



PUBLIC INFORMATION

Revised Outer Continental Shelf Lease Exploration Plan Chukchi Sea, Alaska

**Burger Prospect: Posey Area Blocks 6714, 6762,
6764, 6812, 6912, 6915
Chukchi Sea Lease Sale 193**

May 2011

Submitted to:

**U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation and Enforcement
Alaska OCS Region**

Submitted by:

**Shell Gulf of Mexico Inc.
3601 C Street, Suite 1000
Anchorage, AK 99503**

Table of Contents

	<u>Page</u>
ACRONYMS & ABBREVIATIONS.....	VII
CROSS-REFERENCE TO APPLICABLE REGULATIONS	XI
SECTION 1.0 REVISED EXPLORATION PLAN CONTENTS	1-1
a) Description, Objectives, and Schedule for the Exploration Drilling Program	1-2
b) Location.....	1-3
c) Drillship.....	1-12
d) Service Fee	1-14
SECTION 2.0 GENERAL INFORMATION.....	2-1
a) Application and Permits	2-1
b) Drilling Fluids.....	2-1
c) Chemical Products.....	2-2
d) New or Unusual Technology	2-2
e) Bonds, Oil Spill Financial Responsibility, and Well Control Statements	2-2
f) Suspension of Operations	2-3
g) Blowout Scenario	2-3
h) Contact Information.....	2-4
SECTION 3.0 GEOLOGICAL AND GEOPHYSICAL INFORMATION (PROPRIETARY AND CONFIDENTIAL).....	3-1
a) Geological Description, Drill Sites, and Bathymetry Maps	3-1
b) Structure Contour Maps.....	3-1
c) Key Seismic Lines.....	3-1
d) Geological Cross-Sections.....	3-1
e) Shallow Hazards Report	3-1
f) Shallow Hazards Assessment	3-1
g) High Resolution Seismic Lines	3-1
h) Stratigraphic Columns	3-1
i) Time-versus-Depth Charts.....	3-1
j) Geochemical Information.....	3-1
k) Future Geological and Geophysical Activities	3-1
l) WCD Calculations.....	3-1
SECTION 4.0 HYDROGEN SULFIDE INFORMATION	4-1
a) Concentration	4-1
b) Classification	4-2
c) Contingency Plan.....	4-2
d) Modeling Report.....	4-2
SECTION 5.0 BIOLOGICAL, PHYSICAL, AND SOCIOECONOMIC INFORMATION.....	5-1
a) Biological Environment Reports	5-1
b) Physical Environment Reports	5-2
c) Socioeconomic Study Reports.....	5-5
SECTION 6.0 BIOLOGICAL, PHYSICAL, AND SOCIOECONOMIC INFORMATION.....	6-1
a) Biological Environment Reports	6-1

b)	Ocean Discharges and Disposal Methods	6-1
c)	NPDES Permit	6-14
d)	Modeling Report	6-17
e)	Cooling Water Intake	6-17
f)	Disposal Caisson	6-17
g)	Desalination Unit Brine Water	6-18
SECTION 7.0	AIR EMISSIONS INFORMATION	7-1
a)	Projected Emissions	7-1
b)	Emission Reduction Measures	7-9
c)	Processes, Equipment, Fuels, and Combustibles	7-9
d)	Distance to Shore	7-9
e)	Impact Evaluation for Non-Exempt Drilling Units	7-9
f)	Modeling Report	7-10
SECTION 8.0	OIL AND HAZARDOUS SUBSTANCES SPILL INFORMATION	8-1
a)	Oil Spill Response Planning	8-1
b)	Location of Primary Oil Spill Equipment Base and Staging Area	8-1
c)	Name(s) of Spill Removal Organization(s) for Both Equipment and Personnel	8-2
d)	Calculated Volume of Worst Case Discharge Scenario [30 CFR 254.26(a)]	8-2
e)	Description of Worst Case Discharge Scenario	8-3
f)	Modeling Report	8-3
SECTION 9.0	ALASKA OUTER CONTINENTAL SHELF PLANNING INFORMATION	9-1
a)	Emergency Plan	9-1
b)	Critical Operations and Curtailment Plan and Ice Management Plan	9-1
c)	Well Control Plan	9-1
d)	Fuel Transfer Plan	9-1
e)	Partial Wells	9-1
f)	Surface Intervention – Capping and Containment	9-3
SECTION 10.0	ENVIRONMENTAL MONITORING	10-1
a)	Monitoring Systems	10-1
b)	Incidental Takes	10-2
SECTION 11.0	LEASE STIPULATIONS INFORMATION	11-1
Stipulation No. 1 - Protection of Biological Resources		11-1
Stipulation No. 2 - Orientation Program		11-2
Stipulation No. 3 - Transportation of Hydrocarbons		11-3
Stipulation No. 4 - Industry Site-Specific Bowhead Whale Monitoring Program		11-4
Stipulation No. 5 - Lease Sale 193 Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities		11-8
Stipulation No. 6 - Pre-Booming Requirements for Fuel Transfers		11-15
Stipulation No. 7 - Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider		11-15
SECTION 12.0	ENVIRONMENTAL MITIGATION MEASURE INFORMATION	12-1
a)	Permits and Authorizations	12-1
b)	Protected Species	12-1
c)	Mitigation Measures	12-2

SECTION 13.0	SUPPORT VESSELS AND AIRCRAFT INFORMATION.....	13-1
a)	Planned Chukchi Sea Drillship and Aircraft List	13-1
b)	Air Emissions	13-6
c)	Drilling Fluids and Chemical Products Transportation	13-6
d)	Solid and Liquid Wastes Transportation	13-6
e)	Vicinity Map and Travel Routes	13-7
f)	Aircraft Waste Transportation	13-7
SECTION 14.0	ONSHORE SUPPORT FACILITIES INFORMATION.....	14-1
a)	General	14-1
b)	Air Emissions	14-2
c)	Unusual Solid and Liquid Wastes.....	14-2
d)	Waste Disposal	14-2
SECTION 15.0	COASTAL ZONE MANAGEMENT ACT	15-1
SECTION 16.0	ENVIRONMENTAL IMPACT ANALYSIS.....	16-1
SECTION 17.0	ADMINISTRATIVE.....	17-1
a)	Exempted Information (public information copies only)	17-1
b)	Bibliography	17-1

List of Tables

Table 1-1	Comparison of the Exploration Drilling Program Under Shell's Initial Chukchi Sea EP and the Revised Chukchi Sea EP.....	1-1
Table 1.a-1	Shell Lease Blocks Covered in the Revised Chukchi Sea EP for the Exploration Drilling Program Starting in 2012	1-2
Table 1.b-1	Possible Drill Sites for the Revised Chukchi Sea Exploration Drilling Program, Burger Prospect, Chukchi Sea OCS.....	1-3
Table 1.c-1	<i>Discoverer</i> Specifications	1-12
Table 2.a-1	Permit Applications Pending or Approved	2-1
Table 2.b-1	Drilling Fluid Type, Quantity and Discharge Rates.....	2-2
Table 2.g-1	Calculated Maximum Daily Oil Flowrates for Wells at Drill Sites Identified in the revised Chukchi Sea EP	2-3
Table 6.a-1	Projected Generated Wastes, Disposal, and Ocean Discharges from Burger A	6-2
Table 6.a-2	Projected Generated Wastes, Disposal, and Ocean Discharges from Burger F	6-4
Table 6.a-3	Projected Generated Wastes, Disposal, and Ocean Discharges from Burger J.....	6-6
Table 6.a-4	Projected Generated Wastes, Disposal, and Ocean Discharges from Burger R	6-8
Table 6.a-5	Projected Generated Wastes, Disposal, and Ocean Discharges from Burger S	6-10
Table 6.a-6	Projected Generated Wastes, Disposal, and Ocean Discharges from Burger V	6-12
Table 6.c-1	Drilling Fluid Components per Well for the Revised Chukchi Sea Exploration Drilling Program	6-14
Table 6.e-1	Screen Mesh Size on Water Intakes on the <i>Discoverer</i>	6-17
Table 7.a-1	Description of Emission Units for <i>Discoverer</i> and Support Fleet	7-2
Table 7.a-2	Projected Peak Hourly Emissions of <i>Discoverer</i> and Support Fleet Emission Units.....	7-4
Table 7.a-3	Annual Potentials to Emit for Emission Units on the <i>Discoverer</i> and Associated Support Fleet.....	7-5

Table 7.a-4	Maximum Potentials to Emit for the <i>Discoverer</i> Emission Units and Associated Support Fleet for the Duration ¹ of Exploration Drilling Activities.....	7-6
Table 7.a-5	Source Group Operating Duration and Frequency for the <i>Discoverer</i> and Support Fleet in the Chukchi Sea.....	7-7
Table 7.a-6	PSD Air Quality Permit Conditions on the <i>Discoverer</i> and Support Fleet Vessels During Exploration Drilling Activities in the Chukchi Sea	7-8
Table 7.e-1	Application of BOEMRE Exemption Formula to the Revised Chukchi Sea EP	7-10
Table 7.f-1	Summary of Maximum Predicted Impacts of the <i>Discoverer</i> and Fleet.....	7-10
Table 8.d-1	Oil Volume of the Worst Case Discharge Planning Scenario for the Regional ODPCP.....	8-2
Table 8.d-2	Comparison of the WCD Planning Scenario Developed for the Chukchi Sea Regional ODPCP with the WCD Calculated for the Revised Chukchi Sea EP for Two Relief Well Scenarios	8-3
Table 10.b-1	Number of Potential Exposures of Marine Mammals to Received Sound Levels in the Water of >120 dB rms Generated by Exploration Drilling and >160 dB rms Generated by ZVSPs during each Drilling Season	10-4
Table 11.0-1	Dates and Locations of Meetings Held Regarding Shell's Chukchi Sea Exploration Drilling Program for the Development of the POC	11-12
Table 12.b-1	Species Found in the Northeastern Chukchi Sea and ¹ Protected Under the ESA	12-1
Table 12.b-2	Marine Mammals ¹ Found in the Northeastern Chukchi Sea and Protected Under the MMPA	12-2
Table 13.a-1	Specifications of Support Vessels.....	13-1
Table 13.a-2	Specifications of the Major Oil Spill Response Vessels.....	13-3
Table 13.a-3	Fuel Storage Capacity and Trip Information for Support Vessels and Aircraft.....	13-5
Table 13.b-1	Project Annual Air Pollutant Emissions (TPY) from Support Vessels Associated with the Drillship <i>Discoverer</i> for the revised Chukchi Sea Exploration Drilling Program.....	13-6
Table 13.d-1	Onshore Waste Disposal Facilities, Waste Type, Amount, Rate, and Disposal Method	13-7

List of Figures

Figure 1.b-1	Location Map Exploration Drilling Program.....	1-4
Figure 1.b-2	Burger Prospect Location Map	1-5
Figure 1.b-3	Bathymetry and Planned Drillship Anchor Locations - Burger A	1-6
Figure 1.b-4	Bathymetry and Planned Drillship Anchor Locations - Burger F.....	1-7
Figure 1.b-5	Bathymetry and Planned Drillship Anchor Locations - Burger J	1-8
Figure 1.b-6	Bathymetry and Planned Drillship Anchor Locations - Burger R	1-9
Figure 1.b-7	Bathymetry and Planned Drillship Anchor Locations - Burger S.....	1-10
Figure 1.b-8	Bathymetry and Planned Drillship Anchor Locations - Burger V	1-11
Figure 6.c-1	Sewage and Gray Water Treatment System on the <i>Discoverer</i>	6-15
Figure 6.c-2	Oily Waste Separator System on the <i>Discoverer</i>	6-15
Figure 13.e-1	Marine Vessel Routes	13-8
Figure 13.e-2	Flight Corridor	13-9

List of Appendices

Appendix A	Outer Continental Shelf Plan Information Forms (Form 137)
Appendix B	National Pollutant Discharge Elimination System Authorizations & Notice of Intent
Appendix C	Application for National Marine Fisheries Service Incidental Harassment Authorization
Appendix D	Marine Mammal Monitoring and Mitigation Plan
Appendix E	Application for U.S. Fish & Wildlife Service Letter of Authorization
Appendix F	Environmental Impact Analysis
Appendix G	U.S. Army Corps of Engineers Nationwide Permit 8
Appendix H	Plan of Cooperation
Appendix I	Bird Strike Avoidance and Lighting Plan Chukchi Sea, Alaska
Appendix J	Critical Operations and Curtailment Plan
Appendix K	Ice Management Plan
Appendix L	Well Control Plan
Appendix M	Fuel Transfer Plan
Appendix N	H ₂ S Contingency Plan for <i>M/V Noble Discoverer</i>

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

ACRONYMS & ABBREVIATIONS

~	approximately
°	degree(s)
'	minute(s)
"	second(s)
°C	degree(s) Celsius
°F	degree(s) Fahrenheit
3-D	three-dimensional
4MP	Marine Mammal Monitoring and Mitigation Plan
µg/m ³	micrograms/cubic meter
µ/Pa	micropascals
ac	acre(s)
ACMP	Alaska Coastal Management Program
ADNR	Alaska Department of Natural Resources
AES	ASRC Energy Services
AESC	Alaska Eskimo Whaling Commission
APD	Application for Permit to Drill
API	American Petroleum Institute
APM	Application for Permit to Modify
App	Appendix
ASRC	Arctic Slope Regional Corporation
avg	average
AVO	Amplitude versus Offset
AWAC	acoustical waves and current meter
BACT	best available control technology
bbbl	barrel(s)
BHP	bottomhole pressure
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOP	blowout preventer
Burger #1	OCS-Y-1413 #1 (Burger legacy well)
BWASP	Bowhead Whale Aerial Survey Project
CDPF	catalytic diesel particulate filters
CFR	Code of Federal Regulations
CLO	community liaison officer
cm	centimeter(s)
cm ³	cubic centimeter(s)
CMG IMEX	Computer Modeling Group
CO	carbon monoxide
COCP	Critical Operations and Curtailment Plan
Com Center	Communications and Call Centers
dB	decibel(s)
DNV	Det Norske Veritas
<i>Discoverer</i>	drillship M/V <i>Noble Discoverer</i>
DPP	Development and Production Plan
ea	each
EA	Environmental Assessment - National Environmental Policy Act
EIA	Environmental Impact Analysis
EP	Exploration Plan
EPA	U.S. Environmental Protection Agency

ESA	Endangered Species Act
FBHP1	flowing pressure at the upper most producing level
FBHP2	flowing pressure at the 13-3/8 inch shoe
FWHP	flowing pressure at the top of the BOP stack
FONSI	Finding of No Significant Impact - National Environmental Policy Act
ft	foot/feet
G&G	geological and geophysical
gal	gallon(s)
g/kW-hr	grams per kilowatt-hour
GOM	Gulf of Mexico
GOR	gas/oil ratio
HAP	hazardous air pollutant
HC	hydrocarbon
hp	horsepower
HPU	hydraulic power unit
hr	hour(s)
HSSE	Health, Safety, Security and Environment
H ₂ S	hydrogen sulfide
ICAS	Iñupiat Community of the Arctic Slope
IHA	Incidental Harassment Authorization
IMO	International Maritime Organization
IMP	Ice Management Plan
in.	inch(es)
in. ³	cubic inch(es)
initial Chukchi Sea EP	Shell's initial Chukchi Sea Exploration Plan (Shell 2009) – approved by BOEMRE 7 December 2009
kg	kilogram(s)
km	kilometer(s)
km ²	square kilometer(s)
k _{ro}	endpoint relative permeability to oil
k _{rw}	endpoint relative permeability to water
Kup A	Kuparuk A sand
Kup C	Kuparuk C sand
Kup D	Kuparuk D sand
kW	kilowatt(s)
lb	pound(s)
LBCHU	Ledyard Bay Critical Habitat Unit
LBP	length between perpendiculars
LCMF	LCMF Incorporated
LCU	lower Cretaceous unconformity
LMRP	lower marine riser package
LOA	Letter of Authorization
m	meter(s)
m ³	cubic meter(s)
mBtu/hr	million British Thermal Units per hour
mD	millidarcies
mi	statute mile(s)
min	minute(s)
MARPOL	Marine Pollution
MAWP	maximum anticipated well pressure
MLC	mudline cellar

MLT	measured length thickness
mm	millimeter(s)
MMCF	million cubic feet
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
MMS	U.S. Department of the Interior, Minerals Management Service
mt	metric ton(s)
M/V	Motor Vessel
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NAD 83	North American Datum 1983
NMFS	National Marine Fisheries Service
n mi	nautical mile(s)
n_o	oil Corey exponent
n_w	water Corey exponent
NOI	Notice of Intent
NO ₂	nitrogen dioxide
NO _x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NSB	North Slope Borough
NSR/PSD	New Source Review /Prevention of Significant Deterioration
NTL	Notice to Lessee
NWAB	Northwest Arctic Borough
NWP	Nationwide Permit
OCS	Outer Continental Shelf
ODPCP	Oil Discharge Prevention and Contingency Plan
OSFR	oil spill financial responsibility
OSR	oil spill response
OSRB	oil spill response barge
OSRP	oil spill response plan
OSRV	oil spill response vessel
OST	oil storage tanker
OSV	offshore supply vessel
OWC	oil water contact
OxyCat	oxidation catalysts
PFID	pyrolysis-flame ionization detection
PM _{2.5}	particulate matter less than 2.5 microns
PM ₁₀	particulate matter less than 10 microns
ppb	parts per billion
ppm	parts per million
POC	Plan of Cooperation
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PTD	proposed total depth
PTE	potentials to emit
revised Chukchi Sea EP	revised Chukchi Sea Exploration Plan (Shell 2011)
RFC	reflection coefficient
RFT	Repeat Formation Tester
rms	root mean square

ROV	remotely operated vehicle
rpm	revolutions per minute
RS/FO	Regional Supervisor, Field Operations (BOEMRE)
SA	subsistence advisor
SAR	search and rescue
scf	standard cubic feet
SCR	selective catalytic reduction
sec	second(s)
Shell	Shell Gulf of Mexico Inc.
SO ₂	sulfur dioxide
S _{oi}	initial oil saturation
S _{or}	residual oil saturation
SS	subsea
STB	stock tank barrel
SWEPI	Shell Western Exploration and Production Inc.
TA	temporarily abandon
TD	total depth
TVD	true vertical depth
TVT	true vertical thickness
UIC	Ukpeagvik Inupiat Corporation
ULSD	ultra-low sulfur diesel
U.S.	United States
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
VSP	vertical seismic profile
WBM	water based mud
YBP	years before present
ZVSP	zero-offset vertical seismic profile

CROSS-REFERENCE TO APPLICABLE REGULATIONS

Regulation Section	Regulatory Information	EP Section*
Bureau of Ocean Energy Management, Regulation and Enforcement		
30 CFR 250.211	What must the EP include	Section 1.0, Appendix (App.) A
(a)	Description, objectives and schedule	Section 1.0 b)
(b)	Location	Section 1.0 c)
(c)	Drilling Unit	Section 1.0 d)
(d)	Service fee	Section 1.0 e)
30 CFR 250.212	What information must accompany the EP	Sections 2.0-17.0, App. A-G, N
(a)	General information required by 250.213	Section 2.0
(b)	Geological and geophysical (G&G) information required by 250.214	Section 3.0
(c)	Hydrogen sulfide information required by 250.215	Section 4.0, App. N
(d)	Biological, physical, and socioeconomic information required by 250.216	Section 5.0
(e)	Solid and liquid wastes and discharges information and cooling water intake information required by 250.217	Section 6.0, App. B
(f)	Air emissions information required by 250.218	Section 7.0
(g)	Oil and hazardous substance spills information required by 250.219	Section 8.0, App. F
(h)	Alaska planning information required by 250.220	Section 9.0, App. J-L
(i)	Environmental monitoring information required by 250.221	Section 10.0
(j)	Lease stipulations information required by 250.222	Section 11.0
(k)	Mitigation measures information required by 250.223	Section 12.0
(l)	Support vessel and aircraft information required by 250.224	Section 13.0, App. F
(m)	Onshore support facilities information required by 250.225	Section 14.0
(n)	Coastal zone management information required by 250.226	Section 15.0
(o)	Environmental impact analysis information required by 250.227	Section 16.0, App. F
(p)	Administrative information required by 250.228	Section 17.0
30 CFR 250.213	General information	Section 2.0 App. B,D,E,F, N
(a)	Applications and permits	Section 2.0 a) App. B,C,D,E
(b)	Drilling fluids	Sections 2.0 b), 6.0
(c)	Chemical products	Section 2.0 c)
(d)	New or unusual technology	Section 2.0 d)
(e)	Bonds, oil spill financial responsibility, and well control statements	Section 2.0 e)
(e)(1)	Activity and facility bonds (see 30 CFR 256, subpart I)	Section 2.0 e)
(e)(2)	Oil spill financial responsibility for facilities (30 CFR 253)	Section 2.0 e)
(e)(3)	Relief well financial capability and can conduct other emergency well control operations	Section 2.0 e) App. L
(f)	Suspensions of operations	Sections 2.0 f), 9.0, App. J-L
(g)	Blowout scenario	Sections 2.0 g), 8.0 e)
(h)	Contact	Section 2.0 h)
30 CFR 250.214	G&G information required by 250.214	Section 3.0
(a)	Geological description	Section 3.0 a)
(b)	Structure contour maps	Section 3.0 b)
(c)	Two-dimensional and three-dimensional seismic lines	Section 3.0 c)
(d)	Geological cross-sections	Section 3.0 d)
(e)	Shallow hazards reports	Sections 3.0 e), 3.0 f)
(f)	Shallow hazards assessments	Section 3.0 f)
(g)	High resolution seismic lines	Section 3.0 g)
(h)	Stratigraphic column	Section 3.0 h)

CROSS-REFERENCE TO APPLICABLE REGULATIONS

Regulation Section	Regulatory Information	EP Section*
(i)	Time-vs-depth charts	Section 3.0 i)
(j)	Geochemical information	Section 3.0 j)
(k)	Future G&G activities	Section 3.0 k)
30 CFR 250.215	Hydrogen sulfide (H₂S) information	Section 4.0
(a)	Concentration	Section 4.0 a)
(b)	Classification	Section 4.0 b)
(c)	Contingency plan	Section 4.0 c), App. N
(d)	Modeling report	Section 4.0 d)
(d)(1)	Site specific and area analysis	not applicable (N/A)
(d)(2)	H ₂ S emissions	N/A
30 CFR 250.216	Biological, physical and socioeconomic information	Section 5.0
(a)	Biological environment reports	Section 5.0 a)
(b)	Physical environment reports	Section 5.0 b)
(c)	Socioeconomic study reports	Section 5.0 c)
30 CFR 250.217	Solid and liquid wastes and discharges information and cooling water intake information	Section 6.0, App B
(a)	Projected wastes	Section 6.0 a) Tables 6.a-1 to 6
(a)(1)	Method used to determine this information	Section 6.0 a) Tables 6.a-1 to 6
(a)(2)	Plans for treating, storing and downhole disposal of wastes	Section 6.0 a) Tables 6.a-1 to 6
(b)	Projected ocean discharges	Section 6.0 b) Tables 6.a-1 to 6
(b)(1)	Table of waste name, projected amounts, rate of discharge	Section 6.0 b) Tables 6.a-1 to 6
(b)(2)	Description of discharge method	Section 6.0 a) Tables 6.a-1 to 6
(c)	National Pollutant Discharge Elimination System permit	Section 6.0 c), App. B
(c)(1)	Compliance discussion	N/A
(c)(2)	Copy of the application	App. B
(d)	Modeling report	Section 6.0 d)
(e)	Projected cooling water intake	Section 6.0 e), App. B
30 CFR 250.218	Air emissions information	Section 7.0
(a)	Projected emissions	Section 7.0 a)
(a)(1)	For each source on the drill rig list the following:	
(a)(1)(i)	Projected peak hourly emissions	Section 7.0 a) Table 7.a-2
(a)(1)(ii)	Total annual emissions in tons per year	Section 7.0 a) Table 7.a-3
(a)(1)(iii)	Emissions over the duration of the EP	Section 7.0 a) Table 7.a-4
(a)(1)(iv)	Frequency and duration of emissions	Section 7.0 a) Table 7.a-5
(a)(1)(v)	Total of all emissions listed in (a)(1)(i) through (iv)	Section 7.0 a) Table 7.a-2 to 4
(a)(2)	Basis for emission calculations	Section 7.0 a) Table 7.a-3
(a)(3)	Base projected emissions on maximum rated capacity of the equipment	Section 7.0 a) Table 7.a-1 to 5
(a)(4)	Specific drill unit emissions	Section 7.0 a) Table 7.a-3
(b)	Emission reduction measures	Section 7.0 a) Table 7.a-3
(c)	Processes, equipment, fuels, and combustibles	Section 7.0 c)
(d)	Distance to shore	Section 7.0 d)
(e)	Non-exempt drilling units	Section 7.0 e)
(f)	Modeling report	Section 7.0 f)
30 CFR 250.219	Oil and hazardous substance spills information	Section 8.0
(a)	Oil spill response planning	Section 8.0 a), ODPCP
(a)(1)	Oil spill response plan (OSRP)	Section 8.0 a), ODPCP
(a)(2)	OSRP to include:	Section 8.0 a), ODPCP
(a)(2)(i)	Discussion of regional OSRP	Section 8.0 a), ODPCP
(a)(2)(ii)	Location of primary oil spill equipment base and staging area	Section 8.0 b), ODPCP

CROSS-REFERENCE TO APPLICABLE REGULATIONS

Regulation Section	Regulatory Information	EP Section*
(a)(2)(iii)	Name(s) of oil spill removal organizations for both equipment and personnel	Section 8.0 c), ODPCP
(a)(2)(iv)	Calculated volume of the worst case discharge	Sections 2.20 g),3.0 l), 8.0 d),e) ODPCP
(a)(2)(v)	Description of the worst case scenario discharge	Section 8.0 e), ODPCP
(b)	Modeling report	Section 8.0 f), ODPCP
30 CFR 250.220	Alaska planning information	Section 9.0
(a)	Emergency plans	Section 9.0 a), App. J-L
(b)	Critical operations and curtailment procedures	Section 9.0 b), App. J
30 CFR 250.221	Environmental monitoring information	Section 10.0, App. E, F
(a)	Monitoring systems	Section 10.0 a)
(b)	Incidental takes	Section 10.0 b), App. C
(b)(1)	Threatened and endangered species list under the ESA	Section 12.0 b), App. C,D,E,F
(b)(2)	Marine mammals	Section 12.0 b), App. C,D,E,F
(c)	Flower Garden Banks National Marine Sanctuary	not applicable
30 CFR 250.222	Lease stipulations information	Section 11.0 & App. C,E,F,H, I
	Stipulation No. 1	Section 11.0, App. F
	Stipulation No. 2	Section 11.0
	Stipulation No. 3	Section 11.0
	Stipulation No. 4	Section 11.0, App. C, D
	Stipulation No. 5	Section 11.0, App. H
	Stipulation No. 6	Section 11.0, App. M
	Stipulation No. 7	Section 11.0, App. I
30 CFR 250.223	Mitigation measures information	Section 12.0
(a)	Mitigation measure beyond those required by regs	Section 12.0 c)
(b)	Mitigation measures to avoid/minimize incidental takes of:	Section 12.0 c), App. C,D,E,F,H,I
(b)(1)	Threatened and endangered species list under the ESA	Section 12.0 b), App C,D,E,F,I
(b)(2)	Marine mammals	Section 12.0 b), App. C,D,E,F
30 CFR 250.224	Support vessel and aircraft information	Section 13.0
(a)	General	Section 13.0 a)
(b)	Air emissions	Section 13.0 b)
(c)	Drilling fluids and chemical products transportation	Section 13.0 c)
(d)	Solid and liquid wastes transportation	Section 13.0 d), 13.0 f)
(e)	Vicinity map	Section 13.0 e)
30 CFR 250.225	Onshore support facilities information	Section 14.0
(a)	General	Section 14.0 a)
(a)(1)	Onshore facility existing, to be constructed or expanded	Section 14.0 a)
(a)(2)	Onshore facilities in the western GOM	N/A
(b)	Air emissions	Section 14.0 b)
(c)	Unusual solid and liquid wastes	Section 14.0 c)
(d)	Waste disposal	Section 14.0 d)
30 CFR 250.226	Coastal zone management information	Section 15.0, Attachment (Attach.) 15.1
(a)	Consistency certification	Section 15.0 a), Attach. 15.1
(b)	Other information	N/A
30 CFR 250.227	Environmental impact analysis information	Section 16.0, App. F
(a)	General requirements	App. F (Section 1.0)
(a)(1)	Assess the potential environmental impacts	App. F (Section 4.0)
(a)(2)	Be project specific	App. F (Section 2.0)
(a)(3)	Be as detailed as necessary	
(b)	Resources, conditions and activities	App. F (Section 3.0)
(b)(1)	Meteorology, oceanography, geology, and shallow hazards	App. F (Section 3.0)

CROSS-REFERENCE TO APPLICABLE REGULATIONS

Regulation Section	Regulatory Information	EP Section*
(b)(2)	Air and water quality	App. F (Sections 3.1-3.2)
(b)(3)	Benthic communities, marine mammals, sea turtles, coastal and marine birds, fish and shellfish, and plant life	App. F (Sections 3.4-3.7)
(b)(4)	Threatened and endangered species and their critical habitat	App. F (Section 3.8)
(b)(5)	Sensitive biological resources or habitats	App. F (Section 3.9)
(b)(6)	Archaeological resources	App. F (Section 3.10)
(b)(7)	Socioeconomic resources	App. F (Section 3.11)
(b)(8)	Other coastal and marine uses	App. F (Section 3.12)
(b)(9)	Other resources, conditions, and activities identified by the Regional Supervisor	N/A
(c)	Environmental impacts	App. F (Section 4.0)
(c)(1)	Analyze the potential direct and indirect impacts	App. F (Section 4.1)
(c)(2)	Analyze and potential cumulative impacts	App. F (Section 4.2)
(c)(3)	Describe the potential impacts and their consequences and implications	App. F (Sections 4.1, 4.2)
(c)(4)	Describe potential mitigation measures	App. F (Section 2.10, 4.3)
(c)(5)	Summarize information incorporated by reference	App. F (Section 1.5.2)
(d)	Consultation	App. F (Section 5.0)
(e)	References cited	App. F (Section 6.0)
30 CFR 250.228	Administrative information	Section 17.0
(a)	Exempted information description	Section 17.0 a)
(b)	Bibliography	Section 17.0 b)
(b)(1)	List of all report and materials referenced	Section 17.0 b)
(b)(2)	Location of referenced materials not submitted with EP	Section 17.0 b)
NTL-2010-06	Blowout scenario required by 30 CFR 250.243 and 250.250	Section 2.0 d), 8 a),b),c),d),e)
	Assumptions & calculations used to determine WCD volume	Section 3.0 I), Section 8 d)
U.S. Environmental Protection Agency - Air Quality		
40 CFR 55.4	Outer Continental Shelf Air Regulations	Section 7.0
U.S. Environmental Protection Agency - NPDES		
40 CFR 122.21	Application for a permit	Section 6.0, App. B
National Marine Fisheries Service		
50 CFR 216.104	Submission of requests	Section 10.0 b), App. C,D
50 CFR 216.107	Incidental harassment authorization for Arctic waters	Section 10.0 b), App. C,D
U.S Fish and Wildlife Service		
50 CFR 18.124	How do I obtain a Letter of Authorization	Section 10.0 b), App. E
U.S. Army Corps of Engineers		
33 CFR 325.1	Applications for permits	App. G

CFR = Code of Federal Regulations

SECTION 1.0 REVISED EXPLORATION PLAN CONTENTS

Shell Gulf of Mexico Inc. (Shell) submitted its initial Chukchi Sea Exploration Plan (initial Chukchi Sea EP; Shell 2009) to the former U.S. Department of the Interior Minerals Management Service (MMS), now Bureau of Ocean Energy Management, Regulation and Enforcement, hereinafter collectively referred to as BOEMRE, in May of 2009. The Chukchi Sea EP was deemed submitted by BOEMRE on 20 October 2009. BOEMRE subsequently prepared a draft Environmental Assessment (EA) wherein it analyzed the potential impacts of the proposed exploration drilling program, and it released that draft for public review and comment. On 7 December 2009, following the close of public comment, BOEMRE issued a final EA and Finding of No Significant Impact (FONSI), and approved Shell's Chukchi Sea EP. In that initial Chukchi Sea EP, Shell identified seven blocks (Posey Area Blocks 6713, 6714, 6763, 6764, 6912 and Karo Area Blocks 6864 and 7007) of interest in three prospects (Burger, Crackerjack, and Southwest Shoebill) that contained five potential drill sites (Burger C, F, J, Southwest Shoebill C, and Crackerjack C). The exploration drilling activities contemplated by the initial Chukchi Sea EP included the exploration drilling of an exploration well at up to three of the above-referenced five potential drill sites using the drillship M/V *Frontier Discoverer*, which is now known as the M/V *Noble Discoverer* (*Discoverer*). Shell planned to initiate exploration drilling activities under the Chukchi Sea EP in the summer of 2010, but the exploration drilling activities were postponed when BOEMRE suspended all exploration drilling activities in the Arctic following the Deepwater Horizon (BP Macondo blowout) incident in the Gulf of Mexico.

