP for each drilling rig and each support vessel during the drilling season, and their cumulative time of operation or fuel consumption per unit or emission unit group at the end of each season is provided in Attachment 3.
- Item No. 18.d – Calculated actual emissions during the drilling season for each emission unit or emission unit group per month and cumulative for the duration of the season by unit or group and overall total emissions for all emission units or groups on each drilling rig and support vessel based on hours of operations or fuel consumption reported in item 18.c is provided in Attachment 3. The calculated actual emissions for the criteria pollutants in comparison to the emission levels authorized for each MODU by BOEM with approval of the EP are provided in the Table 1 and Table 2.

Table 1. Application of BOEM Exemption Formula to the *Noble Discoverer*

Parameter	BOEM formula at 30 CFR 250.303(d)	BOEM Exemption Threshold (tons/year)	Total Projected *Noble Discoverer* Emissions (tons/year)	Total Actual *Noble Discoverer* Emissions (tons/year)	Exempt?
CO	$E=3400D^{2/3}$	54,796	100	2	Yes
TSP ($PM_{2.5}$ & PM_{10})	E=33.3D	2,155	16	<1	Yes
SO_2	E=33.3D	2,155	3	<1	Yes
NO_X	E=33.3D	2,155	394	8	Yes
VOC	E=33.3D	2,155	22	<1	Yes

Table 2. Application of BOEM Exemption Formula to the *Transocean Polar Pioneer*

Parameter	BOEM formula at 30 CFR 250.303(d)	BOEM Exemption Threshold (tons/year)	Total Projected *Transocean Polar Pioneer* Emissions (tons/year)	Total Actual *Transocean Polar Pioneer* Emissions (tons/year)	Exempt?
CO	$E=3400D^{2/3}$	54,796	76	12	Yes
TSP ($PM_{2.5}$ & PM_{10})	E=33.3D	2,155	25	4	Yes
SO_2	E=33.3D	2,155	3	<1	Yes
NO_X	E=33.3D	2,155	481	92	Yes
VOC	E=33.3D	2,155	24	4	Yes

- Item No. 18.e – Verification that the respective emission units enumerated in Appendix K to the EP, Table 6 (Units with Emission Controls) and Table 17 (Particulate Matter Emission Controls) have had their respective air emission controls installed and operational is provided in Attachment 4. During the drilling season, based on filter review and replacement, it was indicated that these air emission control systems were operational on vessels while operating within 25 miles of an active drilling unit and on the *Noble Discoverer* while anchored over a drill site.

If you have any questions or concerns, please do not hesitate to contact me at (907) 646-7112 or via e-mail at Susan.Childs@Shell.com; alternatively, you may also contact Greg Horner at (907) 646-7131 or via e-mail at Greg.Horner@Shell.com.

Thank you,

Alaska Venture Support Integrator, Manager

Attachment 1 – Records of Fuel Purchases

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 1
Records of Fuel Purchases and Deliveries to Each Mobile Offshore Drilling Unit (MODU)

Volume, Sulfur Content, and Date of Fuel Purchases or Deliveries (Conditional Approval 18.a.)

Date	Location	Origin/Vendor	Destination	Volume	Suflur Content
02/26/15	Labuan, Malaysia	Farstad Shipping Pty. Ltd.	*Transocean Polar Pioneer*	152,691.4 gallons	10 ppmw
06/09/15	Seattle, Washington	Maxum Petroleum	*Noble Discoverer*	200,093.0 gallons	10.1 ppmw
07/10/15	Dutch Harbor, Alaska	*Sisuaq* [2]	*Transocean Polar Pioneer*	159,803.0 gallons	9.3 ppmw
07/12/15	Dutch Harbor, Alaska	Delta Western	*Noble Discoverer*	112,300.3 gallons	9.3 ppmw
08/20/15	Chukchi Sea	*Aiviq* [3]	*Noble Discoverer*	105,000.0 gallons	8.2 ppmw
08/23/15	Chukchi Sea	*Aiviq* [3]	*Transocean Polar Pioneer*	299,743.0 gallons	8.2 ppmw
09/22/15	Chukchi Sea	*Aiviq* [3]	*Transocean Polar Pioneer*	158,000.0 gallons	8.2 ppmw
09/27/15	Chukchi Sea	*Aiviq* [3]	*Noble Discoverer*	105,668.0 gallons	8.2 ppmw
Total:				**1,293,298.7 gallons**	

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the *Noble Discoverer* was not anchored over the drill site and not considered a facility.

[2] Fuel volume transfer originated from purchase at Delta Western in Dutch Harbor, Alaska.

[3] Fuel volume transfer originated from bulk storage aboard the *Marika.*

Attachment 2 – Records of Fuel Deliveries

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 2
Records of Fuel Deliveries to Individual Support Vessels [2]

Volume and Date of Fuel Deliveries (Conditional Approval 18.b.)

Date	Location	Origin/Vendor	Destination	Volume
07/27/15	Chukchi Sea	*Marika*	*Harvey Sisuaq*	25,162.8 gallons
08/01/15	Dutch Harbor, Alaska	Delta Western	*Harvey Spirit*	30,000.0 gallons
08/04/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Supporter*	52,948.0 gallons
08/05/15	Dutch Harbor, Alaska	Delta Western	*Fennica*	237,754.8 gallons
08/10/15	Chukchi Sea	*Marika*	*Tor Viking*	90,161.3 gallons
08/15/15	Chukchi Sea	*Marika*	*Ross Chouest*	90,229.8 gallons
08/16/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Champion*	50,000.0 gallons
08/19/15	Chukchi Sea	*Marika*	*Ocean Wave*	117,069.0 gallons
08/20/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Spirit*	44,374.0 gallons
08/24/15	Chukchi Sea	*Marika*	*Aiviq*	39,332.3 gallons
08/30/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Supporter*	70,000.0 gallons
08/31/15	Chukchi Sea	*Marika*	*Harvey Explorer*	52,168.1 gallons
08/31/15	Chukchi Sea	*Marika*	*Marika* (Internal)	96,477.8 gallons
09/01/15	Chukchi Sea	*Marika*	*Nanuq*	137,826.5 gallons
09/01/15	Chukchi Sea	*Marika*	*Ocean Wind*	130,741.7 gallons
09/02/15	Dutch Harbor, Alaska	Delta Western	*Aiviq*	402,811.2 gallons
09/07/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Champion*	56,002.0 gallons
09/13/15	Chukchi Sea	*Marika*	*Ross Chouest*	12,004.9 gallons
09/16/15	Chukchi Sea	*Marika*	*Ross Chouest*	80,566.1 gallons
09/17/15	Chukchi Sea	*Marika*	*Harvey Sisuaq*	88,275.9 gallons
09/17/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Spirit*	52,000.0 gallons
09/19/15	Chukchi Sea	*Marika*	*Nordica*	170,406.0 gallons
09/20/15	Chukchi Sea	*Marika*	*Fenica*	152,781.0 gallons
09/21/15	Chukchi Sea	*Marika*	*Tor Viking*	95,569.8 gallons
09/21/15	Chukchi Sea	*Marika*	*Aiviq*	174,942.3 gallons
09/22/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Supporter*	54,000.0 gallons
09/28/15	Chukchi Sea	*Marika*	*Aiviq*	153,873.5 gallons
10/02/15	Dutch Harbor, Alaska	Offshore Supply Inc.	*Harvey Champion*	60,000.0 gallons
Total:				**2,817,478.7 gallons**

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the *Noble Discoverer* was not anchored over the drill site and not considered a facility.

[2] Fuel transfers may include fuel consumed inside and/or outside the 25-mile radius boundary of a drilling unit while operating as a facility.

Attachment 3 – Hours of Operation, Fuel Consumption, and Calculated Actual Emissions

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Oxides of Nitrogen (NO_X) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Cumulative Operation	Cumulative NO_X Emissions
MODU (*Noble Discoverer*)													
Generator Engines	5,287 kW	5.9 g/kW-hr	Vendor Data	0 gallons	0 tons	45,726 gallons	4.2 tons	25,992 gallons	2.4 tons	4,513 gallons	0.4 tons	76,231 gallons	6.9 tons
Propulsion Engine	5,184 kW	14.2 g/kW-hr	Vendor Data	0 gallons	0 tons	98 gallons	0.02 tons	100 gallons	0.02 tons	444 gallons	0.1 tons	642 gallons	0.1 tons
HPU Engine	145 kW	3.0 g/kW-hr	Source Test Data	0 hours	0 tons	0 hours	0 tons	1 hour	4.86E-04 tons	0 hours	0 tons	1 hour	4.86E-04 tons
HPU Engine	145 kW	3.0 g/kW-hr	Source Test Data	0 hours	0 tons	0 hours	0 tons	1 hour	4.86E-04 tons	0 hours	0 tons	1 hour	4.86E-04 tons
Port Deck Crane Engine	360 kW	3.6 g/kW-hr	Vendor Data	0 hours	0 tons	34 hours	0.05 tons	37 hours	0.05 tons	0 hours	0 tons	71 hours	0.1 tons
Starbd Deck Crane Engine	360 kW	3.6 g/kW-hr	Vendor Data	0 hours	0 tons	38 hours	0.05 tons	18 hours	0.03 tons	0 hours	0 tons	56 hours	0.08 tons
Cementing Unit Engine	200 kW	12.6 g/kW-hr	Source Test Data	0 hours	0 tons	3 hours	0.008 tons	0 hours	0 tons	0 hours	0 tons	3 hours	0.008 tons
Cementing Unit Engine	200 kW	12.6 g/kW-hr	Source Test Data	0 hours	0 tons	1 hour	0.003 tons	0 hours	0 tons	0 hours	0 tons	1 hour	0.003 tons
Logging Unit Engine	179 kW	4.0 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Compressor Engine	84 kW	14.8 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	7.5 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	405 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	17 hours	0.1 tons	16 hours	0.1 tons	0 hours	0 tons	33 hours	0.2 tons
Lifeboat No. 1 Engine	18 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.001 tons	2 hours	7.39E-04 tons	0 hours	0 tons	5 hours	0.002 tons
Lifeboat No. 2 Engine	18 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.001 tons	2 hours	7.39E-04 tons	0 hours	0 tons	5 hours	0.002 tons
Lifeboat No. 3 Engine	18 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.001 tons	2 hours	7.39E-04 tons	0 hours	0 tons	5 hours	0.002 tons
Lifeboat No. 4 Engine	18 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.001 tons	2 hours	7.39E-04 tons	0 hours	0 tons	5 hours	0.002 tons
Heat Boiler	8 MMBtu/hr	20.8 lb/kgal	Source Test Data	0 hours	0 tons	100 hours	0.06 tons	288 hours	0.2 tons	22 hours	0.01 tons	410 hours	0.3 tons
Heat Boiler	8 MMBtu/hr	20.8 lb/kgal	Source Test Data	0 hours	0 tons	427 hours	0.3 tons	24 hours	0.02 tons	39 hours	0.02 tons	490 hours	0.3 tons
Incinerator	276 lb/hr	3.2 lb/ton	Source Test Data	0 hours	0 tons	146 hours	0.03 tons	83 hours	0.02 tons	14 hours	0.003 tons	243 hours	0.05 tons
Total - *Noble Discoverer*					**0 tons**		**4.8 tons**		**2.8 tons**		**0.5 tons**		**8.1 tons**
MODU (*Transocean Polar Pioneer*)													
Generator Engines	11,000 kW	11.4 g/kW-hr	Source Test Data	45,856 gallons	8.0 tons	210,537 gallons	36.8 tons	217,680 gallons	38.1 tons	28,013 gallons	4.9 tons	502,086 gallons	87.9 tons
HPU Engine	149 kW	3.0 g/kW-hr	Source Test Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
HPU Engine	149 kW	3.0 g/kW-hr	Source Test Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Logging Unit Engine	179 kW	4.0 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	64 hours	0.05 tons	0 hours	0 tons	64 hours	0.05 tons
Compressor Engine	84 kW	14.8 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	7.5 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	896 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	1 hour	0.01 tons	5 hours	0.07 tons	4 hours	0.06 tons	0 hours	0 tons	10 hours	0.1 tons
Rescue Boat Engine	127 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.003 tons	5 hours	0.01 tons	4 hours	0.01 tons	0 hours	0 tons	10 hours	0.03 tons
Lifeboat No. 1 Engine	31 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	6.45E-04 tons	4 hours	0.003 tons	4 hours	0.003 tons	1 hour	6.45E-04 tons	10 hours	0.006 tons
Lifeboat No. 2 Engine	31 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	6.45E-04 tons	4 hours	0.003 tons	4 hours	0.003 tons	1 hour	6.45E-04 tons	10 hours	0.006 tons
Lifeboat No. 3 Engine	31 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	6.45E-04 tons	4 hours	0.003 tons	4 hours	0.003 tons	1 hour	6.45E-04 tons	10 hours	0.006 tons
Lifeboat No. 4 Engine	31 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	6.45E-04 tons	4 hours	0.003 tons	4 hours	0.003 tons	1 hour	6.45E-04 tons	10 hours	0.006 tons
Forward Fast Rescue Craft Engine	86 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.002 tons	4 hours	0.007 tons	3 hours	0.005 tons	1 hour	0.002 tons	9 hours	0.02 tons
Aft Fast Rescue Craft Engine	118 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.002 tons	4 hours	0.01 tons	3 hours	0.007 tons	1 hour	0.002 tons	9 hours	0.02 tons
Emergency Start Compressor Engine	7 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.36E-04 tons	2 hours	2.73E-04 tons	1 hour	1.36E-04 tons	1 hour	1.36E-04 tons	5 hours	6.82E-04 tons
Heat Boiler	14 MMBtu/hr	20.0 lb/kgal	Table 1.3-1, AP-42	120 hours	0.1 tons	740 hours	0.8 tons	720 hours	0.8 tons	96 hours	0.1 tons	1,676 hours	1.8 tons
Heat Boiler	14 MMBtu/hr	20.0 lb/kgal	Table 1.3-1, AP-42	168 hours	0.2 tons	740 hours	0.8 tons	720 hours	0.8 tons	96 hours	0.1 tons	1,724 hours	1.9 tons
Incinerator	220 lb/hr	3.2 lb/ton	Table 2.1-9, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Transocean Polar Pioneer*					**8.4 tons**		**38.6 tons**		**39.8 tons**		**5.1 tons**		**91.9 tons**
Ice management (*Fennica*)													
Propulsion and Generator Engines	16,800 kW	9.4 g/kW-hr	Source Test Data	0 gallons	0 tons	54,623 gallons	8.0 tons	79,590 gallons	11.6 tons	21,167 gallons	3.1 tons	155,380 gallons	22.6 tons
Harbour Set Generator Engine	424 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	16.0 lb/kgal	Source Test Data	0 hours	0 tons	211 hours	0.06 tons	564 hours	0.2 tons	81 hours	0.02 tons	856 hours	0.2 tons
Heat Boiler	4 MMBtu/hr	16.0 lb/kgal	Source Test Data	0 hours	0 tons	167 hours	0.05 tons	585 hours	0.2 tons	94 hours	0.03 tons	846 hours	0.2 tons
Incinerator	154 lb/hr	7.1 lb/ton	Source Test Data	0 hours	0 tons	41 hours	0.01 tons	105 hours	0.03 tons	29 hours	0.008 tons	175 hours	0.05 tons
Emergency Generator	240 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	4 hours	0.020 tons	4 hours	0.02 tons	1 hour	0.005 tons	9 hours	0.04 tons
Total - *Fennica*					**0 tons**		**8.1 tons**		**12.0 tons**		**3.1 tons**		**23.2 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Oxides of Nitrogen (NO_X) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Cumulative Operation	Cumulative NO_X Emissions
Ice Management (*Nordica*)													
Propulsion and Generator Engines	16,800 kW	9.4 g/kW-hr	Source Test Data	19,179 gallons	2.8 tons	81,950 gallons	11.9 tons	90,742 gallons	13.2 tons	12,123 gallons	1.8 tons	203,994 gallons	29.7 tons
Harbour Set Generator Engine	424 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	20.4 lb/kgal	Source Test Data	33 hours	0.01 tons	41 hours	0.01 tons	26 hours	0.009 tons	59 hours	0.02 tons	159 hours	0.05 tons
Heat Boiler	4 MMBtu/hr	20.4 lb/kgal	Source Test Data	143 hours	0.05 tons	576 hours	0.2 tons	550 hours	0.2 tons	77 hours	0.03 tons	1,346 hours	0.5 tons
Incinerator	154 lb/hr	1.8 lb/ton	Source Test Data	18 hours	0.001 tons	81 hours	0.006 tons	95 hours	0.007 tons	16 hours	0.001 tons	210 hours	0.01 tons
Emergency Generator	240 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0 tons	3 hours	0.01 tons	2 hours	0.01 tons	1 hour	0.005 tons	7 hours	0.03 tons
Total - *Nordica*					**2.9 tons**		**12.2 tons**		**13.4 tons**		**1.8 tons**		**30.3 tons**
Anchor Handler (*Aiviq*)													
Propulsion Engines	13,001 kW	8.1 g/kW-hr	Vendor Data	48,091 gallons	6.0 tons	113,951 gallons	14.2 tons	108,921 gallons	13.6 tons	19,682 gallons	2.5 tons	290,645 gallons	36.2 tons
Generator Engines	5,440 kW	7.6 g/kW-hr	Vendor Data	44,479 gallons	5.2 tons	114,640 gallons	13.4 tons	81,105 gallons	9.5 tons	11,447 gallons	1.3 tons	251,671 gallons	29.4 tons
Heat Boiler	5 MMBtu/hr	20.0 lb/kgal	Table 1.3-1, AP-42	123 hours	0.05 tons	651 hours	0.3 tons	552 hours	0.2 tons	72 hours	0.03 tons	1,398 hours	0.6 tons
Incinerator	276 lb/hr	4.1 lb/ton	Source Test Data	34 hours	0.01 tons	129 hours	0.04 tons	150 hours	0.04 tons	7 hours	0.002 tons	320 hours	0.09 tons
Emergency Generator #1	728 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	10 hours	0.12 tons	40 hours	0 tons	31 hours	0.36 tons	10 hours	0 tons	91 hours	1.07 tons
Emergency Generator #2	728 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	10 hours	0.12 tons	32 hours	0 tons	38 hours	0.45 tons	10 hours	0 tons	90 hours	1.05 tons
Fast Rescue Craft FP 800 Thruster	119 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	2 hours	0 tons	4 hours	0 tons	4 hours	0 tons	1 hour	0 tons	11 hours	0 tons
Delta Craft Main Propulsion	188 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0 tons	2 hours	0 tons	2 hours	0 tons	1 hour	0 tons	6 hours	0 tons
Delta Craft Main Propulsion	188 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0 tons	2 hours	0 tons	2 hours	0 tons	1 hour	0 tons	6 hours	0 tons
Fassemer 64 Mn Enclosed Lifeboat #1	23 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0 tons	2 hours	0 tons	2 hours	0 tons	1 hour	0 tons	6 hours	0 tons
Fassemer 64 Mn Enclosed Lifeboat #2	23 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0 tons	2 hours	0 tons	2 hours	0 tons	1 hour	0 tons	6 hours	0 tons
TranRec150 Power Pack Engine	152 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Aiviq*					**11.5 tons**		**28.8 tons**		**24.2 tons**		**4.1 tons**		**68.5 tons**
Anchor Handler (*Tor Viking*)													
Propulsion Engines	10,752 kW	8.2 g/kW-hr	Source Test Data	32,013 gallons	4.1 tons	85,773 gallons	10.9 tons	79,213 gallons	10.1 tons	25,130 gallons	3.2 tons	222,129 gallons	28.2 tons
Harbor Generator Engine	400 kW	9.8 g/kW-hr	Source Test Data	0 hours	0 tons	27 hours	0.1 tons	212 hours	0.9 tons	53 hours	0.2 tons	292 hours	1.3 tons
Harbor Generator Engine	400 kW	9.8 g/kW-hr	Source Test Data	0 hours	0 tons	28 hours	0.1 tons	202 hours	0.9 tons	81 hours	0.4 tons	311 hours	1.3 tons
Heat Boiler	1 MMBtu/hr	15.1 lb/kgal	Source Test Data	53 hours	0.004 tons	231 hours	0.02 tons	162 hours	0.01 tons	24 hours	0.002 tons	470 hours	0.04 tons
Emergency Generator	136 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.003 tons	7 hours	0.02 tons	4 hours	0.01 tons	1 hour	0.003 tons	13 hours	0.04 tons
Total - *Tor Viking*					**4.1 tons**		**11.2 tons**		**11.9 tons**		**3.8 tons**		**30.9 tons**
Anchor Handler (*Ross Chouest*)													
Propulsion and Generator Engines	10,023 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	52,571 gallons	11.8 tons	81,552 gallons	18.3 tons	13,125 gallons	3.0 tons	147,248 gallons	33.1 tons
Port Winch	573 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	1.2 tons	63 hours	0.6 tons	21 hours	0.2 tons	209 hours	1.9 tons
Starboard Winch	573 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	1.2 tons	53 hours	0.5 tons	21 hours	0.2 tons	199 hours	1.8 tons
Emergency Generator	256 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	0.005 tons	10 hours	0.05 tons	0 hours	0 tons	11 hours	0.06 tons
Total - *Ross Chouest*					**0 tons**		**14.1 tons**		**19.5 tons**		**3.3 tons**		**36.9 tons**
Support Tug (*Lauren Foss*)													
Propulsion Engines	4,896 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	650 gallons	0.1 tons	0 gallons	0 tons	0 gallons	0 tons	0 gallons	0 tons	650 gallons	0.1 tons
Generator	136 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.07 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.07 tons
Generator	136 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.07 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.07 tons
Emergency Generator	56 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.03 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.03 tons
Hydraulic Bow Thruster	299 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.1 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.1 tons
Total - *Lauren Foss*					**0.5 tons**		**0 tons**		**0 tons**		**0 tons**		**0.5 tons**
Support Tug (*Ocean Wind*)													
Propulsion Engines	6,496 kW	8.1 g/kW-hr	Vendor Data	29,180 gallons	3.6 tons	52,100 gallons	6.5 tons	31,548 gallons	3.9 tons	9,668 gallons	1.2 tons	122,496 gallons	15.3 tons
Harbor Generator Engine	272 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	147 hours	0.8 tons	644 hours	3.6 tons	720 hours	4.1 tons	96 hours	0.5 tons	1,607 hours	9.1 tons
Emergency Generator Engine	100 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.002 tons	30 hours	0.06 tons	4 hours	0.008 tons	1 hour	0.002 tons	36 hours	0.07 tons
Total - *Ocean Wind*					**4.5 tons**		**10.2 tons**		**8.0 tons**		**1.8 tons**		**24.4 tons**
Support Tug (*Ocean Wave*)													
Propulsion Engines	6,496 kW	8.1 g/kW-hr	Vendor Data	23,844 gallons	3.0 tons	52,982 gallons	6.6 tons	18,628 gallons	2.3 tons	16,484 gallons	2.1 tons	111,938 gallons	14.0 tons
Harbor Generator Engine	272 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	168 hours	0.9 tons	697 hours	3.9 tons	691 hours	3.9 tons	96 hours	0.5 tons	1,652 hours	9.3 tons
Emergency Generator Engine	100 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.002 tons	4 hours	0.008 tons	4 hours	0.008 tons	1 hour	0.002 tons	10 hours	0.02 tons
Total - *Ocean Wave*					**3.9 tons**		**10.6 tons**		**6.2 tons**		**2.6 tons**		**23.3 tons**

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Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Cumulative Operation	Cumulative NO_X Emissions
Science Vessel (*Harvey Explorer*)													
Propulsion Engines	2,699 kW	9.5 g/kW-hr	Source Test Data	6,271 gallons	0.9 tons	20,520 gallons	3.0 tons	21,694 gallons	3.2 tons	4,997 gallons	0.7 tons	53,482 gallons	7.8 tons
Starboard Generator Engine	275 kW	7.6 g/kW-hr	Source Test Data	124 hours	0.3 tons	254 hours	0.6 tons	251 hours	0.6 tons	52 hours	0.1 tons	681 hours	1.6 tons
Center Generator Engine	275 kW	7.6 g/kW-hr	Source Test Data	1 hour	0.002 tons	178 hours	0.4 tons	342 hours	0.8 tons	6 hours	0.01 tons	527 hours	1.2 tons
Port Generator Engine	275 kW	7.6 g/kW-hr	Source Test Data	93 hours	0.2 tons	400 hours	0.9 tons	220 hours	0.5 tons	90 hours	0.2 tons	803 hours	1.9 tons
Fwd/Port Bow Thruster	507 kW	4.4 g/kW-hr	Source Test Data	72 hours	0.2 tons	134 hours	0.3 tons	83 hours	0.2 tons	51 hours	0.1 tons	340 hours	0.8 tons
Aft/Starboard Bow Thruster	507 kW	4.4 g/kW-hr	Source Test Data	72 hours	0.2 tons	109 hours	0.3 tons	40 hours	0.1 tons	46 hours	0.1 tons	267 hours	0.7 tons
Stern Thruster	322 kW	4.4 g/kW-hr	Source Test Data	72 hours	0.1 tons	111 hours	0.2 tons	44 hours	0.07 tons	51 hours	0.08 tons	278 hours	0.4 tons
Emergency Generator Engine	79 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	5 hours	0.008 tons	2 hours	0.003 tons	1 hour	0.002 tons	8 hours	0.01 tons
FRC Outboard Engine	24 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.001 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.001 tons
Portable Emergy Bilge Pump	4 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Explorer*					**1.9 tons**		**5.7 tons**		**5.4 tons**		**1.4 tons**		**14.4 tons**
Science Vessel (*Sisuaq*) [3]													
Propulsion and Generator Engines	5,840 kW	7.1 g/kW-hr	Source Test Data	10,700 gallons	1.2 tons	44,900 gallons	4.9 tons	57,450 gallons	6.3 tons	5,700 gallons	0.6 tons	118,750 gallons	13.0 tons
Emergency Generator Engine	100 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.002 tons	2 hours	0.004 tons	6 hours	0.01 tons	1 hour	0.002 tons	10 hours	0.02 tons
Starboard Air Compressor Engine	269 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Port Air Compressor Engine	269 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
TranRec150 Power Pack	152 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.006 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.006 tons
AFT-DOP 250 Power Pack	59 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.002 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.002 tons
FWD-DOP 250 Power Pack	59 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.002 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.002 tons
Ocean Buster Power Pack	15 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	3.2 lb/ton	Table 2.1-9, AP-42	0 hours	0 tons	6 hours	4.18E-04 tons	2 hours	1.39E-04 tons	0 hours	0 tons	8 hours	5.57E-04 tons
Total - *Sisuaq*					**1.2 tons**		**4.9 tons**		**6.3 tons**		**0.6 tons**		**13.0 tons**
OSV (*Harvey Supporter*)													
Propulsion and Generator Engines	5,840 kW	7.1 g/kW-hr	Source Test Data	10,250 gallons	1.1 tons	20,250 gallons	2.2 tons	24,570 gallons	2.7 tons	7,550 gallons	0.8 tons	62,620 gallons	6.8 tons
Emergency Generator	100 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	0.002 tons	1 hour	0.002 tons	1 hour	0.002 tons	3 hours	0.006 tons
TranRec150 Power Pack	152 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	10 hours	0.03 tons	2 hours	0.006 tons	2 hours	0.006 tons	0 hours	0 tons	14 hours	0.04 tons
Power Pack	64 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	3.2 lb/ton	Table 2.1-9, AP-42	6 hours	4.18E-04 tons	12 hours	8.36E-04 tons	6 hours	4.18E-04 tons	0 hours	0 tons	24 hours	0.002 tons
Total - *Harvey Supporter*					**1.2 tons**		**2.2 tons**		**2.7 tons**		**0.8 tons**		**6.9 tons**
OSV (*Harvey Champion*) [4]													
Propulsion and Generator Engines	5,840 kW	7.1 g/kW-hr	Source Test Data	6,000 gallons	0.7 tons	28,662 gallons	3.1 tons	16,100 gallons	1.8 tons	0 gallons	0 tons	50,762 gallons	5.5 tons
Emergency Generator	100 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.004 tons	1 hour	0.002 tons	0 hours	0 tons	3 hours	0.006 tons
Incinerator	88 lb/hr	3.2 lb/ton	Table 2.1-9, AP-42	4 hours	2.79E-04 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	4 hours	2.79E-04 tons
Total - *Harvey Champion*					**0.7 tons**		**3.1 tons**		**1.8 tons**		**0 tons**		**5.6 tons**
MLC ROV System Vessel (*Harvey Spirit*) [5]													
Propulsion Engines	3,666 kW	16.9 g/kW-hr	Source Test Data	0 gallons	0 tons	14,050 gallons	3.7 tons	18,652 gallons	4.8 tons	2,900 gallons	0.8 tons	35,602 gallons	9.3 tons
Starboard Generator Engine	384 kW	12.2 g/kW-hr	Source Test Data	0 hours	0 tons	112 hours	0.6 tons	206 hours	1.1 tons	20 hours	0.1 tons	338 hours	1.7 tons
Center Generator Engine	384 kW	12.2 g/kW-hr	Source Test Data	0 hours	0 tons	33 hours	0.2 tons	83 hours	0.4 tons	28 hours	0.1 tons	144 hours	0.7 tons
Port Generator Engine	384 kW	12.2 g/kW-hr	Source Test Data	0 hours	0 tons	133 hours	0.7 tons	205 hours	1.1 tons	20 hours	0.1 tons	358 hours	1.8 tons
Starboard Bow Thruster	746 kW	5.3 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.5 tons	180 hours	0.8 tons	21 hours	0.09 tons	312 hours	1.4 tons
Port Bow Thruster	746 kW	5.3 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.5 tons	192 hours	0.8 tons	21 hours	0.09 tons	324 hours	1.4 tons
Stern Thruster	746 kW	5.3 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.5 tons	192 hours	0.8 tons	21 hours	0.09 tons	324 hours	1.4 tons
Emergency Generator Engine	79 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	0.002 tons	2 hours	0.003 tons	1 hour	0.002 tons	4 hours	0.007 tons
MLC ROV System Engine	800 kW	13.0 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Spirit*					**0 tons**		**6.5 tons**		**9.9 tons**		**1.4 tons**		**17.8 tons**

