Petitioner’s Exhibit 1b

AIR SCIENCES INC.	PROJECT TITLE: Kulluk	BY: R. Steen
	PROJECT NO: 180-15	PAGE 1 OF 1 SHEET 1
CALCULATIONS	SUBJECT: Owner Requested Limit (ORL)	DATE: 2/6/2007

Shell Kulluk Owner Requested Limit (ORL) Fleet wide Diesel Fuel Consumption

General ORL NOx Compliance Equation: $E_A + E_B + E_C + E_D + E_E + K \leq$ 245 ton NOx * 2000 lb NOx

Where:

E_A =	Emissions from Shell Kulluk (Kulluk)	Vessel A
E_B =	Emissions from Vladimir Ignatjuk (VI)	Vessel B
E_C =	Emissions from Tor Viking II (TV)	Vessel C
E_D =	Emissions from Jim Kilabuk (Kilabuk)	Vessel D
E_E =	Emissions from Shell Kulluk OSR Fleet	Vessel E
K =	Emission from sources that are fixed as a constant	

Specific ORL NOx Compliance Equation:

$(F_{A1}*EF_{A1})+(F_{A2}*EF_{A2})+(F_{A3}*EF_{A3})+(F_{B1}*EF_{B1})+(F_{B2}*EF_{B2})+(F_{C1}*EF_{C1})+(F_{C2}*EF_{C2})+(F_{C3}*EF_{C3})+(F_D*EF_D)+(F_E*EF_E) + K \leq$ 245 * 2000 lb NOx

Where:

F_i =	Fuel consumption (gallons) by source group i
EF_i =	Emission factor (lb NOx/gal fuel) by source group i
K =	Constant emissions (tons) from sources with emissions not based on fuel use (incinerators)
245 =	NOx emission limit (tpy)

Calculation of NOx Emission Factors and Example Comparison with ORL

Average Capacity Factor (CF) emissions factor (EF) Adjustment for operation below capacity	
Kulluk main drill engines:	111%
VI propulsion:	104%
TV propulsion, TV harbor genset	100%
All other Engines (the small ones):	108%
Boilers max EF is at capacity:	100%

ORL Equation Variables:

	Vessel Source Group (i)	Adj. Avg. CF^ NOx Emission Factor (lb/gal) (EFi)	Example (measured) Fuel Use (gal) (Fi)	Per Source Group Emissions (tons)	Emission Units to be tested Yes or No	Emissions from Tested Units (tons)
Kulluk main drilling engines	A1	0.339	283,632	48.1	Yes	48.1
Kulluk boilers/hot water heaters	A2	0.020	26,612	0.3	No	
Kulluk remaining sources	A3	0.654	15,000	4.9	No	
VI main propulsion engines/generators	B1	0.455	692,659	157.4	Yes	157.4
VI boiler/hot water heater	B2	0.020	16,802	0.2	No	
TV main propulsion engines	C1	0.111	406,241	22.5	Yes	22.5
TV Harbor generator	C2	0.071	16,352	0.6	No	
TV boiler	C3	0.020	7,070	0.1	No	
Jim Kilabuk sources	D	0.654	6,728	2.2	No	
OSR Fleet sources	E	0.472	25,000	5.9	No	
Constant emissions	K	-	-	0.6	No	
			1,496,096	**242.8**		228.1
						94% of total

If total emission of 242.8 tons NOx is less than 245 ton limit it represents compliance.

^Adj. Avg. CF EF is the adjusted average capacity-factor emission-factor, which is the emission factor at 100% load multiplied by the % adjustment that accounts for changes in emission at operating loads.

AIR SCIENCES INC.

CALCULATIONS

PROJECT TITLE:	BY:
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Emission Factors (EF)	2/6/2007

Emission Factors (EF)