Pursuant to this revised Chukchi Sea EP and appendices (Shell Gulf of Mexico Inc. 2011), which includes a complete Environmental Impact Analysis (EIA – Section 16 and Appendix F) of the revised Chukchi Sea EP, Shell plans to drill exploration wells at several of the same drill sites at one of the prospects identified in the initial exploration plan starting in 2012. The primary elements of the exploration drilling program as described in this revised Chukchi Sea EP are noted in Table 1-1.

Table 1-1 Comparison of the Exploration Drilling Program Under Shell's Initial Chukchi Sea EP and the Revised Chukchi Sea EP

Parameter	Initial Chukchi Sea EP (2010)	Revised Chukchi Sea EP (starting 2012)
Drilling Seasons	One – 2010, July-October	Multiple – starting in 2012, July-October each year
Wells	< Three wells	Six wells
Drilling Unit	Drillship M/V <i>Frontier Discoverer</i>	Drillship M/V <i>Noble Discoverer</i> (same drillship)
Prospects	Burger, Southwest Shoebill, Crackerjack	Burger
Potential Drill Sites	Five - Burger C, F, J, SW Shoebill C, Crackerjack C	Six - Burger A, F, J, R, S, V
Shorebase	Wainwright – marine, Barrow - air support	Wainwright – marine (and possible/ secondary air support), Barrow - air support
Vertical Seismic Profile	None	One planned at each well
Drilling Waste	Water based muds & cuttings discharged	Water based muds & cuttings discharged
Primary Support Fleet	Anchor handler, ice management vessel, offshore supply vessel, shallow water landing craft	Anchor handler, ice management vessel, 2 offshore supply vessels, shallow water landing craft
Oil Spill Response	Oil Spill Response (OSR) vessel, OSR barge, Oil Storage Tanker (OST)	OSR vessel, OSR barge, OST, capping stack and containment system (barge/tug/anchor handler)
Regulatory Update	30 CFR 250 Subpart B	30 CFR 250 Subpart B, NTL-2010-06

As required by 30 Code of Regulations (CFR) 250.212-228, details of the planned exploration drilling program are provided in the following sections and accompanying appendix material. While this

submission is a plan revision, Shell acknowledges that, pursuant to 30 CFR 250.285(c), the plan revision could be subject to all of the procedures under 30 CFR 250.231 through 30 CFR 250.235, and has provided a complete EP meeting all the requirements of 30 CFR 250.212. The document also meets the requirements of Notice to Lessee (NTL) 2010-06.

a) Description, Objectives, and Schedule for the Exploration Drilling Program

This revised Chukchi Sea EP and appendices, including the comprehensive EIA (Section 16.0 and Appendix F), describe the exploration drilling activities Shell plans to conduct starting in 2012 at six lease blocks within a prospect known as the Burger Prospect for its exploration drilling program in the Chukchi Sea (Table 1.a-1), with a single drill site within each block. Those six lease blocks and possible drill sites are described and analyzed herein. Shallow hazards data have been collected at each of these drill sites and each drill site has been reviewed for potential shallow hazards and archaeological evidence. Formal shallow hazards reports and archaeological assessments have been submitted to the BOEMRE in advance of this submission under separate cover for each of the drill sites.

Table 1.a-1 Shell Lease Blocks Covered in the Revised Chukchi Sea EP for the Exploration Drilling Program Starting in 2012

Prospect	Area	Protraction	Lease Block	Shell Lease
Burger	Posey	NR03-02	6764	OCS-Y-2280
Burger	Posey	NR03-02	6714	OCS-Y-2267
Burger	Posey	NR03-02	6912	OCS-Y-2321
Burger	Posey	NR03-02	6812	OCS-Y-2294
Burger	Posey	NR03-02	6762	OCS-Y-2278
Burger	Posey	NR03-02	6915	OCS-Y-2324

The ice-strengthened drillship *Discoverer* will move through the Bering Strait and into the Chukchi Sea on or about 1 July and then onto the Burger Prospect as soon as ice and weather conditions allow. Exploration drilling activities will continue through 31 October, and the drillship and support vessels will exit the Chukchi Sea at the conclusion of the drilling season.

Shell plans to drill an exploration well to a total depth (TD) below objective depth at each of the six possible drill sites. Shell may also elect to construct additional mudline cellars (MLC) or upper hole segments (i.e., “partial holes”) depending on the available time remaining through 31 October. If the final well in a drilling season cannot reach objective depth by the end of the drilling season, the well will be suspended before penetrating objective hydrocarbon-bearing zones and will be secured in compliance with applicable BOEMRE regulations and with the approval of the Regional Supervisor / Field Operations (RS/FO). The well will either be drilled to TD in the subsequent year or the well will be permanently abandoned. No unfinished wellbore will remain open at the end of the final drilling season except in an emergency. If a hazardous condition requires curtailment of critical operations (or prevents initiating them, depending on the time available) per the provisions of the COCP (Appendix J), the well will either be drilled to objective well depth under a subsequent EP or secured and permanently abandoned prior to lease termination. Any well on which exploration drilling operations are suspended at the end of any drilling season will be secured and permanently abandoned prior to lease termination.

A well may also be started, temporarily abandoned due to ice, weather, or other conditions, and finished later in the same drilling season during the period covered by this revised Chukchi Sea EP. This was an operational reality during the 1989–1991 Chukchi Sea exploration drilling campaign. Any well on which drilling is suspended will be secured in compliance with BOEMRE regulations and with the approval of the RS/FO.

The actual number of wells that will be drilled in a season will depend upon ice conditions and the length of time available in each drilling season. The predicted “average” drilling season, constrained by prevailing ice conditions and regulatory restrictions, is long enough for two to three exploration wells to be drilled from spud to proposed total depth (PTD) and possibly construct an additional MLC or drill and secure a partial well. Shell plans to conduct a geophysical survey referred to as a zero-offset vertical seismic profile (ZVSP) at each drill site where a well is drilled. Once the objective intervals are fully evaluated, each exploration well will be plugged and abandoned in compliance with BOEMRE regulations.

Shell plans to drill six exploration wells over the duration of this revised Chukchi Sea EP. All of these six possible drill sites will be permitted for drilling in the initial year to allow for operational flexibility in the event sea ice conditions prevent access to one or more locations. However, Shell expects to drill three wells to PTD below objective depth in the initial drilling season and the remaining wells to a PTD below objective depth in subsequent drilling seasons. Applications for Permits to Drill (APDs) will be submitted to BOEMRE prior to the 2012 drilling season.

b) Location

OCS Lease Sale 193 was held in February 2008 and Shell was subsequently awarded 275 leases (blocks) through a competitive bidding process. The locations of these lease blocks are depicted in Figure 1.b-1. The six blocks in the Burger Prospect that are addressed in this revised Chukchi Sea EP are listed above in Table 1.a-1 and their locations are indicated in Figure 1.b-1. The six possible drill sites identified in these blocks are listed in Table 1.b-1 along with geographical coordinates. Locations of the six drill sites within the blocks are depicted in Figure 1.b-2. Planned drillship anchor locations and bathymetry are indicated for each drill site in Figure 1.b-3 through Figure 1.b-8. The anchor radii indicated in the figures are minimum anchor radii, but any extension would remain within the area surveyed with the fine grid in the shallow hazards surveys. Surface and bottomhole coordinates, OCS Area name and block number, lease number, distance from block line, and other information for each of the drill sites are provided on the respective OCS Plan Information Forms (MMS Form-137) attached to this revised Chukchi Sea EP in Appendix A.

Table 1.b-1 Possible Drill Sites for the Revised Chukchi Sea Exploration Drilling Program, Burger Prospect, Chukchi Sea OCS

Prospect	Well	Area	Block	Lease Number	Coordinates (m)		Latitude	Longitude
					X	Y		
Burger	A	Posey	6764	OCS-Y-2280	563945.26	7912759.34	N71° 18' 30.92"	W163° 12' 43.17"
Burger	F	Posey	6714	OCS-Y-2267	564063.30	7915956.94	N71° 20' 13.96"	W163° 12' 21.75"
Burger	J	Posey	6912	OCS-Y-2321	555036.01	7897424.42	N71° 10' 24.03"	W163° 28' 18.52"
Burger	R	Posey	6812	OCS-Y-2294	553365.47	7907998.91	N71° 16' 06.57"	W163° 30' 39.44"
Burger	S	Posey	6762	OCS-Y-2278	554390.64	7914198.48	N71° 19' 25.79"	W163° 28' 40.84"
Burger	V	Posey	6915	OCS-Y-2324	569401.40	7898124.84	N71° 10' 33.39"	W163° 04' 21.23"

¹ Coordinate system is North American Datum 1983 (NAD 83) UTM Zone 3

Resupply will be from Dutch Harbor using an offshore supply vessel (OSV), with some small vessel support out of Wainwright. Aviation operations will be conducted primarily from Barrow with some operations possibly out of Wainwright. These are the plans only for the exploration drilling program covered by this revised Chukchi Sea EP, and do not reflect Shell’s longer term commitments for shorebases or other facilities needed to support future exploration drilling plans or development of any of its Chukchi Sea prospects.