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Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Cumulative Operation	Cumulative NO_X Emissions
OSRV (*Nanuq*)													
Propulsion Engines	4,336 kW	7.2 g/kW-hr	Source Test Data	5,224 gallons	0.6 tons	50,260 gallons	5.6 tons	45,143 gallons	5.0 tons	6,114 gallons	0.7 tons	106,741 gallons	11.9 tons
Generator Engines	1,534 kW	10.9 g/kW-hr	Source Test Data	7,145 gallons	1.2 tons	39,278 gallons	6.6 tons	35,331 gallons	6.0 tons	4,172 gallons	0.7 tons	85,926 gallons	14.5 tons
Emergency Generator	133 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.003 tons	5 hours	0.01 tons	4 hours	0.01 tons	6 hours	0.02 tons	16 hours	0.04 tons
Lifeboat Propulsion Engine	17 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.60E-04 tons	5 hours	0.002 tons	4 hours	0.001 tons	1 hour	3.60E-04 tons	11 hours	0.004 tons
Backpack Blower	1 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
RubberMax Boom Power Pack	13 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	5.32E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.32E-04 tons
RubberMax Boom Power Pack	13 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.66E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.66E-04 tons
Power Pack	64 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.003 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.003 tons
Power Pack	4 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	8.68E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	8.68E-05 tons
Fire Boom Power Pack	4 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.74E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.74E-04 tons
Dispersant Pump	3 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	6.20E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	6.20E-05 tons
Water Pump	11 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.33E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.33E-04 tons
Water Pump	11 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.33E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.33E-04 tons
3" Pump	3 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	5.48E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	5.48E-05 tons
3" Pump	3 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	5.48E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	5.48E-05 tons
Portable Generator	5 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Pressure Washer	6 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.24E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.24E-04 tons
TranRec150 Power Pack	152 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.006 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.006 tons
Incinerator	125 lb/hr	3.2 lb/ton	Table 2.1-9, AP-42	0 hours	0 tons	286 hours	0.03 tons	243 hours	0.02 tons	63 hours	0.006 tons	592 hours	0.06 tons
Total - *Nanuq*					**1.8 tons**		**12.3 tons**		**11.0 tons**		**1.4 tons**		**26.5 tons**
OSR Workboats (*Kvichaks*)													
Kvichak No. 1 Propulsion Engine	179 kW	5.2 g/kW-hr	Source Test Data	3 hours	0.003 tons	70 hours	0.07 tons	65 hours	0.07 tons	0 hours	0 tons	138 hours	0.1 tons
Kvichak No. 1 Propulsion Engine	179 kW	5.2 g/kW-hr	Source Test Data	3 hours	0.003 tons	86 hours	0.09 tons	70 hours	0.07 tons	0 hours	0 tons	159 hours	0.2 tons
Kvichak No. 1 Generator Engine	7 kW	5.2 g/kW-hr	Source Test Data	3 hours	1.24E-04 tons	71 hours	0.003 tons	74 hours	0.003 tons	0 hours	0 tons	148 hours	0.006 tons
Kvichak No. 2 Propulsion Engine	179 kW	5.2 g/kW-hr	Source Test Data	3 hours	0.003 tons	92 hours	0.09 tons	68 hours	0.07 tons	0 hours	0 tons	163 hours	0.2 tons
Kvichak No. 2 Propulsion Engine	179 kW	5.2 g/kW-hr	Source Test Data	3 hours	0.003 tons	75 hours	0.08 tons	68 hours	0.07 tons	0 hours	0 tons	146 hours	0.2 tons
Kvichak No. 2 Generator Engine	7 kW	5.2 g/kW-hr	Source Test Data	3 hours	1.24E-04 tons	88 hours	0.004 tons	68 hours	0.003 tons	0 hours	0 tons	159 hours	0.007 tons
Kvichak No. 3 Propulsion Engine	179 kW	5.2 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	0.03 tons	16 hours	0.02 tons	0 hours	0 tons	47 hours	0.05 tons
Kvichak No. 3 Propulsion Engine	179 kW	5.2 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	0.03 tons	18 hours	0.02 tons	0 hours	0 tons	49 hours	0.05 tons
Kvichak No. 3 Generator Engine	7 kW	5.2 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	0.001 tons	2 hours	8.25E-05 tons	0 hours	0 tons	33 hours	0.001 tons
Total - *Kvichaks*					**0.01 tons**		**0.4 tons**		**0.3 tons**		**0 tons**		**0.7 tons**
OSR-T/B (*Guardsman /Klamath*)													
Propulsion Engines	4,299 kW	14.6 g/kW-hr	Table 3.4-1, AP-42	5,621 gallons	1.3 tons	32,858 gallons	7.4 tons	20,507 gallons	4.6 tons	0 gallons	0 tons	58,986 gallons	13.3 tons
Generator Engine	119 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.4 tons	720 hours	1.8 tons	474 hours	1.2 tons	0 hours	0 tons	1,338 hours	3.3 tons
Generator Engine	119 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.4 tons	744 hours	1.8 tons	249 hours	0.6 tons	0 hours	0 tons	1,137 hours	2.8 tons
TranRec150 Power Pack	152 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	0.003 tons	0 hours	0 tons	0 hours	0 tons	1 hour	0.003 tons
TranRec150 Power Pack	152 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	0.003 tons	0 hours	0 tons	0 hours	0 tons	1 hour	0.003 tons
Generator Engine	121 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Generator Engine	104 kW	18.8 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.007 tons	0 hours	0 tons	0 hours	0 tons	3 hours	0.007 tons
Total - *Guardsman/Klamath*					**2.0 tons**		**11.0 tons**		**6.4 tons**		**0 tons**		**19.4 tons**

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		Factor	Reference	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Operation	Calculated NO_X Emissions [7,8,9]	Cumulative Operation	Cumulative NO_X Emissions
Arctic Oil Storage Tanker (*Marika*) [6]													
Propulsion Engine	10,848 kW	11.1 g/kW-hr	Vendor Data	0 gallons	0 tons	6,611 gallons	1.1 tons	2,741 gallons	0.5 tons	0 gallons	0 tons	9,352 gallons	1.6 tons
Auxiliary Engines	3,456 kW	10.0 g/kW-hr	Vendor Data	5,036 gallons	0.8 tons	23,906 gallons	3.7 tons	22,059 gallons	3.4 tons	2,763 gallons	0.4 tons	53,764 gallons	8.3 tons
Emergency Generator	221 kW	9.9 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Auxiliary Boiler	25,000 kg/hr	20.0 lb/kgal	Table 1.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Composite Boiler	3,600 kg/hr	20.0 lb/kgal	Table 1.3-1, AP-42	169 hours	0.1 tons	664 hours	0.4 tons	673 hours	0.4 tons	91 hours	0.05 tons	1,597 hours	0.9 tons
Incinerator	238 lb/hr	3.2 lb/ton	Table 2.1-9, AP-42	16 hours	0.003 tons	24 hours	0.005 tons	24 hours	0.005 tons	7 hours	0.001 tons	71 hours	0.01 tons
Total - *Marika*					**0.9 tons**		**5.2 tons**		**4.3 tons**		**0.5 tons**		**10.8 tons**
Total - Support Vessels					**36.8 tons**		**146.6 tons**		**143.2 tons**		**26.6 tons**		**353.2 tons**

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the Noble Discoverer was not anchored over the drill site and not considered a facility.

[2] NO_X emissions are calculated without the application of a control efficiency for existing post-combustion control technology.

[3] The *Sisuaq* (similar to *Harvey Supporter*) served as the backup, second Science Vessel during the period.

[4] The *Harvey Champion* (similar to *Sisuaq*) served as the second offshore supply vessel (OSV) during the period.

[5] The *Harvey Spirit* served as an offshore supply vessel (OSV) during the period. No off-line MLC activity occurred on the *Harvey Spirit* during the period.

[6] The *Marika* served as the Arctic Oil Storage Tanker during the period. A notice of this vessel change from the *Affinity* was made by email to Mr. Johnston with BOEM from Mr. Horner with Shell on July 23, 2015.

[7] Conversion factors

453.592	g/lb
2,000	lb/ton
1.34	hp/kW
2.20462	lb/kg
34.5	lb (steam)/boiler hp-hour
33,446	BTU/boiler hp-hour

[8] Engine heat rate

7,000	BTU/hp-hr

[9] Diesel fuel energy

131,180	BTU/gal

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Carbon Monoxide (CO) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Cumulative Operation	Cumulative CO Emissions
MODU (*Noble Discoverer*)													
Generator Engines	5,287 kW	1.3 g/kW-hr	Vendor Data	0 gallons	0 tons	45,726 gallons	0.9 tons	25,992 gallons	0.5 tons	4,513 gallons	0.09 tons	76,231 gallons	1.5 tons
Propulsion Engine	5,184 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	98 gallons	0.005 tons	100 gallons	0.005 tons	444 gallons	0.02 tons	642 gallons	0.03 tons
HPU Engine	145 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	6.61E-04 tons	0 hours	0 tons	1 hour	6.61E-04 tons
HPU Engine	145 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	6.61E-04 tons	0 hours	0 tons	1 hour	6.61E-04 tons
Port Deck Crane Engine	360 kW	0.6 g/kW-hr	Vendor Data	0 hours	0 tons	34 hours	0.007 tons	37 hours	0.008 tons	0 hours	0 tons	71 hours	0.02 tons
Starbd Deck Crane Engine	360 kW	0.6 g/kW-hr	Vendor Data	0 hours	0 tons	38 hours	0.008 tons	18 hours	0.004 tons	0 hours	0 tons	56 hours	0.01 tons
Cementing Unit Engine	200 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.003 tons	0 hours	0 tons	0 hours	0 tons	3 hours	0.003 tons
Cementing Unit Engine	200 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	9.11E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	9.11E-04 tons
Logging Unit Engine	179 kW	3.5 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Compressor Engine	84 kW	9.9 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	5.0 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	405 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	17 hours	0.03 tons	16 hours	0.02 tons	0 hours	0 tons	33 hours	0.05 tons
Lifeboat No. 1 Engine	18 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	2.43E-04 tons	2 hours	1.62E-04 tons	0 hours	0 tons	5 hours	4.05E-04 tons
Lifeboat No. 2 Engine	18 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	2.43E-04 tons	2 hours	1.62E-04 tons	0 hours	0 tons	5 hours	4.05E-04 tons
Lifeboat No. 3 Engine	18 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	2.43E-04 tons	2 hours	1.62E-04 tons	0 hours	0 tons	5 hours	4.05E-04 tons
Lifeboat No. 4 Engine	18 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	2.43E-04 tons	2 hours	1.62E-04 tons	0 hours	0 tons	5 hours	4.05E-04 tons
Heat Boiler	8 MMBtu/hr	2.4 lb/kgal	Source Test Data	0 hours	0 tons	100 hours	0.007 tons	288 hours	0.02 tons	22 hours	0.002 tons	410 hours	0.03 tons
Heat Boiler	8 MMBtu/hr	2.4 lb/kgal	Source Test Data	0 hours	0 tons	427 hours	0.03 tons	24 hours	0.002 tons	39 hours	0.003 tons	490 hours	0.04 tons
Incinerator	276 lb/hr	10.8 lb/ton	Source Test Data	0 hours	0 tons	146 hours	0.1 tons	83 hours	0.06 tons	14 hours	0.01 tons	243 hours	0.2 tons
Total - *Noble Discoverer*					**0 tons**		**1.1 tons**		**0.6 tons**		**0.1 tons**		**1.9 tons**
MODU (*Transocean Polar Pioneer*)													
Generator Engines	11,000 kW	1.4 g/kW-hr	Source Test Data	45,856 gallons	1.0 tons	210,537 gallons	4.6 tons	217,680 gallons	4.8 tons	28,013 gallons	0.6 tons	502,086 gallons	11.0 tons
HPU Engine	149 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
HPU Engine	149 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Logging Unit Engine	179 kW	3.5 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	64 hours	0.04 tons	0 hours	0 tons	64 hours	0.04 tons
Compressor Engine	84 kW	9.9 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	5.0 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	896 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	1 hour	0.003 tons	5 hours	0.02 tons	4 hours	0.01 tons	0 hours	0 tons	10 hours	0.03 tons
Rescue Boat Engine	127 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	5.77E-04 tons	5 hours	0.003 tons	4 hours	0.002 tons	0 hours	0 tons	10 hours	0.006 tons
Lifeboat No. 1 Engine	31 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.41E-04 tons	4 hours	5.66E-04 tons	4 hours	5.66E-04 tons	1 hour	1.41E-04 tons	10 hours	0.001 tons
Lifeboat No. 2 Engine	31 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.41E-04 tons	4 hours	5.66E-04 tons	4 hours	5.66E-04 tons	1 hour	1.41E-04 tons	10 hours	0.001 tons
Lifeboat No. 3 Engine	31 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.41E-04 tons	4 hours	5.66E-04 tons	4 hours	5.66E-04 tons	1 hour	1.41E-04 tons	10 hours	0.001 tons
Lifeboat No. 4 Engine	31 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.41E-04 tons	4 hours	5.66E-04 tons	4 hours	5.66E-04 tons	1 hour	1.41E-04 tons	10 hours	0.001 tons
Forward Fast Rescue Craft Engine	86 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.92E-04 tons	4 hours	1.57E-03 tons	3 hours	1.18E-03 tons	1 hour	3.92E-04 tons	9 hours	0.004 tons
Aft Fast Rescue Craft Engine	118 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	5.36E-04 tons	4 hours	0.002 tons	3 hours	1.61E-03 tons	1 hour	5.36E-04 tons	9 hours	0.005 tons
Emergency Start Compressor Engine	7 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.99E-05 tons	2 hours	5.98E-05 tons	1 hour	2.99E-05 tons	1 hour	2.99E-05 tons	5 hours	1.50E-04 tons
Heat Boiler	14 MMBtu/hr	5.0 lb/kgal	Table 1.3-1, AP-42	120 hours	0.03 tons	740 hours	0.2 tons	720 hours	0.2 tons	96 hours	0.03 tons	1,676 hours	0.5 tons
Heat Boiler	14 MMBtu/hr	5.0 lb/kgal	Table 1.3-1, AP-42	168 hours	0.05 tons	740 hours	0.2 tons	720 hours	0.2 tons	96 hours	0.03 tons	1,724 hours	0.5 tons
Incinerator	220 lb/hr	0.3 lb/ton	Table 2.1-9, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Transocean Polar Pioneer*					**1.1 tons**		**5.0 tons**		**5.2 tons**		**0.7 tons**		**12.0 tons**
Ice management (*Fennica*)													
Propulsion and Generator Engines	16,800 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	54,623 gallons	2.8 tons	79,590 gallons	4.1 tons	21,167 gallons	1.1 tons	155,380 gallons	8.0 tons
Harbour Set Generator Engine	424 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.4 lb/kgal	Source Test Data	0 hours	0 tons	211 hours	0.001 tons	564 hours	0.004 tons	81 hours	5.38E-04 tons	856 hours	0.006 tons
Heat Boiler	4 MMBtu/hr	0.4 lb/kgal	Source Test Data	0 hours	0 tons	167 hours	0.001 tons	585 hours	0.004 tons	94 hours	6.25E-04 tons	846 hours	0.006 tons
Incinerator	154 lb/hr	29.9 lb/ton	Source Test Data	0 hours	0 tons	41 hours	0.05 tons	105 hours	0.1 tons	29 hours	0.03 tons	175 hours	0.2 tons
Emergency Generator	240 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	4 hours	0.004 tons	4 hours	0.004 tons	1 hour	0.001 tons	9 hours	0.01 tons
Total - *Fennica*					**0 tons**		**2.9 tons**		**4.2 tons**		**1.1 tons**		**8.2 tons**

Shell Gulf of Mexico Inc.
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Calculated Carbon Monoxide (CO) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Cumulative Operation	Cumulative CO Emissions
Ice Management (*Nordica*)													
Propulsion and Generator Engines	16,800 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	19,179 gallons	1.0 tons	81,950 gallons	4.2 tons	90,742 gallons	4.7 tons	12,123 gallons	0.6 tons	203,994 gallons	10.5 tons
Harbour Set Generator Engine	424 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.07 lb/kgal	Source Test Data	33 hours	4.00E-05 tons	41 hours	4.97E-05 tons	26 hours	3.15E-05 tons	59 hours	7.15E-05 tons	159 hours	1.93E-04 tons
Heat Boiler	4 MMBtu/hr	0.07 lb/kgal	Source Test Data	143 hours	1.73E-04 tons	576 hours	6.98E-04 tons	550 hours	6.66E-04 tons	77 hours	9.33E-05 tons	1,346 hours	0.002 tons
Incinerator	154 lb/hr	3.7 lb/ton	Source Test Data	18 hours	0.003 tons	81 hours	0.01 tons	95 hours	0.01 tons	16 hours	0.002 tons	210 hours	0.03 tons
Emergency Generator	240 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.001 tons	3 hours	0.003 tons	2 hours	0.002 tons	1 hour	0.001 tons	7 hours	0.008 tons
Total - *Nordica*					**1.0 tons**		**4.2 tons**		**4.7 tons**		**0.6 tons**		**10.6 tons**
Anchor Handler (*Aiviq*)													
Propulsion Engines	13,001 kW	0.5 g/kW-hr	Vendor Data	48,091 gallons	0.4 tons	113,951 gallons	0.9 tons	108,921 gallons	0.9 tons	19,682 gallons	0.2 tons	290,645 gallons	2.3 tons
Generator Engines	5,440 kW	1.7 g/kW-hr	Vendor Data	44,479 gallons	1.2 tons	114,640 gallons	3.1 tons	81,105 gallons	2.2 tons	11,447 gallons	0.3 tons	251,671 gallons	6.7 tons
Heat Boiler	5 MMBtu/hr	5.0 lb/kgal	Table 1.3-1, AP-42	123 hours	0.01 tons	651 hours	0.07 tons	552 hours	0.06 tons	72 hours	0.007 tons	1,398 hours	0.1 tons
Incinerator	276 lb/hr	11.1 lb/ton	Source Test Data	34 hours	0.03 tons	129 hours	0.1 tons	150 hours	0.1 tons	7 hours	0.005 tons	320 hours	0.2 tons
Emergency Generator #1	728 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	10 hours	0.027 tons	40 hours	0.1 tons	31 hours	0.083 tons	10 hours	0.03 tons	91 hours	0.24 tons
Emergency Generator #2	728 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	10 hours	0.027 tons	32 hours	0.09 tons	38 hours	0.102 tons	10 hours	0.03 tons	90 hours	0.24 tons
Fast Rescue Craft FP 800 Thruster	119 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	2 hours	0.001 tons	4 hours	0.002 tons	4 hours	0.002 tons	1 hour	5.44E-04 tons	11 hours	0.006 tons
Delta Craft Main Propulsion	188 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	8.57E-04 tons	2 hours	0.002 tons	2 hours	0.002 tons	1 hour	8.57E-04 tons	6 hours	0.005 tons
Delta Craft Main Propulsion	188 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	8.57E-04 tons	2 hours	0.002 tons	2 hours	0.002 tons	1 hour	8.57E-04 tons	6 hours	0.005 tons
Fassemer 64 Mn Enclosed Lifeboat #1	23 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.06E-04 tons	2 hours	2.12E-04 tons	2 hours	2.12E-04 tons	1 hour	1.06E-04 tons	6 hours	6.36E-04 tons
Fassemer 64 Mn Enclosed Lifeboat #2	23 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.06E-04 tons	2 hours	2.12E-04 tons	2 hours	2.12E-04 tons	1 hour	1.06E-04 tons	6 hours	6.36E-04 tons
TranRec150 Power Pack Engine	152 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Aiviq*					**1.7 tons**		**4.3 tons**		**3.4 tons**		**0.5 tons**		**9.9 tons**
Anchor Handler (*Tor Viking*)													
Propulsion Engines	10,752 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	32,013 gallons	1.6 tons	85,773 gallons	4.4 tons	79,213 gallons	4.1 tons	25,130 gallons	1.3 tons	222,129 gallons	11.4 tons
Harbor Generator Engine	400 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	27 hours	0.04 tons	212 hours	0.3 tons	53 hours	0.08 tons	292 hours	0.4 tons
Harbor Generator Engine	400 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	28 hours	0.04 tons	202 hours	0.3 tons	81 hours	0.1 tons	311 hours	0.5 tons
Heat Boiler	1 MMBtu/hr	5.0 lb/kgal	Table 1.3-1, AP-42	53 hours	0.001 tons	231 hours	0.006 tons	162 hours	0.004 tons	24 hours	6.27E-04 tons	470 hours	0.01 tons
Emergency Generator	136 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	6.20E-04 tons	7 hours	0.004 tons	4 hours	0.002 tons	1 hour	6.20E-04 tons	13 hours	0.008 tons
Total - *Tor Viking*					**1.7 tons**		**4.5 tons**		**4.7 tons**		**1.5 tons**		**12.4 tons**
Anchor Handler (*Ross Chouest*)													
Propulsion and Generator Engines	10,023 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	52,571 gallons	2.7 tons	81,552 gallons	4.2 tons	13,125 gallons	0.7 tons	147,248 gallons	7.6 tons
Port Winch	573 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.3 tons	63 hours	0.1 tons	21 hours	0.04 tons	209 hours	0.4 tons
Starboard Winch	573 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.3 tons	53 hours	0.1 tons	21 hours	0.04 tons	199 hours	0.4 tons
Emergency Generator	256 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	0.001 tons	10 hours	0.01 tons	0 hours	0 tons	11 hours	0.01 tons
Total - *Ross Chouest*					**0 tons**		**3.2 tons**		**4.5 tons**		**0.8 tons**		**8.5 tons**
Support Tug (*Lauren Foss*)													
Propulsion Engines	4,896 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	650 gallons	0.03 tons	0 gallons	0 tons	0 gallons	0 tons	0 gallons	0 tons	650 gallons	0.03 tons
Generator	136 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.01 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.01 tons
Generator	136 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.01 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.01 tons
Emergency Generator	56 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.006 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.006 tons
Hydraulic Bow Thruster	299 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.03 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.03 tons
Total - *Lauren Foss*					**0.1 tons**		**0 tons**		**0 tons**		**0 tons**		**0.1 tons**
Support Tug (*Ocean Wind*)													
Propulsion Engines	6,496 kW	0.5 g/kW-hr	Vendor Data	29,180 gallons	0.2 tons	52,100 gallons	0.4 tons	31,548 gallons	0.2 tons	9,668 gallons	0.08 tons	122,496 gallons	1.0 tons
Harbor Generator Engine	272 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	147 hours	0.2 tons	644 hours	0.8 tons	720 hours	0.9 tons	96 hours	0.1 tons	1,607 hours	2.0 tons
Emergency Generator Engine	100 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.56E-04 tons	30 hours	0.01 tons	4 hours	0.002 tons	1 hour	4.56E-04 tons	36 hours	0.02 tons
Total - *Ocean Wind*					**0.4 tons**		**1.2 tons**		**1.1 tons**		**0.2 tons**		**3.0 tons**
Support Tug (*Ocean Wave*)													
Propulsion Engines	6,496 kW	0.5 g/kW-hr	Vendor Data	23,844 gallons	0.2 tons	52,982 gallons	0.4 tons	18,628 gallons	0.1 tons	16,484 gallons	0.1 tons	111,938 gallons	0.9 tons
Harbor Generator Engine	272 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	168 hours	0.2 tons	697 hours	0.9 tons	691 hours	0.9 tons	96 hours	0.1 tons	1,652 hours	2.0 tons
Emergency Generator Engine	100 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.56E-04 tons	4 hours	0.002 tons	4 hours	1.82E-03 tons	1 hour	4.56E-04 tons	10 hours	4.56E-03 tons
Total - *Ocean Wave*					**0.4 tons**		**1.3 tons**		**1.0 tons**		**0.2 tons**		**2.9 tons**

