

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
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SEATTLE, WA 98101

TARGET SHEET

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Exhibit No. : A-7

Air Permit Name: Shell Kulluk

File Category: A - Application Materials

2011-06-29 - Final Application Supplements

- Final_Kulluk_Applications_Part1
- Final_Kulluk_Applications_Part2
- Kulluk_Submittals_20110629-ReducedSize
- KullukOCSApplication_20110629
- KullukOCSAppLtr_20110629
- Shell_Kulluk_app_and_supp_cover_ltr_20110629

Original files can be found on the Shell Kulluk Administrative Record Compact Disc.



AIR SCIENCES INC.

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**OCS Permit
Applications,
Conical Drilling
Unit Kulluk,
Beaufort Sea -
Supplemental
Information**

**PREPARED FOR:
SHELL OFFSHORE INC.**

PROJECT NO. 180-20-4
JUNE 29, 2011

possible quartering vessel would remain within about five kilometers of the *Kulluk*, generally not upwind. At times they will be anchored and when they are, their engines would be providing power primarily for lighting and other domestic purposes. The OSR vessel would engage in routine response exercises which would involve use of some of the small work boats transported on the OSR vessel.

2.5 Emissions from the Kulluk

2.5.1 Kulluk Sources

The primary *Kulluk* emissions sources are diesel engines, but also include an incinerator, boilers and heaters. The largest diesel engines drive generators which power the drill motors but also the domestic electric requirements. Other diesel engines power other drilling-related equipment, including hydraulic pumps, cranes, and emergency-related equipment. This emergency-related equipment includes an emergency generator, an emergency anchor lifting engine, lifeboat engines, a hydraulic pump for a remote-operated vehicle (ROV), diver equipment, all of which have highly intermittent use, but will need to be exercised on an infrequent scheduled cycle. The *Kulluk* emission units are grouped for permitting purposes as source groups of similar engines, each group with a maximum emission limit (pounds per day) of NO_x and PM_{2.5}. Since SO₂ emissions are a function of the fuel quality, its emissions are limited by restricting the sulfur in the fuel. CO and VOC will be low and by limiting NO_x and PM_{2.5}, the emissions of CO and VOC are also capped to a sufficient accuracy to guarantee acceptable impacts. All units are diesel-fueled. Tables 2-1, 2-2, and 2-3 provide listings of the source groups of the *Kulluk* (and associated fleet, which is discussed later). There are diesel fuel tanks, listed on Table 2-4, which will have negligible emissions because of the low vapor pressure of diesel fuel, especially at Arctic temperature.

As described earlier, the drilling of each well is comprised of three mutually exclusive activities: (1) the drilling of the MLC, (2) the drilling of the well, and (3) logging, cementing, and casing. The MLC (also called a top hole) is a hole about 20 feet in diameter and about 36 feet deep, created to house the well cap and blowout preventer (BOP). Drilling of the MLC involves high use of the primary generators, air compressors, and MLC Hydraulic Power Units (HPU). MLC drilling represents the activity with the highest hourly emissions from all source groups combined. Each MLC is expected to take up to five days per well.

Table 2-5: Summary of Requested Restrictions

Owner Requested Limit (ORL)	Value
MLC drilling	480 hours per season (20 days)
MLC and well drilling combined	1,632 hours per season (68 days)
All OCS source activities combined	2,880 hours per season (120 days)
Number of resupply/waste removal trips	24 per season
Kulluk incinerator	12 hours per day, 8 a.m. through 8 p.m.
Fuel Sulfur content – Kulluk and Fleet	Purchase ULSD, less than 0.01% during use
All IC engine and heater groups	A set of emission limits (lb/day) for each pollutant, highlighted in Tables 2-1, 2-2, and 2-3.
Annual NOx emissions for Kulluk and Fleet	Less than 250 tons per year

There are multiple emergency and small source units, including life-boat propulsion engines, diver emergency air compressors, and a larger emergency generator. These exist for emergency purposes and are not planned to be used, but they need short and infrequent exercising. This engine exercising results in very minor emissions from each emission unit, and exercising the individual unit emissions will be spaced throughout a weekly or longer period. In other words, the units will not be exercised simultaneously, but will be relatively randomly spaced over at least a two-week or longer period of time. Therefore an ORL of total emissions from these sources, and demonstrated on a weekly time frame, is both practical and reasonable. Compliance with this will be based on a small-engine set of emission factors and tracked through weekly fuel consumption. (For impact modeling purposes, the larger emergency generator emissions are broken out of the seldom-used source allowance and modeled as a 2-hour emission occurrence once every 30 days, consistent with the U.S. Coast Guard (USCG) emergency generator exercising requirements.)