Figure 1.b-1 Location Map Exploration Drilling Program

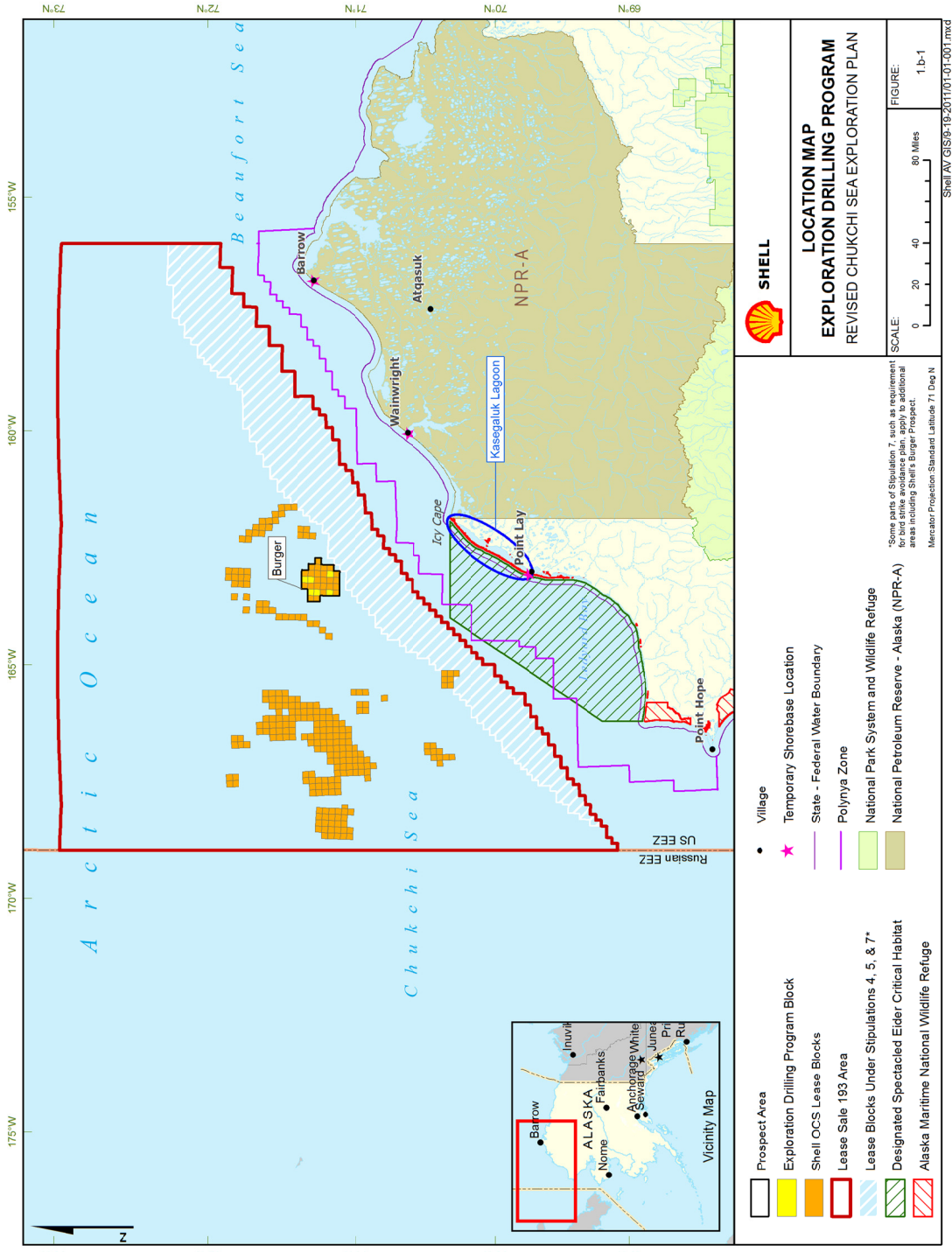


Figure 1.b-2 Burger Prospect Location Map

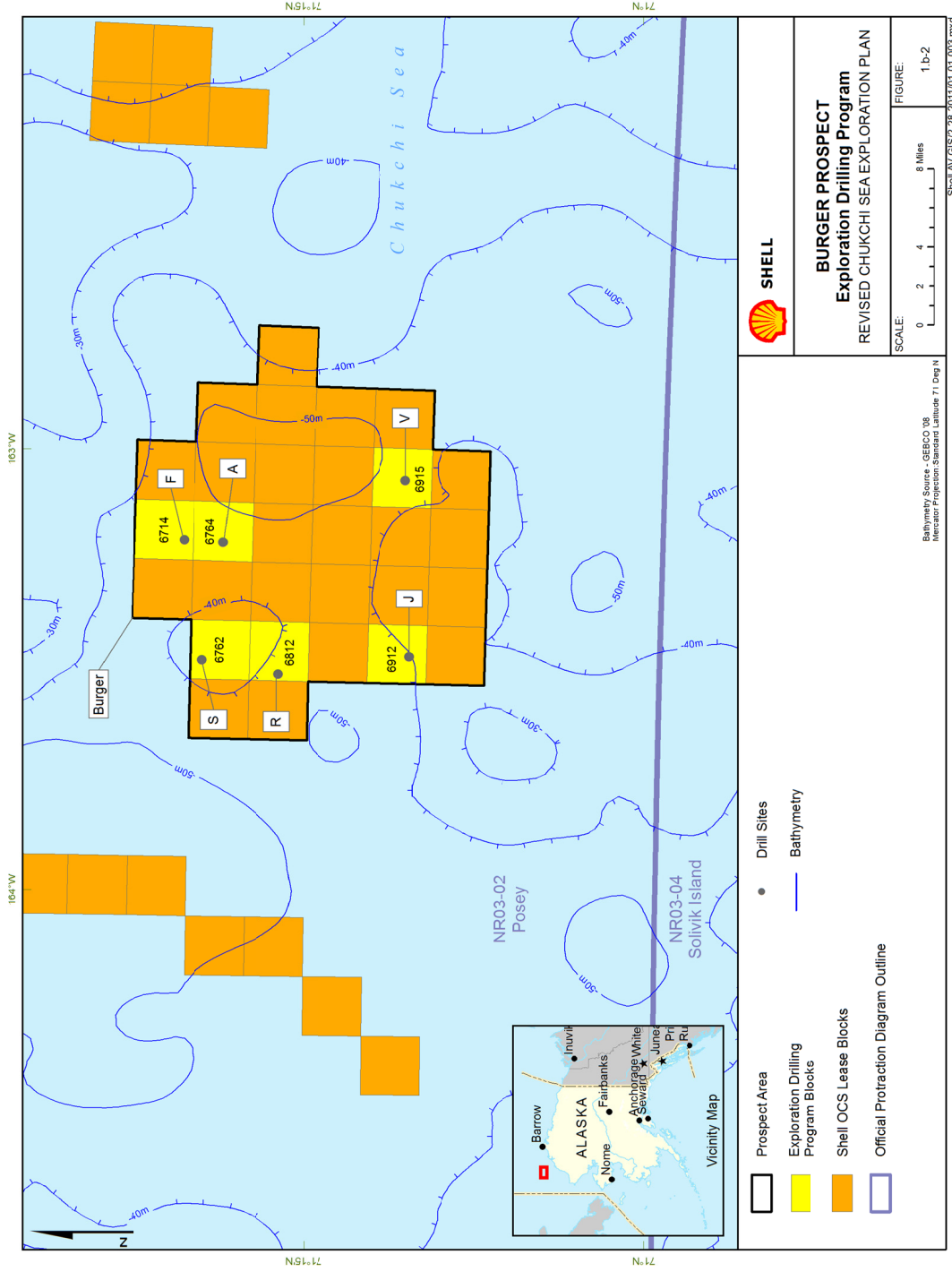


Figure 1.b-3 Bathymetry and Planned Drillship Anchor Locations - Burger A

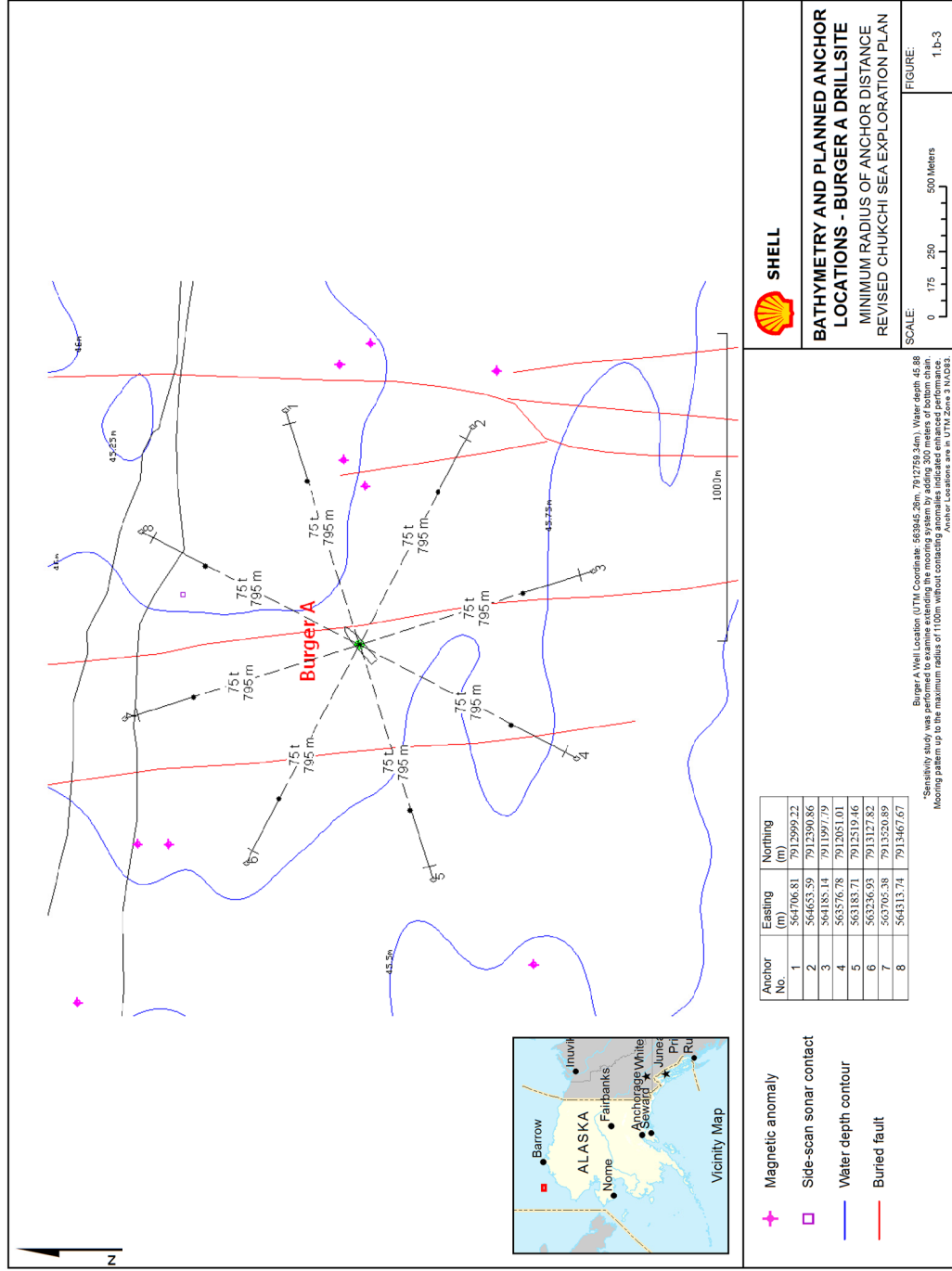


Figure 1.b-4 Bathymetry and Planned Drillship Anchor Locations - Burger F

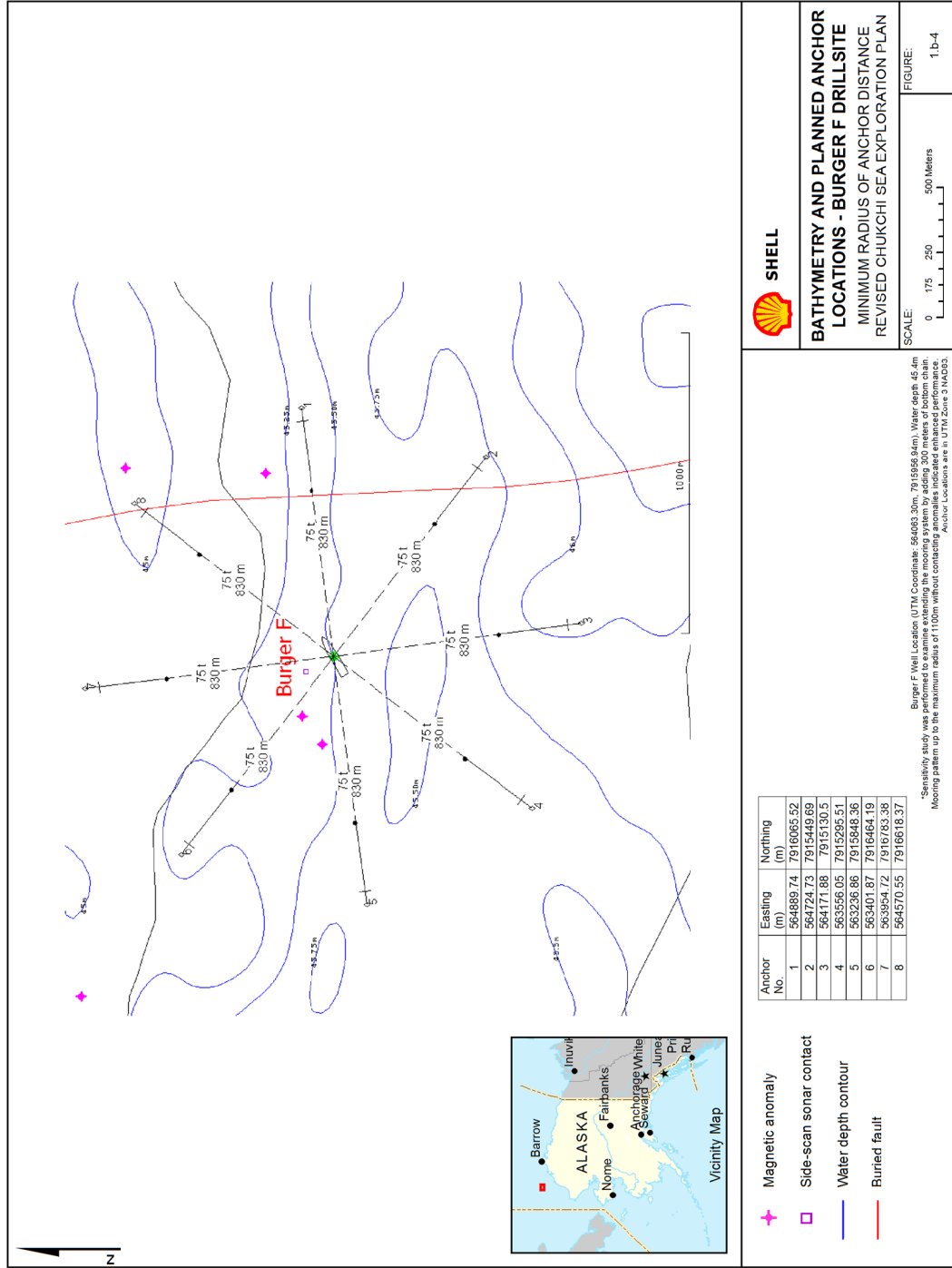


Figure 1.b-5 Bathymetry and Planned Drillship Anchor Locations - Burger J

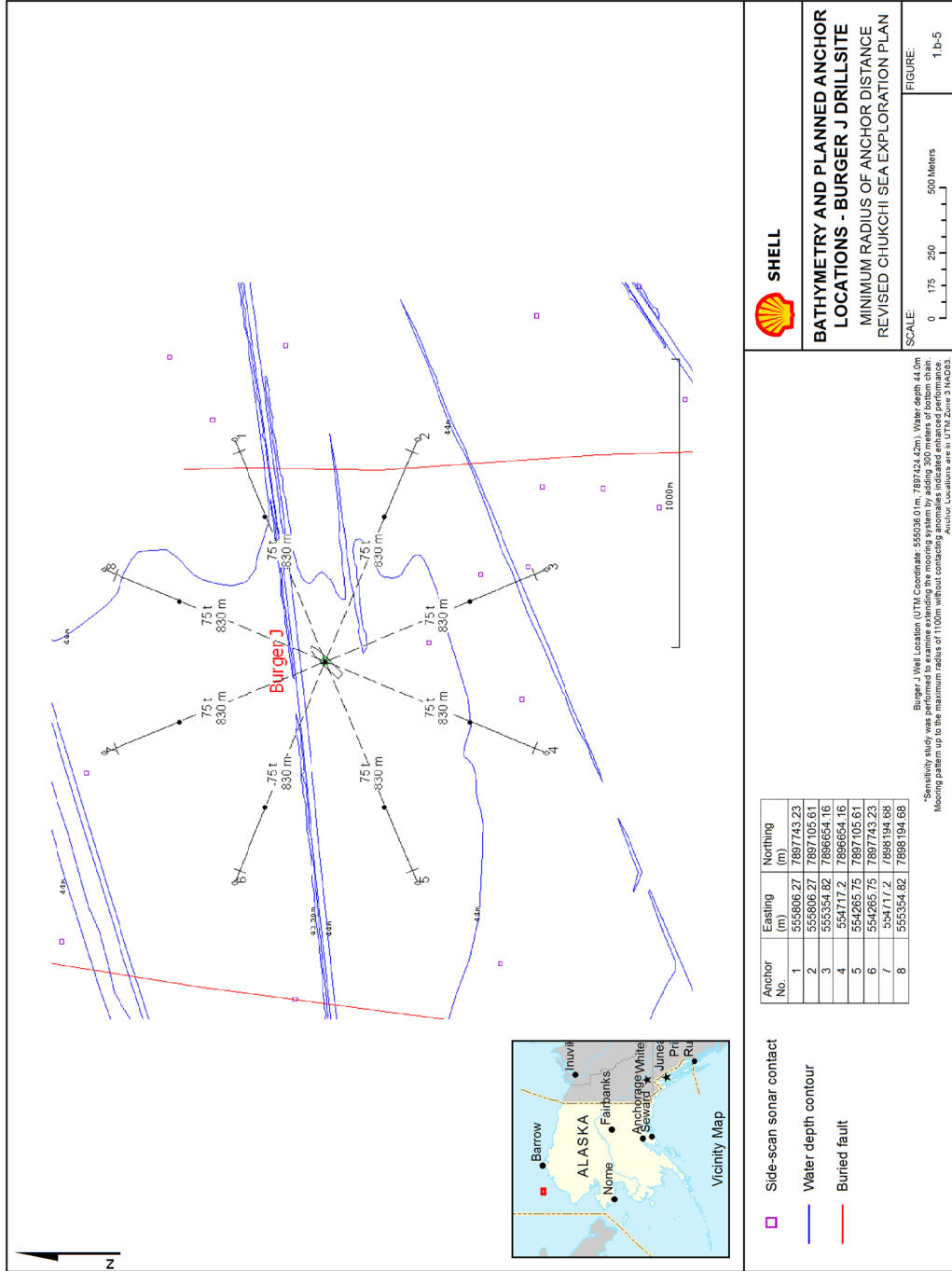


Figure 1.b-6 Bathymetry and Planned Drillship Anchor Locations - Burger R

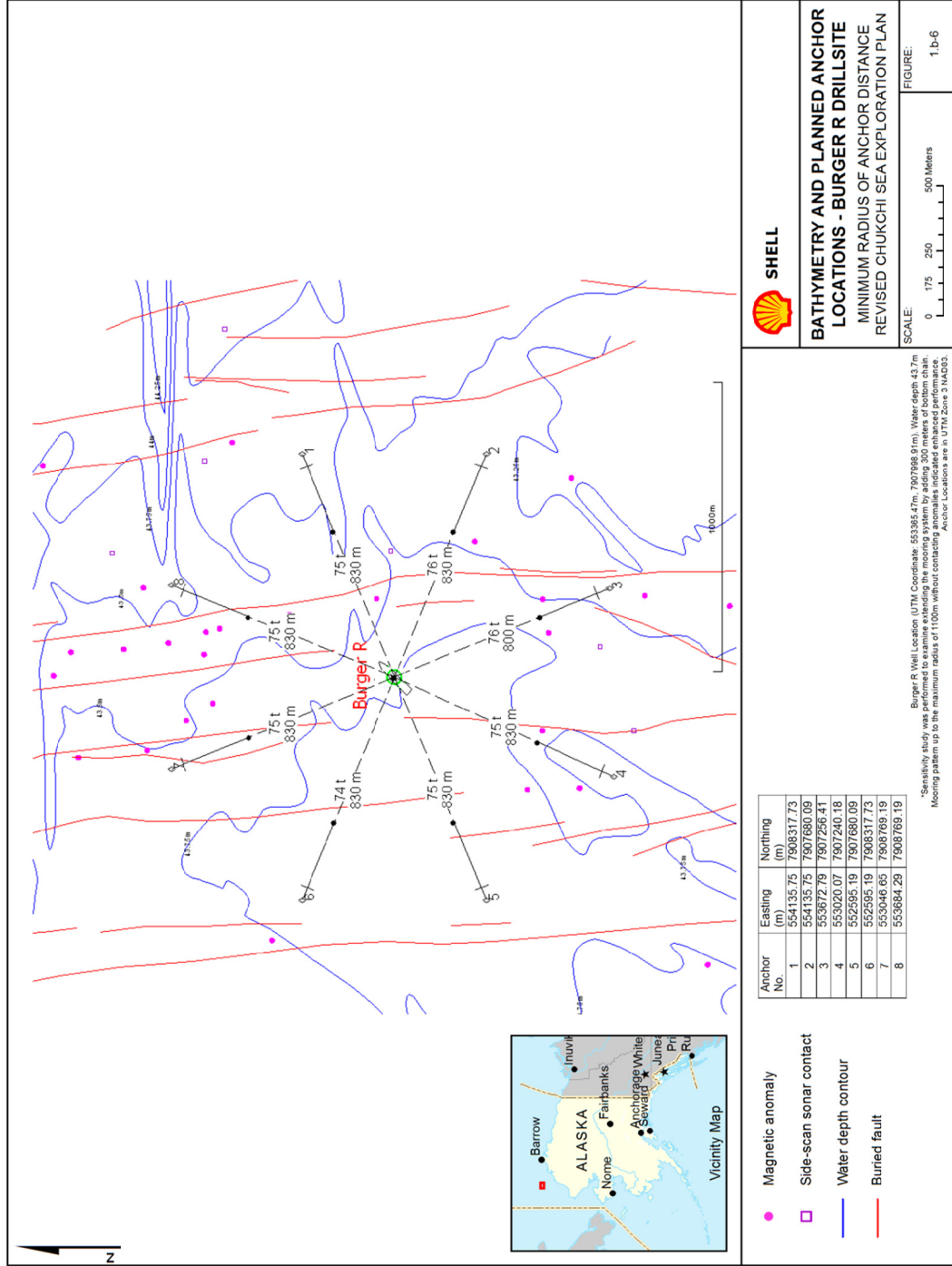
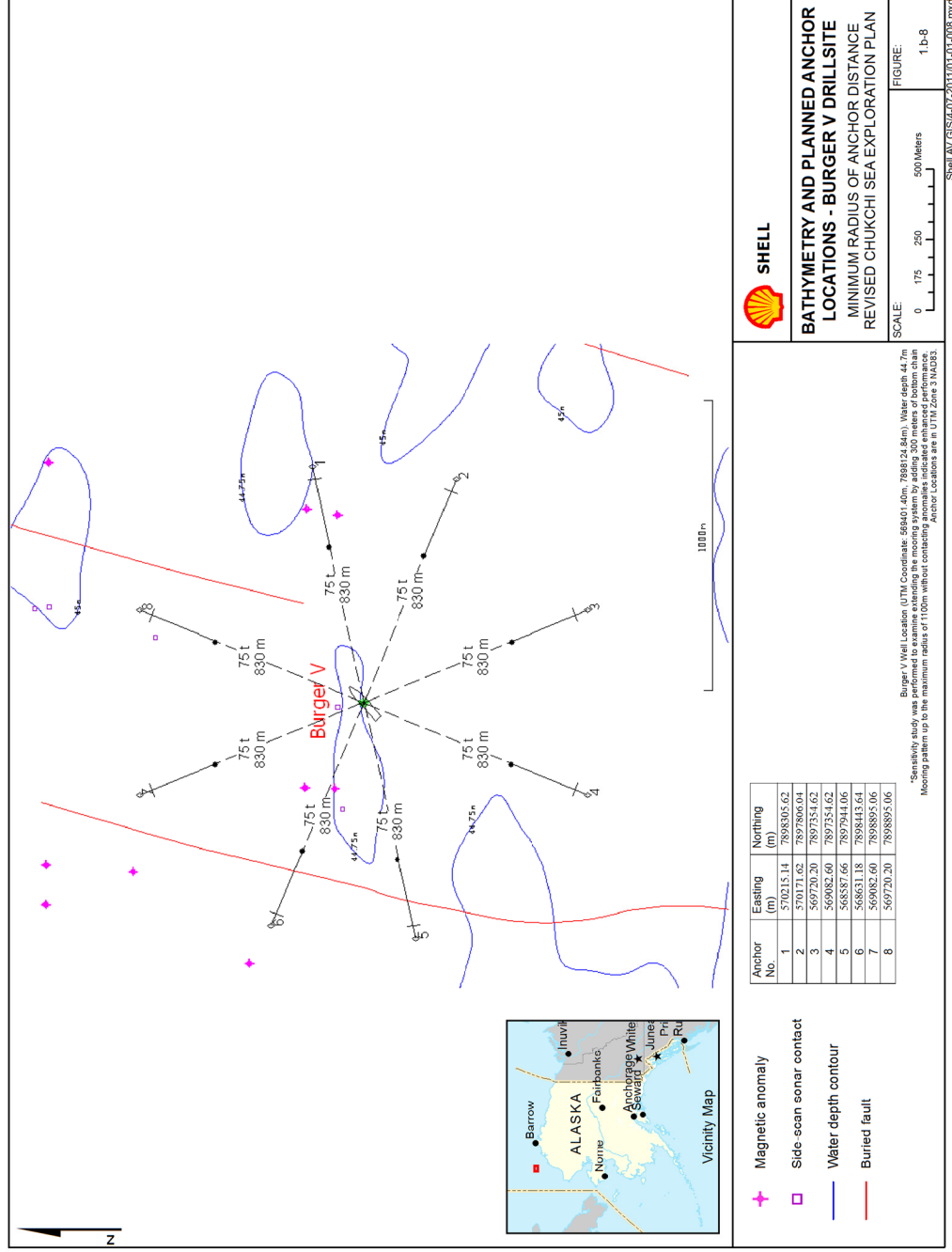


Figure 1.b-8 Bathymetry and Planned Drillship Anchor Locations - Burger V



c) Drillship

All planned exploration drilling in the identified lease blocks will be conducted with the *Discoverer*. The *Discoverer* is a true drillship, and is a largely self-contained drilling vessel. The *Discoverer* is an anchored drillship with an 8-point anchored mooring system. The hull has been reinforced for ice resistance. Specifications for this drillship are provided below in Table 1.c-1.

The *Discoverer* will undergo inspections by BOEMRE and Det Norske Veritas (DNV) for certification in Dutch Harbor before the drillship enters the theater. The DNV report will be forwarded to BOEMRE.

Photograph 1.c-1 *Discoverer*



Table 1.c-1 *Discoverer* Specifications

DISCOVERER SPECIFICATIONS	
TYPE-DESIGN	Drillship - Sonat Offshore Drilling <i>Discoverer</i> Class
SHAPE	Monohull with sponsons added for ice-resistance ¹
SHIP BUILDERS & YEAR	Namura Zonshno Shipyard, Osaka, Japan - hull number 355
YEAR OF HULL CONSTRUCTION	1965
YEAR OF CONVERSION	1976
DATE OF LAST DRY-DOCKING	2010

Table 1.c-1 *Discoverer Specifications (Continued)*

DISCOVERER DIMENSIONS		
LENGTH	514 ft	156.7 m
LENGTH BETWEEN PERPENDICULARS (LBP)	486 ft	148.2 m
BREADTH (MOULDED) OVER SPONSONS	85.3 ft	26.0 m
MAX HEIGHT (ABOVE KEEL)	274 ft	83.7 m
HEIGHT OF DERRICK ABOVE RIG FLOOR	175 ft	53.3 m

DISCOVERER MOORING EQUIPMENT	
Anchor pattern symmetric 8 points system. The unit is fitted with Sonat Offshore Drilling patented roller turret mooring system giving the unit the ability to maintain favorable heading without an interruption of the drilling operations	
ANCHORS	Stevpris New Generation 7,000 kilograms (kg) each (ea) 15,400 pounds (lb) ea
ANCHOR LINES	Chain Wire Combination
SIZE/GRADE	2.75-inch (in.) wire 3-in. ORQ Chain
LENGTH	2,750 ft (838 m) wire + 1,150 ft (351 m) chain (useable) per anchor

DISCOVERER OPERATING WATER DEPTH	
MAX WATER DEPTH	1,000 ft with present equipment (can be outfitted to 2,500 ft)
MAX DRILLING DEPTH	20,000 ft

DISCOVERER DRILLING PACKAGE	
DRAW WORKS	EMSCO E-2,100 - 1,600 horsepower (hp)
ROTARY	National C-495 with 49- ¹ / ₂ -in. opening
MUD PUMPS	2 ea Continental Emsco Model FB-1600 Triplex Mud Pumps
DERRICK	Pyramid 170 ft with 1,300,000 lb nominal capacity
PIPE RACKING	BJ 3-arm system
DRILL STING COMPENSATOR	Shaffer 400,000 lb with 18-ft stroke
RISER TENSIONS	8 ea 80,000 lb Shaffer 50-ft stroke tensioners
CROWN BLOCK	Pyramid with 9 ea 60-in. diameter sheaves rated at 1,330,000 lb
TRAVELING BLOCK	Continental - Emsco RA60-6
BOP	Cameron Type U 18.75-in. x 10,000 pounds per square inch (psi)
RISER	Cameron RCK type
TOP DRIVE	Varco TDS-3S, with GE-752 motor, 500 ton
BOP HANDLING	Hydraulic skid based system, drill floor

DISCOVERER DISPLACEMENT	
FULL LOAD	20,253 metric tons (mt)
DRILLING	18,780 mt (Drilling, max load, deep hole, deep water)

DISCOVERER DRAFT		
DRAFT AT LOAD LINE	27 ft	8.20 m
TRANSIT	27 ft (fully loaded, operating , departure)	8.20 m
DRILLING	25.16 ft	7.67 m

DISCOVERER HELIDECK	
MAXIMUM HELICOPTER SIZE	Sikorsky S-92N
FUEL STORAGE	2 ea 720-gallon (gal) tanks

Table 1.c-1 Discoverer Specifications (Continued)

DISCOVERER ACCOMODATIONS	
NUMBER OF BEDS	140
SEWAGE TREATMENT UNIT	Hamworthy ST-10
DISCOVERER PROPULSION EQUIPMENT	
PROPELLER	1 each 15 ft 7-in. (4.75 m) diameter, fixed blade
PROPULSION DRIVE UNIT	Marine Diesel, 6 cylinder, 2 cycle, Crosshead type
HORSEPOWER	7,200 hp @ 135 RPM
TRANSIT SPEED	8 knots max
GENERAL STORAGE CAPACITIES	
SACK STORAGE AREA	33,000 ft ³ (934 m ³)
BULK STORAGE	
Bentonite / Barite	1,132 bbl (180 m ³) - 4 tanks
Bulk Cement	1,132 bbl (180 m ³) - 4 tanks
LIQUID MUD	
Active	1,200 bbl (191 m ³)
Reserve	1,200 bbl (191 m ³)
Total	2,400 bbl (382 m ³)
POTABLE WATER	1,670 bbl / 265.5 m ³ (aft peak can be used as additional pot water tank)
DRILL WATER	5,798 bbl / 921.7 m ³
FUEL OIL	6,497 bbl / 1,033 m ³

¹ Sponsons designed and constructed to meet requirements of Det Norske Veritas (DNV) Additional Class Notation ICE-05.

The *Discoverer* will comply with all of the regulations of DNV, the International Maritime Organization (IMO), and the U.S. Coast Guard (USCG). All exploration drilling operations will be conducted under the provisions of 30 CFR Part 250 Subpart D, and other applicable regulations and notices including those regarding the avoidance of potential drilling hazards, safety and pollution control. Such measures as inflow detection and well control, monitoring for loss of circulation and seepage loss, and casing design will be the primary safety measures. Primary pollution prevention measures are the contaminated and non-contaminated drain systems, the mud drain system, and the oily water processing system.

Procedures for monitoring and reacting to ice in the prospect areas are provided in the Critical Operations and Curtailment Plan (COCP) and the Ice Management Plan (IMP) which are attached as Appendices J and K of this revised Chukchi Sea EP.

d) Service Fee

The required permit fee of \$20,652 (six drill sites at \$3,442 each) has been paid in full.

SECTION 2.0 GENERAL INFORMATION

a) Application and Permits

Table 2.a-1 lists permit and authorization applications that have been submitted or are revised versions that accompany this EP, for the wells to be drilled in the Burger Prospect under the revised Chukchi Sea EP. Some permits have already been obtained, and some existing permits need renewal or extension. These permits and authorizations are also indicated in Table 2.a-1.

Table 2.a-1 Permit Applications Pending or Approved

Permits & Authorizations	Agency	Submittal Date	Authorization Date	Document Location
Permit to Drill	BOEMRE	To be submitted	Pending	Separate cover
EP - initial Chukchi Sea EP	BOEMRE	Submitted 10/20/09	Approved 12/07/09	BOEMRE website ¹
EP - revised Chukchi Sea EP	BOEMRE	To be submitted	Pending	This document
ODPCP - initial Chukchi Sea EP	BOEMRE	Submitted 05/09	Approved 12/18/09	BOEMRE website ¹
ODPCP – revised Chukchi Sea EP	BOEMRE	To be submitted	Pending	Separate cover
PSD Air Quality Permit – <i>Discoverer</i>	EPA	Submitted 12/11/08 Revised 02/23/09	Approved 03/31/10 Remanded by EAB to EPA ² Approved 09/19/11	EPA website ² R10OCS/PSD-AK-09-01
NPDES – initial Chukchi Sea EP ³	EPA	Submitted 05/29/09	Blocks 6714, 6764 & 6912 Approved 01/20/10	Appendix B
NPDES – initial Chukchi Sea EP ³	EPA	Extension 12/16/10	Blocks 6714, 6764 & 6912 Approved 06/23/11	Appendix B
NPDES – revised Chukchi Sea EP ³	EPA	Submitted 12/16/10	Blocks 6812, 6762, & 6915 Approved 06/23/11	Appendix B
MMPA IHA	NMFS	To be submitted	Pending	Appendix C of this document
MMPA LOA	USFWS	To be submitted	Pending	Appendix E of this document
Section 10/404 NWP#8 initial EP	USACE	Submitted 05/22/10	Approved 07/08/09	Appendix G of this document
Section 10/404 NWP#8 revised EP	USACE	To be submitted	Approved 08/09/11	Appendix G of this document

¹ BOEMRE website at http://alaska.boemre.gov/ref/ProjectHistory/2009_Chukchi_Shell/Chukchi_2009.HTM

² EPA website at <http://yosemite.epa.gov/R10/airpage.nsf/Permits/chukchiap/#comment>

³ Authorization AKG-28-0004 for Posey Blocks 6713, 6714, 6763, 6764, 6912, Karo Block 7007 received from EP on 01/20/10; NOIs submitted to EPA on 12/10 to extend coverage of these blocks and add coverage of Posey Blocks 6812, 6762, 6915; the authorization and the 12/10 NOIs are attached in Appendix B

ACMP = Alaska Coastal Management Program
 ADNR = Alaska Department of Natural Resources
 EPA = U.S. Environmental Protection Agency
 IHA = Incidental Harassment Authorization
 LOA = Letter of Authorization
 MMPA = Marine Mammal Protection Act
 PSD = Prevention of Significant Deterioration
 NMFS = National Marine Fisheries Service
 USFWS = U.S. Fish and Wildlife Service
 USACE = U.S. Army Corps of Engineers

b) Drilling Fluids

The exploration drilling activities will use a maximum of 3,600 bbl of water based drilling fluids per well (Table 2.b-1). This is considered a maximum as circulating and reserve pit volumes are included. Drilling fluids will be recycled to the extent practicable based upon operational considerations (e.g., whether mud properties have deteriorated to the point where they cannot be used further), by carrying

drilling fluids forward from one well to the next until the end of the drilling season. Thus, these quantities are maximums and generally applicable to the last well of the season, with previous wells in the same season requiring lower drilling fluids volumes.

Further details regarding waste stream volumes, discharge rates, mud additives and other information can be found in Section 6.0. Drilling fluid constituents are indicated in the loadout list presented in Section 6.0(c).

Table 2.b-1 Drilling Fluid Type, Quantity and Discharge Rates

Drill Site	Drilling Fluid Type	Quantity ^{1,2,3}	Discharge Rate
Burger A	Water based (brine, fresh water, barite, biopolymers)	3,143 bbl	98 bbl/day
Burger F	Water based (brine, fresh water, barite, biopolymers)	3,269 bbl	102 bbl/day
Burger J	Water based (brine, fresh water, barite, biopolymers)	3,134 bbl	98 bbl/day
Burger R	Water based (brine, fresh water, barite, biopolymers)	3,260 bbl	102 bbl/day
Burger S	Water based (brine, fresh water, barite, biopolymers)	3,177 bbl	99 bbl/day
Burger V	Water based (brine, fresh water, barite, biopolymers)	3,306 bbl	107 bbl/day

¹ Volume of drilling fluid includes drilling mud (1,500 bbl) in tanks at end of well plus dilution volume

² Calculations based on washout factor of 30% and 1:1 ratio of drill cuttings and drilling fluids

³ Includes drilling fluids only (no cuttings), drilling fluids are from hole sections below the 26-in. hole

c) Chemical Products

No chemicals will be stored on the *Discoverer* above reportable quantities.

d) New or Unusual Technology

No new or unusual technology will be used in the drilling of the planned exploration wells.

e) Bonds, Oil Spill Financial Responsibility, and Well Control Statements

BOEMRE has determined that Shell has the financial capacity to allow the BOEMRE to waive supplemental bond requirements of Shell (Operator No. YK02117). Shell Gulf of Mexico Inc. has an areawide Minimum bond for \$300,000 with Travelers Casualty and Surety Company of America, Bond # 104806668 and an areawide Exploration bond \$1,000,000 with Federal Insurance Company, Bond # 8216-14-86.

Shell is of sound financial strength and reliability and has demonstrated oil spill financial responsibility (OSFR) according to 30 CFR 253 for the facilities planned in the revised Chukchi Sea EP. This financial reliability ensures that Shell has the capability to deal with all emergency situations such as blowout control including relief well drilling and kill operations, if such an unlikely event should occur.

This is a planned exploration drilling program with temporary seasonal operations. There will be minimal seabed disturbance for the MLC at each drill site. MLCs are designed to protect the wellhead, casing and blowout preventers from potential ice gouge events. Vessel anchoring systems employed during operations will be removed upon abandonment of each well. Permanent facilities will be limited to the casing, wellhead housings and the permanent guide base remaining after well abandonment. Shell will comply with Abandonment of Wells regulations in 30 CFR 250.1710 - 1723. It is noted that the casing and guide base will be set in the base of the MLC at approximately 40 ft (12.2 m) below the mudline. No portion of any of these permanent facilities will extend above the mudline. The uppermost part of the equipment remaining on the abandoned well, the top of the guide arms, will be no higher than 26 ft (7.9 m) below the mudline.

f) Suspension of Operations

Shell has plans and mitigation measures in place that accommodate the forced or voluntary suspension of operations during implementation of the proposed exploration drilling program detailed in the revised Chukchi Sea EP. Forced suspension of operations could result from conditions such as weather, ice conditions, drillship mechanical conditions, or downhole conditions, among others. In order to facilitate a possible suspension of operations, Shell has drafted several operations plans containing suspension procedures and protocols in accordance with 30 CFR 250.220, including a COCP, which is attached in Appendix J of the revised Chukchi Sea EP. This plan is also discussed in Section 9.0.

g) Blowout Scenario

A blowout scenario has been developed for Shell's revised Regional Oil Discharge Prevention and Contingency Plan (ODPCP) based on 30 CFR 254.47(b). This blowout scenario is described in Section 8.0(d) and (e) of this revised Chukchi Sea EP as required by 30 CFR 250.219. The ODPCP has been prepared to accommodate this blowout scenario. Calculation of a worst case discharge (WCD) is also required by 30 CFR 250.213(g) and NTL 2010-06, and is discussed below.

WCD – Maximum Flow Rate, Duration and Total Volume

Shell calculated WCD flowrates and volumes for a well at each of the drill sites identified in the revised Chukchi Sea EP using a combination of nodal analysis and numerical simulation techniques. Burger J was found to have the greatest flow rate (Table 2.g-1).

Table 2.g-1 Calculated Maximum Daily Oil Flowrates for Wells at Drill Sites Identified in the revised Chukchi Sea EP

Drill Site	Lease	Estimated WCD Maximum Daily Oil Flowrate (bbl/day)
Burger J	OCS-Y-2321	23,100
Burger S	OCS-Y-2278	19,127
Burger A	OCS-Y-2280	19,031
Burger V	OCS-Y-2324	13,812
Burger F	OCS-Y-2267	11,763
Burger R	OCS-Y-2294	8,689

The assumptions and basis for calculation of the WCD are provided in Section 3.0(l) of this document. The ODPCP blowout planning scenario used for oil spill response planning exceeds the WCD calculated for the revised Chukchi Sea EP (Burger J), as discussed in Section 8.0(d).

Potential for Well Bridging

For calculation of the WCD, Shell has assumed uncontrolled flow to the mudline with no drill pipe in the hole, and no formation bridging. There has been only one penetration of the reservoir and it produced insufficient petrophysical data to be considered sufficient for determining bridging tendency at other sites.

Surface Intervention

Well control is discussed in Section 9.0 of this document and a well control plan is provided in Appendix L. Shell will have a capping stack and a containment barge available for the duration of the exploration drilling program. Surface intervention and capping and containment are discussed specifically in Section 9.0(f). The capping stack system will be carried as equipment on an ice management vessel and the

containment barge will be located in the Beaufort Sea or the Chukchi Sea where it can respond as required as discussed in Section 13.

Relief Well Drilling Unit – Availability, Constraints, and Days to Drill and Kill Flow

Relief well drilling procedures are discussed in the ODPCP. Shell's Well Control Plan is attached in Appendix L of this revised Chukchi Sea EP. Well control is the process of maintaining positive hydrostatic pressure in the drilled wellbore greater than that in any drilled formation, a process called positive pressure drilling, that prevents gas or fluids from underground reservoirs escaping from the wellbore in any uncontrolled manner.

The *Discoverer* will serve as its own primary relief well drilling unit in the unlikely event of a well blowout. It would be available and has no constraints, and is described in detail in Section 1.0(c). If the *Discoverer* is undamaged and capable of drilling its own relief well, drilling operations could begin in as little as three days, with the relief well drilled and flow from the blowout being killed in about 28 days. If the *Discoverer* cannot be used to drill the relief well, a second drilling unit would be brought in for that purpose. This second drilling unit would be the conical drilling unit *Kulluk (Kulluk)*. The *Kulluk* is owned by Shell so availability is not an issue. The number of days required to moor the relief well drilling unit, drill the relief well, intercept and kill the blowout and plug both wells is the same for both rigs. The *Kulluk* is anticipated to be in the Camden Bay area in the U.S. Beaufort Sea and could be mobilized to the Burger Prospect and drill a relief well and kill flow within 34 days. Alternatively it could be located in Dutch Harbor (if not drilling in the Beaufort) and could be mobilized to the Burger Prospect and drill a relief well and kill flow in 38 days. The *Kulluk* has no constraints. It was designed specifically to operate in arctic conditions, with a conical hull shape designed to operate in first year ice up to 4.0 ft (1.2 m) thick.

h) Contact Information

Contact Susan Childs, Alaska Venture Support Integrator Manager, Alaska Venture, at telephone number 907-646-7112, fax 907-770-3636, or e-mail at susan.childs@shell.com.

SECTION 3.0 GEOLOGICAL AND GEOPHYSICAL INFORMATION (PROPRIETARY AND CONFIDENTIAL)

The information for the Burger Prospect in this section contains confidential and proprietary information and is not available in this public information copy of the revised Chukchi Sea EP.

- a) **Geological Description, Drill Sites, and Bathymetry Maps**
- b) **Structure Contour Maps**
- c) **Key Seismic Lines**
- d) **Geological Cross-Sections**
- e) **Shallow Hazards Report**
- f) **Shallow Hazards Assessment**
- g) **High Resolution Seismic Lines**
- h) **Stratigraphic Columns**
- i) **Time-versus-Depth Charts**
- j) **Geochemical Information**
- k) **Future Geological and Geophysical Activities**
- l) **WCD Calculations**

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

SECTION 4.0 HYDROGEN SULFIDE INFORMATION

a) Concentration

During the historic 1989–1991 Chukchi exploration drilling program, no H₂S was recorded while drilling in open-hole conditions in any of the five historic wells: OCS-Y 1482 Klondike #1, OCS-Y 1275 #1 (Popcorn), OCS-Y 1413 #1 (Burger), OCS-Y 1320 #1 (Crackerjack) and Chevron OCS-Y 0996 #1 (Diamond). However, two occurrences of minor amounts of H₂S, related to the bacterial digestion of the XC polymer in the mud that was left inside the casing during an extended period of operational suspension, were recorded and are described below.

In early October 1989, a string of 13 ³/₈-in. (340 mm) casing was set and cemented at 5,516 ft (1,681 m) in the legacy OCS-Y 1413 #1 (Burger) well. The cement was displaced by the same XC polymer-based drilling mud as that used to drill the 17 ¹/₂-in. (44.5-cm) hole below 20-in. (508 mm) casing set at 1,440 ft (439 m). The cement was displaced to the float collar some 43 ft (13 m) above the casing shoe leaving a cement plug in the bottom of the casing along with two check valves (i.e., floats). The cement plug and floats, along with the hydrostatic pressure from the mud column within the 20-in. (508 mm) casing, prevented formation fluids from entering the casing. The well was temporarily abandoned with a corrosion cap set on top of the wellhead after pressure testing the wellhead hanger. The well remained in this configuration until it was re-entered.