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		Factor	Reference	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Cumulative Operation	Cumulative CO Emissions
Science Vessel (*Harvey Explorer*)													
Propulsion Engines	2,699 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	6,271 gallons	0.3 tons	20,520 gallons	1.1 tons	21,694 gallons	1.1 tons	4,997 gallons	0.3 tons	53,482 gallons	2.8 tons
Starboard Generator Engine	275 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	124 hours	0.2 tons	254 hours	0.3 tons	251 hours	0.3 tons	52 hours	0.07 tons	681 hours	0.9 tons
Center Generator Engine	275 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	0.001 tons	178 hours	0.2 tons	342 hours	0.4 tons	6 hours	0.008 tons	527 hours	0.7 tons
Port Generator Engine	275 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	93 hours	0.1 tons	400 hours	0.5 tons	220 hours	0.3 tons	90 hours	0.1 tons	803 hours	1.0 tons
Fwd/Port Bow Thruster	507 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	72 hours	0.1 tons	134 hours	0.3 tons	83 hours	0.2 tons	51 hours	0.1 tons	340 hours	0.6 tons
Aft/Starboard Bow Thruster	507 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	72 hours	0.1 tons	109 hours	0.2 tons	40 hours	0.07 tons	46 hours	0.09 tons	267 hours	0.5 tons
Stern Thruster	322 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	72 hours	0.1 tons	111 hours	0.2 tons	44 hours	0.06 tons	51 hours	0.07 tons	278 hours	0.4 tons
Emergency Generator Engine	79 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	5 hours	0.002 tons	2 hours	7.22E-04 tons	1 hour	3.61E-04 tons	8 hours	0.003 tons
FRC Outboard Engine	24 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	2.18E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	2.18E-04 tons
Portable Emergy Bilge Pump	4 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Explorer*					**1.0 tons**		**2.7 tons**		**2.4 tons**		**0.7 tons**		**6.8 tons**
Science Vessel (*Sisuaq*) [3]													
Propulsion and Generator Engines	5,840 kW	1.2 g/kW-hr	Source Test Data	10,700 gallons	0.2 tons	44,900 gallons	0.8 tons	57,450 gallons	1.1 tons	5,700 gallons	0.1 tons	118,750 gallons	2.2 tons
Emergency Generator Engine	100 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.56E-04 tons	2 hours	9.11E-04 tons	6 hours	0.003 tons	1 hour	4.56E-04 tons	10 hours	0.005 tons
Starboard Air Compressor Engine	269 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Port Air Compressor Engine	269 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
TranRec150 Power Pack	152 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.001 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.001 tons
AFT-DOP 250 Power Pack	59 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	5.33E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.33E-04 tons
FWD-DOP 250 Power Pack	59 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	5.33E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.33E-04 tons
Ocean Buster Power Pack	15 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	0.3 lb/ton	Table 2.1-9, AP-42	0 hours	0 tons	6 hours	3.96E-05 tons	2 hours	1.32E-05 tons	0 hours	0 tons	8 hours	5.27E-05 tons
Total - *Sisuaq*					**0.2 tons**		**0.8 tons**		**1.1 tons**		**0.1 tons**		**2.2 tons**
OSV (*Harvey Supporter*)													
Propulsion and Generator Engines	5,840 kW	1.2 g/kW-hr	Source Test Data	10,250 gallons	0.2 tons	20,250 gallons	0.4 tons	24,570 gallons	0.5 tons	7,550 gallons	0.1 tons	62,620 gallons	1.2 tons
Emergency Generator	100 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	4.56E-04 tons	1 hour	4.56E-04 tons	1 hour	4.56E-04 tons	3 hours	1.37E-03 tons
TranRec150 Power Pack	152 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	10 hours	0.007 tons	2 hours	0.001 tons	2 hours	0.001 tons	0 hours	0 tons	14 hours	0.01 tons
Power Pack	64 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	0.3 lb/ton	Table 2.1-9, AP-42	6 hours	3.96E-05 tons	12 hours	7.91E-05 tons	6 hours	3.96E-05 tons	0 hours	0 tons	24 hours	1.58E-04 tons
Total - *Harvey Supporter*					**0.2 tons**		**0.4 tons**		**0.5 tons**		**0.1 tons**		**1.2 tons**
OSV (*Harvey Champion*) [4]													
Propulsion and Generator Engines	5,840 kW	1.2 g/kW-hr	Source Test Data	6,000 gallons	0.1 tons	28,662 gallons	0.5 tons	16,100 gallons	0.3 tons	0 gallons	0 tons	50,762 gallons	1.0 tons
Emergency Generator	100 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	9.11E-04 tons	1 hour	4.56E-04 tons	0 hours	0 tons	3 hours	0.001 tons
Incinerator	88 lb/hr	0.3 lb/ton	Table 2.1-9, AP-42	4 hours	2.64E-05 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	4 hours	2.64E-05 tons
Total - *Harvey Champion*					**0.1 tons**		**0.5 tons**		**0.3 tons**		**0 tons**		**1.0 tons**
MLC ROV System Vessel (*Harvey Spirit*) [5]													
Propulsion Engines	3,666 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	14,050 gallons	0.7 tons	18,652 gallons	1.0 tons	2,900 gallons	0.1 tons	35,602 gallons	1.8 tons
Starboard Generator Engine	384 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	112 hours	0.2 tons	206 hours	0.3 tons	20 hours	0.03 tons	338 hours	0.5 tons
Center Generator Engine	384 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	33 hours	0.05 tons	83 hours	0.1 tons	28 hours	0.04 tons	144 hours	0.2 tons
Port Generator Engine	384 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	133 hours	0.2 tons	205 hours	0.3 tons	20 hours	0.03 tons	358 hours	0.5 tons
Starboard Bow Thruster	746 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	111 hours	0.3 tons	180 hours	0.5 tons	21 hours	0.06 tons	312 hours	0.9 tons
Port Bow Thruster	746 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	111 hours	0.3 tons	192 hours	0.5 tons	21 hours	0.06 tons	324 hours	0.9 tons
Stern Thruster	746 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	111 hours	0.3 tons	192 hours	0.5 tons	21 hours	0.06 tons	324 hours	0.9 tons
Emergency Generator Engine	79 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.61E-04 tons	2 hours	7.22E-04 tons	1 hour	3.61E-04 tons	4 hours	0.001 tons
MLC ROV System Engine	800 kW	0.7 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Spirit*					**0 tons**		**2.0 tons**		**3.2 tons**		**0.4 tons**		**5.7 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Carbon Monoxide (CO) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Cumulative Operation	Cumulative CO Emissions
OSRV (*Nanuq*)													
Propulsion Engines	4,336 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	5,224 gallons	0.3 tons	50,260 gallons	2.6 tons	45,143 gallons	2.3 tons	6,114 gallons	0.3 tons	106,741 gallons	5.5 tons
Generator Engines	1,534 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	7,145 gallons	0.4 tons	39,278 gallons	2.0 tons	35,331 gallons	1.8 tons	4,172 gallons	0.2 tons	85,926 gallons	4.4 tons
Emergency Generator	133 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	6.05E-04 tons	5 hours	0.003 tons	4 hours	0.002 tons	6 hours	0.004 tons	16 hours	0.01 tons
Lifeboat Propulsion Engine	17 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	1 hour	7.89E-05 tons	5 hours	3.94E-04 tons	4 hours	3.16E-04 tons	1 hour	7.89E-05 tons	11 hours	8.68E-04 tons
Backpack Blower	1 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
RubberMax Boom Power Pack	13 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.17E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.17E-04 tons
RubberMax Boom Power Pack	13 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	5.83E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	5.83E-05 tons
Power Pack	64 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	5.83E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.83E-04 tons
Power Pack	4 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.90E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.90E-05 tons
Fire Boom Power Pack	4 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	3.81E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	3.81E-05 tons
Dispersant Pump	3 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.36E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.36E-05 tons
Water Pump	11 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	5.10E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	5.10E-05 tons
Water Pump	11 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	5.10E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	5.10E-05 tons
3" Pump	3 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.20E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.20E-05 tons
3" Pump	3 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.20E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.20E-05 tons
Portable Generator	5 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Pressure Washer	6 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.72E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.72E-05 tons
TranRec150 Power Pack	152 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	0.001 tons	0 hours	0 tons	0 hours	0 tons	2 hours	0.001 tons
Incinerator	125 lb/hr	0.3 lb/ton	Table 2.1-9, AP-42	0 hours	0 tons	286 hours	0.003 tons	243 hours	0.002 tons	63 hours	5.89E-04 tons	592 hours	0.006 tons
Total - *Nanuq*					**0.6 tons**		**4.6 tons**		**4.2 tons**		**0.5 tons**		**9.9 tons**
OSR Workboats (*Kvichaks*)													
Kvichak No. 1 Propulsion Engine	179 kW	1.5 g/kW-hr	Source Test Data	3 hours	8.88E-04 tons	70 hours	0.02 tons	65 hours	0.02 tons	0 hours	0 tons	138 hours	0.04 tons
Kvichak No. 1 Propulsion Engine	179 kW	1.5 g/kW-hr	Source Test Data	3 hours	8.88E-04 tons	86 hours	0.03 tons	70 hours	0.02 tons	0 hours	0 tons	159 hours	0.05 tons
Kvichak No. 1 Generator Engine	7 kW	1.5 g/kW-hr	Source Test Data	3 hours	3.55E-05 tons	71 hours	8.41E-04 tons	74 hours	8.77E-04 tons	0 hours	0 tons	148 hours	0.002 tons
Kvichak No. 2 Propulsion Engine	179 kW	1.5 g/kW-hr	Source Test Data	3 hours	8.88E-04 tons	92 hours	0.03 tons	68 hours	0.02 tons	0 hours	0 tons	163 hours	0.05 tons
Kvichak No. 2 Propulsion Engine	179 kW	1.5 g/kW-hr	Source Test Data	3 hours	8.88E-04 tons	75 hours	0.02 tons	68 hours	0.02 tons	0 hours	0 tons	146 hours	0.04 tons
Kvichak No. 2 Generator Engine	7 kW	1.5 g/kW-hr	Source Test Data	3 hours	3.55E-05 tons	88 hours	0.001 tons	68 hours	8.06E-04 tons	0 hours	0 tons	159 hours	0.002 tons
Kvichak No. 3 Propulsion Engine	179 kW	1.5 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	0.009 tons	16 hours	0.005 tons	0 hours	0 tons	47 hours	0.01 tons
Kvichak No. 3 Propulsion Engine	179 kW	1.5 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	0.009 tons	18 hours	0.005 tons	0 hours	0 tons	49 hours	0.01 tons
Kvichak No. 3 Generator Engine	7 kW	1.5 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	3.67E-04 tons	2 hours	2.37E-05 tons	0 hours	0 tons	33 hours	3.91E-04 tons
Total - *Kvichaks*					**0.004 tons**		**0.1 tons**		**0.09 tons**		**0 tons**		**0.2 tons**
OSR-T/B (*Guardsman /Klamath*)													
Propulsion Engines	4,299 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	5,621 gallons	0.3 tons	32,858 gallons	1.7 tons	20,507 gallons	1.1 tons	0 gallons	0 tons	58,986 gallons	3.0 tons
Generator Engine	119 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.08 tons	720 hours	0.4 tons	474 hours	0.3 tons	0 hours	0 tons	1,338 hours	0.7 tons
Generator Engine	119 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.08 tons	744 hours	0.4 tons	249 hours	0.1 tons	0 hours	0 tons	1,137 hours	0.6 tons
TranRec150 Power Pack	152 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	6.93E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	6.93E-04 tons
TranRec150 Power Pack	152 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	6.93E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	6.93E-04 tons
Generator Engine	121 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Generator Engine	104 kW	4.1 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.001 tons	0 hours	0 tons	0 hours	0 tons	3 hours	0.001 tons
Total - *Guardsman/Klamath*					**0.4 tons**		**2.5 tons**		**1.5 tons**		**0 tons**		**4.4 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Carbon Monoxide (CO) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Operation	Calculated CO Emissions [7,8,9]	Cumulative Operation	Cumulative CO Emissions
Arctic Oil Storage Tanker (*Marika*) [6]													
Propulsion Engine	10,848 kW	3.3 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	6,611 gallons	0.3 tons	2,741 gallons	0.1 tons	0 gallons	0 tons	9,352 gallons	0.5 tons
Auxiliary Engines	3,456 kW	0.8 g/kW-hr	Vendor Data	5,036 gallons	0.06 tons	23,906 gallons	0.3 tons	22,059 gallons	0.3 tons	2,763 gallons	0.03 tons	53,764 gallons	0.7 tons
Emergency Generator	221 kW	3.2 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Auxiliary Boiler	25,000 kg/hr	5.0 lb/kgal	Table 1.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Composite Boiler	3,600 kg/hr	5.0 lb/kgal	Table 1.3-1, AP-42	169 hours	0.02 tons	664 hours	0.1 tons	673 hours	0.1 tons	91 hours	0.01 tons	1,597 hours	0.2 tons
Incinerator	238 lb/hr	0.3 lb/ton	Table 2.1-9, AP-42	16 hours	2.85E-04 tons	24 hours	4.27E-04 tons	24 hours	4.27E-04 tons	7 hours	1.25E-04 tons	71 hours	0.001 tons
Total - *Marika*					**0.09 tons**		**0.7 tons**		**0.5 tons**		**0.05 tons**		**1.4 tons**
Total - Support Vessels					**7.9 tons**		**36.2 tons**		**37.3 tons**		**6.9 tons**		**88.3 tons**

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the Noble Discoverer was not anchored over the drill site and not considered a facility.

[2] CO emissions are calculated without the application of a control efficiency for existing post-combustion control technology.

[3] The *Sisuaq* (similar to *Harvey Supporter*) served as the backup, second Science Vessel during the period.

[4] The *Harvey Champion* (similar to *Sisuaq*) served as the second offshore supply vessel (OSV) during the period.

[5] The *Harvey Spirit* served as an offshore supply vessel (OSV) during the period. No off-line MLC activity occurred on the *Harvey Spirit* during the period.

[6] The *Marika* served as the Arctic Oil Storage Tanker during the period. A notice of this vessel change from the *Affinity* was made by email to Mr. Johnston with BOEM from Mr. Horner with Shell on July 23, 2015.

[7] Conversion factors

453.592	g/lb
2,000	lb/ton
1.34	hp/kW
2.20462	lb/kg
34.5	lb (steam)/boiler hp-hour
33,446	BTU/boiler hp-hour

[8] Engine heat rate

7,000	BTU/hp-hr

[9] Diesel fuel energy

131,180	BTU/gal

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Particulate Matter Less Than 10 Microns (PM_{10}) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Cumulative Operation	Cumulative PM_{10} Emissions
MODU (*Noble Discoverer*)													
Generator Engines	5,287 kW	0.2 g/kW-hr	Vendor Data	0 gallons	0 tons	45,726 gallons	0.1 tons	25,992 gallons	0.08 tons	4,513 gallons	0.01 tons	76,231 gallons	0.2 tons
Propulsion Engine	5,184 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	98 gallons	6.04E-04 tons	100 gallons	6.17E-04 tons	444 gallons	0.003 tons	642 gallons	0.004 tons
HPU Engine	145 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	2.08E-04 tons	0 hours	0 tons	1 hour	2.08E-04 tons
HPU Engine	145 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	2.08E-04 tons	0 hours	0 tons	1 hour	2.08E-04 tons
Port Deck Crane Engine	360 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	34 hours	0.001 tons	37 hours	0.001 tons	0 hours	0 tons	71 hours	0.003 tons
Starbd Deck Crane Engine	360 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	38 hours	0.002 tons	18 hours	7.14E-04 tons	0 hours	0 tons	56 hours	0.002 tons
Cementing Unit Engine	200 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	8.60E-04 tons	0 hours	0 tons	0 hours	0 tons	3 hours	8.60E-04 tons
Cementing Unit Engine	200 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.87E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.87E-04 tons
Logging Unit Engine	179 kW	0.2 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Compressor Engine	84 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	0.4 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	405 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	17 hours	0.003 tons	16 hours	0.003 tons	0 hours	0 tons	33 hours	0.006 tons
Lifeboat No. 1 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Lifeboat No. 2 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Lifeboat No. 3 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Lifeboat No. 4 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Heat Boiler	8 MMBtu/hr	0.3 lb/kgal	Source Test Data	0 hours	0 tons	100 hours	9.11E-04 tons	288 hours	0.003 tons	22 hours	2.00E-04 tons	410 hours	0.004 tons
Heat Boiler	8 MMBtu/hr	0.3 lb/kgal	Source Test Data	0 hours	0 tons	427 hours	0.004 tons	24 hours	2.19E-04 tons	39 hours	3.55E-04 tons	490 hours	0.004 tons
Incinerator	276 lb/hr	6.9 lb/ton	Source Test Data	0 hours	0 tons	146 hours	0.07 tons	83 hours	0.04 tons	14 hours	0.007 tons	243 hours	0.1 tons
Total - *Noble Discoverer*					**0 tons**		**0.2 tons**		**0.1 tons**		**0.02 tons**		**0.4 tons**
MODU (*Transocean Polar Pioneer*)													
Generator Engines	11,000 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	45,856 gallons	0.3 tons	210,537 gallons	1.3 tons	217,680 gallons	1.3 tons	28,013 gallons	0.2 tons	502,086 gallons	3.1 tons
HPU Engine	149 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
HPU Engine	149 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Logging Unit Engine	179 kW	0.2 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	64 hours	0.003 tons	0 hours	0 tons	64 hours	0.003 tons
Compressor Engine	84 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	0.4 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	896 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	1 hour	3.95E-04 tons	5 hours	0.002 tons	4 hours	0.002 tons	0 hours	0 tons	10 hours	0.004 tons
Rescue Boat Engine	127 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.81E-04 tons	5 hours	9.07E-04 tons	4 hours	7.25E-04 tons	0 hours	0 tons	10 hours	0.002 tons
Lifeboat No. 1 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Lifeboat No. 2 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Lifeboat No. 3 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Lifeboat No. 4 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Forward Fast Rescue Craft Engine	86 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.23E-04 tons	4 hours	4.93E-04 tons	3 hours	3.70E-04 tons	1 hour	1.23E-04 tons	9 hours	0.001 tons
Aft Fast Rescue Craft Engine	118 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.69E-04 tons	4 hours	6.74E-04 tons	3 hours	5.06E-04 tons	1 hour	1.69E-04 tons	9 hours	0.002 tons
Emergency Start Compressor Engine	7 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	9.41E-06 tons	2 hours	1.88E-05 tons	1 hour	9.41E-06 tons	1 hour	9.41E-06 tons	5 hours	4.71E-05 tons
Heat Boiler	14 MMBtu/hr	3.3 lb/kgal	Table 1.3-1, AP-42	120 hours	0.02 tons	740 hours	0.1 tons	720 hours	0.1 tons	96 hours	0.02 tons	1,676 hours	0.3 tons
Heat Boiler	14 MMBtu/hr	3.3 lb/kgal	Table 1.3-1, AP-42	168 hours	0.03 tons	740 hours	0.1 tons	720 hours	0.1 tons	96 hours	0.02 tons	1,724 hours	0.3 tons
Incinerator	220 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Transocean Polar Pioneer*					**0.3 tons**		**1.6 tons**		**1.6 tons**		**0.2 tons**		**3.7 tons**
Ice management (*Fennica*)													
Propulsion and Generator Engines	16,800 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	54,623 gallons	0.3 tons	79,590 gallons	0.5 tons	21,167 gallons	0.1 tons	155,380 gallons	1.0 tons
Harbour Set Generator Engine	424 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	0 hours	0 tons	211 hours	0.002 tons	564 hours	0.005 tons	81 hours	6.85E-04 tons	856 hours	0.007 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	0 hours	0 tons	167 hours	0.001 tons	585 hours	0.005 tons	94 hours	7.95E-04 tons	846 hours	0.007 tons
Incinerator	154 lb/hr	17.0 lb/ton	Source Test Data	0 hours	0 tons	41 hours	0.03 tons	105 hours	0.07 tons	29 hours	0.02 tons	175 hours	0.1 tons
Emergency Generator	240 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	4 hours	1.38E-03 tons	4 hours	0.001 tons	1 hour	3.44E-04 tons	9 hours	3.10E-03 tons
Total - *Fennica*					**0 tons**		**0.4 tons**		**0.6 tons**		**0.2 tons**		**1.1 tons**

Shell Gulf of Mexico Inc.
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2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Particulate Matter Less Than 10 Microns (PM_{10}) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Cumulative Operation	Cumulative PM_{10} Emissions
Ice Management (*Nordica*)													
Propulsion and Generator Engines	16,800 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	19,179 gallons	0.1 tons	81,950 gallons	0.5 tons	90,742 gallons	0.6 tons	12,123 gallons	0.1 tons	203,994 gallons	1.3 tons
Harbour Set Generator Engine	424 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	33 hours	2.79E-04 tons	41 hours	3.47E-04 tons	26 hours	2.20E-04 tons	59 hours	4.99E-04 tons	159 hours	0.001 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	143 hours	0.001 tons	576 hours	0.005 tons	550 hours	0.005 tons	77 hours	6.52E-04 tons	1,346 hours	0.01 tons
Incinerator	154 lb/hr	17.0 lb/ton	Source Test Data	18 hours	1.18E-02 tons	81 hours	0.05 tons	95 hours	0.06 tons	16 hours	0.01 tons	210 hours	0.1 tons
Emergency Generator	240 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.44E-04 tons	3 hours	1.03E-03 tons	2 hours	6.88E-04 tons	1 hour	3.44E-04 tons	7 hours	0.002 tons
Total - *Nordica*					**0.1 tons**		**0.6 tons**		**0.6 tons**		**0.09 tons**		**1.4 tons**
Anchor Handler (*Aiviq*)													
Propulsion Engines	13,001 kW	0.3 g/kW-hr	Source Test Data	48,091 gallons	0.2 tons	113,951 gallons	0.4 tons	108,921 gallons	0.4 tons	19,682 gallons	0.1 tons	290,645 gallons	1.1 tons
Generator Engines	5,440 kW	0.2 g/kW-hr	Vendor Data	44,479 gallons	0.1 tons	114,640 gallons	0.4 tons	81,105 gallons	0.3 tons	11,447 gallons	0.04 tons	251,671 gallons	0.8 tons
Heat Boiler	5 MMBtu/hr	3.3 g/kW-hr	Table 1.3-1, AP-42	123 hours	8.12E-03 tons	651 hours	0.04 tons	552 hours	0.04 tons	72 hours	0.005 tons	1,398 hours	0.09 tons
Incinerator	276 lb/hr	18.0 lb/ton	Source Test Data	34 hours	4.22E-02 tons	129 hours	0.2 tons	150 hours	0.2 tons	7 hours	0.009 tons	320 hours	0.4 tons
Emergency Generator #1	728 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10 hours	3.21E-03 tons	40 hours	0.01 tons	31 hours	0.01 tons	10 hours	0.003 tons	91 hours	0.03 tons
Emergency Generator #2	728 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10 hours	3.21E-03 tons	32 hours	0.01 tons	38 hours	0.012 tons	10 hours	0.003 tons	90 hours	0.03 tons
Fast Rescue Craft FP 800 Thruster	119 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	2 hours	3.42E-04 tons	4 hours	6.84E-04 tons	4 hours	6.84E-04 tons	1 hour	1.71E-04 tons	11 hours	0.002 tons
Delta Craft Main Propulsion	188 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.69E-04 tons	2 hours	5.39E-04 tons	2 hours	5.39E-04 tons	1 hour	2.69E-04 tons	6 hours	1.62E-03 tons
Delta Craft Main Propulsion	188 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.69E-04 tons	2 hours	5.39E-04 tons	2 hours	5.39E-04 tons	1 hour	2.69E-04 tons	6 hours	1.62E-03 tons
Fassemer 64 Mn Enclosed Lifeboat #1	23 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.34E-05 tons	2 hours	6.67E-05 tons	2 hours	6.67E-05 tons	1 hour	3.34E-05 tons	6 hours	2.00E-04 tons
Fassemer 64 Mn Enclosed Lifeboat #2	23 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.34E-05 tons	2 hours	6.67E-05 tons	2 hours	6.67E-05 tons	1 hour	3.34E-05 tons	6 hours	2.00E-04 tons
TranRec150 Power Pack Engine	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Aiviq*					**0.4 tons**		**1.0 tons**		**0.9 tons**		**0.1 tons**		**2.5 tons**
Anchor Handler (*Tor Viking*)													
Propulsion Engines	10,752 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	32,013 gallons	0.2 tons	85,773 gallons	0.5 tons	79,213 gallons	0.5 tons	25,130 gallons	0.2 tons	222,129 gallons	1.4 tons
Harbor Generator Engine	400 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	27 hours	0.005 tons	212 hours	0.04 tons	53 hours	0.009 tons	292 hours	0.05 tons
Harbor Generator Engine	400 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	28 hours	0.005 tons	202 hours	0.04 tons	81 hours	0.01 tons	311 hours	0.05 tons
Heat Boiler	1 MMBtu/hr	1.2 lb/kgal	Source Test Data	53 hours	3.32E-04 tons	231 hours	0.001 tons	162 hours	0.001 tons	24 hours	1.50E-04 tons	470 hours	0.003 tons
Emergency Generator	136 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.95E-04 tons	7 hours	1.36E-03 tons	4 hours	7.80E-04 tons	1 hour	1.95E-04 tons	13 hours	0.003 tons
Total - *Tor Viking*					**0.2 tons**		**0.5 tons**		**0.6 tons**		**0.2 tons**		**1.5 tons**
Anchor Handler (*Ross Chouest*)													
Propulsion and Generator Engines	10,023 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	52,571 gallons	0.3 tons	81,552 gallons	0.5 tons	13,125 gallons	0.08 tons	147,248 gallons	0.9 tons
Port Winch	573 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.03 tons	63 hours	0.02 tons	21 hours	0.005 tons	209 hours	0.05 tons
Starboard Winch	573 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.03 tons	53 hours	0.01 tons	21 hours	0.005 tons	199 hours	0.05 tons
Emergency Generator	256 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.67E-04 tons	10 hours	0.004 tons	0 hours	0 tons	11 hours	0.004 tons
Total - *Ross Chouest*					**0 tons**		**0.4 tons**		**0.5 tons**		**0.09 tons**		**1.0 tons**
Support Tug (*Lauren Foss*)													
Propulsion Engines	4,896 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	650 gallons	0.004 tons	0 gallons	0 tons	0 gallons	0 tons	0 gallons	0 tons	650 gallons	0.004 tons
Generator	136 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.005 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.005 tons
Generator	136 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.005 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.005 tons
Emergency Generator	56 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.002 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.002 tons
Hydraulic Bow Thruster	299 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.01 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.01 tons
Total - *Lauren Foss*					**0.03 tons**		**0 tons**		**0 tons**		**0 tons**		**0.03 tons**
Support Tug (*Ocean Wind*)													
Propulsion Engines	6,496 kW	0.2 g/kW-hr	Vendor Data	29,180 gallons	0.07 tons	52,100 gallons	0.1 tons	31,548 gallons	0.07 tons	9,668 gallons	0.02 tons	122,496 gallons	0.3 tons
Harbor Generator Engine	272 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	147 hours	0.057 tons	644 hours	0.25 tons	720 hours	0.3 tons	96 hours	0.04 tons	1,607 hours	0.6 tons
Emergency Generator Engine	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.43E-04 tons	30 hours	0.004 tons	4 hours	5.73E-04 tons	1 hour	1.43E-04 tons	36 hours	0.005 tons
Total - *Ocean Wind*					**0.1 tons**		**0.4 tons**		**0.4 tons**		**0.06 tons**		**0.9 tons**
Support Tug (*Ocean Wave*)													
Propulsion Engines	6,496 kW	0.2 g/kW-hr	Vendor Data	23,844 gallons	0.06 tons	52,982 gallons	0.1 tons	18,628 gallons	0.04 tons	16,484 gallons	0.04 tons	111,938 gallons	0.3 tons
Harbor Generator Engine	272 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	168 hours	0.07 tons	697 hours	0.3 tons	691 hours	0.3 tons	96 hours	0.04 tons	1,652 hours	0.6 tons
Emergency Generator Engine	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.43E-04 tons	4 hours	5.73E-04 tons	4 hours	5.73E-04 tons	1 hour	1.43E-04 tons	10 hours	1.43E-03 tons
Total - *Ocean Wave*					**0.1 tons**		**0.4 tons**		**0.3 tons**		**0.08 tons**		**0.9 tons**

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2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Particulate Matter Less Than 10 Microns (PM_{10}) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Cumulative Operation	Cumulative PM_{10} Emissions
Science Vessel (*Harvey Explorer*)													
Propulsion Engines	2,699 kW	0.13 g/kW-hr	Source Test Data	6,271 gallons	0.01 tons	20,520 gallons	0.04 tons	21,694 gallons	0.04 tons	4,997 gallons	0.01 tons	53,482 gallons	0.1 tons
Starboard Generator Engine	275 kW	0.4 g/kW-hr	Source Test Data	124 hours	0.01 tons	254 hours	0.03 tons	251 hours	0.03 tons	52 hours	0.006 tons	681 hours	0.08 tons
Center Generator Engine	275 kW	0.4 g/kW-hr	Source Test Data	1 hour	1.20E-04 tons	178 hours	0.02 tons	342 hours	0.04 tons	6 hours	7.17E-04 tons	527 hours	0.06 tons
Port Generator Engine	275 kW	0.4 g/kW-hr	Source Test Data	93 hours	0.01 tons	400 hours	0.05 tons	220 hours	0.03 tons	90 hours	0.01 tons	803 hours	0.1 tons
Fwd/Port Bow Thruster	507 kW	0.2 g/kW-hr	Source Test Data	72 hours	0.008 tons	134 hours	0.01 tons	83 hours	0.009 tons	51 hours	0.006 tons	340 hours	0.04 tons
Aft/Starboard Bow Thruster	507 kW	0.2 g/kW-hr	Source Test Data	72 hours	0.008 tons	109 hours	0.01 tons	40 hours	0.004 tons	46 hours	0.005 tons	267 hours	0.03 tons
Stern Thruster	322 kW	0.2 g/kW-hr	Source Test Data	72 hours	0.005 tons	111 hours	0.008 tons	44 hours	0.003 tons	51 hours	0.004 tons	278 hours	0.02 tons
Emergency Generator Engine	79 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	5 hours	5.85E-04 tons	2 hours	2.34E-04 tons	1 hour	1.17E-04 tons	8 hours	9.36E-04 tons
FRC Outboard Engine	24 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	7.05E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	7.05E-05 tons
Portable Emergy Bilge Pump	4 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Explorer*					**0.06 tons**		**0.2 tons**		**0.2 tons**		**0.04 tons**		**0.4 tons**
Science Vessel (*Sisuaq*) [3]													
Propulsion and Generator Engines	5,840 kW	0.2 g/kW-hr	Source Test Data	10,700 gallons	0.03 tons	44,900 gallons	0.1 tons	57,450 gallons	0.2 tons	5,700 gallons	0.02 tons	118,750 gallons	0.3 tons
Emergency Generator Engine	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.48E-04 tons	2 hours	2.95E-04 tons	6 hours	8.86E-04 tons	1 hour	1.48E-04 tons	10 hours	0.001 tons
Starboard Air Compressor Engine	269 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Port Air Compressor Engine	269 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	4.49E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	4.49E-04 tons
AFT-DOP 250 Power Pack	59 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.73E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.73E-04 tons
FWD-DOP 250 Power Pack	59 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.73E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.73E-04 tons
Ocean Buster Power Pack	15 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	6 hours	0.003 tons	2 hours	0.001 tons	0 hours	0 tons	8 hours	0.004 tons
Total - *Sisuaq*					**0.03 tons**		**0.1 tons**		**0.2 tons**		**0.02 tons**		**0.3 tons**
OSV (*Harvey Supporter*)													
Propulsion and Generator Engines	5,840 kW	0.2 g/kW-hr	Source Test Data	10,250 gallons	0.03 tons	20,250 gallons	0.05 tons	24,570 gallons	0.07 tons	7,550 gallons	0.02 tons	62,620 gallons	0.2 tons
Emergency Generator	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.48E-04 tons	1 hour	1.48E-04 tons	1 hour	1.48E-04 tons	3 hours	4.43E-04 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	10 hours	0.002 tons	2 hours	4.49E-04 tons	2 hours	4.49E-04 tons	0 hours	0 tons	14 hours	0.003 tons
Power Pack	64 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	6 hours	0.003 tons	12 hours	0.007 tons	6 hours	0.003 tons	0 hours	0 tons	24 hours	0.01 tons
Total - *Harvey Supporter*					**0.03 tons**		**0.06 tons**		**0.07 tons**		**0.02 tons**		**0.2 tons**
OSV (*Harvey Champion*) [4]													
Propulsion and Generator Engines	5,840 kW	0.2 g/kW-hr	Source Test Data	6,000 gallons	0.02 tons	28,662 gallons	0.08 tons	16,100 gallons	0.04 tons	0 gallons	0 tons	50,762 gallons	0.1 tons
Emergency Generator	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	2.95E-04 tons	1 hour	1.48E-04 tons	0 hours	0 tons	3 hours	4.43E-04 tons
Incinerator	88 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	4 hours	0.002 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	4 hours	0.002 tons
Total - *Harvey Champion*					**0.02 tons**		**0.08 tons**		**0.04 tons**		**0 tons**		**0.1 tons**
MLC ROV System Vessel (*Harvey Spirit*) [5]													
Propulsion Engines	3,666 kW	0.2 g/kW-hr	Source Test Data	0 gallons	0 tons	14,050 gallons	0.04 tons	18,652 gallons	0.06 tons	2,900 gallons	0.009 tons	35,602 gallons	0.1 tons
Starboard Generator Engine	384 kW	0.3 g/kW-hr	Source Test Data	0 hours	0 tons	112 hours	0.01 tons	206 hours	0.02 tons	20 hours	0.002 tons	338 hours	0.04 tons
Center Generator Engine	384 kW	0.3 g/kW-hr	Source Test Data	0 hours	0 tons	33 hours	0.004 tons	83 hours	0.009 tons	28 hours	0.003 tons	144 hours	0.02 tons
Port Generator Engine	384 kW	0.3 g/kW-hr	Source Test Data	0 hours	0 tons	133 hours	0.01 tons	205 hours	0.02 tons	20 hours	0.002 tons	358 hours	0.04 tons
Starboard Bow Thruster	746 kW	0.2 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.02 tons	180 hours	0.03 tons	21 hours	0.003 tons	312 hours	0.05 tons
Port Bow Thruster	746 kW	0.2 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.02 tons	192 hours	0.03 tons	21 hours	0.003 tons	324 hours	0.05 tons
Stern Thruster	746 kW	0.2 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.02 tons	192 hours	0.03 tons	21 hours	0.003 tons	324 hours	0.05 tons
Emergency Generator Engine	79 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.13E-04 tons	2 hours	2.27E-04 tons	1 hour	1.13E-04 tons	4 hours	4.54E-04 tons
MLC ROV System Engine	800 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Spirit*					**0 tons**		**0.1 tons**		**0.2 tons**		**0.03 tons**		**0.4 tons**