	Vessel Source and Group (i)	Unit's capacity (hourly)	EF Reference	NOx Emission Factor		Engine Heat rate (Btu/Hp-hr)	NOx EF* (lb/gal)	Number in group
Kulluk Rig								
Main Engine	**A1**	2,816 Hp	Vendor's data, CBOI injectors.	0.0156	lb/hp-hr	7,000	**0.305**	3
Air Compressor	A3	500 Hp	Tier 3 (CFR § 89.112 (a))	0.00658	lb/hp-hr	7,000	0.129	3
HPP Engine	**A3**	250 Hp	AP42 Sec 3.3 10/96	0.031	lb/hp-hr	7,000	**0.607**	2
Deck Crane	A3	340 Hp	AP42 Sec 3.3 10/96	0.031	lb/hp-hr	7,000	0.607	3
Thrustmaster Cat. 3516 B	A3	2,000 Hp	AP42 Sec 3.4 10/96	3.2	lb/mmBtu	-	0.438	2
Logging Diesel Winch	A3	140 Hp	AP42 Sec 3.3 10/96	0.031	lb/hp-hr	7,000	0.607	1
Heat Boiler	**A2**	2.4 mmBtu	AP42 Tbl 1.3-1 9/98	0.143	lb/mmBtu	-	**0.020**	2
Hot Water Heat	A2	0.54 mmBtu	AP42 Tbl 1.3-1 9/98	0.143	lb/mmBtu	-	0.020	2
Vladimir Ignatjuk								
Main Engine	**B1**	5,800 Hp	AP42 Sec 3.4 10/96	3.2	lb/mmBtu	-	**0.438**	4
Generator	B1	1,431 Hp	AP42 Sec 3.4 10/96	3.2	lb/mmBtu	-	0.438	2
Heat Boiler	**B2**	2.4 mmBtu	AP42 Tbl 1.3-1 9/98	0.143	lb/mmBtu	-	**0.020**	1
Hot Water Heat	B2	0.54 mmBtu	AP42 Tbl 1.3-1 9/98	0.143	lb/mmBtu	-	0.020	1
Tor Viking II								
Main Engine/Generator	**C1**	5,046 Hp	Test of MaK8M32	0.00568	lb/hp-hr	7,000	**0.111**	2
Main Engine/Generator	C1	3,784 Hp	Test of MaK6M32	0.0046	lb/hp-hr	7,000	0.090	2
Harbor generator	**C2**	1,168 Hp	Test of Caterpillar 3412	0.00362	lb/hp-hr	7,000	**0.071**	1
Heat Boiler	**C3**	1.37 mmBtu	AP42 Tbl 1.3-1 9/98	0.143	lb/mmBtu	-	**0.020**	1
Jim Kilabuk (resupply vessel)								
Main Engine EMD V20 645	D	3,600 Hp	AP42 Sec 3.4 10/96	3.2	lb/mmBtu	-	0.438	2
Generator, Cat. D3406	**D**	292 Hp	AP42 Sec 3.3 10/96	0.031	lb/hp-hr	7,000	**0.607**	2
Bow Thruster Cat. D343	D	300 Hp	AP42 Sec 3.3 10/96	0.031	lb/hp-hr	7,000	0.607	1
Kulluk's OSR Fleet								
Engine on OSRV	E	2,710 Hp	Caterpillar data for 3608	0.0146	lb/hp-hr	7,000	0.286	2
Generator on OSRV	E	1,285 Hp	Tier 1 (Caterpillar data)	0.0151	lb/hp-hr	7,000	0.296	2
Emergency generator on OSRV	E	1,285 Hp	Tier 1 (Caterpillar data)	0.0151	lb/hp-hr	7,000	0.296	1
Kvichak 34' work boat #1	E	300 Hp	Cummins data for 6BTA	0.01024	lb/hp-hr	7,000	0.200	2
Kvichak 34' work boat #2	E	300 Hp	Cummins data for 6BTA	0.01024	lb/hp-hr	7,000	0.200	2
Engine on tug for supply barge	**E**	1,500 Hp	AP42 Sec 3.4 10/96	3.2	lb/mmBtu	-	**0.438**	2

*** Bold values are transferred to compliance equation**

Fuel heat content (AP42) 137,000 btu/gal

Constant emissions

				Emissions*
Atlas 600 incinerator on Kulluk	K	100 kg	AP42 Tbl 2.1-12 Ind. multi-chamber 10/96	3 lb/ton	0.5	
Incinerator on the Vladimir Ignatjuk	K	30 kg	AP42 Tbl 2.1-12 Ind. multi-chamber 10/96	3 lb/ton	0.1	
					0.6	Total NOx

*Example of emission s calc	100 kg / hour	2.205 lb / kg	ton / 2000 lb	3 lb NOx / ton of waste	24 hr / day	120 / location	ton / 2000 lb	=	0.5 ton NOx

Air Sciences Inc.	PROJECT TITLE: Kulluk	BY: D Young
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		SHEET 3
CALCULATIONS	SUBJECT: Emission at multiple loads	DATE: 2/6/2007

Kulluk EMD genset engine with CBOI injectors.

CBOI Data from cleint

Given		Calculations	
% load	NOx g/bhp/hr	EF Load/Max load %	EF Cummulative Average %
100	5.90	100%	100%
75	6.30	107%	103%
50	7.49	127%	**111%**
25	9.99	169%	126%

Caterpillar D399 genset on the Discoverer

Manufacturer Data for D399 SCAC (85) at 1200 RPM

Given				Calculations*						
Power kw	% load	Spec. Fuel Consum. gm/kw-hr	NOx^ EF gm/hr	NOx EF g/kw-hr	EF Load/Max load %	EF Cumulative Average %	Fuel gal/hr	NOx lb/gal	NOx lb/hr	Heat rate btu/hp-hr
976.1	100	237.5	7993.9	8.19	100%	100%	71.98	0.245	17.6	7534
732.1	75	233.3	6159.8	8.41	103%	101%	53.03	0.256	13.6	7401
490.3	50	235.3	4360.5	8.89	109%	**104%**	35.82	0.268	9.6	7464
246.3	25	268.6	2407.0	9.77	119%	**108%**	20.54	0.258	5.3	8521

Mass conversion factor	453.6	g/lb
Density of diesel fuel (AP42)	7.1	lb/gallon
Power conversion factor	1.341	hp/kw
Heat content of diesel fuel (AP42)	137,000	btu/gal

*Calculation Examples

NOx emission factor of lb NOx/gal obtained by:

$$\frac{7993.9\ \cancel{g}\ \text{NOx}}{\cancel{hr}} \times \frac{1\ \textbf{lb}}{453.6\ \cancel{g}} \times \frac{1\ \cancel{hr}}{71.98\ \textbf{gal}} = 0.245\ \text{lb NOx /gal}$$

Fuel input in terms of gal/hr obtained by:

$$976.1\ \cancel{kw} \times \frac{237.5\ \cancel{g\ fuel}}{\cancel{kw}\ \textbf{hr}} \times \frac{1\ \cancel{lb}}{453.6\ \cancel{g}} \times \frac{1\ \textbf{gal}}{7.1\ \cancel{lb\ fuel}} = 71.98\ \text{gal/hr}$$

^This NOx value is manufacturer value (i.e., their nominal value for NOx multiplied by their factor of 1.2).