In August 1990, the MLC was cleaned out on the OCS-Y 1413 #1 (Burger #1 well and the corrosion cap was removed. Then a 12¹/₄-in. (31-cm) bit was run through the old mud to the top of the cement plug inside the casing. The old mud was then displaced out of the 20-in. (508 mm) casing with newly mixed drilling mud. When the bottom portion of the old mud reached the surface, a maximum H₂S concentration of 30 parts per million (ppm) was detected at the shale shaker. As the new mud circulated to surface, the H₂S concentration returned to zero. Once the H₂S concentration returned to zero the 12¹/₄-in. (31-cm) bit then drilled through the cement plug and both check valves. It then proceeded to drill new formation on its way to the main objective target.

It is concluded that the H₂S was the byproduct of bacterial digestion of the polymer in the old mud contained within the 20-in. (508 mm) casing. There had been no H₂S detected while drilling the 17 ¹/₂-in. (445 mm) hole and the casing was sealed during the 10-month time between depositing the mud inside the casing and circulating it out. No other H₂S was recorded while drilling the remaining hole segments to the well's final TD of 8,202 ft (2,500 m).

In October 1990, the 13 ³/₈-in. (340 mm) surface casing was set and cemented in the historical OCS-Y 1320 #1 (Crackerjack) well at 5,448 ft (1,661 m) in a 17 ¹/₂-in. (445 mm) hole below the 20-in. (508 mm) casing set at 1,326 ft (404 m). On this casing string, two joints of casing separated the float collar at 5,363 ft (1,635 m) from the float shoe at 5,448 ft (1,661 m), leaving at least 85 ft (26 m) of cement inside the base of the pipe. Again, the cement was displaced with the same XC polymer mud used to drill the 17 ¹/₂-in. (445 mm) hole. The combination of the cement plug and the floats along with the hydrostatic pressure from the mud column within the 13³/₈-in. (340 mm) casing, prevented formation fluids from entering the casing. In addition, an H₂S scavenger, Sulf-X ES at a concentration of 1.0 parts per billion (ppb) was added to the mud to prevent bacterial degradation of the mud (as seen at the Burger #1 well). The Crackerjack well was temporarily abandoned, without drilling out cement inside the surface casing, using a corrosion cap.

In late-July 1991, the rig returned to the OCS-Y 1320 #1 (Crackerjack) well and re-entered the temporarily abandoned hole. A 12¹/₄-in. (31-cm) bit was run to the top of cement inside the 13³/₈-in. (340 mm) casing and the old mud was circulated out of the hole. The returned mud was monitored for

H₂S by a safety specialist and by mud loggers. When mud from approximately 4,000 ft (1,219 m) in the well reached the surface, H₂S in trace concentrations was released at the shakers. As the old mud was displaced with new mud, the H₂S concentration fell to zero prior to drilling out the cement plug and floats, and into new formation. No other H₂S was recorded while drilling the remaining hole segments to the well's final TD of 9,573 ft (2,918 m).

Again, it is concluded that the H₂S in this well was the product of bacterial digestion of the XC polymer in the old mud. There was no H₂S encountered while drilling the 17 ½-in. (445 mm) hole and none was released into the mud during subsequent drilling. Apparently, the H₂S scavenger was not completely successful in preventing the H₂S, but the concentration was reduced from that seen in the Burger well after about the same on-bottom time.

No H₂S was detected or released while drilling any of the other wells in the Chukchi Sea during the 1989-1991 campaign. This reinforces the conclusion that the source of H₂S detected in these two wells was indeed the result of bacterial degradation of the polymer mud left in each hole for approximately 10 months each and not from any geologic formation penetrated by either well.

b) Classification

H₂S is not expected in any hole segment in any exploration well planned in Shell's revised Chukchi Sea EP. This is based on the absence of H₂S in any previously drilled exploration well in the Chukchi Sea, the Beaufort Sea or the Canadian Beaufort Sea, and the fact that no H₂S was encountered while drilling the legacy Burger #1 well. The legacy Burger #1 well, OCS-Y-1413 #1, was drilled through the targeted Cretaceous objective at a total depth in the Jurassic Kingak Formation at 8,202 ft (2,500 m). All of the planned exploration wells described in this revised Chukchi Sea EP will be targeting the same Cretaceous objective interval, as encountered in the OCS-Y-1413 #1 well, and would reach TD above the Kingak Formation.

All of the Burger Prospect drill sites covered by Shell's revised Chukchi Sea EP could be classified as "H₂S absent" because none of the wells is projected to be drilled below the equivalent stratigraphic interval penetrated by the depth of the historic OCS-Y 1413 #1 Burger Well, 8,202 ft (2,500 m). Nonetheless, Shell will be treating these wells as "H₂S Unknown" and has prepared an H₂S Contingency Plan that includes installing all H₂S equipment, providing required training and following all emergency protocols required by 50 CFR 250.490 for the entire drilling season.

c) Contingency Plan

An H₂S Contingency Plan is provided in Appendix N. H₂S-resistant tubular goods and wellheads have been selected for each proposed Chukchi Sea prospect string design. Although these materials of construction will probably not be needed, Shell has chosen them for use in exploration wells to avoid risk in the unlikely event that H₂S is present in some well segment.

d) Modeling Report

A Modeling Report is not included since the actual concentration of H₂S in any exploration well cannot be predicted. There is no reliable analog reservoir on the North Slope containing H₂S with which to compare the planned Burger Prospect. An assumed H₂S concentration would therefore be required to prepare such a model, and no basis for such an assumption is available. Any release model, as a tool for predicting H₂S radii of exposure, would therefore be questionable. It is unlikely that an H₂S release, even at maximum release flow rate and normal concentrations at the remote Burger Prospect drill sites located more than 64 mi (103 km) offshore could significantly impact the public on the northwest coast of Alaska due to expected diffusion and dispersion in the air column over such a long distance.

SECTION 5.0 BIOLOGICAL, PHYSICAL, AND SOCIOECONOMIC INFORMATION

a) Biological Environment Reports

Results of the shallow hazards surveys indicate that the seafloor at all six drill sites is relatively level and smooth with the exception of ice gouges. Seafloor sediments consist largely of silts and clays. No evidence was observed of hard bottom or other special habitats.

Shell funded in part a number of other types of baseline studies in 2008, 2009, and 2010 as part of a multi-faceted study to gather data regarding resources in the project area, and plans to continue these studies in 2011. The study focused on a 30 x 30 nautical mile (n mi) study area (56 x 56 km) encompassing Shell's Burger Prospect. The data collected during the course of these programs was used in the EIA (Appendix F). Final reports are currently available for the following studies:

- Benthic ecology of the Burger and Klondike survey areas: 2008 environmental studies program in the northeastern Chukchi Sea (Blanchard et al. 2010a)
- Benthic ecology of the Burger and Klondike survey areas: 2009 environmental studies program in the northeastern Chukchi Sea (Blanchard et al. 2010b)
- Oceanographic assessment of the planktonic communities in the Klondike and Burger survey areas of the Chukchi Sea: report for survey year 2008 (Hopcroft et al. 2009)
- Oceanographic assessment of the planktonic communities in the Klondike and Burger survey areas of the Chukchi Sea: report for survey year 2009 (Hopcroft et al. 2010)
- Distribution and abundance of seabirds in the northeastern Chukchi Sea, 2008 (Gall and Day 2009)
- Distribution and abundance of seabirds in the northeastern Chukchi Sea, 2008 and 2009 (Gall and Day 2010)
- Marine mammal surveys at the Klondike and Burger survey areas in the Chukchi Sea during the 2008 open water season (Brueggeman 2009)
- Marine mammal surveys at the Klondike and Burger survey areas in the Chukchi Sea during the 2009 open water season (Brueggeman 2010)
- Passive acoustic monitoring of marine mammals in the Chukchi Sea 9 September – 14 October 2008 (The Cornell Lab of Ornithology 2010)

Results of these studies conducted at the Burger Prospect are discussed in the EIA (Appendix F). Results of other studies are pending.

In addition to the baseline surveys described above, Shell has partially funded U.S. Geological Survey (USGS) walrus tagging studies in the Chukchi Sea and ringed seal tagging studies in Kotzebue Sound with the Native Village of Kotzebue. Results of these studies are found on the internet at http://alaska.usgs.gov/science/biology/walrus/2008animation_Norseman.html and http://kotzebueira.org/current_projects2.html.

Shell has also collected a large amount of information regarding marine mammals in the northeastern Chukchi Sea, including the area of Shell's Burger Prospect, through its marine mammal monitoring

program associated with open water activities. Data collected over the last three years is summarized in the comprehensive reports, which have been forwarded to the BOEMRE under separate cover.

- Funk, D. W., R. Rodrigues, D. S. Ireland, and W. R. Koski (eds.). 2007. Joint Monitoring Program in the Chukchi and Beaufort Seas, July-November 2006. LGL Alaska Report P891-2, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greeneridge Sciences, Inc., Bioacoustics Research Program, Cornell University, and Bio-Wave Inc. for Shell Offshore, Inc., ConocoPhillips Alaska, Inc., and GX Technology, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 316 p. plus Appendices.
- Ireland, D.S., D.W. Funk, R. Rodrigues, and W. R. Koski (eds.). 2008. Joint Monitoring Program in the Chukchi and Beaufort Seas, July-November 2007. LGL Alaska Report P1050-3, Report from LGL Alaska Research Associates, Inc., LGL, Ltd., Greeneridge Sciences, Inc., and JASCO Research, Ltd. and for Shell Offshore, Inc., ConocoPhillips Alaska, Inc., and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 445 p. plus Appendices.
- Funk, D.W., D.S. Ireland, R. Rodrigues, and W.R. Koski (eds.). 2010. Joint Monitoring Program in the Chukchi and Beaufort seas, open-water seasons, 2006–2008. LGL Alaska Report P1050-2, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greeneridge Sciences, Inc., and JASCO Applied Sciences, for Shell Offshore, Inc. and Other Industry Contributors, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 462 p. plus Appendices.
- Funk, D.W., D.S. Ireland, R. Rodrigues, and W.R. Koski (eds.). 2011. Joint Monitoring Program in the Chukchi and Beaufort seas, open-water seasons, 2006–2009. LGL Alaska Report P1050-2, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greeneridge Sciences, Inc., and JASCO Applied Sciences, for Shell Offshore, Inc. and Other Industry Contributors, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 462 p. plus Appendices.

b) Physical Environment Reports

Archaeological Assessments

Shell has conducted shallow hazards surveys at the six drill sites. Archaeological resource assessments were conducted for each drill site based on geophysical data collected during the surveys. The shallow hazards survey reports and archaeological assessments have been submitted to BOEMRE under separate cover as listed below.

- Fugro GeoConsulting, Inc. 2010a. Shallow hazards and archaeological assessment Burger Site Survey 1 OCS Lease Sale 193 area Chukchi Sea, Alaska. Report No. 27.2009-2327 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010b. Drill site clearance letter proposed Burger A drill site Block 6764 OCS-Y-2280 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-1 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010c. Drill site clearance letter proposed Burger F drill site Block 6714 OCS-Y-2267 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-3 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010d. Drill site clearance letter proposed Burger S drill site Block 6762 OCS-Y-2278 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-4 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.

- Fugro GeoConsulting, Inc. 2010e. Shallow hazards and archaeological assessment Burger Site Survey 3 OCS Lease Sale 193 area Chukchi Sea, Alaska. Report No. 27.2010-2342 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010f. Drill site clearance letter proposed Burger V drill site Block 6915 OCS-Y-2324 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-6 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2011a. Shallow hazards and archaeological assessment Burger Site Survey 4 OCS Lease Sale 193 area Chukchi Sea, Alaska. Report No. 27.2010-2343 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2011b. Drill site clearance letter proposed Burger R drill site Block 6812 OCS-Y-2294 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-7 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Geoscience Earth & Marine Services, Inc. 2009. Shallow hazards and archeological assessment, Burger J drill site Posey Block NR03-02 6912, Chukchi Sea, Alaska. Prepared by Geoscience Earth & Marine Services, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.

Results of the shallow hazards surveys are summarized in Section 3.0(g) of the “Proprietary” version of this revised Chukchi Sea EP. The results of the archaeological assessments are discussed below and in more detail in Section 3.10 of the EIA (Appendix F) and in the shallow hazards and archaeological assessment reports for Burger J Site Survey (Geoscience Earth & Marine Services, Inc. 2009), Site Survey 1 (Fugro GeoConsulting, Inc. 2010a), Site Survey 3 (Fugro GeoConsulting, Inc. 2010e), and Site Survey 4 (Fugro GeoConsulting, Inc. 2011a).

None of the EP blocks for this revised Chukchi Sea EP or drill sites are located in areas that BOEMRE has identified as having high potential for occurrence of historic archaeological resources. No potential archaeological resources were identified at or near the Burger A, F, J, R, S, or V drill sites. No facilities, shipwrecks, significant debris, or other man-made seafloor obstructions were detected during the shallow hazards surveys. The only man-made object around the proposed sites is the legacy Burger #1 well site. The well was drilled in 1989-1990 in Posey Area Block 6814 (Figure 3.0-2). The historic well was plugged and abandoned in 1990, with all surface wellhead equipment contained well below the seafloor at the bottom of the MLC. None of the observed unidentified side-scan sonar contacts and unidentified magnetic anomalies is believed to be of archaeological significance. Fugro GeoConsulting Inc. (2011a) recognized a cluster of seven unidentified magnetic anomalies in the southern portion of Burger Site Survey 4 and thought that they could represent debris of unknown origin and recommended they be avoided. The seven magnetic anomalies are outside the planned drill site area (Burger R drill site) and thus will be avoided. All of the side-scan sonar contacts and magnetic anomalies will be avoided during the exploration drilling operations.

All the EP blocks and drill sites are located in water depths of less than 200 ft (60 m), which is generally considered to be the low stand of sea level approximately 13,000 years before present (YBP). Recent research in the Bering Sea suggests that the sea level was about 164 ft (50 m) lower than present approximately 11,000 years ago. Between 9,000 YBP and 7,500 YBP sea level rose from approximately 144 ft (44 m) to 59 ft (18 m). These rising marine waters would have inundated all of the planned drill site locations on the Burger Prospect. Early humans could have traversed presently inundated areas within the planned drill sites up until about 9,000 YBP. Therefore, these areas, which were sub-aerially exposed prior to 9,000 YBP could hold prehistoric archaeological resources. Such resources are most likely to occur along relict terrestrial landforms such as preserved levees or terraces associated with paleo-river channels or shorelines.

Pleistocene buried channels have been identified in the area of the Burger A, F, and S drill sites. The levees and internal strata of all identified subsurface channel features have been eroded during the last sea-level rise, and covered by Holocene aged materials, thus the possibility of preserved archaeologically significant sites has been decreased and the potential for disturbance of any such sites by exploration drilling operations is very low. No Pleistocene channels were identified near the Burger J, R, and V drill sites. Both Fugro and GEMS concluded that the potential for the occurrence and preservation of both prehistoric and historic cultural resources at the identified Burger A, F, J, R, S, and V drill sites is very low.

Other Studies of the Physical Environment

Shell funded in part a number of other types of baseline studies in 2008, 2009, and 2010 as part of a multi-faceted study to gather data regarding resources in the project area, and plans to continue these studies in 2011. The study focused on a 30 x 30 n mi study area (56 x 56 km) encompassing Shell's Burger Prospect. The data collected during the course of these programs was used in the EIA. Final reports are currently available for the following:

- Physical oceanographic measurements in the Klondike and Burger survey area of the Chukchi Sea: 2008 and 2009 (Weingartner and Danielson 2010)
- Environmental studies in the Chukchi Sea 2008: chemical characterization (Neff et al. 2010)
- Chukchi Sea environmental studies baseline program 2009 fish sampling – chemistry results (Exponent 2010)

Shell also collected oceanographic information as part of the multi-faceted baseline study conducted at Burger in 2008-2010 described above, Shell:

- Deployed metrological buoy in the Chukchi Sea near the Burger Prospect in 2008-2010 that reported hourly measurements via satellite – this work is being continued in 2011-2012.
- Deployed an acoustical waves and current meter (AWAC) in the Chukchi Sea near the Burger Prospect in 2008-2010, which will be serviced and redeployed in 2011-2012.

Shell also established a meteorological and air quality monitoring station at Wainwright. Data has been collected and reported for November 2008 through December 2010 in the following reports, which indicate that measured concentrations of air pollutants are well below National Ambient Air Quality Standards (NAAQS).

- AECOM, Inc. 2009a. Wainwright near-term ambient air quality monitoring program first quarter data report November 2008 through January 2009 final. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2009b. Wainwright near-term ambient air quality monitoring program second quarter data report February through April 2009 final. Document No. 01865-104-3220 prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2009c. Wainwright near-term ambient air quality monitoring program third quarter data report May through July 2009 final. Document No. 01865-104-3230 prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.

- AECOM, Inc. 2009d. Wainwright near-term ambient air quality monitoring program fourth quarter data report August through October 2009 final. Document No. 60136620-3240 prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2010a. Wainwright near-term ambient air quality monitoring program annual data report November 2008 through November 2009 final. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2010b. Wainwright permanent ambient air quality monitoring program first quarter data report January through March 2010 final. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2010c. Wainwright permanent ambient air quality monitoring program second quarter data report April through June 2010 draft. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2010d. Wainwright permanent ambient air quality monitoring program third quarter data report July through September 2010 draft. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2011a. Wainwright permanent ambient air quality monitoring program fourth quarter data report October through December 2010 draft. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.
- AECOM, Inc. 2011b. Wainwright permanent ambient air quality monitoring program annual data report January 2010 through December 2010 final. Unpublished report prepared by AECOM, Inc. for ConocoPhillips Alaska, Inc. Anchorage, Alaska.

c) Socioeconomic Study Reports

Shell continues with its Plan of Cooperation (POC) meetings, as required by the NMFS, USFWS and BOEMRE in order to gather comments and questions and to address the concerns of the communities that are potentially affected by the planned exploration drilling program.

In addition, Shell offers several programs that involve the training and subsequent hiring of local residents. Programs include the following:

- Marine Mammal Observer (MMO) Program: The MMO program involves intensive training for marine mammal identification and documentation, computer use, and health and safety. Some MMO's are recruited locally from North Slope communities to work during exploration drilling activities, including the planned exploration drilling program.
- Subsistence Advisor (SA) Program: In the SA program, potentially affected villages are represented by one of its residents to relay subsistence information and issues to Shell. The SA speaks with other village members and documents subsistence information. This information may then be integrated into the various Shell exploration drilling programs.
- Community Liaison Officer (CLO) Program: The CLO program includes community liaisons in Point Hope, Barrow, and Kaktovik, that serve as Shell's point-of-contact for questions regarding Shell programs in the area.
- Cultural Awareness Program: Shell and contractor personnel involved in field operations during the planned exploration drilling program will attend the orientation training annually, which

addresses environmental, social, and cultural concerns related to the project area. The program is designed to increase sensitivity and understanding by Shell and its contractors of community values, customs, and lifestyles in the area they will be working, and how to avoid conflicts with Native Alaskans and their subsistence activities. The program stresses the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provides guidance on how to avoid disturbance. The program is discussed in more detail in Section 11.

Shell collected information on the use of coastal areas along the Chukchi Sea for subsistence through its SA Program. Data were collected through a number of person-to-person interviews. Subsistence users from Barrow, Wainwright, Point Lay, and Point Hope were interviewed. The following reports were prepared summarizing and mapping the results of these interviews. The ASRC Energy Services (2009) report was previously submitted to BOEMRE; the ASRC Energy Services (2010) and UMIAQ (2011) reports are attached to this document on a CD.

- ASRC Energy Services. 2009. Subsistence advisor program summary, North Slope, Alaska. Report prepared by ASRC Energy Services, Anchorage, AK for Shell Exploration and Production Company, Houston, TX
- ASRC Energy Services. 2010. 2009 Subsistence Advisor Program Annual Summary North Slope, Alaska. Prepared for Shell Exploration and Production Company. Anchorage, AK. December 2009.
- UMIAQ. 2011. 2010 Subsistence advisor program North Slope, Alaska. Report prepared by UMIAQ, Anchorage, AK for Shell Exploration & Production Company, Anchorage, AK 19 pp. + app.

While developing its ODPCP, Shell conducted interviews with residents of Barrow, Wainwright, Point Lay, and Point Hope to supplement existing formal environmental and resource data for the Chukchi Sea coastline. Data collected pertained to hunting, fishing, land use, and coastal processes such as erosion, ice movement and melting, and coastal dynamics. A report was prepared summarizing and mapping the results of these interviews. The report (Sound Enterprises and Associates, LLC 2008) has been submitted to BOEMRE. Results of these interviews were used in the preparation of the EIA (Appendix F).

- Sound Enterprises and Associates, LLC. 2008. Shell Exploration and Production Company (SEPCO) Chukchi Village interview program. Report prepared for Shell Exploration and Production Company Houston, TX by Sound Enterprises, LLC, Bainbridge, WA.

Shell also conducted an economic analysis of future oil and gas exploration and development in the Beaufort Sea, Chukchi Sea, and North Aleutian Basin. The results (Northern Economics 2009, Northern Economics, Inc. and Institute of Social and Economic Research 2011) of the analyses have been presented to BOEMRE and were used in preparation of the EIA for this revised Chukchi Sea EP, where summaries can be found.

- Northern Economics Inc. 2009. Economic analysis of future offshore oil and gas development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin. Report prepared by Northern Economics, Anchorage Alaska for Shell Exploration and Production, Houston, TX.
- Northern Economics, Inc. and Institute of Social and Economic Research. 2011. Potential National-Level Benefits of Alaska OCS Development. Report prepared by Northern Economics, Inc. and Institute of Social and Economic Research, Anchorage, AK for Shell Exploration & Production, Anchorage, AK.

SECTION 6.0 SOLID AND LIQUID WASTE AND DISCHARGE INFORMATION

a) Projected Generated Wastes

The type, composition, and amount of solid and liquid waste expected to be generated on the *Discoverer* during the planned exploration drilling program at the planned drill sites are listed below in Tables 6.a-1 through 6.a-6. Waste and discharge volumes were calculated based on empirical information and past experience; therefore, the actual generated amounts and ocean discharge volumes may differ.

b) Ocean Discharges and Disposal Methods

The type, composition, and amount of solid and liquid waste expected to be generated on the *Discoverer* during the planned exploration drilling program and discharged to the ocean are listed below in Tables 6.a-1 through 6.a-6. The ocean discharge information has been submitted to the EPA to support NOIs for authorization to conduct these discharges under NPDES General Permit AKG-28-0000 and is further discussed below in Section 6.0(c). The projected wastes and discharges listed in these tables are applicable only to the *Discoverer*. Discharges from drilling support vessels will be made pursuant to the International Convention for the Prevention of Pollution from Ships (Marine Pollution or MARPOL) standards and requirements as well as the NPDES Vessel General Permit.

Additional details regarding the transportation and final disposal location for wastes that will not be discharged to the ocean (as indicated in Tables 6.a-1 through 6.a-6) are provided in Section 13.0(d).

Table 6.a-1 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger A

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Drill cuttings from MLC plus 36-in. and 26-in. holes	Cuttings only; no drilling mud used – only seawater and viscous sweeps	4,100 bbl 342 bbl/day discharge	Discharged on the surface of the seafloor - NPDES Discharge 013
Water based mud (WBM) drilling fluids & cuttings with adhered WBM	1,643 bbl cuttings with 1,643 bbl adhered WBM + 1,500 bbl WBM in reserve tank (if multiple wells drilled in season WBM in reserve will be transferred to and used at next well)	4,786 bbl 239 bbl/day discharge	Discharged to sea through disposal caisson after 30:1 dilution with seawater – NPDES Discharge 001
Sanitary wastewater	Treated human body waste from toilets	960 bbl 30 bbl/day discharge (based on 140 people at 9 gal/person/day)	Discharged to sea through disposal caisson after treatment in marine sanitation device to NPDES limits – NPDES Discharge 003
Domestic wastewater	Gray water (laundry, galley, lavatory)	10,667 bbl 333 bbl/day discharge (based on 140 people at 100 gal/person/day)	Discharged to sea through the disposal caisson – Discharge 004 Note: all food waste to be incinerated
Excess cement slurry	Cement slurry	50 bbl 1 bbl/min discharge (2 times) (45 bbl at seafloor, 5 bbl in equipment washwater)	Discharged to ocean waters while cementing 30-in and 20-in casing - NPDES Discharge 012
Desalination unit waste (brine water)	Rejected water from watermaker unit	4,000 bbl 125 bbl/day discharge	Discharged to ocean waters through disposal caisson - NPDES Discharge 005
Deck drainage	Uncontaminated fresh or seawater	160 bbl 5 bbl/day discharge (precipitation and sea spray dependant)	Drains to oily water separator. Uncontaminated water discharged to ocean waters via disposal caisson - NPDES Discharge 002. Oily water stored aboard in waste oil tank then transferred by boat to approved treatment/disposal site
Non-contact cooling water	Uncontaminated seawater	1,440,000 bbl 45,000 bbl/day discharge	Discharged overboard to ocean waters at several sites around the hull - NPDES Discharge 009
Uncontaminated ballast water	Uncontaminated seawater	160 bbl 5 bbl/day discharge	Discharged to sea through disposal caisson – NPDES Discharge 010
Bilge water	Oily water	416 bbl 13 bbl/day discharge	Treated in oily water separator, uncontaminated water discharged to sea through disposal caisson - NPDES Discharge 011 Oily water stored aboard, transferred for transport by boat to an approved disposal site ¹
Blowout preventer (BOP) fluid	Water, glycol, water soluble lubricant	54 bbl 6 BOP tests at 9 bbl/test average (avg) discharge	Discharged at the seafloor (ocean waters) at the BOP when testing BOP - NPDES Discharge 006

Table 6.a-1 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger A

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Trash and debris	Refuse generated during drilling and abandonment operations	300 bbl/month no discharge	Not discharged to ocean waters; trash & debris segregated & incinerated or disposed of at approved disposal facility ¹
Used oil	Lube oil	50 bbl no discharge	Not discharged to ocean waters; stored aboard in waste oil tank. Transferred to lube cubes for transport by boat. Transfer to an approved treatment/disposal site ¹
Hazardous waste	Chemical products and general hazardous waste	10 bbl no discharge	Not discharged to ocean waters; stored aboard in an approved container; transferred by boat to an approved treatment/disposal site ¹

¹ See Section 14.0(d) for approved treatment/disposal sites

Table 6.a-2 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger F

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Drill cuttings from MLC plus 36-in. and 26-in. holes	Cuttings only; no drilling mud used – only seawater and viscous sweeps	4,101 bbl 342 bbl/day discharge	Discharged on the surface of the seafloor - NPDES Discharge 013
WBM drilling fluids & cuttings with adhered WBM	1,768 bbl cuttings with 1,768 bbl adhered WBM + 1,500 bbl WBM in reserve tank (if multiple wells drilled in season WBM in reserve will be transferred to and used at next well)	5,038 bbl 252 bbl/day discharge	Discharged to sea through disposal caisson after 30:1 dilution with seawater – NPDES Discharge 001
Sanitary wastewater	Treated human body waste from toilets	960 bbl 30 bbl/day discharge (based on 140 people at 9 gal/person/day)	Discharged to sea through disposal caisson after treatment in marine sanitation device to NPDES limits– NPDES Discharge 003
Domestic wastewater	Gray water (laundry, galley, lavatory)	10,667 bbl 333 bbl/day discharge (based on 140 people at 100 gal/person/day)	Discharged to sea through the disposal caisson – Discharge 004 Note: all food waste to be incinerated
Excess cement slurry	Cement slurry	50 bbl 1 bbl/min discharge (2 times) (45 bbl at seafloor, 5 bbl in equipment washwater)	Discharged to ocean waters while cementing 30-in and 20-in casing - NPDES Discharge 012
Desalination unit waste (brine water)	Rejected water from watermaker unit	4,000 bbl 125 bbl/day discharge	Discharged to ocean waters through disposal caisson - NPDES Discharge 005
Deck drainage	Uncontaminated fresh or seawater	160 bbl 5 bbl/day discharge (precipitation and sea spray dependant)	Drains to oily water separator. Uncontaminated water discharged to ocean waters via disposal caisson - NPDES Discharge 002. Oily water stored aboard in waste oil tank then transferred by boat to approved treatment/disposal site ¹
Non-contact cooling water	Uncontaminated seawater	1,440,000 bbl 45,000 bbl/day discharge	Discharged overboard to ocean waters at several sites about the hull - NPDES Discharge 009
Uncontaminated ballast water	Uncontaminated seawater	160 bbl 5 bbl/day discharge	Discharged to sea through disposal caisson – NPDES Discharge 010
Bilge water	Oily water	416 bbl 13 bbl/day discharge	Treated in oily water separator, uncontaminated water discharged to sea through disposal caisson - NPDES Discharge 011 Oily water stored aboard, transferred for transport by boat to an approved disposal site ¹
Blowout preventer fluid	Water, glycol, water soluble lubricant	54 bbl 6 BOP tests at 9 bbl/test (avg) discharge	Discharged at the seafloor (ocean waters) at the BOP when testing BOP - NPDES Discharge 006

Table 6.a-2 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger F

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Trash and debris	Refuse generated during drilling and abandonment operations	300 bbl/month no discharge	Not discharged to ocean waters; trash & debris segregated & incinerated or disposed of at approved disposal facility ¹
Used oil	Lube oil	50 bbl no discharge	Not discharged to ocean waters; stored aboard in waste oil tank, transferred to lube cubes for transport by boat, transfer to an approved treatment/disposal site ¹
Hazardous waste	Chemical products and general hazardous waste	10 bbl no discharge	Not discharged to ocean waters; stored aboard in an approved container; transferred by boat to an approved treatment/disposal site ¹