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Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Particulate Matter Less Than 10 Microns (PM_{10}) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Cumulative Operation	Cumulative PM_{10} Emissions
OSRV (*Nanuq*)													
Propulsion Engines	4,336 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,224 gallons	0.03 tons	50,260 gallons	0.3 tons	45,143 gallons	0.3 tons	6,114 gallons	0.04 tons	106,741 gallons	0.7 tons
Generator Engines	1,534 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	7,145 gallons	0.05 tons	39,278 gallons	0.3 tons	35,331 gallons	0.2 tons	4,172 gallons	0.03 tons	85,926 gallons	0.6 tons
Emergency Generator	133 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.96E-04 tons	5 hours	0.001 tons	4 hours	7.85E-04 tons	6 hours	0.001 tons	16 hours	0.003 tons
Lifeboat Propulsion Engine	17 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.56E-05 tons	5 hours	1.28E-04 tons	4 hours	1.02E-04 tons	1 hour	2.56E-05 tons	11 hours	2.81E-04 tons
Backpack Blower	1 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
RubberMax Boom Power Pack	13 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	3.78E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	3.78E-05 tons
RubberMax Boom Power Pack	13 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.89E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.89E-05 tons
Power Pack	64 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.89E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.89E-04 tons
Power Pack	4 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	6.17E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	6.17E-06 tons
Fire Boom Power Pack	4 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.23E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.23E-05 tons
Dispersant Pump	3 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	4.41E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	4.41E-06 tons
Water Pump	11 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.65E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.65E-05 tons
Water Pump	11 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.65E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.65E-05 tons
3" Pump	3 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.90E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	3.90E-06 tons
3" Pump	3 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.90E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	3.90E-06 tons
Portable Generator	5 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Pressure Washer	6 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	8.82E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	8.82E-06 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	4.49E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	4.49E-04 tons
Incinerator	125 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	286 hours	0.2 tons	243 hours	0.2 tons	63 hours	0.05 tons	592 hours	0.5 tons
Total - *Nanuq*					**0.08 tons**		**0.8 tons**		**0.7 tons**		**0.1 tons**		**1.7 tons**
OSR Workboats (*Kvichaks*)													
Kvichak No. 1 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	70 hours	0.002 tons	65 hours	0.002 tons	0 hours	0 tons	138 hours	0.003 tons
Kvichak No. 1 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	86 hours	0.002 tons	70 hours	0.002 tons	0 hours	0 tons	159 hours	0.004 tons
Kvichak No. 1 Generator Engine	7 kW	0.1 g/kW-hr	Source Test Data	3 hours	2.84E-06 tons	71 hours	6.73E-05 tons	74 hours	7.01E-05 tons	0 hours	0 tons	148 hours	1.40E-04 tons
Kvichak No. 2 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	92 hours	0.002 tons	68 hours	0.002 tons	0 hours	0 tons	163 hours	0.004 tons
Kvichak No. 2 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	75 hours	0.002 tons	68 hours	0.002 tons	0 hours	0 tons	146 hours	0.003 tons
Kvichak No. 2 Generator Engine	7 kW	0.1 g/kW-hr	Source Test Data	3 hours	2.84E-06 tons	88 hours	8.34E-05 tons	68 hours	6.44E-05 tons	0 hours	0 tons	159 hours	1.51E-04 tons
Kvichak No. 3 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	7.34E-04 tons	16 hours	3.79E-04 tons	0 hours	0 tons	47 hours	0.001 tons
Kvichak No. 3 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	7.34E-04 tons	18 hours	4.26E-04 tons	0 hours	0 tons	49 hours	0.001 tons
Kvichak No. 3 Generator Engine	7 kW	0.1 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	2.94E-05 tons	2 hours	1.90E-06 tons	0 hours	0 tons	33 hours	3.13E-05 tons
Total - *Kvichaks*					**2.90E-04 tons**		**0.009 tons**		**0.007 tons**		**0 tons**		**0.02 tons**
OSR-T/B (*Guardsman* /*Klamath*)													
Propulsion Engines	4,299 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,621 gallons	0.04 tons	32,858 gallons	0.2 tons	20,507 gallons	0.1 tons	0 gallons	0 tons	58,986 gallons	0.4 tons
Generator Engine	119 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.03 tons	720 hours	0.1 tons	474 hours	0.08 tons	0 hours	0 tons	1,338 hours	0.2 tons
Generator Engine	119 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.03 tons	744 hours	0.1 tons	249 hours	0.04 tons	0 hours	0 tons	1,137 hours	0.2 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.25E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.25E-04 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.25E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.25E-04 tons
Generator Engine	121 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Generator Engine	104 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	4.63E-04 tons	0 hours	0 tons	0 hours	0 tons	3 hours	4.63E-04 tons
Total - *Guardsman/Klamath*					**0.09 tons**		**0.5 tons**		**0.3 tons**		**0 tons**		**0.8 tons**

Shell Gulf of Mexico Inc.
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Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Operation	Calculated PM_{10} Emissions [10,11,12]	Cumulative Operation	Cumulative PM_{10} Emissions
Arctic Oil Storage Tanker (*Marika*) [6]													
Propulsion Engine	10,848 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	6,611 gallons	0.04 tons	2,741 gallons	0.02 tons	0 gallons	0 tons	9,352 gallons	0.06 tons
Auxiliary Engines	3,456 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,036 gallons	0.03 tons	23,906 gallons	0.2 tons	22,059 gallons	0.1 tons	2,763 gallons	0.02 tons	53,764 gallons	0.4 tons
Emergency Generator	221 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Auxiliary Boiler	25,000 kg/hr	3.3 lb/kgal	Table 1.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Composite Boiler	3,600 kg/hr	3.3 lb/kgal	Table 1.3-1, AP-42	169 hours	0.02 tons	664 hours	0.06 tons	673 hours	0.07 tons	91 hours	0.009 tons	1,597 hours	0.2 tons
Incinerator	238 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	16 hours	0.02 tons	24 hours	0.04 tons	24 hours	0.04 tons	7 hours	0.01 tons	71 hours	0.1 tons
Total - *Marika*					**0.07 tons**		**0.3 tons**		**0.3 tons**		**0.04 tons**		**0.7 tons**
Total - Support Vessels					**1.4 tons**		**5.8 tons**		**5.8 tons**		**1.0 tons**		**14.0 tons**

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the Noble Discoverer was not anchored over the drill site and not considered a facility.

[2] PM emissions are calculated without the application of a control efficiency for existing post-combustion control technology.

[3] The *Sisuaq* (similar to *Harvey Supporter*) served as the backup, second Science Vessel during the period.

[4] The *Harvey Champion* (similar to *Sisuaq*) served as the second offshore supply vessel (OSV) during the period.

[5] The *Harvey Spirit* served as an offshore supply vessel (OSV) during the period. No off-line MLC activity occurred on the *Harvey Spirit* during the period.

[6] The *Marika* served as the Arctic Oil Storage Tanker during the period. A notice of this vessel change from the *Affinity* was made by email to Mr. Johnston with BOEM from Mr. Horner with Shell on July 23, 2015.

[7] Conversion factors

453.592	g/lb
2,000	lb/ton
1.34	hp/kW
2.20462	lb/kg
34.5	lb (steam)/boiler hp-hour
33,446	BTU/boiler hp-hour

[8] Engine heat rate

7,000	BTU/hp-hr

[9] Diesel fuel energy

131,180	BTU/gal

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Calculated Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Cumulative Operation	Cumulative $PM_{2.5}$ Emissions
MODU (*Noble Discoverer*)													
Generator Engines	5,287 kW	0.2 g/kW-hr	Vendor Data	0 gallons	0 tons	45,726 gallons	0.1 tons	25,992 gallons	0.08 tons	4,513 gallons	0.01 tons	76,231 gallons	0.2 tons
Propulsion Engine	5,184 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	98 gallons	6.04E-04 tons	100 gallons	6.17E-04 tons	444 gallons	0.003 tons	642 gallons	0.004 tons
HPU Engine	145 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	2.08E-04 tons	0 hours	0 tons	1 hour	2.08E-04 tons
HPU Engine	145 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	2.08E-04 tons	0 hours	0 tons	1 hour	2.08E-04 tons
Port Deck Crane Engine	360 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	34 hours	0.001 tons	37 hours	0.001 tons	0 hours	0 tons	71 hours	0.003 tons
Starbd Deck Crane Engine	360 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	38 hours	0.002 tons	18 hours	7.14E-04 tons	0 hours	0 tons	56 hours	0.002 tons
Cementing Unit Engine	200 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	8.60E-04 tons	0 hours	0 tons	0 hours	0 tons	3 hours	8.60E-04 tons
Cementing Unit Engine	200 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.87E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.87E-04 tons
Logging Unit Engine	179 kW	0.2 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Compressor Engine	84 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	0.4 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	405 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	17 hours	0.003 tons	16 hours	0.003 tons	0 hours	0 tons	33 hours	0.006 tons
Lifeboat No. 1 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Lifeboat No. 2 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Lifeboat No. 3 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Lifeboat No. 4 Engine	18 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	7.65E-05 tons	2 hours	5.10E-05 tons	0 hours	0 tons	5 hours	1.27E-04 tons
Heat Boiler	8 MMBtu/hr	0.3 lb/kgal	Source Test Data	0 hours	0 tons	100 hours	9.11E-04 tons	288 hours	0.003 tons	22 hours	2.00E-04 tons	410 hours	0.004 tons
Heat Boiler	8 MMBtu/hr	0.3 lb/kgal	Source Test Data	0 hours	0 tons	427 hours	0.004 tons	24 hours	2.19E-04 tons	39 hours	3.55E-04 tons	490 hours	0.004 tons
Incinerator	276 lb/hr	6.9 lb/ton	Source Test Data	0 hours	0 tons	146 hours	0.07 tons	83 hours	0.04 tons	14 hours	0.007 tons	243 hours	0.1 tons
Total - *Noble Discoverer*					**0 tons**		**0.2 tons**		**0.1 tons**		**0.02 tons**		**0.4 tons**
MODU (*Transocean Polar Pioneer*)													
Generator Engines	11,000 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	45,856 gallons	0.3 tons	210,537 gallons	1.3 tons	217,680 gallons	1.3 tons	28,013 gallons	0.2 tons	502,086 gallons	3.1 tons
HPU Engine	149 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
HPU Engine	149 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Logging Unit Engine	179 kW	0.2 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	64 hours	0.003 tons	0 hours	0 tons	64 hours	0.003 tons
Compressor Engine	84 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	0.4 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	896 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	1 hour	3.95E-04 tons	5 hours	0.002 tons	4 hours	0.002 tons	0 hours	0 tons	10 hours	0.004 tons
Rescue Boat Engine	127 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.81E-04 tons	5 hours	9.07E-04 tons	4 hours	7.25E-04 tons	0 hours	0 tons	10 hours	0.002 tons
Lifeboat No. 1 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Lifeboat No. 2 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Lifeboat No. 3 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Lifeboat No. 4 Engine	31 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.45E-05 tons	4 hours	1.78E-04 tons	4 hours	1.78E-04 tons	1 hour	4.45E-05 tons	10 hours	4.45E-04 tons
Forward Fast Rescue Craft Engine	86 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.23E-04 tons	4 hours	4.93E-04 tons	3 hours	3.70E-04 tons	1 hour	1.23E-04 tons	9 hours	0.001 tons
Aft Fast Rescue Craft Engine	118 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.69E-04 tons	4 hours	6.74E-04 tons	3 hours	5.06E-04 tons	1 hour	1.69E-04 tons	9 hours	0.002 tons
Emergency Start Compressor Engine	7 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	9.41E-06 tons	2 hours	1.88E-05 tons	1 hour	9.41E-06 tons	1 hour	9.41E-06 tons	5 hours	4.71E-05 tons
Heat Boiler	14 MMBtu/hr	3.3 lb/kgal	Table 1.3-1, AP-42	120 hours	0.02 tons	740 hours	0.1 tons	720 hours	0.1 tons	96 hours	0.02 tons	1,676 hours	0.3 tons
Heat Boiler	14 MMBtu/hr	3.3 lb/kgal	Table 1.3-1, AP-42	168 hours	0.03 tons	740 hours	0.1 tons	720 hours	0.1 tons	96 hours	0.02 tons	1,724 hours	0.3 tons
Incinerator	220 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Transocean Polar Pioneer*					**0.3 tons**		**1.6 tons**		**1.6 tons**		**0.2 tons**		**3.7 tons**
Ice management (*Fennica*)													
Propulsion and Generator Engines	16,800 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	54,623 gallons	0.3 tons	79,590 gallons	0.5 tons	21,167 gallons	0.1 tons	155,380 gallons	1.0 tons
Harbour Set Generator Engine	424 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	0 hours	0 tons	211 hours	0.002 tons	564 hours	0.005 tons	81 hours	6.85E-04 tons	856 hours	0.007 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	0 hours	0 tons	167 hours	0.001 tons	585 hours	0.005 tons	94 hours	7.95E-04 tons	846 hours	0.007 tons
Incinerator	154 lb/hr	17.0 lb/ton	Source Test Data	0 hours	0 tons	41 hours	0.03 tons	105 hours	0.07 tons	29 hours	0.02 tons	175 hours	0.1 tons
Emergency Generator	240 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	4 hours	1.38E-03 tons	4 hours	0.001 tons	1 hour	3.44E-04 tons	9 hours	3.10E-03 tons
Total - *Fennica*					**0 tons**		**0.4 tons**		**0.6 tons**		**0.2 tons**		**1.1 tons**

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Ice Management (*Nordica*)													
Propulsion and Generator Engines	16,800 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	19,179 gallons	0.1 tons	81,950 gallons	0.5 tons	90,742 gallons	0.6 tons	12,123 gallons	0.1 tons	203,994 gallons	1.3 tons
Harbour Set Generator Engine	424 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	33 hours	2.79E-04 tons	41 hours	3.47E-04 tons	26 hours	2.20E-04 tons	59 hours	4.99E-04 tons	159 hours	0.001 tons
Heat Boiler	4 MMBtu/hr	0.5 lb/kgal	Source Test Data	143 hours	0.001 tons	576 hours	0.005 tons	550 hours	0.005 tons	77 hours	6.52E-04 tons	1,346 hours	0.01 tons
Incinerator	154 lb/hr	17.0 lb/ton	Source Test Data	18 hours	1.18E-02 tons	81 hours	0.05 tons	95 hours	0.06 tons	16 hours	0.01 tons	210 hours	0.1 tons
Emergency Generator	240 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.44E-04 tons	3 hours	1.03E-03 tons	2 hours	6.88E-04 tons	1 hour	3.44E-04 tons	7 hours	0.002 tons
Total - *Nordica*					**0.1 tons**		**0.6 tons**		**0.6 tons**		**0.09 tons**		**1.4 tons**
Anchor Handler (*Aiviq*)													
Propulsion Engines	13,001 kW	0.3 g/kW-hr	Source Test Data	48,091 gallons	0.2 tons	113,951 gallons	0.4 tons	108,921 gallons	0.4 tons	19,682 gallons	0.1 tons	290,645 gallons	1.1 tons
Generator Engines	5,440 kW	0.2 g/kW-hr	Vendor Data	44,479 gallons	0.1 tons	114,640 gallons	0.4 tons	81,105 gallons	0.3 tons	11,447 gallons	0.04 tons	251,671 gallons	0.8 tons
Heat Boiler	5 MMBtu/hr	3.3 g/kW-hr	Table 1.3-1, AP-42	123 hours	8.12E-03 tons	651 hours	0.04 tons	552 hours	0.04 tons	72 hours	0.005 tons	1,398 hours	0.09 tons
Incinerator	276 lb/hr	18.0 lb/ton	Source Test Data	34 hours	4.22E-02 tons	129 hours	0.2 tons	150 hours	0.2 tons	7 hours	0.009 tons	320 hours	0.4 tons
Emergency Generator #1	728 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10 hours	3.21E-03 tons	40 hours	0.01 tons	31 hours	0.01 tons	10 hours	0.003 tons	91 hours	0.03 tons
Emergency Generator #2	728 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10 hours	3.21E-03 tons	32 hours	0.01 tons	38 hours	0.012 tons	10 hours	0.003 tons	90 hours	0.03 tons
Fast Rescue Craft FP 800 Thruster	119 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	2 hours	3.42E-04 tons	4 hours	6.84E-04 tons	4 hours	6.84E-04 tons	1 hour	1.71E-04 tons	11 hours	0.002 tons
Delta Craft Main Propulsion	188 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.69E-04 tons	2 hours	5.39E-04 tons	2 hours	5.39E-04 tons	1 hour	2.69E-04 tons	6 hours	1.62E-03 tons
Delta Craft Main Propulsion	188 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.69E-04 tons	2 hours	5.39E-04 tons	2 hours	5.39E-04 tons	1 hour	2.69E-04 tons	6 hours	1.62E-03 tons
Fassemer 64 Mn Enclosed Lifeboat #1	23 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.34E-05 tons	2 hours	6.67E-05 tons	2 hours	6.67E-05 tons	1 hour	3.34E-05 tons	6 hours	2.00E-04 tons
Fassemer 64 Mn Enclosed Lifeboat #2	23 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.34E-05 tons	2 hours	6.67E-05 tons	2 hours	6.67E-05 tons	1 hour	3.34E-05 tons	6 hours	2.00E-04 tons
TranRec150 Power Pack Engine	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Aiviq*					**0.4 tons**		**1.0 tons**		**0.9 tons**		**0.1 tons**		**2.5 tons**
Anchor Handler (*Tor Viking*)													
Propulsion Engines	10,752 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	32,013 gallons	0.2 tons	85,773 gallons	0.5 tons	79,213 gallons	0.5 tons	25,130 gallons	0.2 tons	222,129 gallons	1.4 tons
Harbor Generator Engine	400 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	27 hours	0.005 tons	212 hours	0.04 tons	53 hours	0.009 tons	292 hours	0.05 tons
Harbor Generator Engine	400 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	28 hours	0.005 tons	202 hours	0.04 tons	81 hours	0.01 tons	311 hours	0.05 tons
Heat Boiler	1 MMBtu/hr	1.2 lb/kgal	Source Test Data	53 hours	3.32E-04 tons	231 hours	0.001 tons	162 hours	0.001 tons	24 hours	1.50E-04 tons	470 hours	0.003 tons
Emergency Generator	136 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.95E-04 tons	7 hours	1.36E-03 tons	4 hours	7.80E-04 tons	1 hour	1.95E-04 tons	13 hours	0.003 tons
Total - *Tor Viking*					**0.2 tons**		**0.5 tons**		**0.6 tons**		**0.2 tons**		**1.5 tons**
Anchor Handler (*Ross Chouest*)													
Propulsion and Generator Engines	10,023 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	52,571 gallons	0.3 tons	81,552 gallons	0.5 tons	13,125 gallons	0.08 tons	147,248 gallons	0.9 tons
Port Winch	573 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.03 tons	63 hours	0.02 tons	21 hours	0.005 tons	209 hours	0.05 tons
Starboard Winch	573 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.03 tons	53 hours	0.01 tons	21 hours	0.005 tons	199 hours	0.05 tons
Emergency Generator	256 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.67E-04 tons	10 hours	0.004 tons	0 hours	0 tons	11 hours	0.004 tons
Total - *Ross Chouest*					**0 tons**		**0.4 tons**		**0.5 tons**		**0.09 tons**		**1.0 tons**
Support Tug (*Lauren Foss*)													
Propulsion Engines	4,896 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	650 gallons	0.004 tons	0 gallons	0 tons	0 gallons	0 tons	0 gallons	0 tons	650 gallons	0.004 tons
Generator	136 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.005 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.005 tons
Generator	136 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.005 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.005 tons
Emergency Generator	56 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.002 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.002 tons
Hydraulic Bow Thruster	299 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.01 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.01 tons
Total - *Lauren Foss*					**0.03 tons**		**0 tons**		**0 tons**		**0 tons**		**0.03 tons**
Support Tug (*Ocean Wind*)													
Propulsion Engines	6,496 kW	0.2 g/kW-hr	Vendor Data	29,180 gallons	0.07 tons	52,100 gallons	0.1 tons	31,548 gallons	0.07 tons	9,668 gallons	0.02 tons	122,496 gallons	0.3 tons
Harbor Generator Engine	272 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	147 hours	0.057 tons	644 hours	0.25 tons	720 hours	0.3 tons	96 hours	0.04 tons	1,607 hours	0.6 tons
Emergency Generator Engine	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.43E-04 tons	30 hours	0.004 tons	4 hours	5.73E-04 tons	1 hour	1.43E-04 tons	36 hours	0.005 tons
Total - *Ocean Wind*					**0.1 tons**		**0.4 tons**		**0.4 tons**		**0.06 tons**		**0.9 tons**
Support Tug (*Ocean Wave*)													
Propulsion Engines	6,496 kW	0.2 g/kW-hr	Vendor Data	23,844 gallons	0.06 tons	52,982 gallons	0.1 tons	18,628 gallons	0.04 tons	16,484 gallons	0.04 tons	111,938 gallons	0.3 tons
Harbor Generator Engine	272 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	168 hours	0.07 tons	697 hours	0.3 tons	691 hours	0.3 tons	96 hours	0.04 tons	1,652 hours	0.6 tons
Emergency Generator Engine	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.43E-04 tons	4 hours	5.73E-04 tons	4 hours	5.73E-04 tons	1 hour	1.43E-04 tons	10 hours	1.43E-03 tons
Total - *Ocean Wave*					**0.1 tons**		**0.4 tons**		**0.3 tons**		**0.08 tons**		**0.9 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Cumulative Operation	Cumulative $PM_{2.5}$ Emissions
Science Vessel (*Harvey Explorer*)													
Propulsion Engines	2,699 kW	0.13 g/kW-hr	Source Test Data	6,271 gallons	0.01 tons	20,520 gallons	0.04 tons	21,694 gallons	0.04 tons	4,997 gallons	0.01 tons	53,482 gallons	0.1 tons
Starboard Generator Engine	275 kW	0.4 g/kW-hr	Source Test Data	124 hours	0.01 tons	254 hours	0.03 tons	251 hours	0.03 tons	52 hours	0.006 tons	681 hours	0.08 tons
Center Generator Engine	275 kW	0.4 g/kW-hr	Source Test Data	1 hour	1.20E-04 tons	178 hours	0.02 tons	342 hours	0.04 tons	6 hours	7.17E-04 tons	527 hours	0.06 tons
Port Generator Engine	275 kW	0.4 g/kW-hr	Source Test Data	93 hours	0.01 tons	400 hours	0.05 tons	220 hours	0.03 tons	90 hours	0.01 tons	803 hours	0.1 tons
Fwd/Port Bow Thruster	507 kW	0.2 g/kW-hr	Source Test Data	72 hours	0.008 tons	134 hours	0.01 tons	83 hours	0.009 tons	51 hours	0.006 tons	340 hours	0.04 tons
Aft/Starboard Bow Thruster	507 kW	0.2 g/kW-hr	Source Test Data	72 hours	0.008 tons	109 hours	0.01 tons	40 hours	0.004 tons	46 hours	0.005 tons	267 hours	0.03 tons
Stern Thruster	322 kW	0.2 g/kW-hr	Source Test Data	72 hours	0.005 tons	111 hours	0.008 tons	44 hours	0.003 tons	51 hours	0.004 tons	278 hours	0.02 tons
Emergency Generator Engine	79 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	5 hours	5.85E-04 tons	2 hours	2.34E-04 tons	1 hour	1.17E-04 tons	8 hours	9.36E-04 tons
FRC Outboard Engine	24 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	7.05E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	7.05E-05 tons
Portable Emergy Bilge Pump	4 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Explorer*					**0.06 tons**		**0.2 tons**		**0.2 tons**		**0.04 tons**		**0.4 tons**
Science Vessel (*Sisuaq*) [3]													
Propulsion and Generator Engines	5,840 kW	0.2 g/kW-hr	Source Test Data	10,700 gallons	0.03 tons	44,900 gallons	0.1 tons	57,450 gallons	0.2 tons	5,700 gallons	0.02 tons	118,750 gallons	0.3 tons
Emergency Generator Engine	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.48E-04 tons	2 hours	2.95E-04 tons	6 hours	8.86E-04 tons	1 hour	1.48E-04 tons	10 hours	0.001 tons
Starboard Air Compressor Engine	269 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Port Air Compressor Engine	269 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	4.49E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	4.49E-04 tons
AFT-DOP 250 Power Pack	59 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.73E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.73E-04 tons
FWD-DOP 250 Power Pack	59 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.73E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.73E-04 tons
Ocean Buster Power Pack	15 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	6 hours	0.003 tons	2 hours	0.001 tons	0 hours	0 tons	8 hours	0.004 tons
Total - *Sisuaq*					**0.03 tons**		**0.1 tons**		**0.2 tons**		**0.02 tons**		**0.3 tons**
OSV (*Harvey Supporter*)													
Propulsion and Generator Engines	5,840 kW	0.2 g/kW-hr	Source Test Data	10,250 gallons	0.03 tons	20,250 gallons	0.05 tons	24,570 gallons	0.07 tons	7,550 gallons	0.02 tons	62,620 gallons	0.2 tons
Emergency Generator	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.48E-04 tons	1 hour	1.48E-04 tons	1 hour	1.48E-04 tons	3 hours	4.43E-04 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	10 hours	0.002 tons	2 hours	4.49E-04 tons	2 hours	4.49E-04 tons	0 hours	0 tons	14 hours	0.003 tons
Power Pack	64 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	6 hours	0.003 tons	12 hours	0.007 tons	6 hours	0.003 tons	0 hours	0 tons	24 hours	0.01 tons
Total - *Harvey Supporter*					**0.03 tons**		**0.06 tons**		**0.07 tons**		**0.02 tons**		**0.2 tons**
OSV (*Harvey Champion*) [4]													
Propulsion and Generator Engines	5,840 kW	0.2 g/kW-hr	Source Test Data	6,000 gallons	0.02 tons	28,662 gallons	0.08 tons	16,100 gallons	0.04 tons	0 gallons	0 tons	50,762 gallons	0.1 tons
Emergency Generator	100 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	2.95E-04 tons	1 hour	1.48E-04 tons	0 hours	0 tons	3 hours	4.43E-04 tons
Incinerator	88 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	4 hours	0.002 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	4 hours	0.002 tons
Total - *Harvey Champion*					**0.02 tons**		**0.08 tons**		**0.04 tons**		**0 tons**		**0.1 tons**
MLC ROV System Vessel (*Harvey Spirit*) [5]													
Propulsion Engines	3,666 kW	0.2 g/kW-hr	Source Test Data	0 gallons	0 tons	14,050 gallons	0.04 tons	18,652 gallons	0.06 tons	2,900 gallons	0.009 tons	35,602 gallons	0.1 tons
Starboard Generator Engine	384 kW	0.3 g/kW-hr	Source Test Data	0 hours	0 tons	112 hours	0.01 tons	206 hours	0.02 tons	20 hours	0.002 tons	338 hours	0.04 tons
Center Generator Engine	384 kW	0.3 g/kW-hr	Source Test Data	0 hours	0 tons	33 hours	0.004 tons	83 hours	0.009 tons	28 hours	0.003 tons	144 hours	0.02 tons
Port Generator Engine	384 kW	0.3 g/kW-hr	Source Test Data	0 hours	0 tons	133 hours	0.01 tons	205 hours	0.02 tons	20 hours	0.002 tons	358 hours	0.04 tons
Starboard Bow Thruster	746 kW	0.2 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.02 tons	180 hours	0.03 tons	21 hours	0.003 tons	312 hours	0.05 tons
Port Bow Thruster	746 kW	0.2 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.02 tons	192 hours	0.03 tons	21 hours	0.003 tons	324 hours	0.05 tons
Stern Thruster	746 kW	0.2 g/kW-hr	Source Test Data	0 hours	0 tons	111 hours	0.02 tons	192 hours	0.03 tons	21 hours	0.003 tons	324 hours	0.05 tons
Emergency Generator Engine	79 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.13E-04 tons	2 hours	2.27E-04 tons	1 hour	1.13E-04 tons	4 hours	4.54E-04 tons
MLC ROV System Engine	800 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Spirit*					**0 tons**		**0.1 tons**		**0.2 tons**		**0.03 tons**		**0.4 tons**