To ensure that the proposal remains a minor source for NOx, Shell requests a condition limiting NOx emissions to less than 250 tons per year, to be demonstrated on a weekly rolling annual total basis. The NOx emissions from the *Kulluk* and the ancillary vessels (when within 25 miles of the *Kulluk*) will be summed for this weekly demonstration. Table 2-6 shows that the NOx emissions summed over all of the short-term potential emission limits, assuming maximum operations for a full 120-day season would be 279 tons, but in the exploration operations context, Shell is certain that actual emissions will be below 250 tons per year and will demonstrate this on the weekly totaled annual sum of NOx emissions. From the annual emission inventory on Table 2-6, which shows all other pollutant emission rates substantially lower than NOx, Shell proposes that by demonstrating compliance with only the annual NOx emissions, all other pollutants will be well below the 250 tons per year limit and it should not be necessary to separately demonstrate this annual emission limit for any of the other regulated pollutants.



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APPENDIX G

Allowable Emission Inventory



Air Sciences Inc.

ENGINEERING CALCULATIONS

PROJECT TITLE: Shell - Exploration Drilling		BY: S. Pryor	
PROJECT NO: 180-20-6	PAGE: 1	OF: 16	SHEET: 2
SUBJECT: Kulluk / Beaufort Pmt App		DATE: May 9, 2011	

ALLOWABLE EMISSIONS

shading represents owner restriction (OR) to be demonstrated by documentation of each event
 shading represents OR to be demonstrated by documentation of daily fuel consumption
 shading represents OR to be demonstrated by documentation of weekly fuel consumption

ANTICIPATED KULLUK OPERATING MAXIMUMS

Kulluk & Associated Fleet

Expected Operating Maximums	Limit	How Defined	How documented
MLC Drilling Activity	480 hrs/activity	20 days/activity	
Well Drilling Activity	1,152 hrs/activity	48 days/activity	
Cementing/Logging Activity	1,248 hrs/activity	52 days/activity	
Season maximum drilling duration as an OCS source (secure and stable for commencement of exploratory activity):	2,880 hrs/season	120 days/season	
Ice mgmt vessel use within 25 miles	38%		
OSR vessel annual fuel limit	60% of daily maximum - annualized		
MLC Activity			
Generators (three units combined) combined production maximum	85% capacity	System Limitation	
Crane (three units combined) maximum	40% capacity	System Limitation	
Crane (three units combined) maximum	30% of time (day)	Shell engineering estimate	
Well Drilling Activity			
Generators (three units combined) combined production maximum	85% capacity	System Limitation	
Crane (three units combined) maximum	40% capacity	System Limitation	
Crane (three units combined) maximum	30% of time (day)	Shell engineering estimate	
Cementing/Logging Activity			
Generators (three units combined) combined production maximum	60% capacity	Shell OR	
Crane (three units combined) maximum	40% capacity	System Limitation	
Crane (three units combined) maximum	50% of time (day)	Shell engineering estimate	
All Activities - OR			
Kulluk Incinerator limited to	12 hr/day	Shell OR	manual - recording of start and stop time
Kulluk emergency generator limited to	2 hr/30-days & hr/day		
Sulfur content of all stationary source engines on Kulluk	0.0100% by weight	Shell OR	Kulluk fuel testing
Sulfur content of associated fleet	0.0100% by weight	Shell OR	Fleet fuel testing
Ice Management Fleet Propulsion & Generation	100% capacity	System Limitation	
Resupply ship in transport limited to	1,200 gal/1-way	Shell OR	Fuel consumption measurement
Resupply ship in DP mode limited to	4,800 gal/event	Shell OR	Fuel consumption measurement
Resupply ship resupply events limited to	24 rnd trip/season	Shell OR	Manual tracking
Resupply ship DP events limited to	24 hr/day=hr/event	Shell OR	Manual tracking
OSR Vessel p & g aggregate power:	2,600 kW		Manufacturer specifications
OSR Vessel p & g aggregate consumption:	2,800 gal/day	Shell OR	Fuel consumption measurement
OSR work boats	3,789 gallons/wk.	Shell OR	Fuel consumption measurement

OSR Boat Options

OSR vessel	Pt. Oliktuk/Arctic Endeavor	
Work Boats		
	#1 OSR 34-foot	32 gal/hr
	#2 OSR 34-foot	32 gal/hr
	#1 OSR 47-foot	63 gal/hr
	ALL	6 hr/day
	ALL	5 day/week
	ALL	100% hourly fuel consumption

Conversions

0.7457 kW / hp
1,000,000 Btu / MMBtu
453.592 g / lb
2,000 lb / ton
24 hr / day
168 hr / wk
2 one-way trips / round trip
32.07 weight S
64.06 weight SO2
2.00 weight conversion of S to SO2
8.34 lb/gal (Density of water)

Assumptions

Diesel Density	0.8398
Diesel Engine Thermal Efficiency	7,000 Btu/hp-hr
Diesel Heating Value	131,180 Btu/gal

Reference

Tesoro Nikiski, Email Royal Harris 4/20/11
<600 hp; AP42 Table 3.3-1 Footnote (a) ver. 10/96.
Tesoro Nikiski, Email Royal Harris 4/20/11

** seldom-used engines are those running < 4 hr/wk.
 blue values are input, black values are calculated or linked