¹ See Section 14.0(d) for approved treatment/disposal sites

Table 6.a-3 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger J

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Drill cuttings from MLC plus 36-in. and 26-in. holes	Cuttings only; no drilling mud used – only seawater and viscous sweeps	4,105 bbl 342 bbl/day discharge	Discharged on the surface of the seafloor - NPDES Discharge 013
WBM drilling fluids & cuttings with adhered WBM	1,634 bbl cuttings with 1,634 bbl adhered WBM + 1,500 bbl WBM in reserve tank (if multiple wells drilled in season WBM in reserve will be transferred to and used at next well)	4,768 bbl/ 238 bbl/day discharge	Discharged to sea through disposal caisson after 30:1 dilution with seawater – NPDES Discharge 001
Sanitary wastewater	Treated human body waste from toilets	960 bbl 30 bbl/day discharge (based on 140 people at 9 gal/person/day)	Discharged to sea through disposal caisson after treatment in marine sanitation device to NPDES limits – NPDES Discharge 003
Domestic wastewater	Gray water (laundry, galley, lavatory)	10,667 bbl 333 bbl/day discharge (based on 140 people at 100 gal/person/day)	Discharged to sea through the disposal caisson – Discharge 004 Note: all food waste to be incinerated
Excess cement slurry	Cement slurry	50 bbl 1 bbl/min discharge (2 times) (45 bbl at seafloor, 5 bbl in equipment washwater)	Discharged to ocean waters while cementing 30-in and 20-in casing - NPDES Discharge 012
Desalination unit waste (brine water)	Rejected water from watermaker unit	4,000 bbl 125 bbl/day discharge	Discharged to ocean waters through disposal caisson - NPDES Discharge 005
Deck drainage	Uncontaminated fresh or seawater	160 bbl 5 bbl/day discharge (precipitation and sea spray dependant)	Drains to oily water separator. Uncontaminated water discharged to ocean waters via disposal caisson - NPDES Discharge 002. Oily water stored aboard in waste oil tank then transferred by boat to approved treatment/disposal site
Non-contact cooling water	Uncontaminated seawater	1,440,000 bbl 45,000 bbl/day discharge	Discharged overboard to ocean waters at several sites around the hull - NPDES Discharge 009
Uncontaminated ballast water	Uncontaminated seawater	160 bbl 5 bbl/day discharge	Discharged to sea through disposal caisson – NPDES Discharge 010
Bilge water	Oily water	416 bbl 13 bbl/day discharge	Treated in oily water separator, uncontaminated water discharged to sea through disposal caisson - NPDES Discharge 011 Oily water stored aboard, transferred for transport by boat to an approved treatment/disposal site ¹
Blowout preventer fluid	Water, glycol, water soluble lubricant	54 bbl 6 BOP tests at 9 bbl/test (avg)	Discharged at the seafloor (ocean waters) at the BOP when testing BOP - NPDES Discharge

Table 6.a-3 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger J

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
		discharge	006
Trash and debris	Refuse generated during drilling and abandonment operations	300 bbl/month no discharge	Not discharged to ocean waters; trash & debris segregated & incinerated or disposed of at approved disposal facility ¹
Used oil	Lube oil	50 bbl no discharge	Not discharged to ocean waters; stored aboard in waste oil tank, transferred to lube cubes for transport by boat, transfer to an approved treatment/disposal site ¹
Hazardous waste	Chemical products and general hazardous waste	10 bbl no discharge	Not discharged to ocean waters; stored aboard in an approved container; transferred by boat to an approved treatment/disposal site ¹

¹ See Section 14.0(d) for approved treatment/disposal sites

Table 6.a-4 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger R

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Drill cuttings from MLC plus 36-in. and 26-in. holes	Cuttings only; no drilling mud used – only seawater and viscous sweeps	4,140 bbl 345 bbl/day discharge	Discharged on the surface of the seafloor - NPDES Discharge 013
WBM drilling fluids & cuttings with adhered WBM	1,760 bbl cuttings with 1,760 bbl adhered WBM + 1,500 bbl WBM in reserve tank (if multiple wells drilled in season WBM in reserve will be transferred to and used at next well)	5,020 bbl 251 bbl/day discharge	Discharged to sea through disposal caisson after 30:1 dilution with seawater – NPDES Discharge 001
Sanitary wastewater	Treated human body waste from toilets	960 bbl 30 bbl/day discharge (based on 140 people at 9 gal/person/day)	Discharged to sea through disposal caisson after treatment in marine sanitation device to NPDES limits – NPDES Discharge 003
Domestic wastewater	Gray water (laundry, galley, lavatory)	10,667 bbl 333 bbl/day discharge (based on 140 people at 100 gal/person/day)	Discharged to sea through the disposal caisson – NPDES Discharge 004 Note: all food waste to be incinerated
Excess cement slurry	Cement slurry	50 bbl 1 bbl/min discharge (2 times) (45 bbl at seafloor, 5 bbl in equipment washwater)	Discharged to ocean waters while cementing 30-in and 20-in casing - NPDES Discharge 012
Desalination unit waste (brine water)	Rejected water from watermaker unit	4,000 bbl 125 bbl/day discharge	Discharged to ocean waters through disposal caisson - NPDES Discharge 005
Deck drainage	Uncontaminated fresh or seawater	160 bbl 5 bbl/day discharge (precipitation and sea spray dependant)	Drains to oily water separator. Uncontaminated water discharged to ocean waters via disposal caisson - NPDES Discharge 002. Oily water stored aboard in waste oil tank then transferred by boat to approved treatment/disposal site
Non-contact cooling water	Uncontaminated seawater	1,440,000 bbl 45,000 bbl/day discharge	Discharged overboard to ocean waters at several sites around the hull - NPDES Discharge 009
Uncontaminated ballast water	Uncontaminated seawater	160 bbl 5 bbl/day discharge	Discharged to sea through disposal caisson – NPDES Discharge 010
Bilge water	Oily water	416 bbl 13 bbl/day discharge	Treated in oily water separator, uncontaminated water discharged to sea through disposal caisson - NPDES Discharge 011 Oily water stored aboard, transferred for transport by boat to an approved disposal site
Blowout preventer fluid	Water, glycol, water soluble lubricant	54 bbl 6 BOP tests at 9 bbl/test (avg) discharge	Discharged at the seafloor (ocean waters) at the BOP when testing BOP - NPDES Discharge 006

Table 6.a-4 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger R

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Trash and debris	Refuse generated during drilling and abandonment operations	300 bbl/month no discharge	Not discharged to ocean waters; trash & debris segregated & incinerated or disposed of at approved disposal facility ¹
Used oil	Lube oil	50 bbl no discharge	Not discharged to ocean waters; stored aboard in waste oil tank, transferred to lube cubes for transport by boat, transfer to an approved treatment/disposal site ¹
Hazardous waste	Chemical products and general hazardous waste	10 bbl no discharge	Not discharged to ocean waters; stored aboard in an approved container; transferred by boat to an approved treatment/disposal site ¹

¹ See Section 14.0(d) for approved treatment/disposal sites

Table 6.a-5 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger S

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Drill cuttings from MLC plus 36-in. and 26-in. holes	Cuttings only; no drilling mud used – only seawater and viscous sweeps	4,102 bbl 342 bbl/day discharge	Discharged on the surface of the seafloor - NPDES Discharge 013
WBM drilling fluids & cuttings with adhered WBM	1,677 bbl cuttings with 1,677 bbl adhered WBM + 1,500 bbl WBM in reserve tank (if multiple wells drilled in season WBM in reserve will be transferred to and used at next well)	4,854 bbl 243 bbl/day discharge	Discharged to sea through disposal caisson after 30:1 dilution with seawater – NPDES Discharge 001
Sanitary wastewater	Treated human body waste from toilets	960 bbl 30 bbl/day discharge (based on 140 people at 9 gal/person/day)	Discharged to sea through disposal caisson after treatment in marine sanitation device to NPDES limits – NPDES Discharge 003
Domestic wastewater	Gray water (laundry, galley, lavatory)	10,667 bbl 333 bbl/day discharge (based on 140 people at 100 gal/person/day)	Discharged to sea through the disposal caisson - Discharge 004 Note: all food waste to be incinerated
Excess cement slurry	Cement slurry	50 bbl 1 bbl/min discharge (2 times) (45 bbl at seafloor, 5 bbl in equipment washwater)	Discharged to ocean waters while cementing 30-in and 20-in casing - NPDES Discharge 012
Desalination unit waste (brine water)	Rejected water from watermaker unit	4,000 bbl 125 bbl/day discharge	Discharged to ocean waters through disposal caisson - NPDES Discharge 005
Deck drainage	Uncontaminated fresh or seawater	160 bbl 5 bbl/day discharge (precipitation and sea spray dependant)	Drains to oily water separator. Uncontaminated water discharged to ocean waters via disposal caisson - NPDES Discharge 002. Oily water stored aboard in waste oil tank then transferred by boat to approved treatment/disposal site ¹
Non-contact cooling water	Uncontaminated seawater	1,440,000 bbl 45,000 bbl/day discharge	Discharged overboard to ocean waters at several sites around the hull - NPDES Discharge 009
Uncontaminated ballast water	Uncontaminated seawater	160 bbl 5 bbl/day discharge	Discharged to sea through disposal caisson – NPDES Discharge 010
Bilge water	Oily water	416 bbl 13 bbl/day discharge	Treated in oily water separator, uncontaminated water discharged to sea through disposal caisson - NPDES Discharge 011 Oily water stored aboard, transferred for transport by boat to an approved treatment/disposal site ¹
Blowout preventer fluid	Water, glycol, water soluble lubricant	54 bbl 6 BOP tests at	Discharged at the seafloor (ocean waters) at the BOP when

Table 6.a-5 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger S

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
		9 bbl/test (avg) discharge	testing BOP - NPDES Discharge 006
Trash and debris	Refuse generated during drilling and abandonment operations	300 bbl/month no discharge	Not discharged to ocean waters; trash & debris segregated & incinerated or disposed of at approved disposal facility ¹
Used oil	Lube oil	50 bbl no discharge	Not discharged to ocean waters; stored aboard in waste oil tank, transferred to lube cubes for transport by boat, transfer to an approved treatment/disposal site ¹
Hazardous waste	Chemical products and general hazardous waste	10 bbl no discharge	Not discharged to ocean waters; stored aboard in an approved container; transferred by boat to an approved treatment/disposal site ¹

¹ See Section 14.0(d) for approved treatment/disposal sites

Table 6.a-6 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger V

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Drill cuttings from MLC plus 36-in. and 26-in. holes	Cuttings only; no drilling mud used – only seawater and viscous sweeps	4,152 bbl 346 bbl/day discharge	Discharged on the surface of the seafloor - NPDES Discharge 013
WBM drilling fluids & cuttings with adhered WBM	1,806 bbl cuttings with 1,806 bbl adhered WBM + 1,500 bbl WBM in reserve tank (if multiple wells drilled in season WBM in reserve will be transferred to and used at next well)	5,112 bbl 269 bbl/day discharge	Discharged to sea through disposal caisson after 30:1 dilution with seawater – NPDES Discharge 001
Sanitary wastewater	Treated human body waste from toilets	930 bbl 30 bbl/day discharge (based on 140 people at 9 gal/person/day)	Discharged to sea through disposal caisson after treatment in marine sanitation device to NPDES limits – NPDES Discharge 003
Domestic wastewater	Gray water (laundry, galley, lavatory)	10,323 bbl 333 bbl/day discharge (based on 140 people at 100 gal/person/day)	Discharged to sea through the disposal caisson Note: all food waste to be incinerated
Excess cement slurry	Cement slurry	50 bbl 1 bbl/min discharge (2 times) (45 bbl at seafloor, 5 bbl in equipment washwater)	Discharged to ocean waters while cementing 30-in and 20-in casing - NPDES Discharge 012
Desalination unit waste (brine water)	Rejected water from watermaker unit	3,875 bbl 125 bbl/day discharge	Discharged to ocean waters through disposal caisson - NPDES Discharge 005
Deck drainage	Uncontaminated fresh or seawater	155 bbl 5 bbl/day discharge (precipitation and sea spray dependant)	Drains to oily water separator. Uncontaminated water discharged to ocean waters via disposal caisson - NPDES Discharge 002. Oily water stored aboard in waste oil tank then transferred by boat to approved treatment/disposal site ¹
Non-contact cooling water	Uncontaminated seawater	1,395,000 bbl 45,000 bbl/day discharge	Discharged overboard to ocean waters at several sites around the hull - NPDES Discharge 009
Uncontaminated ballast water	Uncontaminated seawater	155 bbl 5 bbl/day discharge	Discharged to sea through disposal caisson – NPDES Discharge 010
Bilge water	Oily water	403 bbl 13 bbl/day discharge	Treated in oily water separator, uncontaminated water discharged to sea through disposal caisson - NPDES Discharge 011 Oily water stored aboard, transferred for transport by boat to an approved disposal site ¹
Blowout preventer fluid	Water, glycol, water soluble lubricant	54 bbl 6 BOP tests at 9 bbl/test (avg) discharge	Discharged at the seafloor (ocean waters) at the BOP when testing BOP - NPDES Discharge 006

Table 6.a-6 Projected Generated Wastes, Disposal, and Ocean Discharges from Burger V

Type of Waste	Composition	Projected Generated Amount / Discharge Rate	Treatment / storage/ disposed
Trash and debris	Refuse generated during drilling and abandonment operations	300 bbl/month no discharge	Not discharged to ocean waters; trash & debris segregated & incinerated or disposed of at approved disposal facility ¹
Used oil	Lube oil	50 bbl no discharge	Not discharged to ocean waters; stored aboard in waste oil tank, transferred to lube cubes for transport by boat, transfer to an approved treatment/disposal site ¹
Hazardous waste	Chemical products and general hazardous waste	10 bbl no discharge	Not discharged to ocean waters; stored aboard in an approved container; transferred by boat to an approved treatment/disposal site ¹

¹ See Section 14.0(d) for approved treatment/disposal sites

c) NPDES Permit

All discharges from the *Discoverer* during the exploration drilling program (as itemized above in Tables 6.a-1 through 6.a-6) will be made in accordance with the EPA NPDES program through the General Permit AKG-28-0000 (NPDES General Permit) or its reauthorizations for the Chukchi Sea. As indicated above in Table 2.a-1, NOIs for some of these blocks (Posey Area Blocks 6714, 6764, and 6912) were submitted in May of 2009 as they were part of the initial Chukchi Sea EP and planned 2010 exploration drilling program. The EPA issued Authorization AKG-28-0004 on 20 January 2010, indicating that the described drilling discharges within these named blocks are covered under the NPDES General Permit. Per regulations at 40 CFR 122.2, Shell resubmitted NOIs for these blocks on 16 December 2010. NOIs for the remaining Burger Prospect blocks, (Posey Area Blocks 6812, 6762, and 6915) in the revised Chukchi Sea EP, were filed at the same time. The EPA authorized the extensions and additional requests for coverage under the NPDES General Permit on 23 June 2011. Copies of Shell's authorizations from EPA and the NOIs submitted in December 2010 are attached to this revised Chukchi Sea EP in Appendix B. A flow diagram for the *Discoverer* is provided with the NOIs in Appendix B. Schematics for oily waste separator systems, sewage and gray water treatment systems are provided below in Figures 6.c-1 and 6.c-2.

Drilling Fluid Components

A list of the components that may be added to the drilling fluid is provided in Table 6.c-1 on a per well basis. This component list and the respective volumes have been designed for drilling depth from the MLC to proposed total depth.

Table 6.c-1 Drilling Fluid Components per Well for the Revised Chukchi Sea Exploration Drilling Program

Component	Description/Function	Unit Size	Package	Total Usage (packages)	¹ Total Weight (lb)
MI Bar	Barite - weighting agent	Bulk	Bulk	NA	680,000
MI Gel	Bentonite viscosifier	Bulk	Bulk	NA	150,000
Caustic soda	Sodium hydroxide, ph control	50 lb	Sack	50	2,500
Soda ash	Sodium carbonate, for calcium precipitation	50 lb	Sack	50	5,000
Sodium bicarbonate	Sodium bicarbonate, alkalinity control	50 lb	Sack	50	5,000
Duovis	Polysaccharide biopolymer viscosifier	25 lb	Sack	320	8,000
Poly Pac R	Polyanionic cellulose, reduce filtration rate	50 lb	Sack	80	4,000
Poly Pac UL	Polyanionic cellulose, reduce filtration rate	50 lb	Sack	160	8,000
Citric acid	Alkalinity control	50 lb	Sack	100	5,000
KlaStop	Shale inhibitor	55 gal	Drum	172	90,800
Contingency					
Salt or liquid brine	Sodium chloride	3,300 lb	Sack	55	*1,500
Defoam-X	Polyglycol, reduce foaming in fluids	5 gal	Can	32	1,500
Nut plug (assorted)	Ground nut shells, for lost circulation	50 lb	Sack	40	2,000
DCAP D	Lost circulation	50 lb	Sack	60	18,000
Mix II (assorted)	Blended calcium carbonate & polymers	25 lb	Sack	40	1,000
Desco CF	Organic thinner	25 lb	Sack	80	2,000
SAPP	Sodium acid pyrophosphate, dispersant	50 lb	Sack	45	2,250
Durogel	Sepiolite clay, viscosifier, filtration reducer	50 lb	Sack	320	16,000
MYACIDE	Bacteriacide	5 gal	Can	128	5,300
Total		--	--	1,610	1,191,800
Brine	Brine 9.8 ppg – will bring 8 Big Bags granular salt for contingencies	Bulk	Bulk	NA	1,993,400

¹ Total amount aboard vessel depends on storage space available and weight limitations, the remainder will be on support vessels or supplied by offshore supply vessels from Dutch Harbor.

Figure 6.c-1 Sewage and Gray Water Treatment System on the *Discoverer*

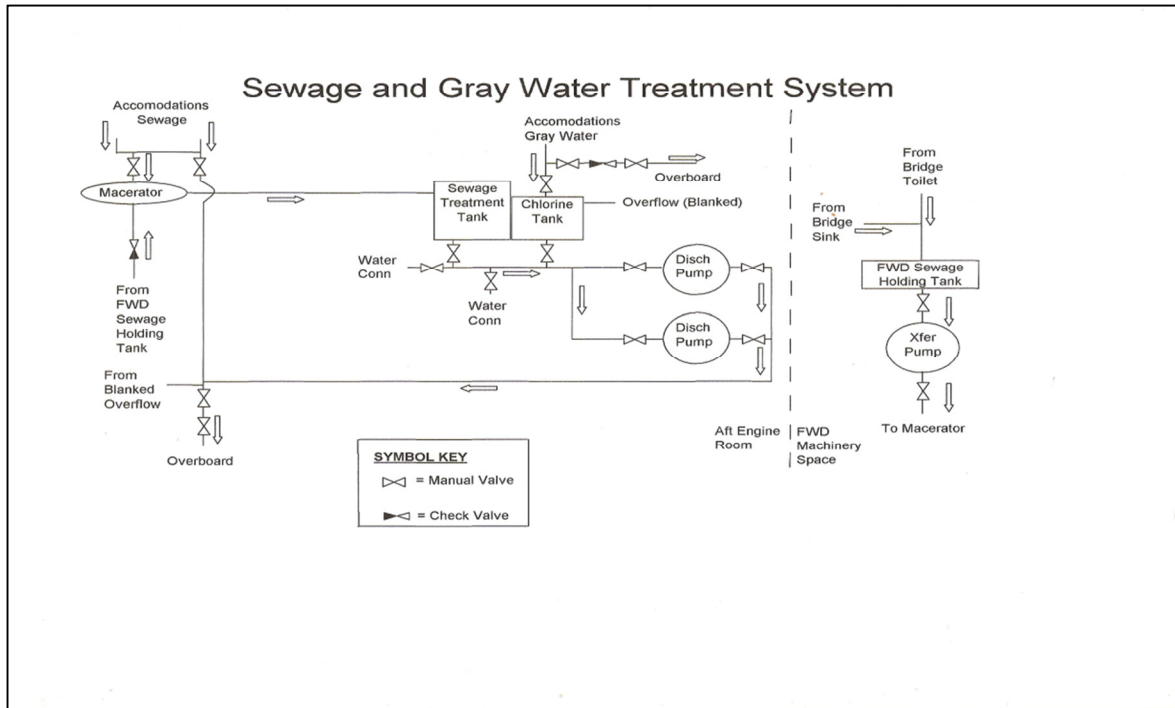
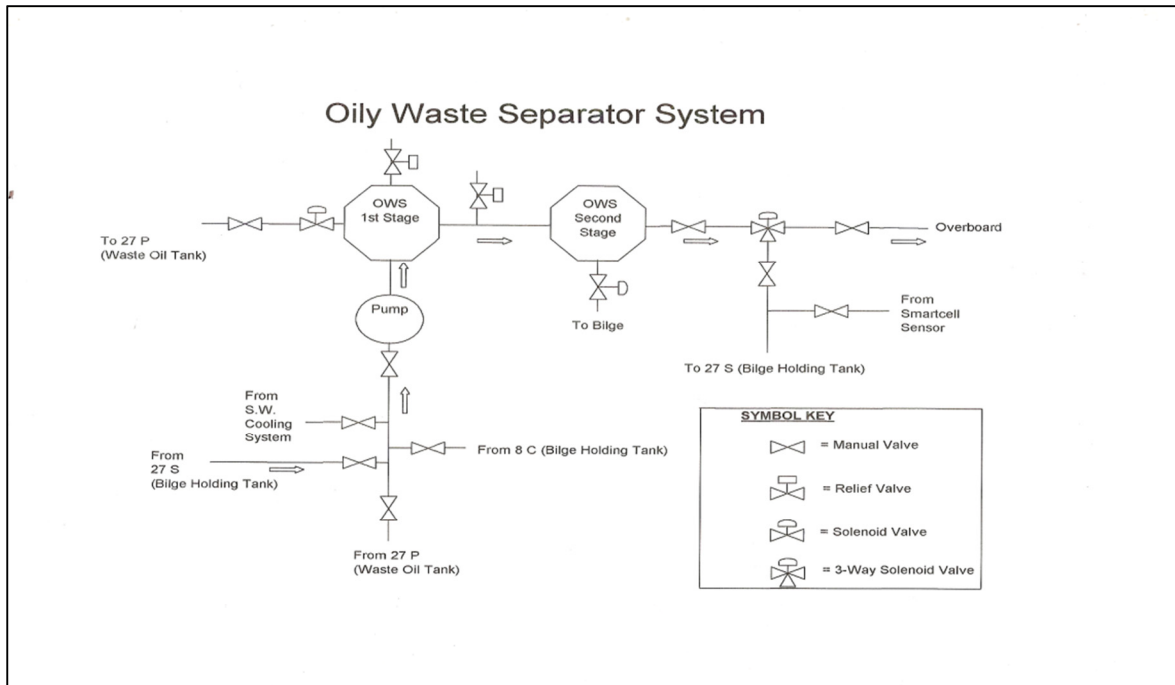


Figure 6.c-2 Oily Waste Separator System on the *Discoverer*



Cement Composition

Two types of cement discharges are expected. One of these discharges involves bulk cement plus additives, which are circulated around the 30-in. structural pipe and 20-in. conductor casing, and collect in the base of the MLC. The cement cures to a hardened mass surrounding the 30-in. conductor. The combined volume of both (30-in. and 20-in.) circulated cement volumes can be as much as 45 bbl of cement slurry per well. Both of these large-diameter pipe strings are cemented using the following mixture:

- Type C Permafrost cement (API Class C cement plus gypsum and/or calcium sulfate hemihydrate)
- Seawater

The other type of cement discharge involves small volumes of cement washed from the cement pump and lines on the drilling vessel at the surface after cementing casing strings or setting cement abandonment plugs. While cementing each casing string, the surface lines and cement pump will be cleaned by washing up “on top of the plug” meaning that the cement so removed is pumped down the casing ahead of the displacement fluid to minimize discharges to the sea. The total volume of cement slurry discharged to the ocean from these operations could be as much as 5.0 bbl per well. Cement and other materials washed from the cement unit and piping may include:

- Type C Permafrost cement
- API Class G “Premium” cement
- Econolite L (fly ash, calcium oxide) in small amounts
- Halad-344EXP (fluid loss additive) in very small amounts
- Calcium chloride (accelerator) in very small amounts
- SCR-100 (sodium citrate retarder) in very small amounts
- Dual Spacer (surfactant blend) in trace amounts
- Fresh water (mixing fluid)
- Seawater (wash water)

Blowout Preventer Fluid Composition

BOP fluid is a pressured fresh water-based fluid used to operate various components of the subsea BOP including rams, locking mechanisms, annular preventers, choke and kill line valves and the hydraulic connectors to the wellhead and to the lower marine riser package. The fluid is discharged at the device after use rather than bringing it back to the surface in a closed loop system. This reduces back-pressure and ensures the devices will function quickly. Only small volumes of fluid are discharged within and just above the MLC which dilute and diffuse quickly in the seawater column. It is estimated that 6 or 7 BOP tests will occur during the drilling of each well for a total of 54 bbl of BOP fluid per well (Tables 6.1-a through 6.a-6). The composition of the BOP fluid is as follows:

- Fresh water
- 12.5% Pelagic GZ (water-based lubricant concentrate classified Green / PLONOR by OSPAR)
- 25% monoethylene glycol (antifreeze)

Drilling support vessels in excess of 300 gross registered tons or having a ballast capacity of 2,133 gal (8 m³) or greater must acquire authorization to discharge under the Vessel General Permit for Discharges Incidental to the Normal Operation of Commercial Vessels and Large Recreational Vessels. Authorizations to discharge under this vessel general permit for discharges incidental to normal operations will be undertaken by the vessel owner and/or operator and is not a part of Shell's required permit and authorization application submittals.

d) Modeling Report

All requested NPDES permitted discharges will be carried out in federal waters of the OCS. No expanded mixing zones or zones of deposit are being requested and no modeling was conducted in support of such requests. Shell has carried out modeling of the expected discharges of drill cuttings and drilling fluids and of the projected discharges of cooling water for impact assessment purposes. The results of these modeling efforts are discussed in Section 4.1.2 and Section 4.1.3 of the EIA (Appendix F).

e) Cooling Water Intake

A saltwater service system supplies the *Discoverer's* requirement for saltwater, including that for the exploration drilling operations. The system is primarily used to supply cooling water to equipment heat exchangers. A piping flow diagram for *Discoverer* is provided with the NOIs in Appendix B. The portion of seawater that will be used for non-contact cooling water is 45,000 bbl/day. This volume includes cooling water for the mud cooler, hydraulic coolers, the Silicon-Controlled Rectifier house air-conditioning coolers and all other cooling water service lines. The total volume of seawater used by the rig is slightly higher to provide desalination unit feed and boiler feed. Pumps can be brought on line as needed to provide this extra volume. This does not include the seawater volume that would be supplied by the fire water pumps to provide firefighting capability in an emergency situation. Shell has installed an impressed current anti-biofouling system on the *Discoverer* known as the Blum system. This system uses aluminum anodes that yield a thin coating of aluminum chloride on the inside of the cooling system piping denying nucleation sites for bacterial colonies to attach.

The saltwater service system consists of saltwater pumps (Aurora 5-483-11C), four sea-suctions (each with strainer having holes 5 mm in diameter), and associated distribution piping. Screen mesh sizes on the water intakes, which have been reduced to minimize entrainment of larger fish eggs and larvae, are provided below in Table 6.e-1.

Table 6.e-1 Screen Mesh Size on Water Intakes on the *Discoverer*

Sea-suction	Screen Mesh Size
Pumproom Sea Suction	0.2 in. (5.0 mm) diameter holes in plate
Lower Engine Room Sea Suction	0.2 in. (5.0 mm) diameter holes in plate
Upper Engine Room Sea Suction	0.2 in. (5.0 mm) diameter holes in plate
Generator Room Sea Suction	0.2 in. (5.0 mm) diameter holes in plate

The calculated velocity of intake water across the screens is approximately 40 feet per minute (ft/min) (20 cm/sec).

f) Disposal Caisson

The disposal caisson runs vertically through the sponson from the main deck level to the base of the sponson. The sponson is an exterior reinforced cladding on the hull to provide ice resistance. It is hollow

and extends from the main deck level to well below the water line. Certain waste streams are collected aboard the drillship to a point on the main deck near the mud room. A 15-in. (381-mm) diameter pipe exits the hull, turns downwards and is connected to the top of the disposal caisson.

The disposal caisson is a 15-in. (381-mm) diameter pipe welded into the sponson top and bottom (such that the inside of the sponson remains dry). The bottom of the sponson is 5.6 ft (1.7 m) above the keel depth. The disposal caisson is not equipped with a "float" valve; it is an open pipe. Because it remains open to the sea at all times, the disposal caisson is constantly filled with water. This caisson is not equipped with a "float" valve; it is merely an open conduit to the sea through which most waste streams are disposed below sea level. A diagram of the disposal caisson is provided in each NOI in Appendix B.

With the bottom of the sponson being located 5.6 ft (1.7 m) above the keel, and the draught of the *Discover* being 25.2 ft (7.7 m) while drilling, the base of the disposal caisson while drilling is approximately 19.6 ft (6.0 m) below mean sea level. Because of heave, the water level inside the caisson changes constantly.

g) Desalination Unit Brine Water

The watermaker operates via evaporation/condensation of seawater. The remaining stream has slightly elevated concentrations of all dissolved solids. Thus, the stream is basically seawater with a higher salt, hardness and higher concentrations of all other dissolved component concentration.

SECTION 7.0 AIR EMISSIONS INFORMATION

The air emissions information provided herein is for the *Discoverer* and associated support vessels. Shell submitted a major new source review Prevention of Significant Deterioration (NSR/PSD) application to EPA Region 10 (R10) (for the then *Frontier Discoverer*) on 11 December 2008 and a revised application on 23 February 2009. Responses to additional EPA requests for information were submitted on 18 May and 29 May 2009 respectively with copies to BOEMRE. The EPA prepared a Statement of Basis (EPA 2010) and issued PSD Permit No. R10OCS/PSD-AK-09-01 to Shell on 31 March 2010.