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Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Cumulative Operation	Cumulative $PM_{2.5}$ Emissions
OSRV (*Nanuq*)													
Propulsion Engines	4,336 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,224 gallons	0.03 tons	50,260 gallons	0.3 tons	45,143 gallons	0.3 tons	6,114 gallons	0.04 tons	106,741 gallons	0.7 tons
Generator Engines	1,534 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	7,145 gallons	0.05 tons	39,278 gallons	0.3 tons	35,331 gallons	0.2 tons	4,172 gallons	0.03 tons	85,926 gallons	0.6 tons
Emergency Generator	133 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.96E-04 tons	5 hours	0.001 tons	4 hours	7.85E-04 tons	6 hours	0.001 tons	16 hours	0.003 tons
Lifeboat Propulsion Engine	17 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.56E-05 tons	5 hours	1.28E-04 tons	4 hours	1.02E-04 tons	1 hour	2.56E-05 tons	11 hours	2.81E-04 tons
Backpack Blower	1 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
RubberMax Boom Power Pack	13 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	3.78E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	3.78E-05 tons
RubberMax Boom Power Pack	13 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.89E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.89E-05 tons
Power Pack	64 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.89E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.89E-04 tons
Power Pack	4 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	6.17E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	6.17E-06 tons
Fire Boom Power Pack	4 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.23E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.23E-05 tons
Dispersant Pump	3 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	4.41E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	4.41E-06 tons
Water Pump	11 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.65E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.65E-05 tons
Water Pump	11 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.65E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.65E-05 tons
3" Pump	3 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.90E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	3.90E-06 tons
3" Pump	3 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.90E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	3.90E-06 tons
Portable Generator	5 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Pressure Washer	6 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	8.82E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	8.82E-06 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	4.49E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	4.49E-04 tons
Incinerator	125 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	286 hours	0.2 tons	243 hours	0.2 tons	63 hours	0.05 tons	592 hours	0.5 tons
Total - *Nanuq*					**0.08 tons**		**0.8 tons**		**0.7 tons**		**0.1 tons**		**1.7 tons**
OSR Workboats (*Kvichaks*)													
Kvichak No. 1 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	70 hours	0.002 tons	65 hours	0.002 tons	0 hours	0 tons	138 hours	0.003 tons
Kvichak No. 1 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	86 hours	0.002 tons	70 hours	0.002 tons	0 hours	0 tons	159 hours	0.004 tons
Kvichak No. 1 Generator Engine	7 kW	0.1 g/kW-hr	Source Test Data	3 hours	2.84E-06 tons	71 hours	6.73E-05 tons	74 hours	7.01E-05 tons	0 hours	0 tons	148 hours	1.40E-04 tons
Kvichak No. 2 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	92 hours	0.002 tons	68 hours	0.002 tons	0 hours	0 tons	163 hours	0.004 tons
Kvichak No. 2 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	3 hours	7.11E-05 tons	75 hours	0.002 tons	68 hours	0.002 tons	0 hours	0 tons	146 hours	0.003 tons
Kvichak No. 2 Generator Engine	7 kW	0.1 g/kW-hr	Source Test Data	3 hours	2.84E-06 tons	88 hours	8.34E-05 tons	68 hours	6.44E-05 tons	0 hours	0 tons	159 hours	1.51E-04 tons
Kvichak No. 3 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	7.34E-04 tons	16 hours	3.79E-04 tons	0 hours	0 tons	47 hours	0.001 tons
Kvichak No. 3 Propulsion Engine	179 kW	0.1 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	7.34E-04 tons	18 hours	4.26E-04 tons	0 hours	0 tons	49 hours	0.001 tons
Kvichak No. 3 Generator Engine	7 kW	0.1 g/kW-hr	Source Test Data	0 hours	0 tons	31 hours	2.94E-05 tons	2 hours	1.90E-06 tons	0 hours	0 tons	33 hours	3.13E-05 tons
Total - *Kvichaks*					**2.90E-04 tons**		**0.009 tons**		**0.007 tons**		**0 tons**		**0.02 tons**
OSR-T/B (*Guardsman /Klamath*)													
Propulsion Engines	4,299 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,621 gallons	0.04 tons	32,858 gallons	0.2 tons	20,507 gallons	0.1 tons	0 gallons	0 tons	58,986 gallons	0.4 tons
Generator Engine	119 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.03 tons	720 hours	0.1 tons	474 hours	0.08 tons	0 hours	0 tons	1,338 hours	0.2 tons
Generator Engine	119 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.03 tons	744 hours	0.1 tons	249 hours	0.04 tons	0 hours	0 tons	1,137 hours	0.2 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.25E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.25E-04 tons
TranRec150 Power Pack	152 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.25E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.25E-04 tons
Generator Engine	121 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Generator Engine	104 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	4.63E-04 tons	0 hours	0 tons	0 hours	0 tons	3 hours	4.63E-04 tons
Total - *Guardsman/Klamath*					**0.09 tons**		**0.5 tons**		**0.3 tons**		**0 tons**		**0.8 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Operation	Calculated $PM_{2.5}$ Emissions [7,8,9]	Cumulative Operation	Cumulative $PM_{2.5}$ Emissions
Arctic Oil Storage Tanker (*Marika*) [6]													
Propulsion Engine	10,848 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	6,611 gallons	0.04 tons	2,741 gallons	0.02 tons	0 gallons	0 tons	9,352 gallons	0.06 tons
Auxiliary Engines	3,456 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,036 gallons	0.03 tons	23,906 gallons	0.2 tons	22,059 gallons	0.1 tons	2,763 gallons	0.02 tons	53,764 gallons	0.4 tons
Emergency Generator	221 kW	1.3 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Auxiliary Boiler	25,000 kg/hr	3.3 lb/kgal	Table 1.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Composite Boiler	3,600 kg/hr	3.3 lb/kgal	Table 1.3-1, AP-42	169 hours	0.02 tons	664 hours	0.06 tons	673 hours	0.07 tons	91 hours	0.009 tons	1,597 hours	0.2 tons
Incinerator	238 lb/hr	25.1 lb/ton	Table 2.1-2, AP-42	16 hours	0.02 tons	24 hours	0.04 tons	24 hours	0.04 tons	7 hours	0.01 tons	71 hours	0.1 tons
Total - *Marika*					**0.07 tons**		**0.3 tons**		**0.3 tons**		**0.04 tons**		**0.7 tons**
Total - Support Vessels					**1.4 tons**		**5.8 tons**		**5.8 tons**		**1.0 tons**		**14.0 tons**

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the Noble Discoverer was not anchored over the drill site and not considered a facility.

[2] PM emissions are calculated without the application of a control efficiency for existing post-combustion control technology.

[3] The *Sisuaq* (similar to *Harvey Supporter*) served as the backup, second Science Vessel during the period.

[4] The *Harvey Champion* (similar to *Sisuaq*) served as the second offshore supply vessel (OSV) during the period.

[5] The *Harvey Spirit* served as an offshore supply vessel (OSV) during the period. No off-line MLC activity occurred on the *Harvey Spirit* during the period.

[6] The *Marika* served as the Arctic Oil Storage Tanker during the period. A notice of this vessel change from the *Affinity* was made by email to Mr. Johnston with BOEM from Mr. Horner with Shell on July 23, 2015.

[7] Conversion factors

453.592	g/lb
2,000	lb/ton
1.34	hp/kW
2.20462	lb/kg
34.5	lb (steam)/boiler hp-hour
33,446	BTU/boiler hp-hour

[8] Engine heat rate

7,000	BTU/hp-hr

[9] Diesel fuel energy

131,180	BTU/gal

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Volatile Organic Compound (VOC) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Cumulative Operation	Cumulative VOC Emissions
MODU (*Noble Discoverer*)													
Generator Engines	5,287 kW	0.5 g/kW-hr	Vendor Data	0 gallons	0 tons	45,726 gallons	0.3 tons	25,992 gallons	0.2 tons	4,513 gallons	0.03 tons	76,231 gallons	0.5 tons
Propulsion Engine	5,184 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	98 gallons	6.50E-04 tons	100 gallons	6.63E-04 tons	444 gallons	0.003 tons	642 gallons	0.004 tons
HPU Engine	145 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	2.40E-04 tons	0 hours	0 tons	1 hour	2.40E-04 tons
HPU Engine	145 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	1 hour	2.40E-04 tons	0 hours	0 tons	1 hour	2.40E-04 tons
Port Deck Crane Engine	360 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	34 hours	0.001 tons	37 hours	0.001 tons	0 hours	0 tons	71 hours	0.002 tons
Starbd Deck Crane Engine	360 kW	0.1 g/kW-hr	Vendor Data	0 hours	0 tons	38 hours	0.001 tons	18 hours	5.71E-04 tons	0 hours	0 tons	56 hours	0.002 tons
Cementing Unit Engine	200 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	0.001 tons	0 hours	0 tons	0 hours	0 tons	3 hours	9.92E-04 tons
Cementing Unit Engine	200 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	3.31E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	3.31E-04 tons
Logging Unit Engine	179 kW	4.0 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Compressor Engine	84 kW	0.6 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	7.5 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	405 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	17 hours	0.003 tons	16 hours	0.003 tons	0 hours	0 tons	33 hours	6.34E-03 tons
Lifeboat No. 1 Engine	18 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	8.83E-05 tons	2 hours	5.88E-05 tons	0 hours	0 tons	5 hours	1.47E-04 tons
Lifeboat No. 2 Engine	18 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	8.83E-05 tons	2 hours	5.88E-05 tons	0 hours	0 tons	5 hours	1.47E-04 tons
Lifeboat No. 3 Engine	18 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	8.83E-05 tons	2 hours	5.88E-05 tons	0 hours	0 tons	5 hours	1.47E-04 tons
Lifeboat No. 4 Engine	18 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	8.83E-05 tons	2 hours	5.88E-05 tons	0 hours	0 tons	5 hours	1.47E-04 tons
Heat Boiler	8 MMBtu/hr	0.1 lb/kgal	Source Test Data	0 hours	0 tons	100 hours	2.58E-04 tons	288 hours	7.44E-04 tons	22 hours	5.68E-05 tons	410 hours	0.001 tons
Heat Boiler	8 MMBtu/hr	0.1 lb/kgal	Source Test Data	0 hours	0 tons	427 hours	0.001 tons	24 hours	6.20E-05 tons	39 hours	1.01E-04 tons	490 hours	0.001 tons
Incinerator	276 lb/hr	0.4 lb/ton	Source Test Data	0 hours	0 tons	146 hours	0.004 tons	83 hours	0.002 tons	14 hours	3.62E-04 tons	243 hours	0.006 tons
Total - *Noble Discoverer*					**0 tons**		**0.3 tons**		**0.2 tons**		**0.03 tons**		**0.6 tons**
MODU (*Transocean Polar Pioneer*)													
Generator Engines	11,000 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	45,856 gallons	0.3 tons	210,537 gallons	1.4 tons	217,680 gallons	1.4 tons	28,013 gallons	0.2 tons	502,086 gallons	3.3 tons
HPU Engine	149 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
HPU Engine	149 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Logging Unit Engine	179 kW	4.0 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	64 hours	0.05 tons	0 hours	0 tons	64 hours	0.05 tons
Compressor Engine	84 kW	0.6 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	7.5 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	896 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	1 hour	4.25E-04 tons	5 hours	0.002 tons	4 hours	0.002 tons	0 hours	0 tons	10 hours	0.004 tons
Rescue Boat Engine	127 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.09E-04 tons	5 hours	0.001 tons	4 hours	8.37E-04 tons	0 hours	0 tons	10 hours	0.002 tons
Lifeboat No. 1 Engine	31 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	5.13E-05 tons	4 hours	2.05E-04 tons	4 hours	2.05E-04 tons	1 hour	5.13E-05 tons	10 hours	5.13E-04 tons
Lifeboat No. 2 Engine	31 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	5.13E-05 tons	4 hours	2.05E-04 tons	4 hours	2.05E-04 tons	1 hour	5.13E-05 tons	10 hours	5.13E-04 tons
Lifeboat No. 3 Engine	31 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	5.13E-05 tons	4 hours	2.05E-04 tons	4 hours	2.05E-04 tons	1 hour	5.13E-05 tons	10 hours	5.13E-04 tons
Lifeboat No. 4 Engine	31 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	5.13E-05 tons	4 hours	2.05E-04 tons	4 hours	2.05E-04 tons	1 hour	5.13E-05 tons	10 hours	5.13E-04 tons
Forward Fast Rescue Craft Engine	86 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.42E-04 tons	4 hours	5.69E-04 tons	3 hours	4.26E-04 tons	1 hour	1.42E-04 tons	9 hours	0.001 tons
Aft Fast Rescue Craft Engine	118 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.94E-04 tons	4 hours	7.78E-04 tons	3 hours	5.83E-04 tons	1 hour	1.94E-04 tons	9 hours	0.002 tons
Emergency Start Compressor Engine	7 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.09E-05 tons	2 hours	2.17E-05 tons	1 hour	1.09E-05 tons	1 hour	1.09E-05 tons	5 hours	5.43E-05 tons
Heat Boiler	14 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	120 hours	0.002 tons	740 hours	0.01 tons	720 hours	0.01 tons	96 hours	0.002 tons	1,676 hours	0.03 tons
Heat Boiler	14 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	168 hours	0.003 tons	740 hours	0.01 tons	720 hours	0.01 tons	96 hours	0.002 tons	1,724 hours	0.03 tons
Incinerator	220 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Transocean Polar Pioneer*					**0.3 tons**		**1.4 tons**		**1.5 tons**		**0.2 tons**		**3.5 tons**
Ice management (*Fennica*)													
Propulsion and Generator Engines	16,800 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	54,623 gallons	0.4 tons	79,590 gallons	0.5 tons	21,167 gallons	0.1 tons	155,380 gallons	1.0 tons
Harbour Set Generator Engine	424 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	0 hours	0 tons	211 hours	0.001 tons	564 hours	0.003 tons	81 hours	4.66E-04 tons	856 hours	0.005 tons
Heat Boiler	4 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	0 hours	0 tons	167 hours	0.001 tons	585 hours	0.003 tons	94 hours	5.41E-04 tons	846 hours	0.005 tons
Incinerator	154 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	0 hours	0 tons	41 hours	0.005 tons	105 hours	0.01 tons	29 hours	0.003 tons	175 hours	0.02 tons
Emergency Generator	240 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	4 hours	1.59E-03 tons	4 hours	0.002 tons	1 hour	3.97E-04 tons	9 hours	3.57E-03 tons
Total - *Fennica*					**0 tons**		**0.4 tons**		**0.5 tons**		**0.1 tons**		**1.1 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Volatile Organic Compound (VOC) Emissions [2]

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Cumulative Operation	Cumulative VOC Emissions
Ice Management (*Nordica*)													
Propulsion and Generator Engines	16,800 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	19,179 gallons	0.1 tons	81,950 gallons	0.5 tons	90,742 gallons	0.6 tons	12,123 gallons	0.08 tons	203,994 gallons	1.4 tons
Harbour Set Generator Engine	424 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	33 hours	1.90E-04 tons	41 hours	2.36E-04 tons	26 hours	1.50E-04 tons	59 hours	3.39E-04 tons	159 hours	9.15E-04 tons
Heat Boiler	4 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	143 hours	8.23E-04 tons	576 hours	0.003 tons	550 hours	0.003 tons	77 hours	4.43E-04 tons	1,346 hours	0.008 tons
Incinerator	154 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	18 hours	0.002 tons	81 hours	0.009 tons	95 hours	0.01 tons	16 hours	0.002 tons	210 hours	0.02 tons
Emergency Generator	240 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.97E-04 tons	3 hours	0.001 tons	2 hours	7.94E-04 tons	1 hour	3.97E-04 tons	7 hours	0.003 tons
Total - *Nordica*					**0.1 tons**		**0.6 tons**		**0.6 tons**		**0.08 tons**		**1.4 tons**
Anchor Handler (*Aiviq*)													
Propulsion Engines	13,001 kW	0.7 g/kW-hr	Vendor Data	48,091 gallons	0.5 tons	113,951 gallons	1.2 tons	108,921 gallons	1.2 tons	19,682 gallons	0.2 tons	290,645 gallons	3.2 tons
Generator Engines	5,440 kW	0.5 g/kW-hr	Vendor Data	44,479 gallons	0.4 tons	114,640 gallons	0.9 tons	81,105 gallons	0.7 tons	11,447 gallons	0.1 tons	251,671 gallons	2.0 tons
Heat Boiler	5 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	123 hours	8.36E-04 tons	651 hours	0.004 tons	552 hours	0.004 tons	72 hours	4.90E-04 tons	1,398 hours	0.01 tons
Incinerator	276 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	34 hours	0.007 tons	129 hours	0.03 tons	150 hours	0.03 tons	7 hours	0.001 tons	320 hours	0.07 tons
Emergency Generator #1	728 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10 hours	0.003 tons	40 hours	0.01 tons	31 hours	0.01 tons	10 hours	0.003 tons	91 hours	0.03 tons
Emergency Generator #2	728 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10 hours	0.003 tons	32 hours	0.01 tons	38 hours	0.01 tons	10 hours	0.003 tons	90 hours	0.03 tons
Fast Rescue Craft FP 800 Thruster	119 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	2 hours	3.95E-04 tons	4 hours	7.90E-04 tons	4 hours	7.90E-04 tons	1 hour	1.97E-04 tons	11 hours	0.002 tons
Delta Craft Main Propulsion	188 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.11E-04 tons	2 hours	6.22E-04 tons	2 hours	6.22E-04 tons	1 hour	3.11E-04 tons	6 hours	0.002 tons
Delta Craft Main Propulsion	188 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.11E-04 tons	2 hours	6.22E-04 tons	2 hours	6.22E-04 tons	1 hour	3.11E-04 tons	6 hours	0.002 tons
Fassemer 64 Mn Enclosed Lifeboat #1	23 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.85E-05 tons	2 hours	7.70E-05 tons	2 hours	7.70E-05 tons	1 hour	3.85E-05 tons	6 hours	2.31E-04 tons
Fassemer 64 Mn Enclosed Lifeboat #2	23 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	3.85E-05 tons	2 hours	7.70E-05 tons	2 hours	7.70E-05 tons	1 hour	3.85E-05 tons	6 hours	2.31E-04 tons
TranRec150 Power Pack Engine	152 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Aiviq*					**0.9 tons**		**2.2 tons**		**1.9 tons**		**0.3 tons**		**5.3 tons**
Anchor Handler (*Tor Viking*)													
Propulsion Engines	10,752 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	32,013 gallons	0.2 tons	85,773 gallons	0.6 tons	79,213 gallons	0.5 tons	25,130 gallons	0.2 tons	222,129 gallons	1.5 tons
Harbor Generator Engine	400 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	27 hours	0.005 tons	212 hours	0.04 tons	53 hours	0.01 tons	292 hours	0.06 tons
Harbor Generator Engine	400 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	28 hours	0.005 tons	202 hours	0.04 tons	81 hours	0.01 tons	311 hours	0.05 tons
Heat Boiler	1 MMBtu/hr	0.3 lb/kgal	Table 1.3-1, AP-42	53 hours	9.41E-05 tons	231 hours	4.10E-04 tons	162 hours	2.88E-04 tons	24 hours	4.26E-05 tons	470 hours	8.34E-04 tons
Emergency Generator	136 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.25E-04 tons	7 hours	0.002 tons	4 hours	8.99E-04 tons	1 hour	2.25E-04 tons	13 hours	0.003 tons
Total - *Tor Viking*					**0.2 tons**		**0.6 tons**		**0.6 tons**		**0.2 tons**		**1.6 tons**
Anchor Handler (*Ross Chouest*)													
Propulsion and Generator Engines	10,023 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	52,571 gallons	0.3 tons	81,552 gallons	0.5 tons	13,125 gallons	0.1 tons	147,248 gallons	1.0 tons
Port Winch	573 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.03 tons	63 hours	0.02 tons	21 hours	0.006 tons	209 hours	0.06 tons
Starboard Winch	573 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	125 hours	0.03 tons	53 hours	0.01 tons	21 hours	0.006 tons	199 hours	0.05 tons
Emergency Generator	256 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	4.23E-04 tons	10 hours	0.004 tons	0 hours	0 tons	11 hours	0.005 tons
Total - *Ross Chouest*					**0 tons**		**0.4 tons**		**0.6 tons**		**0.1 tons**		**1.1 tons**
Support Tug (*Lauren Foss*)													
Propulsion Engines	4,896 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	650 gallons	0.004 tons	0 gallons	0 tons	0 gallons	0 tons	0 gallons	0 tons	650 gallons	0.004 tons
Generator	136 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.005 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.005 tons
Generator	136 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.005 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.005 tons
Emergency Generator	56 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.002 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.002 tons
Hydraulic Bow Thruster	299 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	24 hours	0.01 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	0.01 tons
Total - *Lauren Foss*					**0.03 tons**		**0 tons**		**0 tons**		**0 tons**		**0.03 tons**
Support Tug (*Ocean Wind*)													
Propulsion Engines	6,496 kW	0.7 g/kW-hr	Vendor Data	29,180 gallons	0.3 tons	52,100 gallons	0.6 tons	31,548 gallons	0.3 tons	9,668 gallons	0.1 tons	122,496 gallons	1.3 tons
Harbor Generator Engine	272 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	147 hours	0.066 tons	644 hours	0.29 tons	720 hours	0.3 tons	96 hours	0.04 tons	1,607 hours	0.7 tons
Emergency Generator Engine	100 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.65E-04 tons	30 hours	0.005 tons	4 hours	6.61E-04 tons	1 hour	1.65E-04 tons	36 hours	0.006 tons
Total - *Ocean Wind*					**0.4 tons**		**0.9 tons**		**0.7 tons**		**0.1 tons**		**2.1 tons**
Support Tug (*Ocean Wave*)													
Propulsion Engines	6,496 kW	0.7 g/kW-hr	Vendor Data	23,844 gallons	0.3 tons	52,982 gallons	0.6 tons	18,628 gallons	0.2 tons	16,484 gallons	0.2 tons	111,938 gallons	1.2 tons
Harbor Generator Engine	272 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	168 hours	0.08 tons	697 hours	0.3 tons	691 hours	0.3 tons	96 hours	0.04 tons	1,652 hours	0.7 tons
Emergency Generator Engine	100 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.65E-04 tons	4 hours	6.61E-04 tons	4 hours	6.61E-04 tons	1 hour	1.65E-04 tons	10 hours	0.002 tons
Total - *Ocean Wave*					**0.3 tons**		**0.9 tons**		**0.5 tons**		**0.2 tons**		**2.0 tons**

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Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Cumulative Operation	Cumulative VOC Emissions
Science Vessel (*Harvey Explorer*)													
Propulsion Engines	2,699 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	6,271 gallons	0.04 tons	20,520 gallons	0.1 tons	21,694 gallons	0.1 tons	4,997 gallons	0.03 tons	53,482 gallons	0.4 tons
Starboard Generator Engine	275 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	124 hours	0.06 tons	254 hours	0.1 tons	251 hours	0.1 tons	52 hours	0.02 tons	681 hours	0.3 tons
Center Generator Engine	275 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	4.55E-04 tons	178 hours	0.08 tons	342 hours	0.2 tons	6 hours	0.003 tons	527 hours	0.2 tons
Port Generator Engine	275 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	93 hours	0.04 tons	400 hours	0.2 tons	220 hours	0.1 tons	90 hours	0.04 tons	803 hours	0.4 tons
Fwd/Port Bow Thruster	507 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	72 hours	0.02 tons	134 hours	0.03 tons	83 hours	0.02 tons	51 hours	0.01 tons	340 hours	0.08 tons
Aft/Starboard Bow Thruster	507 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	72 hours	0.02 tons	109 hours	0.03 tons	40 hours	0.01 tons	46 hours	0.01 tons	267 hours	0.06 tons
Stern Thruster	322 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	72 hours	0.01 tons	111 hours	0.02 tons	44 hours	0.007 tons	51 hours	0.008 tons	278 hours	0.04 tons
Emergency Generator Engine	79 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	5 hours	6.55E-04 tons	2 hours	2.62E-04 tons	1 hour	1.31E-04 tons	8 hours	0.001 tons
FRC Outboard Engine	24 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	7.90E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	7.90E-05 tons
Portable Emergy Bilge Pump	4 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Explorer*					**0.2 tons**		**0.6 tons**		**0.6 tons**		**0.1 tons**		**1.5 tons**
Science Vessel (*Sisuaq*) [3]													
Propulsion and Generator Engines	5,840 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10,700 gallons	0.07 tons	44,900 gallons	0.3 tons	57,450 gallons	0.4 tons	5,700 gallons	0.04 tons	118,750 gallons	0.8 tons
Emergency Generator Engine	100 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	1.65E-04 tons	2 hours	3.31E-04 tons	6 hours	0.001 tons	1 hour	1.65E-04 tons	10 hours	0.002 tons
Starboard Air Compressor Engine	269 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Port Air Compressor Engine	269 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
TranRec150 Power Pack	152 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	5.03E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.03E-04 tons
AFT-DOP 250 Power Pack	59 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.93E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.93E-04 tons
FWD-DOP 250 Power Pack	59 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.93E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.93E-04 tons
Ocean Buster Power Pack	15 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	0 hours	0 tons	6 hours	3.97E-04 tons	2 hours	1.32E-04 tons	0 hours	0 tons	8 hours	5.29E-04 tons
Total - *Sisuaq*					**0.07 tons**		**0.3 tons**		**0.4 tons**		**0.04 tons**		**0.8 tons**
OSV (*Harvey Supporter*)													
Propulsion and Generator Engines	5,840 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	10,250 gallons	0.07 tons	20,250 gallons	0.1 tons	24,570 gallons	0.2 tons	7,550 gallons	0.05 tons	62,620 gallons	0.4 tons
Emergency Generator	100 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.65E-04 tons	1 hour	1.65E-04 tons	1 hour	1.65E-04 tons	3 hours	4.96E-04 tons
TranRec150 Power Pack	152 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	10 hours	0.003 tons	2 hours	5.03E-04 tons	2 hours	5.03E-04 tons	0 hours	0 tons	14 hours	0.004 tons
Power Pack	64 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	6 hours	3.97E-04 tons	12 hours	7.94E-04 tons	6 hours	3.97E-04 tons	0 hours	0 tons	24 hours	0.002 tons
Total - *Harvey Supporter*					**0.07 tons**		**0.1 tons**		**0.2 tons**		**0.05 tons**		**0.4 tons**
OSV (*Harvey Champion*) [4]													
Propulsion and Generator Engines	5,840 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	6,000 gallons	0.04 tons	28,662 gallons	0.2 tons	16,100 gallons	0.1 tons	0 gallons	0 tons	50,762 gallons	0.3 tons
Emergency Generator	100 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	3.31E-04 tons	1 hour	1.65E-04 tons	0 hours	0 tons	3 hours	4.96E-04 tons
Incinerator	88 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	4 hours	2.65E-04 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	4 hours	2.65E-04 tons
Total - *Harvey Champion*					**0.04 tons**		**0.2 tons**		**0.1 tons**		**0 tons**		**0.3 tons**
MLC ROV System Vessel (*Harvey Spirit*) [5]													
Propulsion Engines	3,666 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	14,050 gallons	0.09 tons	18,652 gallons	0.1 tons	2,900 gallons	0.02 tons	35,602 gallons	0.2 tons
Starboard Generator Engine	384 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	112 hours	0.02 tons	206 hours	0.04 tons	20 hours	0.004 tons	338 hours	0.06 tons
Center Generator Engine	384 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	33 hours	0.006 tons	83 hours	0.02 tons	28 hours	0.005 tons	144 hours	0.03 tons
Port Generator Engine	384 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	133 hours	0.02 tons	205 hours	0.04 tons	20 hours	0.004 tons	358 hours	0.07 tons
Starboard Bow Thruster	746 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	111 hours	0.04 tons	180 hours	0.06 tons	21 hours	0.007 tons	312 hours	0.1 tons
Port Bow Thruster	746 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	111 hours	0.04 tons	192 hours	0.07 tons	21 hours	0.007 tons	324 hours	0.1 tons
Stern Thruster	746 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 hours	0 tons	111 hours	0.04 tons	192 hours	0.07 tons	21 hours	0.007 tons	324 hours	0.1 tons
Emergency Generator Engine	79 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.31E-04 tons	2 hours	2.62E-04 tons	1 hour	1.31E-04 tons	4 hours	5.24E-04 tons
MLC ROV System Engine	800 kW	0.2 g/kW-hr	Vendor Data	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Spirit*					**0 tons**		**0.3 tons**		**0.4 tons**		**0.05 tons**		**0.7 tons**

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Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor	Reference	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Cumulative Operation	Cumulative VOC Emissions
OSRV (*Nanuq*)													
Propulsion Engines	4,336 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,224 gallons	0.03 tons	50,260 gallons	0.3 tons	45,143 gallons	0.3 tons	6,114 gallons	0.04 tons	106,741 gallons	0.7 tons
Generator Engines	1,534 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	7,145 gallons	0.05 tons	39,278 gallons	0.3 tons	35,331 gallons	0.2 tons	4,172 gallons	0.03 tons	85,926 gallons	0.6 tons
Emergency Generator	133 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.20E-04 tons	5 hours	0.001 tons	4 hours	8.78E-04 tons	6 hours	0.001 tons	16 hours	0.004 tons
Lifeboat Propulsion Engine	17 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	1 hour	2.86E-05 tons	5 hours	1.43E-04 tons	4 hours	1.15E-04 tons	1 hour	2.86E-05 tons	11 hours	3.15E-04 tons
Backpack Blower	1 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
RubberMax Boom Power Pack	13 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	4.23E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	4.23E-05 tons
RubberMax Boom Power Pack	13 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.12E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.12E-05 tons
Power Pack	64 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	2.12E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	2.12E-04 tons
Power Pack	4 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	6.91E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	6.91E-06 tons
Fire Boom Power Pack	4 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	1.38E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.38E-05 tons
Dispersant Pump	3 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	4.94E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	4.94E-06 tons
Water Pump	11 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.85E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.85E-05 tons
Water Pump	11 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	1.85E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.85E-05 tons
3" Pump	3 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	4.37E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	4.37E-06 tons
3" Pump	3 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	4.37E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	4.37E-06 tons
Portable Generator	5 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Pressure Washer	6 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	9.87E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	9.87E-06 tons
TranRec150 Power Pack	152 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	2 hours	5.03E-04 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.03E-04 tons
Incinerator	125 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	0 hours	0 tons	286 hours	0.03 tons	243 hours	0.02 tons	63 hours	0.006 tons	592 hours	0.06 tons
Total - *Nanuq*					**0.08 tons**		**0.6 tons**		**0.6 tons**		**0.08 tons**		**1.3 tons**
OSR Workboats (*Kvichaks*)													
Kvichak No. 1 Propulsion Engine	179 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	3 hours	8.88E-04 tons	70 hours	0.02 tons	65 hours	0.02 tons	0 hours	0 tons	138 hours	0.04 tons
Kvichak No. 1 Propulsion Engine	179 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	3 hours	8.88E-04 tons	86 hours	0.03 tons	70 hours	0.02 tons	0 hours	0 tons	159 hours	0.05 tons
Kvichak No. 1 Generator Engine	7 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	3 hours	3.55E-05 tons	71 hours	8.41E-04 tons	74 hours	8.77E-04 tons	0 hours	0 tons	148 hours	0.002 tons
Kvichak No. 2 Propulsion Engine	179 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	3 hours	8.88E-04 tons	92 hours	0.03 tons	68 hours	0.02 tons	0 hours	0 tons	163 hours	0.05 tons
Kvichak No. 2 Propulsion Engine	179 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	3 hours	8.88E-04 tons	75 hours	0.02 tons	68 hours	0.02 tons	0 hours	0 tons	146 hours	0.04 tons
Kvichak No. 2 Generator Engine	7 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	3 hours	3.55E-05 tons	88 hours	1.04E-03 tons	68 hours	8.06E-04 tons	0 hours	0 tons	159 hours	0.002 tons
Kvichak No. 3 Propulsion Engine	179 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	31 hours	0.009 tons	16 hours	0.005 tons	0 hours	0 tons	47 hours	0.01 tons
Kvichak No. 3 Propulsion Engine	179 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	31 hours	0.009 tons	18 hours	0.005 tons	0 hours	0 tons	49 hours	0.01 tons
Kvichak No. 3 Generator Engine	7 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	31 hours	3.67E-04 tons	2 hours	2.37E-05 tons	0 hours	0 tons	33 hours	3.91E-04 tons
Total - *Kvichaks*					**0.004 tons**		**0.1 tons**		**0.09 tons**		**0 tons**		**0.2 tons**
OSR-T/B (*Guardsman /Klamath*)													
Propulsion Engines	4,299 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,621 gallons	0.04 tons	32,858 gallons	0.2 tons	20,507 gallons	0.1 tons	0 gallons	0 tons	58,986 gallons	0.4 tons
Generator Engine	119 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.03 tons	720 hours	0.1 tons	474 hours	0.09 tons	0 hours	0 tons	1,338 hours	0.3 tons
Generator Engine	119 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	144 hours	0.03 tons	744 hours	0.15 tons	249 hours	0.05 tons	0 hours	0 tons	1,137 hours	0.2 tons
TranRec150 Power Pack	152 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.51E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.51E-04 tons
TranRec150 Power Pack	152 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	1 hour	2.51E-04 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.51E-04 tons
Generator Engine	121 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Generator Engine	104 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	3 hours	5.18E-04 tons	0 hours	0 tons	0 hours	0 tons	3 hours	5.18E-04 tons
Total - *Guardsman/Klamath*					**0.09 tons**		**0.5 tons**		**0.3 tons**		**0 tons**		**0.9 tons**

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		Factor	Reference	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Operation	Calculated VOC Emissions [7,8,9]	Cumulative Operation	Cumulative VOC Emissions
Arctic Oil Storage Tanker (*Marika*) [6]													
Propulsion Engine	10,848 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	0 gallons	0 tons	6,611 gallons	0.04 tons	2,741 gallons	0.02 tons	0 gallons	0 tons	9,352 gallons	0.06 tons
Auxiliary Engines	3,456 kW	0.4 g/kW-hr	Table 3.4-1, AP-42	5,036 gallons	0.03 tons	23,906 gallons	0.2 tons	22,059 gallons	0.1 tons	2,763 gallons	0.02 tons	53,764 gallons	0.4 tons
Emergency Generator	221 kW	1.5 g/kW-hr	Table 3.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Auxiliary Boiler	25,000 kg/hr	0.3 lb/kgal	Table 1.3-1, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Composite Boiler	3,600 kg/hr	0.3 lb/kgal	Table 1.3-1, AP-42	169 hours	0.001 tons	664 hours	0.006 tons	673 hours	0.006 tons	91 hours	8.01E-04 tons	1,597 hours	0.01 tons
Incinerator	238 lb/hr	3.0 lb/ton	Table 2.1-12, AP-42	16 hours	0.003 tons	24 hours	0.004 tons	24 hours	0.004 tons	7 hours	0.001 tons	71 hours	0.01 tons
Total - *Marika*					**0.04 tons**		**0.2 tons**		**0.2 tons**		**0.02 tons**		**0.4 tons**
Total - Support Vessels					**2.6 tons**		**8.8 tons**		**8.2 tons**		**1.6 tons**		**21.2 tons**

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the Noble Discoverer was not anchored over the drill site and not considered a facility.

[2] VOC emissions are calculated without the application of a control efficiency for existing post-combustion control technology.

[3] The *Sisuaq* (similar to *Harvey Supporter*) served as the backup, second Science Vessel during the period.

[4] The *Harvey Champion* (similar to *Sisuaq*) served as the second offshore supply vessel (OSV) during the period.

[5] The *Harvey Spirit* served as an offshore supply vessel (OSV) during the period. No off-line MLC activity occurred on the *Harvey Spirit* during the period.

[6] The *Marika* served as the Arctic Oil Storage Tanker during the period. A notice of this vessel change from the *Affinity* was made by email to Mr. Johnston with BOEM from Mr. Horner with Shell on July 23, 2015.

[7] Conversion factors

453.592	g/lb
2,000	lb/ton
1.34	hp/kW
2.20462	lb/kg
34.5	lb (steam)/boiler hp-hour
33,446	BTU/boiler hp-hour

[8] Engine heat rate

7,000	BTU/hp-hr

[9] Diesel fuel energy

131,180	BTU/gal

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
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Seasonal Operating Report - Attachment 3
Calculated Sulfur Dioxide (SO_2) Emissions

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor [2]	Reference	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Cumulative Operation	Cumulative SO_2 Emissions
MODU (*Noble Discoverer*)													
Generator Engines	5,287 kW	100 ppmw	Mass Balance Calculation	0 gallons	0 tons	45,726 gallons	0.03 tons	25,992 gallons	0.02 tons	4,513 gallons	0.003 tons	76,231 gallons	0.05 tons
Propulsion Engine	5,184 kW	100 ppmw	Mass Balance Calculation	0 gallons	0 tons	98 gallons	6.86E-05 tons	100 gallons	7.00E-05 tons	444 gallons	3.11E-04 tons	642 gallons	4.49E-04 tons
HPU Engine	145 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	1 hour	7.26E-06 tons	0 hours	0 tons	1 hour	7.26E-06 tons
HPU Engine	145 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	1 hour	7.26E-06 tons	0 hours	0 tons	1 hour	7.26E-06 tons
Port Deck Crane Engine	360 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	34 hours	6.12E-04 tons	37 hours	6.66E-04 tons	0 hours	0 tons	71 hours	0.001 tons
Starbd Deck Crane Engine	360 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	38 hours	6.84E-04 tons	18 hours	3.24E-04 tons	0 hours	0 tons	56 hours	0.001 tons
Cementing Unit Engine	200 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	3 hours	3.00E-05 tons	0 hours	0 tons	0 hours	0 tons	3 hours	3.00E-05 tons
Cementing Unit Engine	200 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	1.00E-05 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.00E-05 tons
Logging Unit Engine	179 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Compressor Engine	84 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	405 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	17 hours	3.45E-04 tons	16 hours	3.24E-04 tons	0 hours	0 tons	33 hours	6.69E-04 tons
Lifeboat No. 1 Engine	18 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	3 hours	2.67E-06 tons	2 hours	1.78E-06 tons	0 hours	0 tons	5 hours	4.45E-06 tons
Lifeboat No. 2 Engine	18 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	3 hours	2.67E-06 tons	2 hours	1.78E-06 tons	0 hours	0 tons	5 hours	4.45E-06 tons
Lifeboat No. 3 Engine	18 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	3 hours	2.67E-06 tons	2 hours	1.78E-06 tons	0 hours	0 tons	5 hours	4.45E-06 tons
Lifeboat No. 4 Engine	18 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	3 hours	2.67E-06 tons	2 hours	1.78E-06 tons	0 hours	0 tons	5 hours	4.45E-06 tons
Heat Boiler	8 MMBtu/hr	100 ppmw	Mass Balance Calculation	0 hours	0 tons	100 hours	0.004 tons	288 hours	0.01 tons	22 hours	9.35E-04 tons	410 hours	0.02 tons
Heat Boiler	8 MMBtu/hr	100 ppmw	Mass Balance Calculation	0 hours	0 tons	427 hours	0.02 tons	24 hours	0.001 tons	39 hours	0.002 tons	490 hours	0.02 tons
Incinerator	276 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	146 hours	0.03 tons	83 hours	0.02 tons	14 hours	0.003 tons	243 hours	0.06 tons
Total - *Noble Discoverer*					**0 tons**		**0.09 tons**		**0.05 tons**		**0.009 tons**		**0.2 tons**
MODU (*Transocean Polar Pioneer*)													
Generator Engines	11,000 kW	100 ppmw	Mass Balance Calculation	45,856 gallons	0.03 tons	210,537 gallons	0.1 tons	217,680 gallons	0.2 tons	28,013 gallons	0.02 tons	502,086 gallons	0.4 tons
HPU Engine	149 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
HPU Engine	149 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Logging Unit Engine	179 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	64 hours	5.74E-04 tons	0 hours	0 tons	64 hours	5.74E-04 tons
Compressor Engine	84 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Sidewall Core Tool Engine	34 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Emergency Generator Engine	896 kW	100 ppmw	Mass Balance Calculation	1 hour	4.48E-05 tons	5 hours	2.24E-04 tons	4 hours	1.79E-04 tons	0 hours	0 tons	10 hours	4.48E-04 tons
Rescue Boat Engine	127 kW	100 ppmw	Mass Balance Calculation	1 hour	6.33E-06 tons	5 hours	3.17E-05 tons	4 hours	2.53E-05 tons	0 hours	0 tons	10 hours	6.33E-05 tons
Lifeboat No. 1 Engine	31 kW	100 ppmw	Mass Balance Calculation	1 hour	1.55E-06 tons	4 hours	6.21E-06 tons	4 hours	6.21E-06 tons	1 hour	1.55E-06 tons	10 hours	1.55E-05 tons
Lifeboat No. 2 Engine	31 kW	100 ppmw	Mass Balance Calculation	1 hour	1.55E-06 tons	4 hours	6.21E-06 tons	4 hours	6.21E-06 tons	1 hour	1.55E-06 tons	10 hours	1.55E-05 tons
Lifeboat No. 3 Engine	31 kW	100 ppmw	Mass Balance Calculation	1 hour	1.55E-06 tons	4 hours	6.21E-06 tons	4 hours	6.21E-06 tons	1 hour	1.55E-06 tons	10 hours	1.55E-05 tons
Lifeboat No. 4 Engine	31 kW	100 ppmw	Mass Balance Calculation	1 hour	1.55E-06 tons	4 hours	6.21E-06 tons	4 hours	6.21E-06 tons	1 hour	1.55E-06 tons	10 hours	1.55E-05 tons
Forward Fast Rescue Craft Engine	86 kW	100 ppmw	Mass Balance Calculation	1 hour	4.30E-06 tons	4 hours	1.72E-05 tons	3 hours	1.29E-05 tons	1 hour	4.30E-06 tons	9 hours	3.87E-05 tons
Aft Fast Rescue Craft Engine	118 kW	100 ppmw	Mass Balance Calculation	1 hour	5.88E-06 tons	4 hours	2.35E-05 tons	3 hours	1.77E-05 tons	1 hour	5.88E-06 tons	9 hours	5.30E-05 tons
Emergency Start Compressor Engine	7 kW	100 ppmw	Mass Balance Calculation	1 hour	3.29E-07 tons	2 hours	6.57E-07 tons	1 hour	3.29E-07 tons	1 hour	3.29E-07 tons	5 hours	1.64E-06 tons
Heat Boiler	14 MMBtu/hr	100 ppmw	Mass Balance Calculation	120 hours	0.009 tons	740 hours	0.06 tons	720 hours	0.06 tons	96 hours	0.007 tons	1,676 hours	0.1 tons
Heat Boiler	14 MMBtu/hr	100 ppmw	Mass Balance Calculation	168 hours	0.01 tons	740 hours	0.06 tons	720 hours	0.06 tons	96 hours	0.007 tons	1,724 hours	0.1 tons
Incinerator	220 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Transocean Polar Pioneer*					**0.05 tons**		**0.3 tons**		**0.3 tons**		**0.03 tons**		**0.6 tons**
Ice management (*Fennica*)													
Propulsion and Generator Engines	16,800 kW	100 ppmw	Mass Balance Calculation	0 gallons	0 tons	54,623 gallons	0.04 tons	79,590 gallons	0.06 tons	21,167 gallons	0.01 tons	155,380 gallons	0.1 tons
Harbour Set Generator Engine	424 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	100 ppmw	Mass Balance Calculation	0 hours	0 tons	211 hours	0.005 tons	564 hours	0.01 tons	81 hours	0.002 tons	856 hours	0.02 tons
Heat Boiler	4 MMBtu/hr	100 ppmw	Mass Balance Calculation	0 hours	0 tons	167 hours	0.004 tons	585 hours	0.01 tons	94 hours	0.002 tons	846 hours	0.02 tons
Incinerator	154 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	41 hours	0.005 tons	105 hours	0.01 tons	29 hours	0.004 tons	175 hours	0.02 tons
Emergency Generator	240 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	4 hours	4.80E-05 tons	4 hours	4.80E-05 tons	1 hour	1.20E-05 tons	9 hours	1.08E-04 tons
Total - *Fennica*					**0 tons**		**0.05 tons**		**0.1 tons**		**0.02 tons**		**0.2 tons**

Shell Gulf of Mexico Inc.
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Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor [2]	Reference	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Cumulative Operation	Cumulative SO_2 Emissions
Ice Management (*Nordica*)													
Propulsion and Generator Engines	16,800 kW	100 ppmw	Mass Balance Calculation	19,179 gallons	0.01 tons	81,950 gallons	0.06 tons	90,742 gallons	0.06 tons	12,123 gallons	0.008 tons	203,994 gallons	0.1 tons
Harbour Set Generator Engine	424 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Heat Boiler	4 MMBtu/hr	100 ppmw	Mass Balance Calculation	33 hours	7.81E-04 tons	41 hours	9.71E-04 tons	26 hours	6.16E-04 tons	59 hours	0.001 tons	159 hours	0.004 tons
Heat Boiler	4 MMBtu/hr	100 ppmw	Mass Balance Calculation	143 hours	0.003 tons	576 hours	0.01 tons	550 hours	0.01 tons	77 hours	0.002 tons	1,346 hours	0.03 tons
Incinerator	154 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	18 hours	0.002 tons	81 hours	0.01 tons	95 hours	0.01 tons	16 hours	0.002 tons	210 hours	0.03 tons
Emergency Generator	240 kW	100 ppmw	Mass Balance Calculation	1 hour	1.20E-05 tons	3 hours	3.60E-05 tons	2 hours	2.40E-05 tons	1 hour	1.20E-05 tons	7 hours	8.40E-05 tons
Total - *Nordica*					**0.02 tons**		**0.08 tons**		**0.09 tons**		**0.01 tons**		**0.2 tons**
Anchor Handler (*Aiviq*)													
Propulsion Engines	13,001 kW	100 ppmw	Mass Balance Calculation	48,091 gallons	0.03 tons	113,951 gallons	0.08 tons	108,921 gallons	0.08 tons	19,682 gallons	0.01 tons	290,645 gallons	0.2 tons
Generator Engines	5,440 kW	100 ppmw	Mass Balance Calculation	44,479 gallons	0.03 tons	114,640 gallons	0.08 tons	81,105 gallons	0.06 tons	11,447 gallons	0.01 tons	251,671 gallons	0.2 tons
Heat Boiler	5 MMBtu/hr	100 ppmw	Mass Balance Calculation	123 hours	0.003 tons	651 hours	0.02 tons	552 hours	0.02 tons	72 hours	0.002 tons	1,398 hours	0.04 tons
Incinerator	276 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	34 hours	0.008 tons	129 hours	0.03 tons	150 hours	0.04 tons	7 hours	0.002 tons	320 hours	0.08 tons
Emergency Generator #1	728 kW	100 ppmw	Mass Balance Calculation	10 hours	3.64E-04 tons	40 hours	0.001 tons	31 hours	0.001 tons	10 hours	3.64E-04 tons	91 hours	0.003 tons
Emergency Generator #2	728 kW	100 ppmw	Mass Balance Calculation	10 hours	3.64E-04 tons	32 hours	0.001 tons	38 hours	0.001 tons	10 hours	3.64E-04 tons	90 hours	0.003 tons
Fast Rescue Craft FP 800 Thruster	119 kW	100 ppmw	Mass Balance Calculation	2 hours	1.19E-05 tons	4 hours	2.39E-05 tons	4 hours	2.39E-05 tons	1 hour	5.97E-06 tons	11 hours	6.57E-05 tons
Delta Craft Main Propulsion	188 kW	100 ppmw	Mass Balance Calculation	1 hour	9.41E-06 tons	2 hours	1.88E-05 tons	2 hours	1.88E-05 tons	1 hour	9.41E-06 tons	6 hours	5.65E-05 tons
Delta Craft Main Propulsion	188 kW	100 ppmw	Mass Balance Calculation	1 hour	9.41E-06 tons	2 hours	1.88E-05 tons	2 hours	1.88E-05 tons	1 hour	9.41E-06 tons	6 hours	5.65E-05 tons
Fassemer 64 Mn Enclosed Lifeboat #1	23 kW	100 ppmw	Mass Balance Calculation	1 hour	1.16E-06 tons	2 hours	2.33E-06 tons	2 hours	2.33E-06 tons	1 hour	1.16E-06 tons	6 hours	6.99E-06 tons
Fassemer 64 Mn Enclosed Lifeboat #2	23 kW	100 ppmw	Mass Balance Calculation	1 hour	1.16E-06 tons	2 hours	2.33E-06 tons	2 hours	2.33E-06 tons	1 hour	1.16E-06 tons	6 hours	6.99E-06 tons
TranRec150 Power Pack Engine	152 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Aiviq*					**0.08 tons**		**0.2 tons**		**0.2 tons**		**0.03 tons**		**0.5 tons**
Anchor Handler (*Tor Viking*)													
Propulsion Engines	10,752 kW	100 ppmw	Mass Balance Calculation	32,013 gallons	0.02 tons	85,773 gallons	0.06 tons	79,213 gallons	0.06 tons	25,130 gallons	0.02 tons	222,129 gallons	0.2 tons
Harbor Generator Engine	400 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	27 hours	5.40E-04 tons	212 hours	0.004 tons	53 hours	0.001 tons	292 hours	0.006 tons
Harbor Generator Engine	400 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	28 hours	5.60E-04 tons	202 hours	0.004 tons	81 hours	0.002 tons	311 hours	0.006 tons
Heat Boiler	1 MMBtu/hr	100 ppmw	Mass Balance Calculation	53 hours	3.87E-04 tons	231 hours	0.002 tons	162 hours	0.001 tons	24 hours	1.75E-04 tons	470 hours	0.003 tons
Emergency Generator	136 kW	100 ppmw	Mass Balance Calculation	1 hour	6.80E-06 tons	7 hours	4.76E-05 tons	4 hours	2.72E-05 tons	1 hour	6.80E-06 tons	13 hours	8.85E-05 tons
Total - *Tor Viking*					**0.02 tons**		**0.06 tons**		**0.06 tons**		**0.02 tons**		**0.2 tons**
Anchor Handler (*Ross Chouest*)													
Propulsion and Generator Engines	10,023 kW	100 ppmw	Mass Balance Calculation	0 gallons	0 tons	52,571 gallons	0.04 tons	81,552 gallons	0.06 tons	13,125 gallons	0.009 tons	147,248 gallons	0.1 tons
Port Winch	573 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	125 hours	0.004 tons	63 hours	0.002 tons	21 hours	6.02E-04 tons	209 hours	0.006 tons
Starboard Winch	573 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	125 hours	0.004 tons	53 hours	0.002 tons	21 hours	6.02E-04 tons	199 hours	0.006 tons
Emergency Generator	256 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	1.28E-05 tons	10 hours	1.28E-04 tons	0 hours	0 tons	11 hours	1.41E-04 tons
Total - *Ross Chouest*					**0 tons**		**0.04 tons**		**0.06 tons**		**0.01 tons**		**0.1 tons**
Support Tug (*Lauren Foss*)													
Propulsion Engines	4,896 kW	100 ppmw	Mass Balance Calculation	650 gallons	4.55E-04 tons	0 gallons	0 tons	0 gallons	0 tons	0 gallons	0 tons	650 gallons	4.55E-04 tons
Generator	136 kW	100 ppmw	Mass Balance Calculation	24 hours	1.63E-04 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	1.63E-04 tons
Generator	136 kW	100 ppmw	Mass Balance Calculation	24 hours	1.63E-04 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	1.63E-04 tons
Emergency Generator	56 kW	100 ppmw	Mass Balance Calculation	24 hours	6.72E-05 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	6.72E-05 tons
Hydraulic Bow Thruster	299 kW	100 ppmw	Mass Balance Calculation	24 hours	3.58E-04 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	24 hours	3.58E-04 tons
Total - *Lauren Foss*					**0.001 tons**		**0 tons**		**0 tons**		**0 tons**		**0.001 tons**
Support Tug (*Ocean Wind*)													
Propulsion Engines	6,496 kW	100 ppmw	Mass Balance Calculation	29,180 gallons	0.02 tons	52,100 gallons	0.04 tons	31,548 gallons	0.02 tons	9,668 gallons	0.007 tons	122,496 gallons	0.09 tons
Harbor Generator Engine	272 kW	100 ppmw	Mass Balance Calculation	147 hours	2.00E-03 tons	644 hours	0.009 tons	720 hours	0.01 tons	96 hours	0.001 tons	1,607 hours	0.02 tons
Emergency Generator Engine	100 kW	100 ppmw	Mass Balance Calculation	1 hour	5.00E-06 tons	30 hours	1.50E-04 tons	4 hours	2.00E-05 tons	1 hour	5.00E-06 tons	36 hours	1.80E-04 tons
Total - *Ocean Wind*					**0.02 tons**		**0.05 tons**		**0.03 tons**		**0.008 tons**		**0.1 tons**
Support Tug (*Ocean Wave*)													
Propulsion Engines	6,496 kW	100 ppmw	Mass Balance Calculation	23,844 gallons	0.02 tons	52,982 gallons	0.04 tons	18,628 gallons	0.01 tons	16,484 gallons	0.01 tons	111,938 gallons	0.08 tons
Harbor Generator Engine	272 kW	100 ppmw	Mass Balance Calculation	168 hours	0.002 tons	697 hours	0.009 tons	691 hours	0.009 tons	96 hours	0.001 tons	1,652 hours	0.02 tons
Emergency Generator Engine	100 kW	100 ppmw	Mass Balance Calculation	1 hour	5.00E-06 tons	4 hours	2.00E-05 tons	4 hours	2.00E-05 tons	1 hour	5.00E-06 tons	10 hours	5.00E-05 tons
Total - *Ocean Wave*					**0.02 tons**		**0.05 tons**		**0.02 tons**		**0.01 tons**		**0.1 tons**