The PSD permit was remanded back to the EPA, and Shell subsequently conducted additional air quality impact analyses incorporating new standards for sulfur dioxide (SO₂) and nitrogen dioxide (NO₂). The results (Air Sciences Inc. 2011a) of these new analyses were provided to EPA on 18 March 2011 and in a revised memo on 19 May 2011 (Air Sciences Inc. 2011b). The EPA has issued a Supplemental Statement of Basis (EPA 2011) and issued a final permit PSD and re-issued the final permit R10OCS/PSD-AK-09-01 on 19 September 2011. Projected emissions provided below in Tables 7.a-1 through 7.a-4, and estimated air quality impacts provided in Section 7.0(f) and Table 7.f-1 below, are from the revised modeling report (Air Sciences Inc. 2011a, 2011b) and the Supplemental Statement of Basis (EPA 2011).

BOEMRE should refer to the above-mentioned documents for additional information on the projected emissions, how emissions were calculated, and how impacts were modeled.

Shell has proposed several emission reduction measures and owner-requested enforceable limits in the application including burning ultra-low sulfur diesel (ULSD) fuel; and installing diesel particulate filters, catalytic diesel particulate filters (CDPF), oxidation catalysts (OxyCat) devices, and selective catalytic reduction (SCR) controls on some of the drillship emission units and ice management vessels. These emission reduction measures satisfy the best available control technology (BACT) component of PSD permitting and EPA has incorporated these measures and other emission reduction measures as enforceable permit limitations. Shell's PSD application includes emission unit spreadsheets that describe all of the source units of the drillship and support vessels and an analysis of potential impacts to air quality based on the emissions and source descriptions. These are summarized below.

a) Projected Emissions

Sources: The *Discoverer* emission units are listed in Table 7.a-1 and consist of engines for electric generation, pneumatic compression and hydraulic compression, engines for movement of materials (cranes), heaters, and an incinerator primarily for domestic purposes. The primary emission units of the ancillary vessels are the propulsion engines.

Projected Peak Hourly Emissions [30 CFR 250.218(a)(1)(i)]: Projected peak hourly emissions of nitrogen oxide (NO_x), particulate matter < 2.5 microns (PM_{2.5}), particulate matter < 10 microns (PM₁₀), carbon monoxide (CO), SO₂, and volatile organic compounds (VOCs) from the emission sources are provided below in Table 7.a-2.

Total Annual Emissions [30 CFR 250.218(a)(1)(ii)] and Emissions over the Duration of the Exploration Drilling Program [30 CFR 250.218(a)(1)(iii)]: Emissions for all sources associated with the *Discoverer* are estimated as potentials to emit (PTE). Total annual PTEs for the *Discoverer* emission sources, and associated vessels, are provided in Table 7.a-3 by pollutant. The PTEs over the duration of the program are provided in Table 7.a-4.

Frequency and Duration of Emissions [30 CFR 250.218(a)(1)(iv)] and Basis for Calculation of Emissions [30 CFR 250.218(a)(2)]: Total projected annual PTEs by pollutant for the *Discoverer* sources and for the associated vessels, are provided in Table 7.a-3. These PTEs are based on a maximum 120-day drilling season. The actual drilling window from 4 July to 31 October is approximately 119 days, therefore the 120-days used for projected air emissions is a worst case calculation. Emissions for all emission units

associated with the *Discoverer* are estimated as PTEs, which are the emissions assuming continuous operation at capacity for the entire drilling season per year, unless limited by owner-requested restriction. Source operating duration and frequency are provided in Table 7.a.5. These restrictions and the following text summarize the basis for the calculation of the PTEs. The emissions for the associated vessels are estimated at 150 percent of expected use. *Discoverer* emissions are estimated without the propulsion engines operating (drilling and propulsion are exclusive). The maximum length of drilling season is 120 days of drilling per calendar year. The emergency and backup engines are only used during emergencies and maintenance of paired engines. Shell will purchase fuel for the *Discoverer* and associated vessels with a sulfur content equal to or less than 0.0015 percent by weight. Additional details are provided in the permit (OCS PSD R10OCS/PSD-AK-09-01), Statement of Basis for the permit (EPA 2010), available on-line at: <http://yosemite.epa.gov/R10/airpage.nsf/Permits/chukchiap/#comment>.

Table 7.a-1 Description of Emission Units for *Discoverer* and Support Fleet

Source Group ³	Unit Description ³	Make/Model ³	Rating ³	Max Fuel ³ Consumption
<i>Discoverer</i>				
Generation	Generator Engine	Cat / D399	1,325 hp	297 gal/hr
	Generator Engine	Cat / D399	1,325 hp	
	Generator Engine	Cat / D399	1,325 hp	
	Generator Engine	Cat / D399	1,325 hp	
	Generator Engine	Cat / D399	1,325 hp	
	Generator Engine	Cat / D399	1,325 hp	
Propulsion	Propulsion Engine ¹	MI / 6UEC65	7,200 hp	NA
Emergency	Emergency Generator ¹	Caterpillar / 3412	639 hp	67 gal/month
MLC Compression	MLC Compressor	Caterpillar C – 15	540 hp	57 gal/hr
	MLC Compressor	Caterpillar C – 15	540 hp	
	MLC Compressor ¹	Caterpillar C – 15	540 hp	
HPU Engines	HPU Engine	TBD	250 hp	26 gal/hr
	HPU Engine	TBD	250 hp	
Cranes	Port Deck Crane	Cat / D343	365 hp	15 gal/hr
	Starboard Deck Crane	Cat / D343	365 hp	
Cementing / Logging	Cementing Unit	Detroit / 8V-71N	335 hp	320 gal/day
	Cementing Unit	Detroit / 8V-71N	335 hp	
	Cementing Unit	GM 3-71	147 hp	
	Logging Winch ²	Caterpillar/C7	250 hp	
	Logging Winch ²	John Deere/PE4020TF270D	35 hp	
Heaters & Boilers	Heat Boiler	Clayton 200 Boiler	7.97 MMBtu/hr	120 gal/hr
	Heat Boiler	Clayton 200 Boiler	7.97 MMBtu/hr	
Incinerator	Incinerator	TeamTec/GS500C	276 lb/hr	NA
Ice Management Vessel				
Propulsion & Generation	Main Prop Engine	Wartsila/16V32	6,000 kW	1,313 gal/hr
	Main Prop Engine	Wartsila/16V32	6,000 kW	
	Main Prop Engine	Wartsila/12V32	4,500 kW	
	Main Prop Engine	Wartsila/12V32	4,500 kW	
	Generator	ABB Stromberg/HS 1120 MP8	8,314 kVA	
	Generator	ABB Stromberg/HS 1120 MP8	8,314 kVA	
	Generator	ABB Stromberg/HSG 900LR8	6,235 kVA	
	Generator	ABB Stromberg/HSG 900LR8	6,235 kVA	
	Harbor Set Generator	Wartsila/VASA 4R22	710 hp	
	Bow Thruster	Brunvoll FV-80 LTC-2250	1,150 kW	
	Bow Thruster	Brunvoll FV-80 LTC-2250	1,150 kW	
	Bow Thruster	Brunvoll FV-80 LTC-2250	1,150 kW	

Table 7.a-1 Description of Emission Units for *Discoverer* and Support Fleet

Source Group ³	Unit Description ³	Make/Model ³	Rating ³	Max Fuel Consumption ³	
Heaters & Boilers	Heat Boiler	unknown	4.44 MMBtu/hr	75 gal/hr	
	Heat Boiler	unknown	4.44 MMBtu/hr		
Seldom-used	Emergency Generator	Caterpillar 3412	300 hp	100 gal/wk	
Incinerator	Incinerator	unknown	154 lb/hr	NA	
Anchor Handler					
Propulsion & Generation	Main Prop Engine	MaK 8M32	5,046 hp	1,353 gal/hr	
	Main Prop Engine	MaK 8M32	5,046 hp		
	Main Prop Engine	MaK 6M32	3,784 hp		
	Main Prop Engine	MaK 6M32	3,784 hp		
	Harbor Generator	Caterpillar 3412	1,168 hp		
	Harbor Generator	Caterpillar 3412	1,168 hp		
Heaters/Boilers	Heat Boiler	Pyro/E1130	1.37 MMBtu/hr	30 gal/hr	
Seldom used	Skimmer	--	--	100 gal/wk	
Incinerator	none	--	--	NA	
OSV Resupply					
Propulsion & Generation	Main Engine	GE/7FDM12D5	3,070 hp	1,200 gal/ 1 way trip in transit	
	Main Engine	GE/7FDM12D5	3,070 hp		
	Generator	Cummins/KTA-19-D(M)	485 kW		
	Generator	Cummins/KTA-19-D(M)	485 kW		
	Bow Thruster	Bow Thruster	Cummins/KTA-38-D(M)	1,200 hp	4,800 gal/event in DP mode
		Bow Thruster	Cummins/KTA-38-D(M)	1,200 hp	
		Stern Thrusters	Cummins/KTA-38-D(M)	1,200 hp	
	Seldom-used	Emergency Generator	Cummins/6BTAA5.9-G1	99 hp	100 gal/wk
Skimmer		--	--	--	
OSR Vessel					
Propulsion & Generation	Propulsion Engine	Caterpillar 3608	2,710 kW	3,800 gal/day	
	Propulsion Engine	Caterpillar 3608	2,710 kW		
	Electrical Generator	Caterpillar 3508	1,285 hp		
	Electrical Generator	Caterpillar 3508	1,285 hp		
Seldom-used	Emergency Generator	John Deere	166 kW	100 gal/wk	
Incinerator	Incinerator	ASC/CP 100	125 lb/hr	NA	
OSR Work Boats					
(3) Kvichaks 34 ft each	Propulsion	Cummins QSB 5.9	300 hp	2,856 gal/wk	
	Propulsion	Cummins QSB 5.9	300 hp		
	Generator	unknown	12 hp		
	Propulsion	Cummins QSB 5.9	300 hp		
	Propulsion	Cummins QSB 5.9	300 hp		
	Generator	unknown	12 hp		
	Propulsion	Lugger 6140	300 hp		
	Propulsion	Cummins QSB 5.9	300 hp		
	Generator	unknown	12 hp		

¹ Not used during drilling² Logging winch operation combined with cementing units³ Unit descriptions, make/model, rating from Shell PSD Permit R10OCS/PSD-AK-09-01 and spreadsheet Discover_EI_20110602_D.xlsx provided with this document

Table 7.a-2 Projected Peak Hourly Emissions of Discoverer and Support Fleet Emission Units

Vessel	Source Group	Maximum (lb/hr) ⁸					
		¹ NO _x	² PM _{2.5}	³ PM ₁₀	⁴ CO	⁵ SO ₂	⁶ VOC
Discoverer	Generation	4.6	1.2	1.2	1.7	6.30E-02	0.2
	Emergency Generator	19.7	1.4	1.4	4.2	7.13E-03	1.6
	MLC Compressors	7.1	0.2	0.2	3.3	1.20E-02	7.1
	Cranes	5.0	3.43E-02	3.43E-02	0.1	3.26E-03	3.07E-02
	Cement / Logging	6.6	0.2	0.2	0.4	2.83E-03	0.2
	HPU Engines	3.3	2.47E-02	2.47E-02	0.6	5.58E-03	3.3
	Seldom Used Units	5.24E-01	3.68E-02	3.68E-02	1.13E-01	1.89E-04	4.16E-02
	Heaters and Boilers	3.2	0.4	0.4	1.2	2.54E-02	2.23E-02
	Incinerator	0.7	1.0	1.1	4.3	3.45E-01	0.4
Ice Management Vessel	Propulsion /Generation	65.7	10.3	10.3	29.7	2.78E-01	4.7
	Heaters and Boilers	1.5	0.2	0.2	0.4	1.59E-02	2.55E-02
	Seldom Used Units	3.49E-01	2.46E-02	2.46E-02	7.53E-02	1.26E-04	2.77E-02
	Incinerator	0.4	0.7	1.0	23.1	1.93E-01	7.7
Anchor Handler	Propulsion/Generation	67.7	10.6	10.6	30.6	2.87E-01	4.9
	Heaters and Boilers	0.6	0.1	0.1	0.2	6.37E-03	1.02E-02
	Seldom Used Units	3.49E-01	2.46E-02	2.46E-02	7.53E-02	1.26E-04	2.77E-02
	Incinerator	0.4	0.7	1.0	23.1	1.93E-01	7.7
OSV Tr ⁷	Propulsion/Generation	0.0	0.0	0.0	0.0	0.0	0.0
OSV DP ⁷	Propulsion/Generation	370.4	9.9	9.9	79.8	1.34E-01	29.4
OSR Vessel	Propulsion/Generation	67.4	0.1	0.1	0.4	3.36E-02	0.5
	Seldom Used Units	3.49E-01	2.46E-02	2.46E-02	7.53E-02	1.26E-04	2.77E-02
	Incinerator	0.3	0.6	0.8	18.8	1.56E-01	6.3
OSR Work Boats	Propulsion/Generation	210.0	0.7	0.7	2.1	3.61E-03	0.8

¹ NO_x emissions from Page 4 of 11, Attachment A, of Air Sciences Inc. 2011b² PM_{2.5} emissions from Page 5 of 11, Attachment A, of Air Sciences Inc. 2011b; in the absence of data to the contrary, and to provide the worst case, it was assumed that PM_{2.5} emissions equal 100 percent of PM₁₀ emissions³ PM₁₀ emissions from Page 6 of 11, Attachment A, of Air Sciences Inc. 2011b⁴ CO emissions from Page 7 of 11, Attachment A, of Air Sciences Inc. 2011b⁵ SO₂ emissions from Page 8 of 11, Attachment A, of Air Sciences Inc. 2011b⁶ VOC emissions from Page 9 of 11, Attachment A, of Air Sciences Inc. 2011b⁷ Resupply Ship Tr = Resupply Ship in transport mode; Resupply Ship DP = Resupply Ship in Dynamic-Positioning mode; these two activities cannot occur simultaneously, DP mode has greater impacts⁸ Emission values from spreadsheet Discover_EI_20110923_BOEMRE.xlsx provided to BOEMRE

Table 7.a-3 Annual Potentials to Emit for Emission Units on the *Discoverer* and Associated Support Fleet

Vessel	Source Group	Maximum (tons/year) ^{1,9}					
		² NO _x	³ PM _{2.5}	⁴ PM ₁₀	⁵ CO	⁶ SO ₂	⁷ VOC
<i>Discoverer</i>	Generation	5.8	1.5	1.5	2.1	7.90E-02	0.3
	Emergency Generator	0.1	5.55E-03	5.55E-03	1.70E-02	2.85E-05	6.26E-03
	MLC Compressors	1.7	4.26E-02	4.26E-02	7.93E-01	2.89E-03	1.7
	Cranes	2.8	1.91E-02	1.91E-02	5.88E-02	1.81E-03	1.71E-02
	Cement / Logging	4.1	0.1	0.1	0.2	1.76E-03	1.30E-01
	HPU Engines	0.8	5.92E-03	5.92E-03	1.38E-01	1.34E-03	0.8
	Seldom Used Units	0.8	5.30E-02	5.30E-02	1.63E-01	2.73E-04	5.99E-02
	Heaters and Boilers	4.6	0.5	0.5	1.8	3.66E-02	3.21E-02
	Incinerator	0.2	0.3	0.3	1.2	9.75E-02	1.17E-01
Ice Management Vessel	Propulsion and Generation	36.0	5.6	5.6	16.3	1.52E-01	2.6
	Heaters and Boilers	0.8	1.36E-01	1.36E-01	2.06E-01	8.72E-03	1.40E-02
	Seldom Used Units	0.2	1.34E-02	1.34E-02	4.12E-02	6.91E-05	1.52E-02
	Incinerator	0.2	0.4	0.6	12.6	1.05E-01	4.2
Anchor Handler	Propulsion and Generation	37.1	5.8	5.8	16.8	1.57E-01	2.7
	Heaters and Boilers	0.3	5.43E-02	5.43E-02	8.22E-02	3.49E-03	5.59E-03
	Seldom Used Units	0.2	1.34E-02	1.34E-02	4.12E-02	6.91E-05	1.52E-02
	Incinerator	0.2	0.4	0.6	12.6	1.05E-01	4.2
OSV Tr ⁸	Propulsion and Generation	16.9	0.5	0.5	3.6	6.11E-03	1.3
OSV DP ⁸	Propulsion and Generation	33.8	0.9	0.9	7.3	1.22E-02	2.7
OSR Vessel	Propulsion and Generation	97.1	0.2	0.2	0.5	4.83E-02	0.7
	Seldom Used Units	0.5	3.54E-02	3.54E-02	1.08E-01	1.82E-04	3.99E-02
	Incinerator	0.5	0.8	1.2	27.0	2.25E-01	9.0
OSR Work Boats	Propulsion and Generation	14.4	1.0	1.0	3.1	5.19E-03	1.1
Total	All	258.9	18.3	19.1	106.8	1.1	31.8

¹ Emissions in short tons (2,000 lb/ton)

² NO_x emissions from Page 4 of 11, Attachment A, of Air Sciences Inc. 2011b

³ PM_{2.5} emissions from Page 5 of 11, Attachment A, of Air Sciences Inc. 2011b; in the absence of data to the contrary, and to provide the worst case, it was assumed that PM_{2.5} emissions equal 100 percent of PM₁₀ emissions.

⁴ PM₁₀ emissions from Page 6 of 11, Attachment A, of Air Sciences Inc. 2011b

⁵ CO emissions from Page 7 of 11, Attachment A, of Air Sciences Inc. 2011b

⁶ SO₂ emissions from Page 8 of 11, Attachment A, of Air Sciences Inc. 2011b

⁷ VOC emissions from Page 9 of 11, Attachment A, of Air Sciences Inc. 2011b

⁸ OSV Tr = offshore supply vessel (Resupply Ship) in transit mode; OSV DP = offshore supply vessel (Resupply Ship) in dynamic-positioning mode

⁹ Emission values provided are after BACT; emission values from spreadsheet Discover_EI_20110923_BOEMRE.xlsx provided to BOEMRE

Table 7.a-4 Maximum Potentials to Emit for the *Discoverer* Emission Units and Associated Support Fleet for the Duration¹ of Exploration Drilling Activities

Vessel	Source Group	Maximum (tons) ^{1,4}					
		NO _x	PM _{2.5} ⁵	PM ₁₀	CO	SO ₂	VOC
<i>Discoverer</i>	Generation	11.6	3.0	3.0	4.2	1.58E-01	0.6
	Emergency Generator	0.2	1.11E-02	1.11E-02	3.40E-02	5.70E-05	1.25E-02
	MLC Compressors	3.4	0.1	0.1	1.6	5.78E-03	3.4
	Cranes	5.6	3.82E-02	3.82E-02	0.12	3.62E-03	3.42E-02
	Cement / Logging	8.2	0.2	0.2	0.4	3.52E-03	0.3
	HPU Engines	1.6	1.18E-02	1.18E-02	0.3	2.68E-03	1.6
	Seldom Used Units	1.6	0.1	0.1	0.3	5.46E-04	0.1
	Heaters and Boilers	9.2	1.0	1.0	3.6	7.32E-02	0.1
	Incinerator	0.4	0.6	0.6	2.4	1.95E-01	0.2
Ice Management Vessel	Propulsion/Generation	72	11.2	11.2	32.6	3.04E-01	5.2
	Heaters and Boilers	1.6	0.3	0.3	0.4	1.74E-02	2.80E-02
	Seldom Used Units	0.4	2.68E-02	2.68E-02	0.1	1.38E-04	3.04E-02
	Incinerator	0.4	0.8	1.2	25.2	2.10E-01	8.4
Anchor Handler	Propulsion/Generation	74.2	11.6	11.6	33.6	3.14E-01	5.4
	Heaters and Boilers	0.6	0.1	0.1	0.2	6.98E-03	1.12E-02
	Seldom Used Units	0.4	2.68E-02	2.68E-02	0	1.38E-04	3.04E-02
	Incinerator	0.4	0.8	1.2	25.2	2.10E-01	8.4
Resupply Ship Tr ²	Propulsion/Generation	33.8	1.0	1.0	7.2	1.22E-02	2.6
Resupply Ship DP ²	Propulsion/Generation	67.6	1.8	1.8	14.6	2.44E-02	5.4
OSR Vessel	Propulsion/Generation	194.2	0.4	0.4	1.0	9.66E-02	1.4
	Seldom Used Units	1.0	0.1	0.1	0.2	3.64E-04	0.1
	Incinerator	1.0	1.6	2.4	54.0	4.50E-01	18.0
OSR Work Boats	Propulsion/Generation	28.7	2.0	2.0	6.2	1.04E-02	2.3
Total	All	517.8	36.6	38.2	213.5	2.1	63.5

¹ Emissions in short tons (2,000 lb/ton)

² Assumes for analysis only, that all six planned exploration wells will be drilled within two drilling seasons

³ Resupply Ship Tr = Resupply Ship in transit mode; Resupply Ship DP = Resupply Ship in dynamic-positioning mode

⁴ Emission values provided are after BACT; emission values from spreadsheet Discover_EI_20110923_BOEMRE.xlsx provided to BOEMRE

⁵ In the absence of data to the contrary, and to provide the worst case, it was assumed that PM_{2.5} emissions equal 100 percent of PM₁₀ emissions

Table 7.a-5 Source Group Operating Duration and Frequency for the *Discoverer* and Support Fleet in the Chukchi Sea

Source		Capacity ¹			Operating Duration ²			Operating Frequency
		MLC	Drill	C/L	MLC	Drill	C/L	
Discoverer	Generation	71%	71%	50%	24	24	24	Every day of listed activity ³
	Emergency Generator	100%	100%	100%	2	2	2	Every 30 days
	MLC Compressors	67%	0%	0%	24	0	0	Every day of listed activity ³
	HPU Engines	100%	0%	0%	24	0	0	Every day of listed activity ³
	Cranes	40%	40%	40%	7.2	7.2	12	Every day of listed activity ³
	Cementing/Logging	-	-	-	-	-	-	Based on daily fuel limit
	Heaters and Boilers	100%	100%	100%	24	24	24	Every day
	Seldom Used	100%	100%	100%	24	24	24	Based on weekly fuel limit
Incinerator	20%	20%	20%	5	5	5	Every day	
Resupply Vessel (transit)		-	-	-				8 events per year, Based on fuel limit
Resupply Vessel (DP mode)		-	-	-	24			8 events per year
Ice Management Vessel		-	-	-	24			When ice, 38% of season ⁴
Anchor Handler		-	-	-	24			When ice, 38% of season ⁴
OSR Vessel		-	-	-	-			Based on daily fuel limit
OSR Work Boats		-	-	-	-			Based on weekly fuel limit

¹ Capacity values from Table 2-5 in Air Sciences Inc. 2011a

² Operating duration values (hr/day) in this table are specific to assumptions made for air quality modeling purposes. Emissions from seldom used sources (several small engines, non-emergency generator) will occur at undefined times evenly spread over the 30-day period for modeling purposes. Emissions for seldom used sources are based on maximum fuel consumption of ≤ 150 gal/wk, which is based on the expectation that they are used sources operate only a few hours per week.

³ Listed activities are those activities (MLC Construction, Drilling, Cementing/Logging) with some (>0) hours indicated in the Operating Duration columns.

⁴ Based on a Shell analysis of Canadian Ice Service data from 2003 thru 2005 was heavy 15% and moderate 23% of time – email dated 1/19/09 from K. Craik (Shell) to R. Steen (Air Sciences)

Table 7.a-6 PSD Air Quality Permit Conditions on the *Discoverer* and Support Fleet Vessels During Exploration Drilling Activities in the Chukchi Sea

Source		Permit Condition ¹
<i>Discoverer</i>	Generators	Aggregate electrical power not to exceed 3,872 kWe for any hour used
	Propulsion Engine	Will not be used when <i>Discoverer</i> is an OCS source
	Emergency Generator	Operation of source will not exceed 120 minutes per day and a total of 10 hours per season
	MLC Compressors	Limited to 81,346 gallons of fuel in all 3 units in aggregate during any rolling 12-month period
	HPU Engines	Limited to 44,338 gallons of fuel in both units in aggregate during any rolling 12-month period
	Deck Cranes	Limited to 63,661 gallons of fuel in both units in aggregate during any rolling 12-month period
	Cementing/Logging Winches	Limited to 320 gallons of fuel per day and 53,760 gallons during any rolling 12-month period in all units in aggregate
	Incinerator	Limited to 50,400 lb of all types of trash in any rolling 12-month period
	Seldom Used Units	Limited to 150 gallons of fuel in the <i>Discoverer</i> emergency generator and all seldom used sources in aggregate during any rolling 7 day period
Ice Mgt Vessel	Seldom Used Units	Limited to 100 gallons of fuel in the Icebreaker #1 seldom used sources in aggregate during any rolling 7-day period
	Heat Boiler	Limited to 1,800 gallons of fuel per day, 302,400 gallons per any rolling 12 month period
Anchor Handler	Seldom Used Units	Limited to 100 gallons of fuel in the Icebreaker #2 seldom used sources in aggregate during any rolling 7 day period
	Heat Boiler	Limited to 240 gallons of fuel per day, 40,320 gallons per any rolling 12 month period
OSR Vessel	Seldom Used Units	Limited to 100 gallons of fuel in the seldom used sources in aggregate during any 7 day period
	Generators	Limited to 3,800 gallons of fuel per day, 456,000 gallons per any rolling 12 month period in aggregate
OSR Workboats	Kvickak 1-3	Limited to 2,856 gallons of fuel per any 7 day period in aggregate
Supply Ship	Generator	Limited to 184 gallons of fuel per day, 1,472 gallons per any rolling 12-month period
Supply Ship	All Engines	Limited to 1,200 gallons of fuel per day when in transit, 4,800 gallons of fuel per day when in DP mode and 8 events in any drilling season
<i>Discoverer</i> & Support Vessels	Stationary Source Engines	Fuel sulfur content < 0.0015% by weight (ULSD)
		GHG emissions (CO ₂ e) limited to < 70 tons per any rolling 12 month period
		MLC construction limited to 480 hours per season
		MLC construction and well drilling combined limited to 1,632 hours per season
		Drilling season limited to 120 days per season

¹ Restrictions and permit conditions from Shell's PSD Permit No. R10OCS/PSD-AK-09-01 issued 09/19/11

b) Emission Reduction Measures

In addition to limitations on capacity, duration, and fuel use, Shell is implementing a number of mitigation measures to reduce the amounts of emissions. These emission reduction measures include:

- Primary generators on the *Discoverer* have been retrofitted with selective catalytic reduction SCR devices to reduce NO_x emissions to under 0.5 grams/kilowatt-hour (g/kW-hr), and OxyCat to reduce CO by at least 80 percent, volatile organic compounds VOCs by at least 70 percent, and PM₁₀ by at least 50 percent
- All other engines on *Discoverer* will either be Tier 3 (low emissions) or have been retrofitted with CDPF devices to reduce CO, VOCs, and hazardous air pollutants (HAPs) by at least 90 percent and fine particulate matter by at least 85 percent
- Propulsion and generation engines on the ice management vessel and anchor handler will have SCR devices to reduce NO_x emissions to under 1.6 g/kW-hr, and OxyCat devices to reduce CO by at least 80 percent, VOCs by at least 70 percent, and PM₁₀ to under 0.25 g/kW-hr
- ULSD (0.0015 percent sulfur by weight) fuel will be purchased for the *Discoverer* and for support vessels, which will reduce SO₂ emissions by more than 97%.

These emission reduction efficiencies are from Attachment A of Air Sciences Inc. (2011). Basis for emission reduction efficiencies are provided in Shell's application materials (Air Sciences Inc. 2009) for the PSD permit and EPA's (2010) Statement of Basis.

c) Processes, Equipment, Fuels, and Combustibles

The processes of the *Discoverer* are focused on the generation of electrical, compressed air, and hydraulic energy for drilling operation. All other processes are secondary and related to general purpose heating, transfer of materials about the deck, pumping of cement, incineration (primarily of domestic waste) etc. All stationary source engines on the *Discoverer* and its associated fleet will be fueled by diesel purchased with sulfur content at or below 0.0015 weight percent.

d) Distance to Shore

Minimum distance from shoreline for a drill site will be 64 mi (103 km).

e) Impact Evaluation for Non-Exempt Drilling Units

As required by 30 CFR 250.218(e), the following describes how Shell's program complies with the requirements of 30 CFR 250.303. The drillship and associated support vessels are exempt using the exemption formula found at 30 CFR 250.303(d). Modeled concentrations do not exceed significant concentrations identified in 30 CFR 250.303(e) for all pollutants.

Shell has obtained a PSD permit from the EPA, and BACT has been applied to all pollutants. The BACT is described in Shell's air permit application (*Preconstruction Permit Application for the Frontier Discoverer Drill Vessel in Chukchi Sea, beyond the 25 mile Alaska Seaward Boundary*), prepared by Air Sciences Inc. Impacts are estimated using dispersion modeling procedures provided by EPA Region 10. Projected impacts based on dispersion modeling are provided in Section 7 (f).

Table 7.e-1 Application of BOEMRE Exemption Formula to the Revised Chukchi Sea EP

Parameter	BOEMRE formula at 30 CFR 250.303(d) ¹	BOEMRE Value (V in tons/yr)	Shell Projected Annual Total (tons/yr)	Exempt?
CO	$V=3400D^{2/3}$	55,159	107	Yes
TSP (PM _{2.5} & PM ₁₀)	$V=33.3D$	2,597	38	Yes
SO ₂	$V=33.3D$	2,597	1	Yes
NO _x	$V=33.3D$	2,597	259	Yes
VOC	$V=33.3D$	2,597	32	Yes

¹ D=distance from the edge of the Burger Prospect to the nearest onshore area (64 mi, 103 km)

f) Modeling Report

Results of the modeling and impact analysis are summarized below in Table 7.f-1. The impacts were remodeled using the AERMOD model for SO₂ and nitrogen dioxide (NO₂). The EPA-acceptable dispersion modeling indicates that the NAAQS and PSD increments will be met at the ambient air boundary 1,640 ft (500 m) from the hull of the *Discoverer*. More details on the modeling effort are provided in the reports listed below, which have previously been forwarded to BOEMRE.

Air Sciences Inc. 2011a. Discoverer drillship impact evaluation for SO₂ and NO₂ using AEROMOD: Chukchi and Beaufort Sea, Shell Alaska Exploratory Drilling Program. Report prepared for Shell Offshore Inc., Anchorage AK, by Air Sciences Inc.

EPA. 2011. Supplemental statement of basis for proposed Outer Continental Shelf Prevention of Significant Deterioration Permits, Noble Discoverer drillship. Prepared by U.S. Environmental Protection Agency, Region 10, Seattle, WA. 70 pp.

Air Sciences Inc. 2011b. AERMOD air quality impact analysis of NO₂, SO₂, PM_{2.5}, PM₁₀, CO, and NH₃ – Discoverer. Technical Memorandum prepared for Pauline Ruddy, Shell, by Tim Martine, Air Sciences Inc. 20 pp + attach.

Table 7.f-1 Summary of Maximum Predicted Impacts of the Discoverer and Fleet

Pollutant	Period	NAAQS AAQS ¹	Background ² Concentration (µg/m ³)	Max Modeled Impact with Background ³ (µg/m ³)	PSD Class II Increment (µg/m ³)	Max Modeled Impact Without Background ⁴ (µg/m ³)
NO ₂	1-hour	0.10 ppm	13.2	174.0	NE ⁵	160.8
	Annual	100 µg/m ³	1.9	5.2	25	3.3
PM ₁₀	24-hour	150 µg/m ³	91.0	102.5	30	11.5
	Annual	NE	N/A	N/A	17	0.5
PM _{2.5}	24-hour	35 µg/m ³	7	19.4	N/A ⁶	12.4
	Annual	15 µg/m ³	2.0	2.4	N/A ⁶	0.4
SO ₂	1-hour	0.075 ppm	23.6	40.9	NE ⁵	17.3
	3-hour	1,300 µg/m ³	13.1	26.7	512	13.6
	24-hour	365 µg/m ³	5.2	13.3	91	8.1
	Annual	80 µg/m ³	0	1.4	20	1.4
CO	1-hour	40,000 µg/m ³	960.0	1,522	N/A ⁶	561.9
	8-hour	10,000 µg/m ³	945.0	1,274	N/A ⁶	328.7

¹ National Ambient Air Quality Standards and Alaska Ambient Air Quality Standards

² Background concentration data collected at Wainwright and Point Lay monitoring stations July-November 2008-2010 as detailed in Air Sciences Inc. 2011b Table 1

³ Maximum modeled impacts plus background concentration are compared to the NAAQS/AAQS ; impact values from Air Sciences Inc. 2011b Table 4

⁴ Maximum modeled impacts only without background concentration are compared to the PSD Increments; impact values from Air Sciences Inc. 2011b Table 4

⁵ NE = not established

⁶ N/A = not applicable, PM_{2.5} increments have been established but are not yet in effect

SECTION 8.0 OIL AND HAZARDOUS SUBSTANCES SPILL INFORMATION

a) Oil Spill Response Planning

Shell has prepared the Chukchi Sea Regional Exploration ODPCP as a fundamental component of the planned exploration drilling program (submitted as part of this revised Chukchi Sea EP as a separate document). Despite the very low likelihood of a large oil spill event, Shell has designed a response program based upon a regional capability of responding to a range of spill volumes, from small operational spills up to and including an ODPCP WCD for planning purposes from an exploration well blowout. Shell's program is developed to fully satisfy the response planning requirements of the State of Alaska and federal oil spill planning regulations. The ODPCP presents specific information on the response program that includes a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics used to implement effective and sustained spill containment and recovery operations.

Shell is committed to conducting safe and environmentally responsible operations in the Chukchi Sea. To achieve this goal, oil spill prevention is a primary priority in all aspects of operations. Prevention practices will include personnel training programs and adherence to strict procedures and management practices to prohibit spills. Shell's Chukchi Sea Regional Exploration Program ODPCP emphasizes the prevention of oil pollution by employing the best control mechanisms for blowout prevention and fuel transfer, and by implementing mandatory programs for personnel training. All project personnel, including employees and contractors, involved in oil spill contingency response would receive discharge prevention and response training as described in the ODPCP. Training drills also would be conducted periodically to familiarize personnel with on-site equipment, proper deployment techniques, and maintenance procedures.

b) Location of Primary Oil Spill Equipment Base and Staging Area

A dedicated OSR barge and on-site OSR vessel will be staged in the vicinity of the drillship when drilling into potential liquid hydrocarbon bearing zones. The OSR vessel will be positioned within 10 n mi (19 km, 1 hour transit time) of the drilling vessel and an OSR barge will be positioned approximately 25 n mi (46 km) from the drilling vessel (approximately 3 hours transit time). The OSR barge and vessel possess sufficient storage capacity to provide containment, recovery, and storage for the initial operational period.

An Arctic Oil Storage Tanker (OST) will be staged within 240 n mi (445 km) of the drill site in an area absent the presence of ice or other hazards so that it will arrive at the recovery site within 24 hours of departure from its staging location. Response personnel will conduct maintenance, training and other activities to ensure their continued readiness in the event they are needed. The OST will possess a minimum liquid storage capacity of 513,000 bbl (81,558 m³), sufficient capacity to store all recovered liquids (oil and emulsified oil/water) for initial 20 days of the 30-day blowout. By Day 19, a second OST chartered to Shell would arrive from outside the Chukchi Sea with sufficient capacity to provide storage of all recovered liquids for the duration of the 30-day blowout. By hour 42, two additional dedicated VOSSs would arrive at the spill site, from their staging location near Camden Bay in the Beaufort Sea, to support skimming capacity at the site. The OSR barge and vessels would work in conjunction to sustain containment and skimming operations and transfer recovered fluids to the OSTs for the duration of the response.

An ice-strengthened OSR barge with skimming capability, and an associated tug, will be mobilized from their staging locations in the Beaufort Sea and re-located in the nearshore zone of the Chukchi Sea within 96 hours for shoreline cleanup, if necessary. It will be mobilized to arrive prior to earliest projected time oil could arrive in the Chukchi nearshore zone. The OSR barge would possess storage capacity of 76,900 bbl (12,226 m³) for recovered liquids. It will also carry response equipment, including a 47 ft (14 m) skimming vessel, 34 ft (10 m) workboats, mini-barges, boom and duplex skimming units for nearshore recovery and possibly support nearshore protection. The OSR barge will carry designated response personnel and will mobilize to recovery areas, deploy equipment and begin operations.

c) Name(s) of Spill Removal Organization(s) for Both Equipment and Personnel

Alaska Clean Seas (ACS) is Shell's primary response action contractor for the Chukchi Sea spill response program. ACS would lead the spill response efforts in the offshore, nearshore, and shoreline environments. ACS's response personnel and oil spill response equipment would be maintained on standby while critical exploration drilling operations into liquid hydrocarbon bearing zones are underway and provide offshore, nearshore, and shoreline response operations in the unlikely event of an actual oil spill incident. Additionally, ACS provides program oversight, spill management team support, response training, and additional responders through Auxiliary Contract Response Teams (ACRT), North Slope Spill Response Team (NSSRT), and Village Response Teams (VRTs).

Shell provides dedicated response vessels, skimmers, and equipment for the nearshore and offshore operations. Response activities will be conducted using Shell or ACS tactics as defined in the Shell's *Beaufort and Chukchi Seas Regional Tactics Manual* and/or ACS's *Technical Manual*, or otherwise as defined in the ODPCP.

d) Calculated Volume of Worst Case Discharge Scenario [30 CFR 254.26(a)]

The planning volume of a WCD scenario for the Regional ODPCP is provided in Table 8.d-1.

Table 8.d-1 Oil Volume of the Worst Case Discharge Planning Scenario for the Regional ODPCP

Element	Capacity (bbl)	Reference
Possible Daily Volume of Highest Capacity Well	25,000	30 CFR 254.47(b)
Total Worst Case Discharge (Daily Volume X 30-day Duration of Blowout)	750,000	30 CFR 254.47(b)
Total Storage Capacity Requirements	750,000	30 CFR 254.47(b)

The WCD planning scenario provided above in Table 8.d-1 exceeds the WCD calculated for the revised Chukchi Sea EP as indicated below in Table 8.d-2. The comparison indicates that OSR capabilities exceed the calculated WCD for the revised Chukchi Sea EP.

Table 8.d-2 Comparison of the WCD Planning Scenario Developed for the Chukchi Sea Regional ODPCP with the WCD Calculated for the Revised Chukchi Sea EP for Two Relief Well Scenarios

	ODPCP WCD Scenario	Revised Chukchi Sea EP WCD – Kulluk Operating in Camden Bay	Revised Chukchi Sea EP WCD – Kulluk Warm-Stacked in Dutch Harbor
Maximum Flow Rate	25,000 bbl	^a 23,100 bbl	^a 23,100 bbl
Total Duration	30 days	34 days	38 days
Total Oil Volume	750,000 bbl	603,564 bbl	669,479 bbl

^a Calculated WCD for Burger J; flow rate diminishes over time

e) Description of Worst Case Discharge Scenario

Under BOEMRE requirements, the plan must include a WCD scenario. For exploration drilling operations, the WCD scenario is equal to the daily volume possible from an uncontrolled blowout for period of 30 days. The WCD scenario also was developed to address the ADEC regulations (18 Alaska Administrative Code [AAC] 75.434) that require the Response Planning Standard volume to be 5,500 bbl (874 m³) of oil per day (bopd) for an exploration drilling facility for fifteen (15) days duration. In order to address BOEMRE NTL No. 2010-N06 and 30 CFR 254.47, the total WCD planning volume was based upon BOEMRE's planning requirement for a 30-day blowout resulting in a WCD scenario volume of 750,000 bbl (119,237 m³) of oil during the 30 days. The entire WCD scenario can be found within Section 1.6.13 of the ODPCP.

f) Modeling Report

The WCD scenario is based upon a spill simulation model of a 25,000 bopd well blowout at the seafloor (or mudline) in the Burger Prospect at Latitude 71° 16' 37.2", Longitude 163° 19' 48.0", the site of the historical Burger well (SWEPI OCS-Y-1413 #1), in approximately 138-144 ft (42-44 m) of water. Modeling of the oil plume trajectory was conducted by Applied Science Associates, Inc. (ASA), using historical wind data and the BOEMRE hydrodynamic ocean-ice current model. The ASA trajectory model includes algorithms for spreading, evaporation, emulsification, and entrainment, all of which are input parameters based on the properties of an Alaska North Slope crude oil with an API gravity of 30.6°.

The ASA's OILMAP software was used to run the trajectory model based on environmental conditions including predominate winds and currents. Oil on the ocean's surface is assumed to move as the sum of vectors: surface currents plus 3.5 percent of the wind speed in the downwind direction. Oil plume migration is driven by ocean currents and prevailing winds for the 30-day duration of this scenario. Wind data used for the trajectory modeling were collected by Shell from 22 locations in the Chukchi Sea during June through November for the years 1980, 1982, and 1983. Data from these three years were used for stochastic modeling. Wind data for the period of August 7 to September 6 was used in the trajectory modeling.

Based upon the collected data, the offshore winds originated from the northeast to southeast 54 percent of the time and the northwest to southwest 23 percent of the time during the June through November period. Three predominant wind directions had a measured frequency of occurrence greater than 10 percent of the time originating from the northeast (NE), east-northeast (ENE) and east (E) based upon the 16 cardinal compass directions. These three wind directions on average occurred at the following frequencies for the June through November period:

- ENE wind = 14.6 percent frequency

- NE wind = 13.8 percent frequency
- E wind = 13.0 percent frequency

The trajectory simulation uses a subsea blowout rising through the water column and surfacing above the well location. The trajectory simulation moves and spreads the oil under the influence of local winds measured at the closest station for the August 7 to September 6 time period and the BOEMRE ocean-current information.

The trajectory analysis revealed that the oil plume would move away from shorelines in a southwesterly direction. From Day 1 through Day 3, the oil movement is directed by winds predominantly from the SW and the predicted current. By Day 14, wind shifts move the oil plume principally to the west (W) and SW. Through Day 21, the oil movement is to the south and southwest away from land. If not intercepted by containment and recovery operations, the oil slick is predicted to begin drift to the SW and south-southeast (SSE) and toward shorelines. If unrecovered, the earliest oil is predicted to potential contact with shorelines is Day 28 in the area between Wainwright Inlet and Kasegaluk Lagoon (Figure 1.b-1). Following Day 30, oil would continue drifting to the NE toward open ocean north of land.

SECTION 9.0 ALASKA OUTER CONTINENTAL SHELF PLANNING INFORMATION

a) Emergency Plan

The following emergency plans and documentation regarding spill prevention and response actions are included in the ODPCP that will be submitted to BOEMRE as a separate document, concurrent with this revised Chukchi Sea EP:

- Response Action Plan
- Emergency Action Checklist
- Reporting and Notification
- Safety
- Communications
- Deployment Strategies
- Response Strategies
- Non-mechanical Response Options
- Prevention Plan
- Prevention Inspection & Maintenance Program
- Bulk Storage Containers
- Command System
- Best Available Technology

b) Critical Operations and Curtailment Plan and Ice Management Plan

A copy of Shell's proposed regional COCP for the Chukchi Sea is attached in Appendix J of the revised Chukchi Sea EP and a copy of Shell's regional IMP is provided in Appendix K. These plans are complementary documents that address the methods by which Shell will cease, limit, or not initiate specific critical operations due to environmental conditions that may be encountered at the exploration drill site. However, the scope of the IMP is limited to approaching hazardous ice and its potential effects on exploration drilling operations and the *Discoverer* safety.

c) Well Control Plan

An outline of Shell's well control plan is provided in Appendix L. Well control is the process of maintaining barriers in the drilled wellbore that prevent gas or fluids from underground reservoirs escaping from the wellbore in an uncontrolled flow.

d) Fuel Transfer Plan

Shell has prepared a Fuel Transfer Plan that covers activities with its planned exploration drilling program in the Chukchi Sea. A copy of the plan is provided in Appendix M. The Fuel Transfer Plan outlines the procedures used to transfer fuel from vessel-to-vessel and dock-to-vessel.

e) Partial Wells

Two scenarios exist that could result in partial wells being drilled in a multi-year exploration plan:

- Exploration drilling and/or evaluation of the deepest primary objective has not been concluded on the final well in the drilling season by 31 October

- A hazardous condition (e.g., ice) forces suspension of the exploration drilling operations, temporary abandonment of a wellbore in a safe and secure manner, and rig demobilization from the Chukchi Sea with no opportunity to return before the end of the drilling season

Each of these is discussed more fully below.

Initial Drilling Season

If exploration drilling and/or evaluation of the initial or a subsequent well has not been concluded (i.e. the deepest primary objective has not been penetrated and or evaluated), with the well fully plugged and permanently abandoned before the end of the first drilling season on 31 October, Shell plans to stop the exploration drilling operations, temporarily abandon (TA) the well in compliance with BOEMRE regulations and leave the drill site during the winter.

If there is sufficient time prior to 31 October operations may begin on another well in the drilling season. This work could include MLC construction, drilling additional hole sections and cementing casing strings during the time remaining in the drilling season. If there is not sufficient time remaining to drill the well to objective depth and evaluate the reservoir section, the well will be suspended before penetrating objective hydrocarbon-bearing zones. The best way to suspend a well is to run casing, cement it in the hole, then set a mechanical plug near the top of the well and cap the well. This provides multiple barriers to prevent unexpected flows and leave the well suitable for safe re-entry. The proposed suspension procedure on any unfinished, or partial well, will be provided via submission of an Application for Permit to Modify (APM) for BOEMRE approval. In the succeeding drilling season, the drillship will return to this unfinished drill site, re-enter the well and continue exploration drilling or evaluation as described in the APM. Once all objectives have been satisfied, the well will be plugged and permanently abandoned according to BOEMRE regulations before the drillship moves to a new drill site to initiate exploration drilling operations.

If a hazardous condition requires curtailment of critical operations (or prevents initiation of them, depending on time available) per the provisions of the Critical Operations and Curtailment Plan (Appendix J), the well will be suspended and secured using a BOEMRE-approved procedure, moorings will be recovered if possible and the drillship will move to a safe area. Once the hazardous condition has passed, the drillship will return to the drill site and conclude exploration drilling operations, evaluation, permanent plugging and abandonment operations.

If, however, the hazardous condition (e.g., ice) does not permit moving back over the well, re-mooring, re-entering and continuing drilling/evaluation operations before the end of any drilling season, the well will remain temporarily abandoned until the next drilling season. The drillship will return to the suspended well and finish exploration drilling/evaluation operations during the next drilling season prior to permanently abandoning the well.

Subsequent Drilling Seasons

A planned partial well will not be left at the end of the last drilling season under this EP. All wells will be plugged and permanently abandoned before the drilling fleet demobilizes. The only exception to this plan involves the inability to return to the drill site following an emergency evacuation due to an approaching hazard such as ice. If a well cannot be permanently abandoned due to ice, it will be properly suspended before the drillship evacuates. At the beginning of the next drilling season, the drillship will return to the drill site to permanently abandon the unfinished well or continue exploration drilling/evaluation of the well under another approved EP.

The MLC is constructed such that the ram-type BOP stack (i.e., the bottom section of the stack) can remain installed on the high-pressure wellhead housing as part of the TA procedure with the top of the upper H4 mandrel remaining below the maximum ice keel scour depth. Efforts will be made to preferentially provide a sufficient number of independent verified barriers in the wellbore (a minimum of two) to ensure that the well cannot leak or flow while temporarily abandoned without the lower stack remaining on the well. These barriers can include cement not drilled out from the bottom joints of casing after cementing it in place, double float valves inside the casing, a wellhead seal assembly between casing strings, cement plugs, mechanical plugs and sealed hang-off tools. These techniques and barriers are also described in the COCP in Appendix J. If there are a sufficient number of quality barriers left in the well when it is temporarily abandoned, the entire BOP stack will be recovered for repair and testing during the winter season in preparation for the next drilling season.

f) Surface Intervention – Capping and Containment

Shell's capping and containment capability in the unlikely event of a blowout in Chukchi Sea is provided by a combination of a subsea capping stack positioned on an ice management vessel, and surface separation equipment on a containment vessel.

Surface intervention involves work done on the wellhead of a subsea well. Surface intervention in the OCS, involves subsea devices used on the top of the well or some device connected thereto (e.g., the BOP stack or wellhead).

A set of subsea devices is being assembled for the drilling seasons to provide direct surface intervention capability with the following priorities:

- Attaching a device or series of devices to the well to affect a seal capable of withstanding the maximum anticipated wellhead pressure (MAWP) and closing the assembly to completely seal the well against further flows (commonly called “capping and killing”)
- Attaching a device or series of devices to the well and diverting flow to surface vessel(s) equipped for separation and disposal of hydrocarbons (commonly called “capping and diverting”)

These devices form what is generally known as a capping stack. The devices include ram-type BOP bodies equipped with blind and/or pipe rams, spacer spools, flow crosses (or mud crosses) for pumping kill weight fluid into the well or for flowing the well in a controlled manner through piping to the surface and connectors to attach to the upper H4 connector mandrel, the high-pressure wellhead housing if the entire BOP stack has been removed or the flanged connection on top of the lower marine riser package (LMRP). This equipment will be stored aboard a designated vessel in Alaska with a marine crew aboard, warm-stored and ready for use. It is anticipated that surface intervention efforts will successfully stop the flow from a blowout in less time than is required to drill a relief well.

Various crossovers and spools, ram sets and other equipment (including demolition tools for clearing debris away from the well) will be included on the designated vessel. Extra studs, nuts, gaskets, hydraulic wrenches and other tools will be available to allow the capping stack to be modified aboard the vessel as necessary to provide flexibility to deal with a wide variety of capping situations.

All of the separation equipment on the containment vessel will be designed for conditions found in the Arctic including ice and cold temperatures. This equipment will also be designed for reliability, ease of operation, flexibility and robustness so it could be used for a variety of blowout situations. The capping stack, located on an ice management vessel, and the separation equipment located on the containment vessel, will be available prior to the drilling season.

Efforts to contain the blowout will begin when the equipment arrives to clear debris from the well and a capping stack will be attached as necessary. If these efforts fail to capture all the oil, Shell's OSR fleet will still be available at the blowout well site to collect and recover fugitive oil emissions from the surface. This equipment will be positioned downwind and down current from the blowout well and will not interfere with either containment efforts or relief well drilling. Containment efforts will continue during relief well drilling operations unless it is unsafe or futile to do so. The surface oil spill response fleet would remain and oil spill cleanup would continue, as necessary, until the blowout is under control.

SECTION 10.0 ENVIRONMENTAL MONITORING

a) Monitoring Systems

The *Discoverer* will be equipped with the following monitoring equipment:

Navigation Radar	Furuno ARPA FAR - 28 X 7 SERIES Furuno FAR - 21 X 7 (-BB) SERIES
Satellite Communications	GMDSS EQUIPMENT Sailor HC 4500 MF / HF control units [2 units] System 4000 GMDSS Sailor HF SSB 250W PEP Thrane & Thrane TT - 3020C / TT - 3022D Capsat Transceiver JMC Dual Frequency Navtex Receiver Model NT - 1800 Satellite Phone Sailor TT3622B
Navigation Receiver	Furuno GPS Navigator GP - 150 AIS L3 Communications
Gyro Compass	Simrad GL 80 / 85
Magnetic Compass	Cassen & Plath GmbH Type 12 Reflector compass
Echo Sounder	Furuno FE 700
Pitch & Roll	Standard clinometer model MOELLER 5 / 15 degs [6 each]
Anchor Tensions	Plimsoll Anchor tension monitoring system [4 each]
Wind	Young Marine Wind Tracker model 06206 [4 each]
Water Temp	Laser mounted flute to measure seawater inlet temp.
Barometric Pressure	Sato Sigma - II Barograph model NS II - BR Barometer Hanseatic Instruments [2 each]
Helicopter Landing Info.	Philips 190S, SMC Ship Motion Control Recording Roll, Pitch, Helideck Inclination, Max Heave, Heave Period. Philips 170 S, Observation Instruments BV. Wind obs.: Actual, Average, Minimum, Maximum, Gust, Air Temp, Air Pressure, Humidity.

Shell received a PSD air quality permit (R10OCS/PSD-AK-09-01) from the EPA on 31 March 2010. Air emissions from the *Discoverer* and associated fleet will be monitored in compliance with the air permit conditions after remand.

Shell received authorization for discharges associated with the *Discoverer* in Posey Blocks 6714, 6764, and 6912 under EPA's NPDES General Permit AKG-20-000 on 20 January 2010 and on 16 December

2010 applied for an extension of this authorization and for similar authorization for discharges in Posey Blocks 6812, 6762, and 6915 (Appendix B). The EPA granted these extensions and authorizations on 23 June 2011. The *Discoverer* will have the required waste monitoring equipment onboard to monitor and report the discharges as required by the permit.

Environmental Monitoring at Drill Sites While Drilling

In addition to monitoring of marine mammals, a comprehensive environmental monitoring program will be implemented during exploration drilling operations. A dedicated science vessel staffed by a team of physical and biological oceanographers will be responsible for assessing pre-, during, and post-drilling conditions in both biota and water and sediment quality. All drilling locations have been sampled at multiple times during the last three years to provide a baseline understanding of pre-existing conditions and interannual variability at these sites.

Physical oceanography characteristics that will be monitored continuously at the each location throughout the drilling process include: surface wind direction and speed, ambient air temperature, current speed and direction throughout the water column, water temperature through the water column and salinity through the water column.

Water chemistry and characteristics that will be monitored will include assessment of metals and organics through the water column at multiple fixed and random locations around the exploration drilling operation. These measurements will be made regularly before, during, and after drilling and will capture conditions during all significant phases of the exploration drilling operations and potential discharges. Physical characteristics of the water column will also be assessed including turbidity, temperature, and oxygen content in an effort to document and model plumes of released discharges.

Biological observations will include assessments of benthos, epibenthos, zooplankton and phytoplankton, and fishes. In addition to characterization of the communities of these organisms at and near the drill site before, during, and after operations, samples of biota will be collected before and after operations for tissue analysis for metals and organics.

Bird and mammal observations will be made from all surface operation vessels throughout the exploration drilling activities in accordance with the 4MP and Bird Strike Avoidance and Lighting Plan.

b) Incidental Takes

Applications have been submitted concurrently with the EP for the following MMPA authorizations:

- Incidental Harassment Authorization (IHA) from NMFS – Non-lethal, Incidental Take of Whales and Seals (Appendix C)
- LOA from the USFWS – Non-lethal, Incidental and Intentional Take of Polar Bear and Pacific Walrus (Appendix E)

During the planned exploration drilling program, the *Discoverer* and support vessels will each have MMOs onboard to observe for marine mammals and record all observations. Complete details of the MMO program are presented in the Marine Mammal Monitoring and Mitigation Plan (4MP) submitted in support of the NMFS IHA application.

Species for which an incidental harassment authorization is sought are:

- Mysticetes: bowhead, fin, gray, humpback and minke whales
- Odontocetes: beluga, narwhal, killer whale, and harbor porpoise

- Pinnipeds: bearded, ribbon, ringed, and spotted seals

Potential impacts to these species are discussed in detail in the EIA (Appendix F). Any impacts to whales and seals from the planned exploration drilling program would be temporary and result in only short-term disturbance or displacement. From a historical perspective, the temporary activity of offshore exploration drilling and associated support vessel activities, collectively and individually, have not resulted in impacts of biological significance to marine mammals of the Arctic, or interference with the subsistence harvest of those marine mammals by the residents of the communities along the Beaufort and Chukchi Seas.

The numbers of marine mammals that may potentially be exposed to sound levels of ≥ 160 decibels (dB) root mean squared (rms) while conducting ZVSPs, and sound levels ≥ 120 dB rms during exploration drilling or ice management, are summarized in Table 10.b-1 and discussed in the IHA (Appendix C). Many animals exposed to sound levels near 120 dB rms would not react to those sound levels, particularly pinnipeds, and exposure to this sound level should not be considered as “takes by harassment”. Even for species that may change their behavior or alter their migration route, those changes are likely to be within the normal range of activities for the animals and may not rise to the level of “taking” based on guidance in NMFS (2001). Animals that divert around the activity at the lower sound levels would not approach close enough that they would alter their behavior to the degree that they would be “taken by harassment.” The actual number of animals that will be “taken” lies somewhere below the numbers exposed to ≥ 120 and ≥ 160 dB rms.

These represent small takes based on their effect (temporary behavioral effects) and the proportion of the population that would be affected. For example, an estimated maximum of 14 bowheads may be exposed to sounds ≥ 160 dB re 1 micropascal (μPa) rms equaling <1.0 percent of the population. An even smaller percentage of seal populations in the Chukchi Sea would be exposed to underwater sounds in excess of 160 dB. In regard to the subsistence harvest of bowhead whale, as a consequence of Shell’s planned mitigation measures (see Section 12.0) any effects on the bowhead whale as a subsistence resource also will be negligible.

The LOA application (Appendix E) provides an outline of the planned exploration drilling program and includes an updated, drilling program-specific bear and walrus plan titled: *Polar Bear, Pacific Walrus and Grizzly Bear Avoidance and Encounter/Interaction Plan, Chukchi Sea, Alaska, Exploration Drilling Program*. The LOA application does not require the inclusion of take estimates for polar bears or Pacific walrus.

Table 10.b-1 Number of Potential Exposures of Marine Mammals to Received Sound Levels in the Water of >120 dB rms Generated by Exploration Drilling and >160 dB rms Generated by ZVSPs during each Drilling Season

Species	Number of Exposures to Sound Levels > 120 dB and >160 dB ²							
	To 120 dB During Drilling		To 120 dB During Ice Breaking		To 160 dB During ZVSPs		Total Exposures	
	Avg	¹ Max	Avg	¹ Max	Avg	¹ Max	Avg	¹ Max
Beluga	0	5	4	5	1	5	5	15
Narwhal	0	5	0	5	0	5	0	15
Killer whale	0	5	0	5	0	5	0	15
Harbor porpoise	0	5	1	5	0	5	0	15
Bowhead whale	1	5	19	38	5	11	25	53
Fin whale	0	5	0	5	0	5	1	15
Gray whale	1	5	14	28	6	13	21	46
Humpback whale	0	5	0	5	0	5	0	15
Minke whale	0	5	0	5	0	5	0	15
Bearded seal	1	5	12	23	5	9	17	36
Ribbon seal	0	5	0	5	0	5	1	15
Ringed seal	17	28	343	568	132	218	492	814
Spotted seal	0	5	7	11	3	5	10	21

¹ Arbitrary estimates have been included in the maximum columns to account for chance encounters or where greater numbers may be encountered than calculations suggested. Not all marine mammals will change their behavior when exposed to these sound levels

² Assumes three wells and a partial well per season

SECTION 11.0 LEASE STIPULATIONS INFORMATION

The source for the italicized text below is the OCS Chukchi Sea Planning Area Oil and Gas Lease Sale 193.