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		Factor [2]	Reference	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Cumulative Operation	Cumulative SO_2 Emissions
Science Vessel (*Harvey Explorer*)													
Propulsion Engines	2,699 kW	100 ppmw	Mass Balance Calculation	6,271 gallons	0.004 tons	20,520 gallons	0.01 tons	21,694 gallons	0.02 tons	4,997 gallons	0.003 tons	53,482 gallons	0.04 tons
Starboard Generator Engine	275 kW	100 ppmw	Mass Balance Calculation	124 hours	0.002 tons	254 hours	0.003 tons	251 hours	0.003 tons	52 hours	7.16E-04 tons	681 hours	0.009 tons
Center Generator Engine	275 kW	100 ppmw	Mass Balance Calculation	1 hour	1.38E-05 tons	178 hours	0.002 tons	342 hours	0.005 tons	6 hours	8.26E-05 tons	527 hours	0.007 tons
Port Generator Engine	275 kW	100 ppmw	Mass Balance Calculation	93 hours	0.001 tons	400 hours	0.006 tons	220 hours	0.003 tons	90 hours	0.001 tons	803 hours	0.01 tons
Fwd/Port Bow Thruster	507 kW	100 ppmw	Mass Balance Calculation	72 hours	0.002 tons	134 hours	0.003 tons	83 hours	0.002 tons	51 hours	0.001 tons	340 hours	0.009 tons
Aft/Starboard Bow Thruster	507 kW	100 ppmw	Mass Balance Calculation	72 hours	0.002 tons	109 hours	0.003 tons	40 hours	0.001 tons	46 hours	0.001 tons	267 hours	0.007 tons
Stern Thruster	322 kW	100 ppmw	Mass Balance Calculation	72 hours	0.001 tons	111 hours	0.002 tons	44 hours	7.10E-04 tons	51 hours	8.23E-04 tons	278 hours	0.004 tons
Emergency Generator Engine	79 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	5 hours	1.98E-05 tons	2 hours	7.92E-06 tons	1 hour	3.96E-06 tons	8 hours	3.17E-05 tons
FRC Outboard Engine	24 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	2.39E-06 tons	0 hours	0 tons	0 hours	0 tons	2 hours	2.39E-06 tons
Portable Emergy Bilge Pump	4 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Explorer*					**0.01 tons**		**0.03 tons**		**0.03 tons**		**0.009 tons**		**0.09 tons**
Science Vessel (*Sisuaq*) [3]													
Propulsion and Generator Engines	5,840 kW	100 ppmw	Mass Balance Calculation	10,700 gallons	0.007 tons	44,900 gallons	0.03 tons	57,450 gallons	0.04 tons	5,700 gallons	0.004 tons	118,750 gallons	0.08 tons
Emergency Generator Engine	100 kW	100 ppmw	Mass Balance Calculation	1 hour	5.00E-06 tons	2 hours	1.00E-05 tons	6 hours	3.00E-05 tons	1 hour	5.00E-06 tons	10 hours	5.00E-05 tons
Starboard Air Compressor Engine	269 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Port Air Compressor Engine	269 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
TranRec150 Power Pack	152 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	1.52E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.52E-05 tons
AFT-DOP 250 Power Pack	59 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	5.85E-06 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.85E-06 tons
FWD-DOP 250 Power Pack	59 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	5.85E-06 tons	0 hours	0 tons	0 hours	0 tons	2 hours	5.85E-06 tons
Ocean Buster Power Pack	15 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	6 hours	4.58E-04 tons	2 hours	1.53E-04 tons	0 hours	0 tons	8 hours	6.10E-04 tons
Total - *Sisuaq*					**0.007 tons**		**0.03 tons**		**0.04 tons**		**0.004 tons**		**0.08 tons**
OSV (*Harvey Supporter*)													
Propulsion and Generator Engines	5,840 kW	100 ppmw	Mass Balance Calculation	10,250 gallons	0.007 tons	20,250 gallons	0.01 tons	24,570 gallons	0.02 tons	7,550 gallons	0.005 tons	62,620 gallons	0.04 tons
Emergency Generator	100 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	5.00E-06 tons	1 hour	5.00E-06 tons	1 hour	5.00E-06 tons	3 hours	1.50E-05 tons
TranRec150 Power Pack	152 kW	100 ppmw	Mass Balance Calculation	10 hours	7.60E-05 tons	2 hours	1.52E-05 tons	2 hours	1.52E-05 tons	0 hours	0 tons	14 hours	1.06E-04 tons
Power Pack	64 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Incinerator	88 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	6 hours	4.58E-04 tons	12 hours	9.15E-04 tons	6 hours	4.58E-04 tons	0 hours	0 tons	24 hours	0.002 tons
Total - *Harvey Supporter*					**0.008 tons**		**0.02 tons**		**0.02 tons**		**0.005 tons**		**0.05 tons**
OSV (*Harvey Champion*) [4]													
Propulsion and Generator Engines	5,840 kW	100 ppmw	Mass Balance Calculation	6,000 gallons	0.004 tons	28,662 gallons	0.02 tons	16,100 gallons	0.01 tons	0 gallons	0 tons	50,762 gallons	0.04 tons
Emergency Generator	100 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	1.00E-05 tons	1 hour	5.00E-06 tons	0 hours	0 tons	3 hours	1.50E-05 tons
Incinerator	88 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	4 hours	3.05E-04 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	4 hours	3.05E-04 tons
Total - *Harvey Champion*					**0.005 tons**		**0.02 tons**		**0.01 tons**		**0 tons**		**0.04 tons**
MLC ROV System Vessel (*Harvey Spirit*) [5]													
Propulsion Engines	3,666 kW	100 ppmw	Mass Balance Calculation	0 gallons	0 tons	14,050 gallons	0.01 tons	18,652 gallons	0.01 tons	2,900 gallons	0.002 tons	35,602 gallons	0.02 tons
Starboard Generator Engine	384 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	112 hours	0.002 tons	206 hours	0.004 tons	20 hours	3.84E-04 tons	338 hours	0.006 tons
Center Generator Engine	384 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	33 hours	6.34E-04 tons	83 hours	0.002 tons	28 hours	5.38E-04 tons	144 hours	0.003 tons
Port Generator Engine	384 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	133 hours	0.003 tons	205 hours	0.004 tons	20 hours	3.84E-04 tons	358 hours	0.007 tons
Starboard Bow Thruster	746 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	111 hours	0.004 tons	180 hours	0.007 tons	21 hours	7.84E-04 tons	312 hours	0.01 tons
Port Bow Thruster	746 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	111 hours	0.004 tons	192 hours	0.007 tons	21 hours	7.84E-04 tons	324 hours	0.01 tons
Stern Thruster	746 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	111 hours	0.004 tons	192 hours	0.007 tons	21 hours	7.84E-04 tons	324 hours	0.01 tons
Emergency Generator Engine	79 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	3.96E-06 tons	2 hours	7.92E-06 tons	1 hour	3.96E-06 tons	4 hours	1.58E-05 tons
MLC ROV System Engine	800 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Total - *Harvey Spirit*					**0 tons**		**0.03 tons**		**0.04 tons**		**0.006 tons**		**0.08 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Sulfur Dioxide (SO_2) Emissions

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor [2]	Reference	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Cumulative Operation	Cumulative SO_2 Emissions
OSRV (*Nanuq*)													
Propulsion Engines	4,336 kW	100 ppmw	Mass Balance Calculation	5,224 gallons	0.004 tons	50,260 gallons	0.04 tons	45,143 gallons	0.03 tons	6,114 gallons	0.004 tons	106,741 gallons	0.07 tons
Generator Engines	1,534 kW	100 ppmw	Mass Balance Calculation	7,145 gallons	0.005 tons	39,278 gallons	0.03 tons	35,331 gallons	0.02 tons	4,172 gallons	0.003 tons	85,926 gallons	0.06 tons
Emergency Generator	133 kW	100 ppmw	Mass Balance Calculation	1 hour	6.64E-06 tons	5 hours	3.32E-05 tons	4 hours	2.66E-05 tons	6 hours	3.99E-05 tons	16 hours	1.06E-04 tons
Lifeboat Propulsion Engine	17 kW	100 ppmw	Mass Balance Calculation	1 hour	8.66E-07 tons	5 hours	4.33E-06 tons	4 hours	3.46E-06 tons	1 hour	8.66E-07 tons	11 hours	9.53E-06 tons
Backpack Blower	1 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
RubberMax Boom Power Pack	13 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	1.28E-06 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.28E-06 tons
RubberMax Boom Power Pack	13 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	6.40E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	6.40E-07 tons
Power Pack	64 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	6.40E-06 tons	0 hours	0 tons	0 hours	0 tons	2 hours	6.40E-06 tons
Power Pack	4 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	2.09E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.09E-07 tons
Fire Boom Power Pack	4 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	4.18E-07 tons	0 hours	0 tons	0 hours	0 tons	2 hours	4.18E-07 tons
Dispersant Pump	3 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	1.49E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.49E-07 tons
Water Pump	11 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	5.60E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	5.60E-07 tons
Water Pump	11 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	5.60E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	5.60E-07 tons
3" Pump	3 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	1.32E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.32E-07 tons
3" Pump	3 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	1.32E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	1.32E-07 tons
Portable Generator	5 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Pressure Washer	6 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	2.99E-07 tons	0 hours	0 tons	0 hours	0 tons	1 hour	2.99E-07 tons
TranRec150 Power Pack	152 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	2 hours	1.52E-05 tons	0 hours	0 tons	0 hours	0 tons	2 hours	1.52E-05 tons
Incinerator	125 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	0 hours	0 tons	286 hours	0.03 tons	243 hours	0.03 tons	63 hours	0.007 tons	592 hours	0.06 tons
Total - *Nanuq*					**0.009 tons**		**0.09 tons**		**0.08 tons**		**0.01 tons**		**0.2 tons**
OSR Workboats (*Kvichaks*)													
Kvichak No. 1 Propulsion Engine	179 kW	100 ppmw	Mass Balance Calculation	3 hours	2.69E-05 tons	70 hours	6.27E-04 tons	65 hours	5.82E-04 tons	0 hours	0 tons	138 hours	0.001 tons
Kvichak No. 1 Propulsion Engine	179 kW	100 ppmw	Mass Balance Calculation	3 hours	2.69E-05 tons	86 hours	7.71E-04 tons	70 hours	6.27E-04 tons	0 hours	0 tons	159 hours	0.001 tons
Kvichak No. 1 Generator Engine	7 kW	100 ppmw	Mass Balance Calculation	3 hours	1.08E-06 tons	71 hours	2.54E-05 tons	74 hours	2.65E-05 tons	0 hours	0 tons	148 hours	5.30E-05 tons
Kvichak No. 2 Propulsion Engine	179 kW	100 ppmw	Mass Balance Calculation	3 hours	2.69E-05 tons	92 hours	8.24E-04 tons	68 hours	6.09E-04 tons	0 hours	0 tons	163 hours	0.001 tons
Kvichak No. 2 Propulsion Engine	179 kW	100 ppmw	Mass Balance Calculation	3 hours	2.69E-05 tons	75 hours	6.72E-04 tons	68 hours	6.09E-04 tons	0 hours	0 tons	146 hours	0.001 tons
Kvichak No. 2 Generator Engine	7 kW	100 ppmw	Mass Balance Calculation	3 hours	1.08E-06 tons	88 hours	3.15E-05 tons	68 hours	2.44E-05 tons	0 hours	0 tons	159 hours	5.70E-05 tons
Kvichak No. 3 Propulsion Engine	179 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	31 hours	2.78E-04 tons	16 hours	1.43E-04 tons	0 hours	0 tons	47 hours	4.21E-04 tons
Kvichak No. 3 Propulsion Engine	179 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	31 hours	2.78E-04 tons	18 hours	1.61E-04 tons	0 hours	0 tons	49 hours	4.39E-04 tons
Kvichak No. 3 Generator Engine	7 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	31 hours	1.11E-05 tons	2 hours	7.17E-07 tons	0 hours	0 tons	33 hours	1.18E-05 tons
Total - *Kvichaks*					**1.10E-04 tons**		**0.004 tons**		**0.003 tons**		**0 tons**		**0.006 tons**
OSR-T/B (*Guardsman /Klamath*)													
Propulsion Engines	4,299 kW	100 ppmw	Mass Balance Calculation	5,621 gallons	0.004 tons	32,858 gallons	0.02 tons	20,507 gallons	0.01 tons	0 gallons	0 tons	58,986 gallons	0.04 tons
Generator Engine	119 kW	100 ppmw	Mass Balance Calculation	144 hours	8.60E-04 tons	720 hours	0.004 tons	474 hours	0.003 tons	0 hours	0 tons	1,338 hours	0.008 tons
Generator Engine	119 kW	100 ppmw	Mass Balance Calculation	144 hours	8.60E-04 tons	744 hours	0.004 tons	249 hours	0.001 tons	0 hours	0 tons	1,137 hours	0.007 tons
TranRec150 Power Pack	152 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	7.60E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	7.60E-06 tons
TranRec150 Power Pack	152 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	1 hour	7.60E-06 tons	0 hours	0 tons	0 hours	0 tons	1 hour	7.60E-06 tons
Generator Engine	121 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Generator Engine	104 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	3 hours	1.57E-05 tons	0 hours	0 tons	0 hours	0 tons	3 hours	1.57E-05 tons
Total - *Guardsman/Klamath*					**0.006 tons**		**0.03 tons**		**0.02 tons**		**0 tons**		**0.06 tons**

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan - Chukchi Sea
2015 Exploration Season [1]
Seasonal Operating Report - Attachment 3
Calculated Sulfur Dioxide (SO_2) Emissions

Monthly and Seasonal Hours of Operation, Fuel Consumption, and Calculated Actual Emissions (Conditional Approval 18.c. and 18.d.)

Unit Description	Maximum Rating	Emission Factor		July		August		September		October		Seasonal	
		Factor [2]	Reference	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Operation	Calculated SO_2 Emissions [7,8,9,10]	Cumulative Operation	Cumulative SO_2 Emissions
Arctic Oil Storage Tanker (*Marika*) [6]													
Propulsion Engine	10,848 kW	100 ppmw	Mass Balance Calculation	0 gallons	0 tons	6,611 gallons	0.005 tons	2,741 gallons	0.002 tons	0 gallons	0 tons	9,352 gallons	0.007 tons
Auxiliary Engines	3,456 kW	100 ppmw	Mass Balance Calculation	5,036 gallons	0.004 tons	23,906 gallons	0.02 tons	22,059 gallons	0.02 tons	2,763 gallons	0.002 tons	53,764 gallons	0.04 tons
Emergency Generator	221 kW	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Auxiliary Boiler	25,000 kg/hr	100 ppmw	Mass Balance Calculation	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons	0 hours	0 tons
Composite Boiler	3,600 kg/hr	100 ppmw	Mass Balance Calculation	169 hours	0.007 tons	664 hours	0.03 tons	673 hours	0.03 tons	91 hours	0.004 tons	1,597 hours	0.07 tons
Incinerator	238 lb/hr	3.5 lb/ton	Table 2.1-2, AP-42	16 hours	0.003 tons	24 hours	0.005 tons	24 hours	0.005 tons	7 hours	0.001 tons	71 hours	0.01 tons
Total - *Marika*					**0.01 tons**		**0.05 tons**		**0.05 tons**		**0.007 tons**		**0.1 tons**
Total - Support Vessels					**0.2 tons**		**0.9 tons**		**0.9 tons**		**0.2 tons**		**2.1 tons**

Notes:

[1] The drilling season for the *Transocean Polar Pioneer* began on July 25, 2015 and ended on October 4, 2015. The drilling season for the *Noble Discoverer* began on August 5, 2015 and ended on October 2, 2015. From August 27, 2015 to September 18, 2015, the Noble Discoverer was not anchored over the drill site and not considered a facility.

[2] SO_2 emissions calculated using 100 parts per million by weight (ppmw) sulfur content to account for fuel blending. All fuel delivered during the drilling season or purchased prior to the drilling season was ultra low sulfur diesel (ULSD) of 15 ppmw or less.

[3] The *Sisuaq* (similar to *Harvey Supporter*) served as the backup, second Science Vessel during the period.

[4] The *Harvey Champion* (similar to *Sisuaq*) served as the second offshore supply vessel (OSV) during the period.

[5] The *Harvey Spirit* served as an offshore supply vessel (OSV) during the period. No off-line MLC activity occurred on the *Harvey Spirit* during the period.

[6] The *Marika* served as the Arctic Oil Storage Tanker during the period. A notice of this vessel change from the *Affinity* was made by email to Mr. Johnston with BOEM from Mr. Horner with Shell on July 23, 2015.

[7] Conversion factors

453.592	g/lb
2,000	lb/t
1.34	hp/kW
2.20462	lb/kg
34.5	lb (steam)/boiler hp-hour
33,446	BTU/boiler hp-hour
32.1	lb S/lb-mole S
64.1	lb SO_2/lb-mole SO_2

[8] Engine heat rate

7,000	BTU/hp-hr

[9] Diesel fuel energy

131,180	BTU/gal

[10] Diesel fuel density

7.00	lb/gal

Attachment 4 – Pre-season Emission Control Status Report

GHG environmental management inc.

14441 Prator Street
Anchorage, AK 99516

Shell Gulf of Mexico Inc.
Revised Outer Continental Shelf Lease Exploration Plan
Chukchi Sea, Alaska
2015 Exploration Drilling Program
Pre-season Assessment of Air Emission Controls Installation and Operation

Introduction

This report documents an assessment of specific air emission controls onboard marine vessels and a drilling unit supporting Shell's 2015 exploration drilling program in the Chukchi Sea of Alaska. The purpose of the pre-season assessment was to address the requirements of Item Number 18.e of the Conditional Approval dated May 11, 2015, issued for Shell's Chukchi Sea Exploration Plan (EP) Revision 2 by the Alaska Region of the Bureau of Ocean Energy Management (BOEM). Item No. 18.e states that Shell must provide to the Alaska BOEM Regional Supervisor, Office of Leasing and Plans (RSLP), the following information:

> *Verification that the respective emission units enumerated in Appendix K to the EP, Table 6 (Units with Emission Controls) and Table 17 (Particulate Matter Emission Controls) have had their respective emission controls installed and operational.*

According to Shell's approved Chukchi Sea EP, the following emission units have been identified in Table 6 and Table 17 with respective emission controls.

Table 6. Units with Emission Controls

Category	Emission Unit	Controls [a]
Drilling Unit	*Discoverer* – Main Generator Engines	SCR and CDPF
Ice Management	*Fennica* – Propulsion and Generator Engines	SCR and OxyCat
Ice Management	*Nordica* – Propulsion and Generator Engines	SCR and OxyCat
Anchor Handler	*Aiviq* – Propulsion Engines	SCR and DOC
Anchor Handler	*Aiviq* – Generator Engines	SCR and CDPF
Anchor Handler	*Tor Viking* – Propulsion and Generator Engines	SCR and OxyCat
Oil Spill Response Vessel	*Nanuq* – Propulsion and Generator Engines	CDPF

[a] DOC = Diesel Oxidation Catalyst, SCR = Selective Catalyst Reduction, OxyCat = Oxidation Catalyst, CDPF = Catalyzed Diesel Particulate Filter

Table 17. Particulate Matter Emission Controls

Category	Emission Units	PM Control Type
Ice Management	*Fennica* – Propulsion and Generator Engines	OxyCat
Anchor Handler	*Aiviq* – Propulsion Engines	DOC
Anchor Handler	*Aiviq* – Generator Engines	CDPF
Ice Management	*Nordica* – Propulsion and Generator Engines	OxyCat
Anchor Handler	*Tor Viking* – Propulsion and Generator Engines	OxyCat
OSRV	*Nanuq* – Propulsion and Generator Engines	CDPF

The pre-season assessment was conducted by Wayne M. Coppel, President, GHG Environmental Management Inc. Mr. Coppel has over 5 years' experience with air quality management including conducting inventories of emission sources and controls at oil and gas platforms and fields in Alaska.

The scope of the assessment included the following:

--Conduct onboard visits of the Noble Discoverer drill ship, Tor Viking, Nordica, Fennica, Aiviq and Nanuq;

--Inventory, observe and photodocument the emission control installations;

--Interview knowledgeable vessel/rig representatives about operational readiness of the emission controls, and;

--Review Shell-provided documentation.

Findings

Noble Discoverer

The Noble Discoverer was visited dockside at the Port of Everett, Washington on June 13, 2015. The Chief Engineer was the vessel representative who accompanied Mr. Coppel. The six main generator engines were equipped with selective catalyst reduction (SCR) and catalyzed diesel particulate filter (CDPF) emission controls. The SCR system including SCR control panels, urea pumps, urea entry ports were observed and photographed. The CDPF system was also photographed. The SCR and CDPF system was undergoing maintenance during the visit and information provided by the Chief Engineer indicated that the systems would become operational upon SCR brick installation and CDPF filter replacement. The information provided by Shell in Attachment B indicates that after the completion of SCR brick and CDPF filter installation the emission control systems were made operational prior to the season.

Tor Viking II

The Tor Viking was visited dockside at the Port of Everett, Washington on June 13, 2015. The 1st Engineer assisted with the onboard visit. The four main propulsion engines and two harbor generator engines were equipped with SCR and oxidation catalyst (OxyCat) emission controls. The SCR system including SCR control panels, urea pumps, urea entry

ports was installed and photographed. The OxyCat system was also installed and photographed. The 1st Engineer indicated that both the SCR and OxyCat systems were operational.

Aiviq

The Aiviq was visited dockside at the Port of Everett, Washington on June 14, 2015. A Chief Engineer designee assisted with the onboard visit. The four main propulsion engines had SCR and diesel oxidation catalyst (DOC) emission controls and the four hybrid generator engines had SCRs and CDPF emission controls. The SCR system including SCR control panels, urea pumps, urea entry ports was installed and photographed. The DOC and CDPF were also installed and photographed. The Chief Engineer designee indicated that the SCR, DOC and CDPF systems were operational.

Fennica

The Fennica was visited dockside at the Port of Everett, Washington on June 15, 2015. The 1st Engineer assisted with the onboard visit. The four main propulsion engines had SCR and OxyCat emission controls. The SCR system including SCR control panels, urea pumps, and urea entry ports was installed and photographed. The OxyCat system was also installed and photographed. The 1st Engineer indicated that the SCR and OxyCat systems were operational.

Nordica

The Nordica was visited dockside at the Port of Portland, Oregon, Vigor site on June 17, 2015. The Chief Engineer assisted with the onboard visit. The four main propulsion engines had SCR and OxyCat emission controls. The SCR system including SCR control panels, urea pumps, urea entry ports was installed and photographed. The OxyCat system was also installed and photographed. The Chief Engineer indicated that the SCR and OxyCat systems were operational.

Nanuq

The Nanuq was visited in Dutch Harbor, Alaska on June 30, 2015. A Chief Engineer designee assisted with the onboard visit. The two propulsion engines and the two main generators were equipped with CDPF emission controls. The CDPF system including filter housings and monitors was installed and photographed. The Chief Engineer designee indicated that the CDPF system was operational.

Conclusion

The BOEM Conditional Approval Number 18.e specifies that at the conclusion of the drilling season, Shell must provide the RSLP with information verifying the installation and operational status of the air quality emission control systems identified in the EP. GHG Environmental Management Inc. was contracted to conduct a pre-season assessment including onboard visits on the Noble Discoverer drill ship and Tor Viking, Fennica, Nordica, Aiviq and Nanuq vessels to determine whether the emission controls identified in Shell's Chukchi Sea EP were installed and operational prior to the 2015 drilling season. Based on the onboard visits, photodocumentation, interviews with vessel/rig representatives and information provided by Shell, the emission controls identified in the EP were installed and operational prior to the start of the 2015 drilling season.

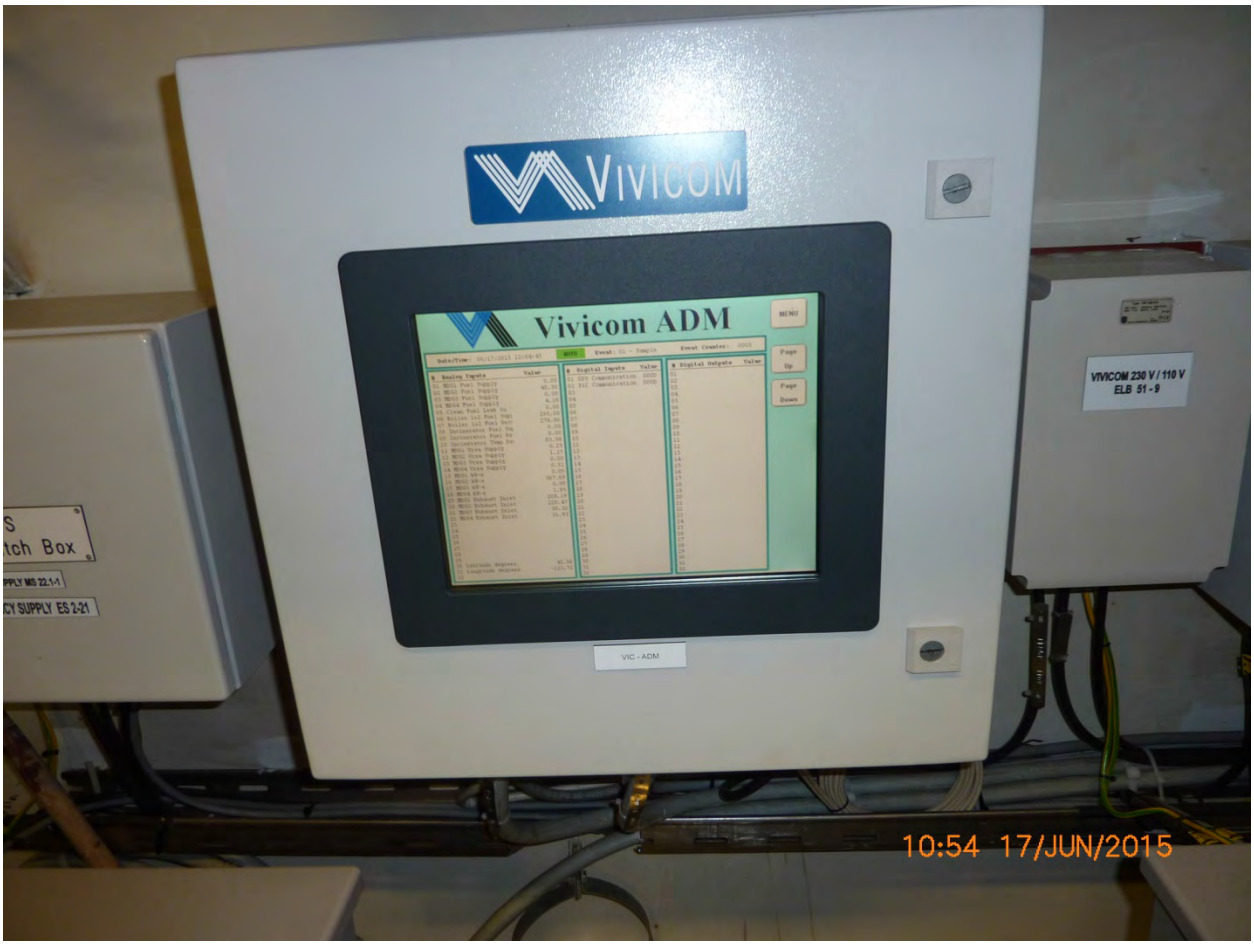
Attachment A – Photodocumentation

Nanuq 1 – Port Main Engine -- Catalyzed Diesel Particulate Filter (CDPF) Housing

Nanuq 2 – Starboard Main Engine -- Catalyzed Diesel Particulate Filter Housing

Nanuq 3 – Forward Generator Engine -- Catalyzed Diesel Particulate Filter Housing

Nanuq 4 – Aft Generator Engine -- Catalyzed Diesel Particulate Filter Housing



Nordica 1– Air Quality Monitor

Nordica 2 – SCR Tank Heater Panel

Nordica 3 – SCR Pump Control Panel No. 2 and Urea Pump

Nordica 4 – SCR Pump Control Panel No. 1 and Urea Pump

Nordica 5 – Main Engine No. 4 – Oxycat Housing

Nordica 6 – Main Engine No. 3 – Oxycat Housing

Nordica 7 – Main Engine No. 2 – Oxycat Housing

Nordica 8 – Main Engine No. 1 – Oxycat Housing

Nordica 9 – Main Engine No. 4 – Urea Injection Port

Nordica 10 – Main Engine No. 1 – Urea Injection Port

Nordica 11 – Main Engine No. 2 – Urea Injection Port

Nordica 12 – Main Engine No. 3 – Urea Injection Port

Nordica 13 – Main Engine No. 3 – SCR control valves

Nordica 14 – Main Engine No. 2 – SCR control valves

Nordica 15 – Main Engine No. 1 – SCR control valves

Nordica 16 – Main Engine No. 4 – SCR control valves

Nordica 17 – Main Engine No. 4 – SCR control panel (inside)

Nordica 18 – Main Engine No. 1 – SCR control panel

Nordica 19 – Main Engine No. 4 – SCR control panel

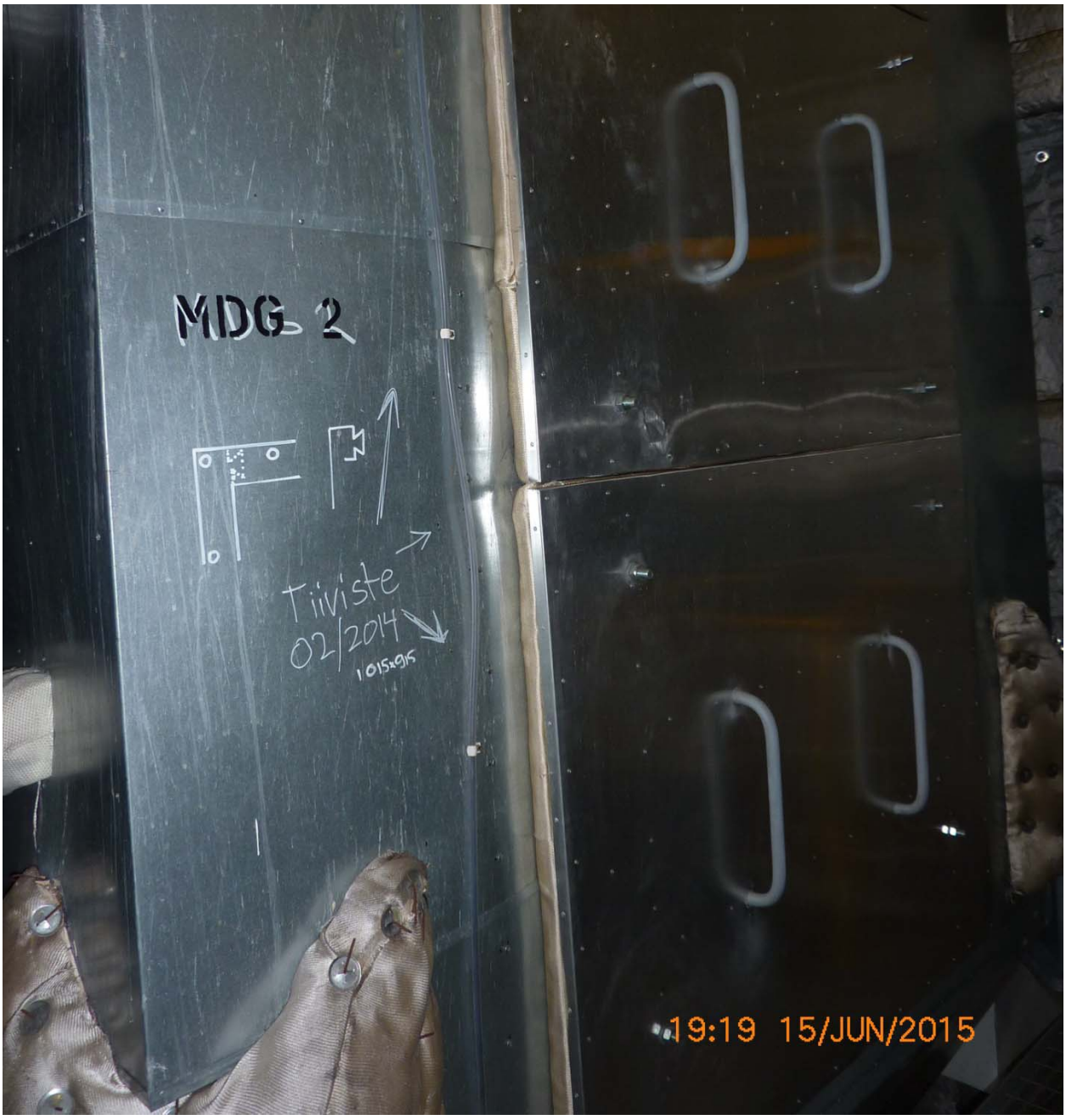
Nordica 20 – Main Engine No. 3 – SCR control panel

Nordica 21 – Main Engine No. 2 – SCR control panel

Fennica 1 – Main Engine No. 1 – SCR control panel

Fennica 2 – Main Engine No. 4 – Oxycat housing

Fennica 3 – Main Engine No. 3 – Oxycat housing



Fennica 4 – Main Engine No. 2 – Oxycat housing

Fennica 5 – Main Engine No. 1 – Oxycat housing

Fennica 6 – Urea flow meters

Fennica 7 – Main Engine No. 4 – Urea injection port

Fennica 8 – Main Engine No. 3 – Urea injection port

Fennica 9 – Main Engine No. 2 -- SCR control panel

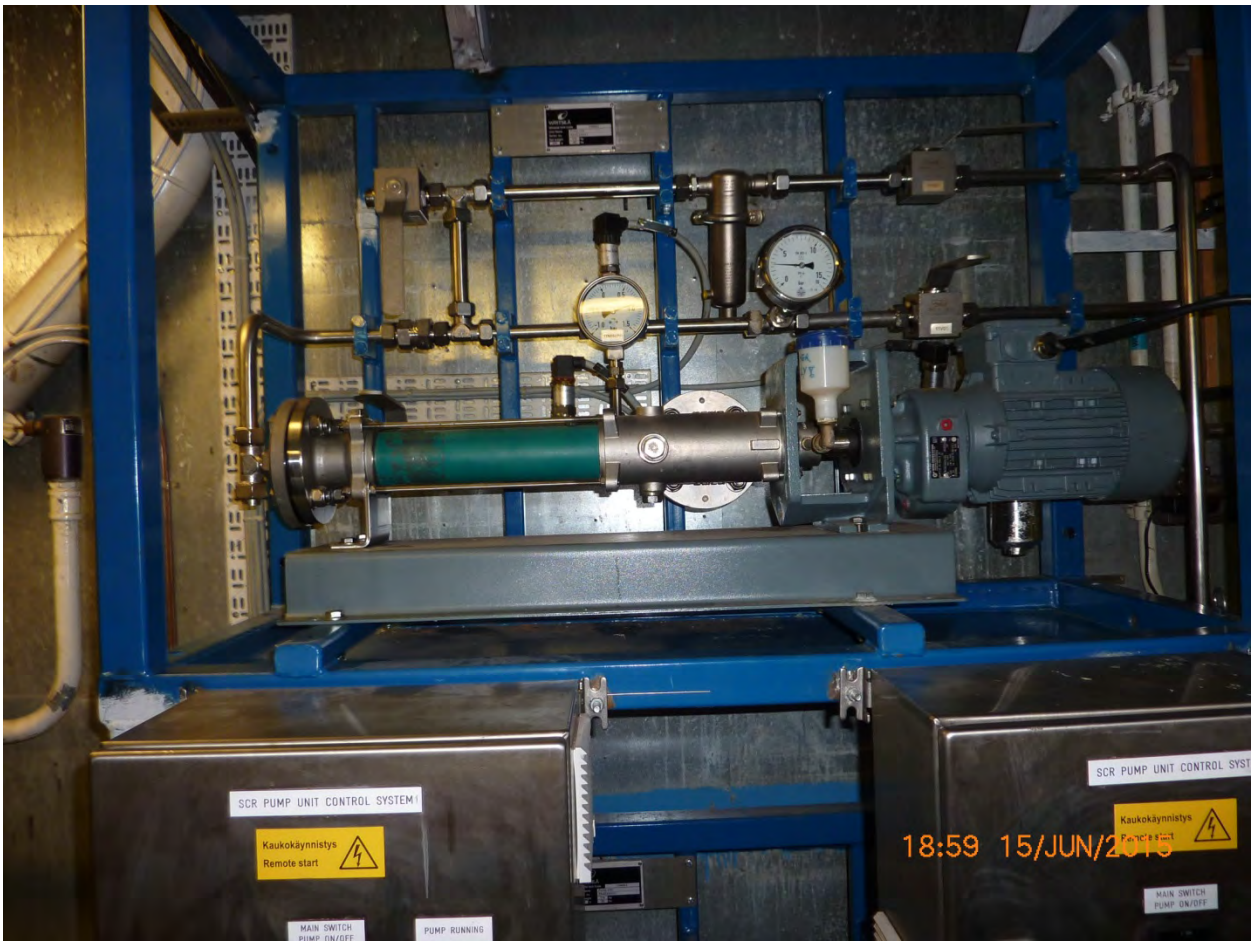
Fennica 10 – Main Engine No. 1 -- SCR control panel

Fennica 11 – Main Engine No. 3 -- SCR control panel (inside)

Fennica 12 – Main Engine No. 4 – Urea injection port

Fennica 13 – Main Engine No. 1 – Urea injection port

Fennica 14 – Air quality monitor



Fennica 15 – Urea pump and SCR urea control panels

Fennica 16 – SCR urea control panels

Fennica 17 – SCR urea pump

Fennica 18 – SCR urea control panel

Aiviq 1 – Main Engine No. 4 – Diesel oxidation catalyst housing and urea entry port

Aiviq 2– Main Engine No. 3 – Diesel oxidation catalyst housing and urea entry port

Aiviq 3 – Generator Engine No. 4 – Catalyzed diesel particulate filter housing

Aiviq 4 – Generator Engine No. 5 – Catalyzed diesel particulate filter housing and urea entry port

Aiviq 5 – Main Engine No. 1 – Diesel oxidation catalyst housing and urea entry port

Aiviq 6 – Main Engine No. 2 – Diesel oxidation catalyst housing and urea entry port

Aiviq 7 – Generator Engine No. 3 – Catalyzed diesel particulate filter housing and urea entry port

Aiviq 8 – Generator Engine No. 2 – Catalyzed diesel particulate filter housing and urea entry port

Aiviq 9 – Generator Engine No. 5 – SCR urea control panel

Aiviq 10 – Generator Engine No. 4 – SCR urea control panel

Aiviq 11 – Generator Engine No. 3 – SCR urea control panel

Aiviq 12 – Generator Engine No. 2 – SCR urea control panel

Aiviq 13 – Main Engine No. 4 – SCR urea control panel

Aiviq 14 – Main Engine No. 3 – SCR urea control panel

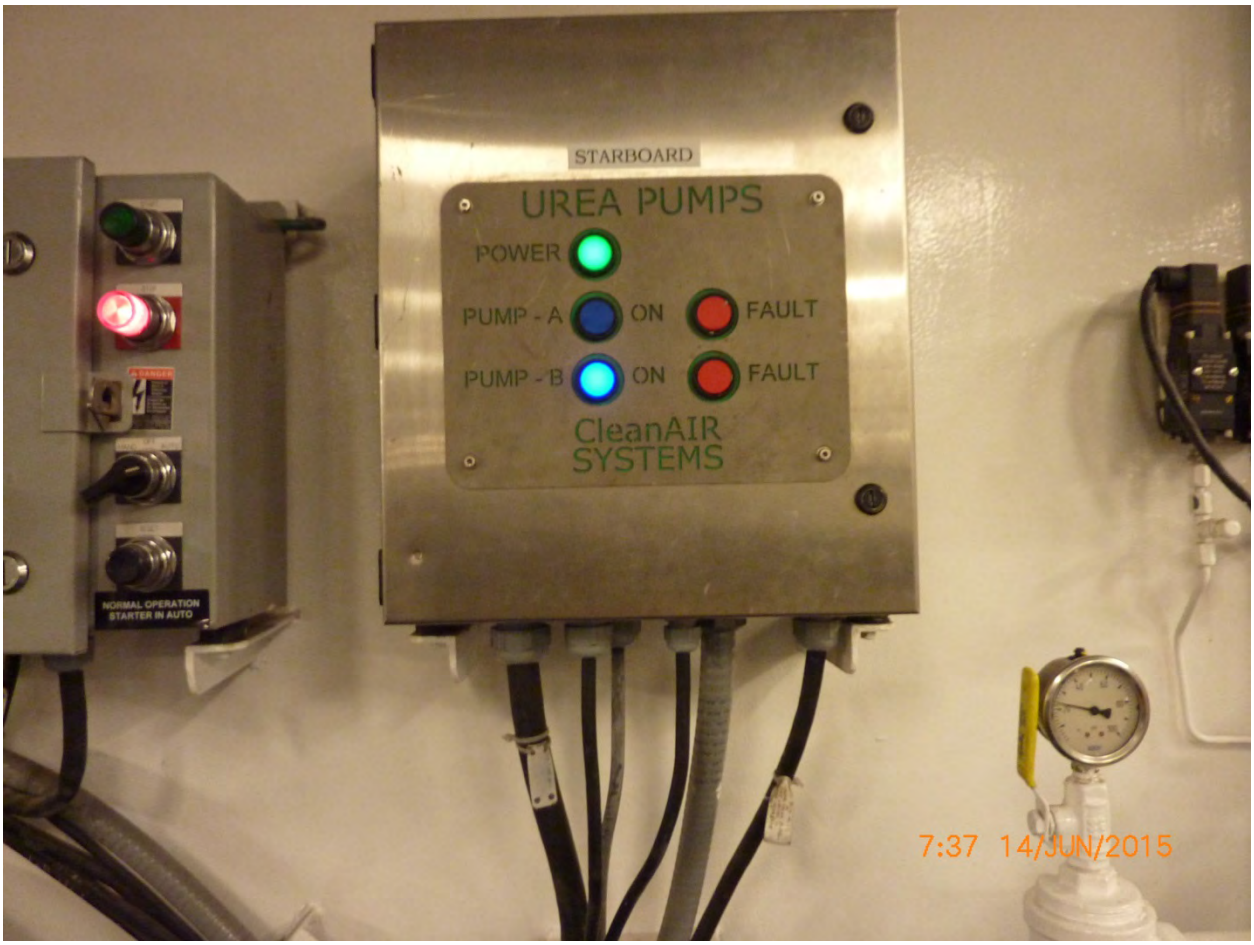
Aiviq 15 – Main Engine No. 2 – SCR urea control panel

Aiviq 16 – Main Engine No. 1 – SCR urea control panel (inside)

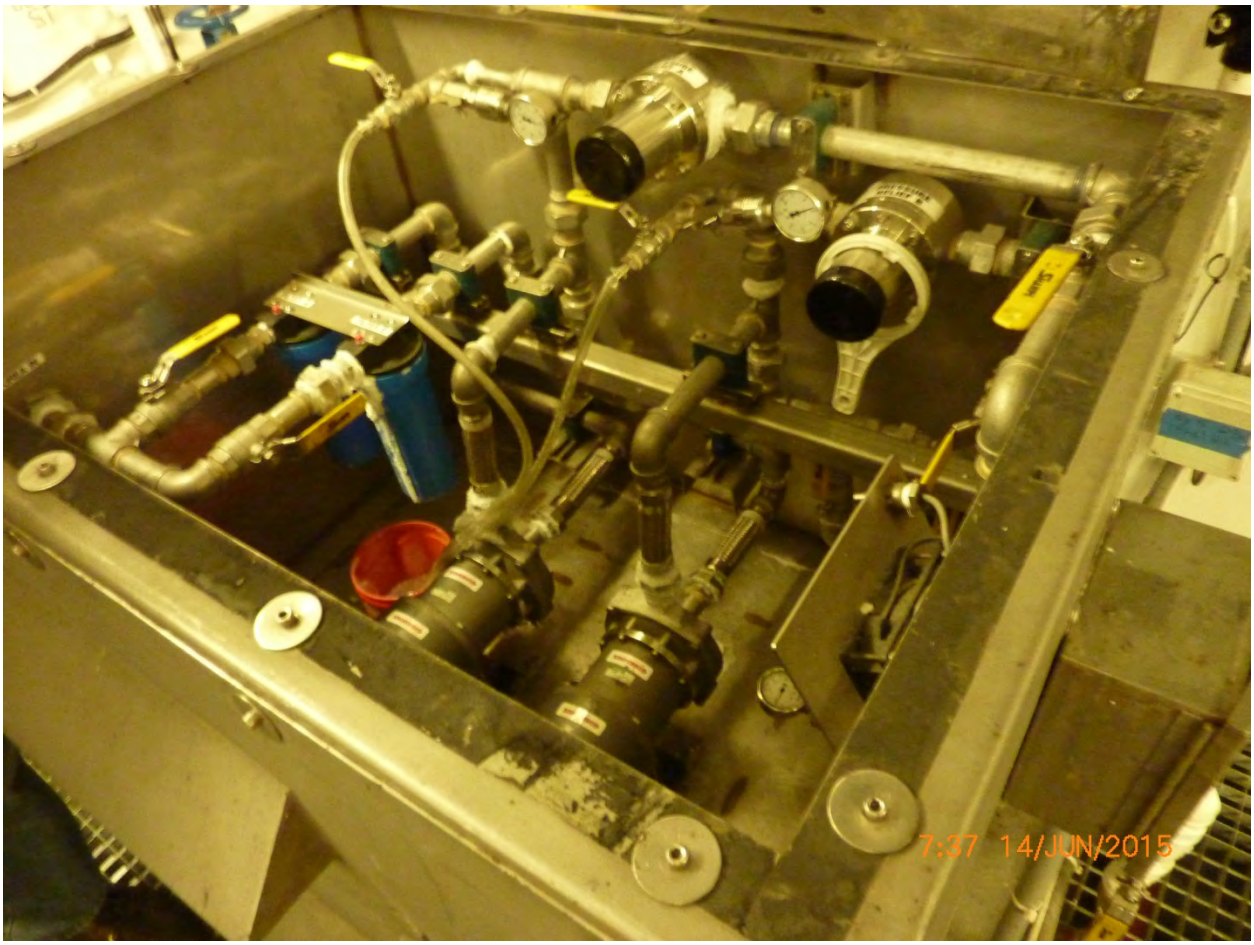
Aiviq 17 – Main Engine No. 1 – SCR urea control panel (outside)

Aiviq 18 – SCR urea pumps (port)

Aiviq 19 – SCR urea pump controller (port)



Aiviq 20 – SCR urea pump controller (starboard)



Aiviq 21 – SCR urea starter pump

Aiviq 22 – SCR urea tank

Tor Viking 1 – SCR Monitor

Tor Viking 2 – Urea pump (back-up)

Tor Viking 3 – Urea pump

Tor Viking 4 – Urea tank (aft)

Tor Viking 5 – Urea tank (forward)

Tor Viking 6 – Main Engine No. 4 – SCR Control Panel

Tor Viking 7 – Main Engine No. 3 – SCR Control Panel

Tor Viking 8 – Main Engine No. 2 – SCR Control Panel

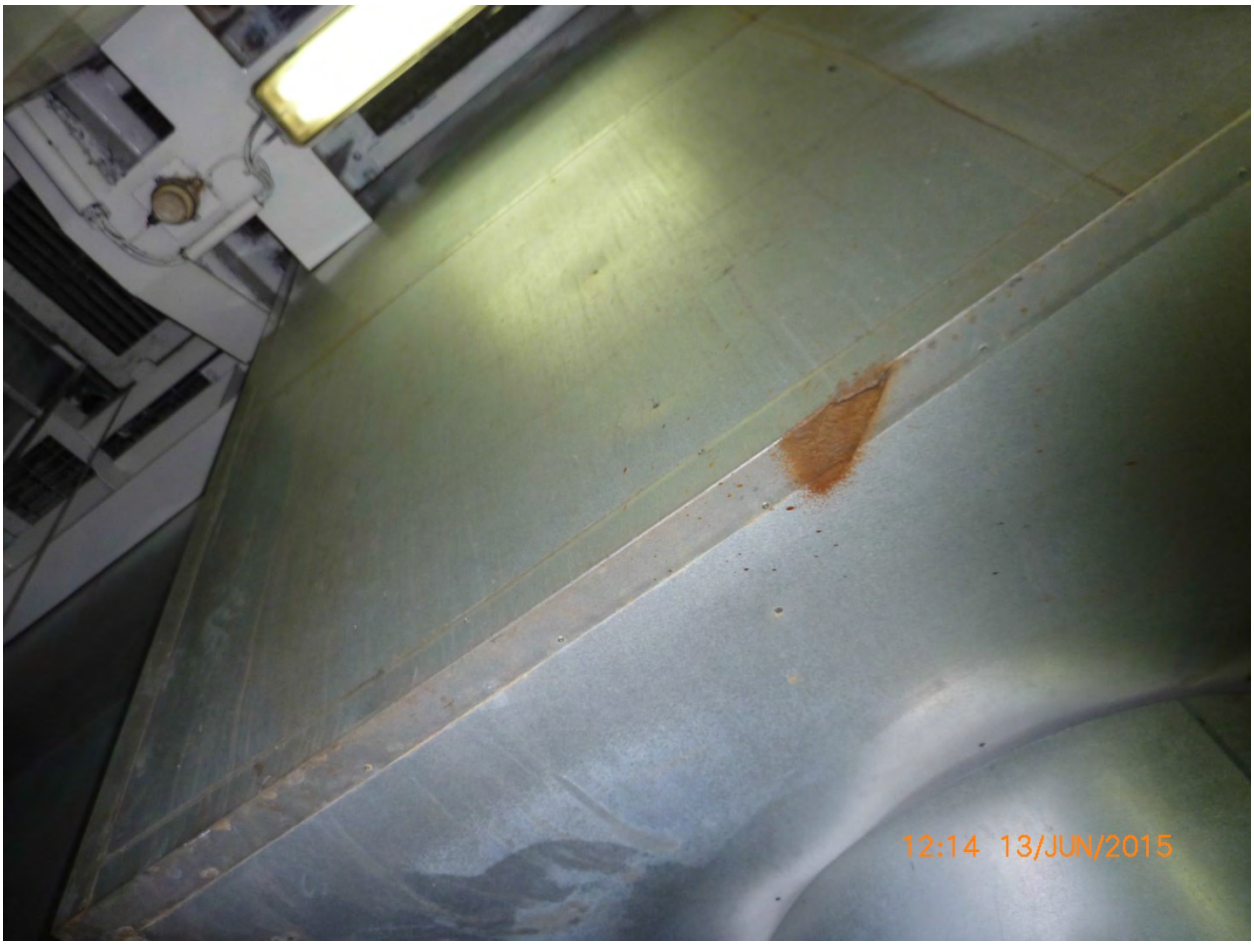
Tor Viking 9 – Main Engine No. 1 – SCR Control Panel

Tor Viking 10 – SCR air compressor urea service pump monitor

Tor Viking 11 – Generator No. 2 – SCR Control Panel

Tor Viking 12 – Generator No. 1 – SCR Control Panel

Tor Viking 13 – SCR Panels



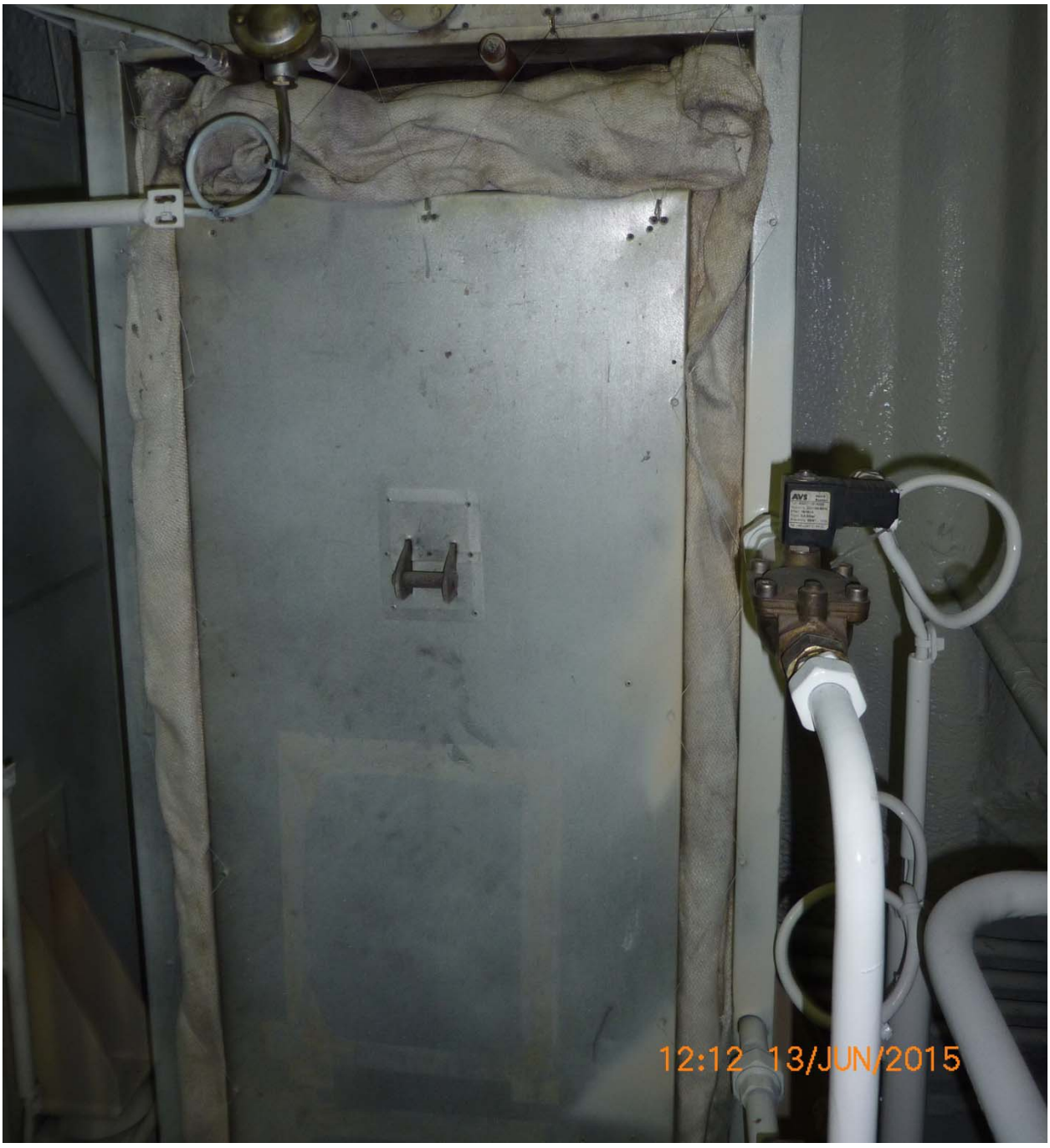
Tor Viking 14 – Main Engine No. 4 – Oxycat housing

Tor Viking 15 – Main Engine No. 3 – Oxycat housing

Tor Viking 16 – Main Engine No. 2 – Oxycat housing

Tor Viking 17 – Main Engine No. 1 – Oxycat housing

Tor Viking 18 – Generator Engine No. 2 – Oxycat housing



Tor Viking 19 – Generator Engine No. 1 – Oxycat housing

Tor Viking 20 – Generator Engine No. 2 – SCR urea entry port

Tor Viking 21 – Generator Engine No. 1 – SCR urea entry port

Tor Viking 22 – Main Engine No. 4 – SCR urea entry port

Tor Viking 23 – Main Engine No. 3 – SCR urea entry port

Tor Viking 24 – Main Engine No. 2 – SCR urea entry port

Tor Viking 25 – Main Engine No. 1 – SCR urea entry port

Noble Discoverer 1 – Main Generator Engine No. 1 – SCR urea control panel

Noble Discoverer 2 – Main Generator Engine No. 2 – SCR urea control panel

Noble Discoverer 3 – Main Generator Engine No. 3 – SCR urea control panel

Noble Discoverer 4 – Main Generator Engine No. 4 – SCR urea control panel

Noble Discoverer 5 – Main Generator Engine No. 5 – SCR urea control panel

Noble Discoverer 6 – Main Generator Engine No. 6 – SCR urea control panel

Noble Discoverer 7 – SCR urea pump control panel

Noble Discoverer 8 – SCR urea day tank

Noble Discoverer 9 – Main Generator No. 6 – SCA urea feed port; CDPF housing

Noble Discoverer 10 – Main Generator No. 6 – E-Pod heater panel

Noble Discoverer 11 – Main Generator No. 5 – E-Pod heater panel

Noble Discoverer 12 – Main Generator No. 4 – E-Pod heater panel

Noble Discoverer 13 – Main Generator No. 3 – E-Pod heater panel

Noble Discoverer 14 – Main Generator No. 2 – E-Pod heater panel

Noble Discoverer 1 – Main Generator No. 1 – E-Pod heater panel

Noble Discoverer 16 – Spare catalyzed diesel particulate filters

Noble Discoverer 17 – Main Generator Engine No. 1 -- brick housing (inside)

Noble Discoverer 18 – SCR bricks

Noble Discoverer 19 – Main Generator Engine No. 5 -- Catalyzed diesel particulate filter housing

Noble Discoverer 20 – Main Generator Engine No. 4 -- Catalyzed diesel particulate filter housing

Noble Discoverer 21 – Main Generator Engine No. 3-- Catalyzed diesel particulate filter housing with filters

Noble Discoverer 22 – Main Generator Engine No. 2-- Catalyzed diesel particulate filter housing with filters

Noble Discoverer 23 – Main Generator Engine No. 1-- Catalyzed diesel particulate filters in housing

Noble Discoverer 24 – SCR urea pump

Attachment B – Noble Discoverer Air Emission Control Service Documentation

From: Kirkconnell, William J SEPCO-PTW/A
Sent: Friday, October 09, 2015 4:13 PM
To: Walla, William C SEPCO-UAA/H/E
Cc: Choate, Shae SEPCO-PTW/H/D; Willoughby, Chris V SEPCO-PTW/A; Harris, Tony R SEPCO-PTW/A; Vassaur, John SEPCO-PTW/A; Morris, Jason R SEPCO-PTW/A; Keefe, Brandon SEPCO-PTW/A
Subject: DPF service on Discoverer - FW: READ/ACTION: ACTION REQUIRED: Near-End-of-Season Email

Hello William,

Below is what is applicable to the Noble Discoverer regarding bullet 1 of your original email. I have also attached the email sent earlier pertaining to bullet 2. We will address bullet 3 as soon as the tabulation of data is provided.

Thanks,
Bill

From: Rig - Discoverer - Chief Engineer [mailto:cengndl@noblecorp.com]
Sent: Friday, October 09, 2015 3:40 PM
To: Kirkconnell, William J SEPCO-PTW/A
Subject: RE: Service Reports for SCR's

Bill,

6-15-15 Installed DPF filters and bricks on #1 Gen

6-17-15 Installed DPF Filters and bricks on #2 Gen

6-18-15 Installed DPF Filters and bricks on #3 Gen

6-19-15 Installed DPF Filters and bricks on #4 Gen

6-22-15 Installed DPF Filters and bricks on #6 Gen

6-26-15 Installed DPF Filters and bricks on #5 Gen

Let me know if you need anything else.

Best Regards,

Edwin R. "Chip" Perkins III
Chief Engineer