Stipulation No. 1 - Protection of Biological Resources

If previously unidentified biological populations or habitats that may require additional protection are identified in the lease area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RS/FO shall give written notification to the lessee of the RS/FO's decision to require such surveys.

Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to:

- 1) Relocate the site of operations;*
- 2) Establish to the satisfaction of the RS/FO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;*
- 3) Operate during those periods of time, as established by the RS/FO, that do not adversely affect the biological resources; and/or*
- 4) Modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.*

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such findings to the RS/FO and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO has given the lessee direction with respect to its protection.

The lessee shall submit all data obtained in the course of biological surveys to the RS/FO with the locational information for drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RS/FO provides written directions to the lessee with regard to permissible actions.

Shell Proposed Actions

The BOEMRE has not requested that Shell conduct any biological resource surveys in the area of the planned drill sites. No areas of special biological significance have been identified within or near the blocks identified in the revised Chukchi Sea EP.

In addition to the shallow hazards surveys, which provide detailed information on the seafloor sediments and relief, Shell conducted or participated in the funding or in the facilitation of several types of environmental studies in and near the prospects in 2008, 2009, and 2010 to gather baseline data regarding resources in the project area. These studies included coastline surveys to assess the relative environmental sensitivity of Chukchi Sea coastline segments, walrus tagging and monitoring studies, seal tagging and monitoring studies, bird and marine mammal surveys, assessments of the benthic invertebrate communities, oceanographic studies, and sediment quality assessments at the planned drill sites. The results of the marine mammal and bird surveys are summarized in the EIA in Appendix F.

These studies also indicated that there are no areas of special biological significance in the vicinity of the drill sites. Video reconnaissance surveys were conducted at historical drill sites at Burger in 1989, and the results were submitted to BOEMRE at that time. These surveys also found a relatively flat and featureless seafloor with a silty substrate and a benthic fauna typical of the Lease Sale 193 Area (Finney 1989, Boudreau 1989).

Stipulation No. 2 - Orientation Program

The lessee shall include in any exploration plan (EP) or development and production plan (DPP) submitted under 30 CFR 250.211 and 250.241 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the RS/FO. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas. The program shall address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provide guidance on how to avoid disturbance. This guidance will include the production and distribution of information cards on endangered and/or threatened species in the sale area. The program shall be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program shall also include information concerning avoidance of conflicts with subsistence activities and pertinent mitigation.

The program shall be attended at least once a year by all personnel involved in onsite exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors.

The lessee shall maintain a record of all personnel who attend the program onsite for so long as the site is active, not to exceed 5 years. This record shall include the name and date(s) of attendance of each attendee.

Shell Proposed Actions:

Shell has developed and is currently implementing an approved orientation program for Shell and contractor personnel involved in Shell's Alaska Venture exploration drilling program that was first approved by the Alaska OCS Region of the BOEMRE RS/FO on 15 February 2007. An outline of the program was again submitted to BOEMRE with the initial Chukchi Sea EP, and found by the BOEMRE RS/FO on 7 December 2009 to satisfy the requirements of Stipulation No. 2. Shell revised the orientation program based on BOEMRE comments regarding the 2009 orientation program, and submitted the complete orientation program to BOEMRE for approval on 9 June 2011.

All Shell and contractor personnel involved in field exploration drilling activities will attend the orientation training annually. All other Shell and contractor personnel will attend the program at least once at the time they join the team. Shell will retain and maintain a record, for at least 5 years, of all personnel who attend the program, including relevant attendee and program information.

Shell has designed a specific program that addresses environmental, social, and cultural concerns related to the project area. The program is designed to increase sensitivity and understanding by Shell and its contractors of community values, customs, and lifestyles in the area they will be working, and how to avoid conflicts with subsistence activities. The program stresses the importance of not disturbing

archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provides guidance on how to avoid disturbance.

Shell's Cultural Awareness Program addresses the following:

- Alaska Native Ethnic Breakdown
- Brief history of land claims
- Formation of regional corporations, and region within which Shell is working
- History of the North Slope
- Cultural diversity
- Comparison of cultural values of Alaska Natives v. non-Natives
- Patterns of language
- Communication skills and body language
- Guidelines on cultural artifacts
- Local community values and customs
- Whaling

Shell has further developed a Health, Safety, Security and Environment (HSSE) Awareness Program, which addresses the following:

- Shell's HSSE Commitment
- Intervention policy
- Journey Management requirements
- Personal Protective Equipment requirements
- General Alaska Venture Hazards, such as earthquakes and volcanoes
- Medical emergencies
- Security
- North Slope Safety requirements
- Shell Alaska Venture Standards and Procedures
 - Cold Climate Work Standard
 - Firearms Use in Wildlife Confrontations
 - Procedure for Vessel-to-Vessel Personnel Transfers
- Incident Reporting
- Environmental Awareness
 - ESA – Major Provisions
 - Endangered and threatened species
 - MMPA of 1972
 - Marine mammal interactions
 - Sensitive Habitats on the North Slope
 - Wildlife interactions
 - Prohibited activities of hunting, trapping and fishing
 - Environmental requirements, for air, spills and waste
 - Environmental training

Stipulation No. 3 - Transportation of Hydrocarbons

Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased

environmental protection or reduced multiple-use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to recommendations of any Federal, State, and local governments and industry.

Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of an emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the RS/FO.

Shell Proposed Action:

Not applicable to the activities described in this revised Chukchi Sea EP.

Stipulation No. 4 - Industry Site-Specific Bowhead Whale Monitoring Program

A lessee proposing to conduct exploration operations, including ancillary seismic surveys, on a lease within the blocks identified below during the periods of subsistence use related to bowhead whales, beluga whales, ice seals, walrus, and polar bears will be required to conduct a site-specific monitoring program approved by the RS/FO; unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with appropriate agencies and co-management organizations, determines that a monitoring program is not necessary. Organizations currently recognized by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) for the co-management of the marine mammals resources are the Alaska Eskimo Whaling Commission, the Alaska Beluga Whale Committee, the Alaska Eskimo Walrus Commission, the Ice Seal Commission, and the Nanuk Commission. The RS/FO will provide the appropriate agencies and co-management organizations a minimum of 30 calendar days, but no longer than 60 calendar days to review and comment on a proposed monitoring program prior to Minerals Management Service (MMS) approval. The monitoring program must be approved each year before exploratory drilling operations can be commenced.

The monitoring program will be designed to assess when bowhead and beluga whales, ice seals, walrus, and polar bears are present in the vicinity of lease operations and the extent of behavioral effects on these marine mammals due to these operations. In designing the program, the lessee must consider the potential scope and extent of effects that the type of operation could have on these marine mammals. Experiences relayed by subsistence hunters indicate that, depending on the type of operations, some whales demonstrate avoidance behavior at distances of up to 35 miles. The program must also provide for the following:

- 1) Recording and reporting information on sighting of the marine mammals of concern and the extent of behavioral effects due to operations;*
- 2) Coordinating the monitoring logistics beforehand with the MMS Bowhead Whale Aerial Survey Project (BWASP) and other mandated aerial monitoring programs;*
- 3) Inviting a local representative to be determined by consensus of the appropriate co-management organizations to participate as an observer in the monitoring program;*
- 4) Submitting daily monitoring results to the RS/FO;*
- 5) Submitting a draft report on the results of the monitoring program to the RS/FO within 90 days following the completion of the operation. The RS/FO will distribute this draft report to the appropriate agencies and co-management organizations;*
- 6) Allowing 30 days for independent peer review of the draft monitoring report; and*
- 7) Submitting a final report on the results of the monitoring program to the RS/FO within 30 days after the completion of the independent peer review. The final report will include a discussion*

of the results of the peer review of the draft report. The RS/FO will distribute this report to the appropriate agencies and co-management organizations.

The RS/FO may extend the report review and submittal timelines if the RS/FO determines such an extension is warranted to accommodate extenuating circumstances.

The lessee will be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program for bowhead whales. The lessee may be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program for other co-managed marine mammal resources. This peer review will consist of independent reviewers who have knowledge and experience in statistics, monitoring marine mammal behavior, the type and extent of the proposed operations, and an awareness of traditional knowledge. The peer reviewers will be selected by the RS/FO from experts recommended by the appropriate agencies and co-management resource organizations. The results of these peer reviews will be provided to the RS/FO for consideration in final MMS approval of the monitoring program and the final report, with copies to the appropriate agencies and co-management organizations.

In the event the lessee is seeking a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) for incidental take from NMFS and/or FWS, the monitoring program and review process required under the LOA or IHA may satisfy the requirements of this stipulation. The lessee must advise the RS/FO when it is seeking an LOA or IHA in lieu of meeting the requirements of this stipulation and provide the RS/FO with copies of all pertinent submittals and resulting correspondence. The RS/FO will coordinate with the NMFS and/or FWS and will advise the lessee if the LOA or IHA will meet these requirements.

The MMS, NMFS, and FWS will establish procedures to coordinate results from site-specific surveys required by this stipulation and the LOA's or IHA's to determine if further modification to lease operations are necessary.

This stipulation applies to the following blocks:

NR02-06, Chukchi Sea

6624, 6625, 6674, 6675, 6723-6725, 6773-6775, 6822, 6823, 6872

NR03-02, Posey

6872, 6873, 6918-6923, 6967-6973, 7016-7023, 7063-7073, 7112-7123

NR03-03, Colbert

6674, 6723, 6724, 6771-6774, 6820-6824, 6869-6874, 6918-6924, 6966-6974, 7015-7024, 7064-7074, 7113-7124

NR03-04, Solivik Island

6011-6023, 6060-6073, 6109-6122, 6157-6171, 6206-6219, 6255-6268, 6305-6317, 6354-6365, 6403-6414, 6453-6462, 6502-6511, 6552-6560, 6601-6609, 6651-6658, 6701-6707, 6751-6756, 6801-6805, 6851-6854, 6901-6903, 6951, 6952, 7001

NR03-05, Point Lay West

6014-6024, 6062-6073, 6111-6122, 6160-6171, 6209-6221, 6258-6269, 6307-6317, 6356-6365, 6406-6414, 6455-6462, 6503-6510, 6552-6558, 6602-6606, 6652-6655, 6702, 6703

NR04-01, Hanna Shoal

6223, 6267-6273, 6315-6323, 6363-6373, 6411-6423, 6459-6473, 6507-6523,
6556-6573, 6605-6623, 6654-6671, 6703-6721, 6752-6771, 6801-6819, 6851-6868,
6901-6916, 6951-6964, 7001-7010, 7051-7059, 7101-7107

NR04-02, Barrow

6003-6022, 6052-6068, 6102-6118, 6151-6164, 6201-6214, 6251-6262, 6301-6312,
6351-6359, 6401-6409, 6451-6456, 6501-6506, 6551, 6552, 6601, 6602

NR04-03, Wainwright

6002-6006, 6052, 6053

NS04-08, (Unnamed)

6816-6822, 6861-6872, 6910-6922, 6958-6972, 7007-7022, 7055-7072, 7104-7122

This stipulation applies during the time periods for subsistence-harvesting described below for each community.

Subsistence Whaling and Marine Mammal Hunting Activities by Community

Barrow: Spring bowhead whaling occurs from April to June; Barrow hunters hunt from ice leads from Point Barrow southwestward along the Chukchi Sea coast to the Skull Cliff area. Fall whaling occurs from August to October in an area extending from approximately 10 miles west of Barrow to the east side of Dease Inlet. Beluga whaling occurs from April to June in the spring leads between Point Barrow and Skull Cliff; later in the season, belugas are hunted in open water around the barrier islands off Elson Lagoon. Walrus are harvested from June to September from west of Barrow southwestward to Peard Bay. Polar bear are hunted from October to June generally in the same vicinity used to hunt walrus. Seal hunting occurs mostly in winter, but some open water sealing is done from the Chukchi coastline east as far as Dease Inlet and Admiralty Bay in the Beaufort Sea.

Wainwright: Bowhead whaling occurs from April to June in the spring leads offshore of Wainwright, with whaling camps sometimes as far as 10 to 15 miles from shore. Wainwright hunters hunt beluga whales in the spring lead system from April to June but only if no bowheads are in the area. Later in the summer, from July to August, belugas can be hunted along the coastal lagoon systems. Walrus hunting occurs from July to August at the southern edge of the retreating pack ice. From August to September, walrus can be hunted at local haulouts with the focal area from Milliktagvik north to Point Franklin. Polar bear hunting occurs primarily in the fall and winter around Icy Cape, at the headland from Point Belcher to Point Franklin, and at Seahorse Island.

Point Lay: Because Point Lay's location renders it unsuitable for bowhead whaling, beluga whaling is the primary whaling pursuit. Beluga whales are harvested from the middle of June to the middle of July. The hunt is concentrated in Naokak and Kukpowruk Passes south of Point Lay where hunters use boats to herd the whales into the shallow waters of Kasegaluk Lagoon where they are hunted. If the July hunt is unsuccessful, hunters can travel as far north as Utukok Pass and as far south as Cape Beaufort in search of whales. When ice conditions are favorable, Point Lay residents hunt walrus from June to August along the entire length of Kasegaluk Lagoon, south of Icy Cape, and as far as 20 miles offshore. Polar bear are hunted from September to April along the coast, rarely more than 2 miles offshore.

Point Hope: Bowhead whales are hunted from March to June from whaling camps along the ice edge south and southeast of the point. The pack-ice lead is rarely more than 6 to 7 miles offshore. Beluga whales are harvested from March to June in the same area used for the bowhead whale hunt. Beluga

whales can also be hunted in the open water later in the summer from July to August near the southern shore of Point Hope close to the beaches, as well as areas north of the point as far as Cape Dyer. Walrus are harvested from May to July along the southern shore of the point from Point Hope to Akoviknak Lagoon. Point Hope residents hunt polar bears primarily from January to April and occasionally from October to January in the area south of the point and as far out as 10 miles from shore.

This stipulation will remain in effect until termination or modification by the Department of the Interior after consultation with appropriate agencies.

Shell Proposed Actions:

Although none of the blocks listed in Stipulation No. 4 are included in those planned for exploration drilling in Shell's revised Chukchi Sea EP, Shell will voluntarily submit to the BOEMRE a site-specific 4MP in support of its application for an IHA (Appendix C). Shell plans to be an active participant in future NMFS Open Water meetings and an active participant in the independent peer review of the monitoring plan and reports generated for future activities. The 4MP is located in Appendix D. Since issuance of Stipulation No. 4, Wainwright whaling crews have conducted fall whaling, with the first harvest of a fall bowhead in more than 90 years occurring in October 2010. Wainwright residents have expressed their intent to conduct fall whaling in the future when it is possible to do so. Shell's POC, 4MP, and other mitigation measures are designed to address this change in area subsistence activities.

Shell intends to use contractors based in the North Slope Borough (NSB) and Northwest Arctic Borough (NWAB) that will in turn provide job opportunities to local residents, including recruitment and training of SAs and MMOs. Summaries of key components of the program are presented below.

Marine Mammal Observers

Vessel-based monitoring for marine mammals will be done throughout the period of exploration drilling operations to comply with expected provisions in the IHA and LOA that Shell receives. Those provisions will be implemented during the exploration drilling program by a team of trained MMOs. The presence of MMOs onboard drilling and support vessels will be a core component of compliance with the 4MP. The MMOs will be responsible for collecting basic data on observations of marine mammals and for implementing mitigation measures including vessel avoidance measures and factored into decisions concerning operational shutdown. The observations made by MMOs serve as the primary basis for estimation of impacts to marine mammals. Because their ranks include representatives of the Alaska Native community, the MMOs also serve as an important means of providing local hire and local oversight of the monitoring program. MMOs will be stationed on the drillship, ice management vessel, anchor handler and other drilling support vessels engaged in transit to and between drill sites, exploration drilling, and other operational and intermittent activities to monitor for marine mammals.

Aerial Survey Program

With agreement from hunters in the coastal villages, aerial surveys of coastal areas to approximately 23 mi (37 km) offshore between Point Hope and Point Barrow will begin in early- to mid- July and will continue until exploration drilling operations in the Chukchi Sea are concluded. The objectives of the aerial survey are to collect data on the distribution and abundance of marine mammals in coastal areas of the eastern Chukchi Sea; and to collect and report data on the distribution, numbers, orientation and behavior of marine mammals, particularly beluga whales, near traditional hunting areas in the eastern Chukchi Sea.

Acoustic Recorders

A combination of acoustic recorder technologies will be employed to document the distribution of marine mammals; the distribution of marine mammals in relation to activities; to add clarity to the characterization of exploration drilling sound levels, character, and propagation; and to document presence of marine mammals in subsistence hunting areas. This will be accomplished by deploying several acoustic recorder buoys in a wide area surrounding the planned locations. Acoustic monitoring instruments have been deployed in the Chukchi Sea in past years in late July. With drilling scheduled to commence in early July, the deployment date would be pushed forward to occur after ice out and before exploration drilling. This is expected to be in late June / early July. Over-wintering sonobuoys have also been located in the proposed exploration drilling area since 2007. In that early drilling related activities would be initiated upon arrival and while the arrays are being deployed, these over-wintered recorders would capture the sound associated with early activities.

Sound Modeling

Sound modeling will be conducted during the exploration drilling program in the Chukchi Sea.

Sound Source Verification

Field measurement sound propagation profiles of vessels and the drillship will be conducted during different operational modes, so as to determine those activities that produce the greatest opportunities for mitigation. Initial sound source verification of the drillship and support vessels will be conducted within five days of arrival at the prospect. Shell will maintain acoustic recorders in the area of exploration drilling activities for the duration of the exploration drilling program.

Additional Studies

Shell plans to participate in additional studies of marine resources in the Chukchi Sea in an effort to gain an understanding of baseline conditions and the distribution of critical resources, to gain an understanding of interactions between industry activities and marine resources, and to contribute to the understanding of resource status and conservation/management needs. The list of potential studies and monitoring projects includes:

- Baseline studies of the air quality, oceanography, sediment chemistry, benthic and planktonic communities, fish, marine birds, and marine mammals in the Burger Prospect area
- Marine mammal distribution and response to industry activities in the northeastern Chukchi Sea
- Participation in, and funding of, walrus and ringed seal tagging studies
- Collection of subsistence use of coastal and offshore waters through a system of Subsistence Advisors
- Drilling waste discharge and benthic community monitoring

With the exception of the discharge monitoring, Shell has been participating in these studies since 2006. Reports summarizing the methods and findings of the studies are listed in Sections 5.0(a), (b), and (c). Discharge monitoring studies Shell expects to conduct are described in Section 10.0.

Stipulation No. 5 - Lease Sale 193 Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities

Exploration and development and production operations shall be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities. This stipulation applies to exploration, development, and production operations on a lease within the blocks identified below during periods of subsistence use related to bowhead whales, beluga whales, ice seals, walrus, and polar bears. The stipulation also applies to support activities, such as vessel and aircraft traffic, that

traverse the blocks listed below or Federal waters landward of the sale during periods of subsistence use regardless of lease location. Transit for human safety emergency situations shall not require adherence to this stipulation.

This stipulation applies to the following blocks:

NR02-06, Chukchi Sea

6624, 6625, 6674, 6675, 6723-6725, 6773-6775, 6822, 6823, 6872

NR03-02, Posey

6872, 6873, 6918-6923, 6967-6973, 7016-7023, 7063-7073, 7112-7123

NR03-03, Colbert

6674, 6723, 6724, 6771-6774, 6820-6824, 6869-6874, 6918-6924, 6966-6974, 7015-7024, 7064-7074, 7113-7124

NR03-04, Solivik Island

6011-6023, 6060-6073, 6109-6122, 6157-6171, 6206-6219, 6255-6268, 6305-6317, 6354-6365, 6403-6414, 6453-6462, 6502-6511, 6552-6560, 6601-6609, 6651-6658, 6701-6707, 6751-6756, 6801-6805, 6851-6854, 6901-6903, 6951, 6952, 7001

NR03-05, Point Lay West

6014-6024, 6062-6073, 6111-6122, 6160-6171, 6209-6221, 6258-6269, 6307-6317, 6356-6365, 6406-6414, 6455-6462, 6503-6510, 6552-6558, 6602-6606, 6652-6655, 6702, 6703

NR04-01, Hanna Shoal

6223, 6267-6273, 6315-6323, 6363-6373, 6411-6423, 6459-6473, 6507-6523, 6556-6573, 6605-6623, 6654-6671, 6703-6721, 6752-6771, 6801-6819, 6851-6868, 6901-6916, 6951-6964, 7001-7010, 7051-7059, 7101-7107

NR04-02, Barrow

6003-6022, 6052-6068, 6102-6118, 6151-6164, 6201-6214, 6251-6262, 6301-6312, 6351-6359, 6401-6409, 6451-6456, 6501-6506, 6551, 6552, 6601, 6602

NR04-03, Wainwright

6002-6006, 6052, 6053

NS04-08, (Unnamed)

6816-6822, 6861-6872, 6910-6922, 6958-6972, 7007-7022, 7055-7072, 7104-7122

Prior to submitting an exploration plan or development and production plan (including associated oil-spill response plans) to the MMS for activities proposed during subsistence-use critical times and locations described below for bowhead whale and other marine mammals, the lessee shall consult with the North Slope Borough, and with directly affected subsistence communities (Barrow, Point Lay, Point Hope, or Wainwright) and co-management organizations to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures that could be implemented by the operator to prevent unreasonable conflicts. Organizations currently recognized by the NMFS and the USFWS for the co-management of the marine mammals resources are the Alaska Eskimo Whaling Commission, the Alaska Beluga Whale Committee, the Alaska Eskimo Walrus Commission, the Ice Seal Commission, and the Nanuuq Commission. Through this consultation, the

lessee shall make every reasonable effort, including such mechanisms as a conflict avoidance agreement, to assure that exploration, development, and production activities are compatible with whaling and other marine mammal subsistence hunting activities and will not result in unreasonable interference with subsistence harvests.

A discussion of resolutions reached during this consultation process and plans for continued consultation shall be included in the exploration plan or the development and production plan. In particular, the lessee shall show in the plan how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The lessee shall also include a discussion of multiple or simultaneous operations, such as ice management and seismic activities, that can be expected to occur during operations in order to more accurately assess the potential for any cumulative effects. Communities, individuals, and other entities who were involved in the consultation shall be identified in the plan. The RS/FO shall send a copy of the exploration plan or development and production plan (including associated oil-spill response plans) to the directly affected communities and the appropriate co-management organizations at the time the plans are submitted to the MMS to allow concurrent review and comment as part of the plan approval process. In the event no agreement is reached between the parties, the lessee, NMFS, USFWS, the appropriate co-management organizations, and any communities that could be directly affected by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the parties to specifically address the conflict and attempt to resolve the issues. The RS/FO will invite appropriate parties to a meeting if the RS/FO determines such a meeting is warranted and relevant before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests. The lessee shall notify the RS/FO of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns. Activities on a lease may be restricted if the RS/FO determines it is necessary to prevent unreasonable conflicts with local subsistence hunting activities. In enforcing this stipulation, the RS/FO will work with other agencies and the public to assure that potential conflicts are identified and efforts are taken to avoid these conflicts. Subsistence-harvesting activities occur generally in the areas and time periods listed below.

Subsistence Whaling and Marine Mammal Hunting Activities by Community

Barrow: Spring bowhead whaling occurs from April to June; Barrow hunters hunt from Ice leads from Point Barrow southwestward along the Chukchi Sea coast to the Skull Cliff area; fall whaling occurs from August to October in an area extending from approximately 10 miles west of Barrow to the east side of Dease Inlet. Beluga whaling occurs from April to June in the spring leads between Point Barrow and Skull Cliff; later in the season, belugas are hunted in open water around the barrier islands off Elson Lagoon. Walrus are harvested from June to September from west of Barrow southwestward to Peard Bay. Polar bear are hunted from October to June generally in the same vicinity used to hunt walruses. Seal hunting occurs mostly in winter, but some open-water sealing is done from the Chukchi coastline east as far as Dease Inlet and Admiralty Bay in the Beaufort Sea.

Wainwright: Bowhead whaling occurs from April to June in the spring leads offshore of Wainwright, with whaling camps sometimes as far as 10 to 15 miles from shore. Wainwright hunters hunt beluga whales in the spring lead system from April to June but only if no bowheads are in the area. Later in the summer, from July to August, belugas can be hunted along the coastal lagoon systems. Walrus hunting occurs from July to August at the southern edge of the retreating pack ice. From August to September, walruses can be hunted at local haulouts with the focal area from Milliktagvik north to Point Franklin. Polar bear hunting occurs primarily in the fall and winter around Icy Cape, at the headland from Point Belcher to Point Franklin, and at Seahorse Island.

Point Lay: *Because Point Lay's location renders it unsuitable for bowhead whaling, beluga whaling is the primary whaling pursuit. Beluga whales are harvested from the middle of June to the middle of July. The hunt is concentrated in Naokak and Kukpowruk Passes south of Point Lay where hunters use boats to herd the whales into the shallow waters of Kasegaluk Lagoon where they are hunted. If the July hunt is unsuccessful, hunters can travel as far north as Utukok Pass and as far south as Cape Beaufort in search of whales. When ice conditions are favorable, Point Lay residents hunt walrus from June to August along the entire length of Kasegaluk Lagoon, south of Icy Cape, and as far as 20 miles offshore. Polar bears are hunted from September to April along the coast, rarely more than 2 miles offshore.*

Point Hope: *Bowhead whales are hunted from March to June from whaling camps along the ice edge south and southeast of the point. The pack-ice lead is rarely more than 6 to 7 miles offshore. Beluga whales are harvested from March to June in the same area used for the bowhead whale hunt. Beluga whales can also be hunted in the open water later in the summer from July to August near the southern shore of Point Hope close to the beaches, as well as areas north of the point as far as Cape Dyer. Walrus are harvested from May to July along the southern shore of the point from Point Hope to Akoviknak Lagoon. Point Hope residents hunt polar bears primarily from January to April and occasionally from October to January in the area south of the point and as far out as 10 miles from shore*

Shell Proposed Actions:

Shell has actively engaged the NSB, NWAB, and the subsistence communities of Kaktovik, Nuiqsut, Barrow, Wainwright, Point Lay, Point Hope, Kivalina, Kotzebue, Shishmaref, Kiana, Savoonga, and Gambell, and co-management organizations, including the Alaska Eskimo Whaling Commission (AWEC), Alaska Beluga Whale Committee, the Alaska Eskimo Walrus Commission, the Ice Seal Commission, and the Alaska Nanuq Commission, to discuss potential conflicts between planned oil and gas activities and subsistence use activities. Shell's EP lease blocks do not lie within the stipulation area, but support activities associated with the exploration drilling program will transit the stipulation area.

Plan of Cooperation

Shell began consulting with potentially affected subsistence communities, stakeholders and federal, state, and local agencies in 2006 and prepared a POC for its Chukchi Sea open water activities (3D seismic activities and vessel transit) in November 2007. Shell continued with these consultations through 2011. Shell will continue to engage with subsistence stakeholders to build on its past efforts to inform and engage the communities that could be potentially affected by exploration drilling activities in the Chukchi Sea. It is also noted that a POC is required for an IHA from the NMFS and USFWS. Since issuance of Stipulation No. 4, Wainwright whaling crews have conducted fall whaling, with the first harvest of a fall bowhead in more than 90 years occurring in October 2010. Wainwright residents have expressed their intent to conduct fall whaling in the future when it is possible to do so. Shell's POC, 4MP, and other mitigation measures are designed to address this change in area subsistence activities.

Shell met with public and community leaders beginning in January-April 2009 specifically to discuss the planned 2010 exploration drilling program in the Chukchi Sea as detailed in the initial Chukchi Sea EP, and to hear their concerns. Shell prepared a written POC based on that effort, which described when and where the meetings were held, what was presented by Shell, the comments received, and Shell's responses to these comments. The POC also identified mitigation measures that Shell prepared in response to these concerns. A copy of the POC was attached as an appendix to the initial Chukchi Sea EP, and was forwarded to NMFS as part of the IHA requirements. Shell's consultation efforts have

continued since that time, and in February-April of 2011, Shell held a series of meetings specifically to discuss the exploration drilling activities outline in the revised Chukchi Sea EP. The dates and locations of the meetings held in 2009, 2010, and 2011 as part of consultation effort associated with exploration drilling in the Chukchi, along with the persons Shell met with, are listed below in Table 11.0-1. Shell has prepared an addendum to the POC submitted with the 2010 Chukchi Sea EP, which provides information on the meetings held specifically to address the revised Chukchi Sea EP. The POC addendum is attached in Appendix H of this document.

Table 11.0-1 Dates and Locations of Meetings Held Regarding Shell's Chukchi Sea Exploration Drilling Program for the Development of the POC

2009	Meeting Location	Meeting Attendees – Position
12-13 January	Barrow	Harry Brower – Whaling Captain, AEWG Chairman and Assistant Director of the NSB Wildlife Department Edward Itta – Whaling Captain and Mayor of the NSB Eugene Brower – Whaling Captain, ASRC Board Member and President of the NSB Assembly Anthony Edwardsen – Whaling Captain and President of UIC Andy Mack – NSB Assistant to the Mayor Harold Curran – NSB Chief Administrative Officer Robert Suydam – NSB Wildlife Department Biologist Cheryl Rosa – NSB Wildlife Department Research Biologist Craig George – NSB Wildlife Department Biologist
21 January	Point Hope	Steve Oommittuk - Mayor of Point Hope
21 January	Barrow	Charlie Hopson – Whaling Captain, LCMF employee, and AEWG alternate commissioner in Barrow Adeline Hopson – NSB Assembly Member Deano Oleuman – NSB Assembly Member
21 January	Barrow	Ray Koonuk – AEWG Commissioner and Point Hope Whaling Captain
21 January	Barrow	George Edwardson – ICAS President Juanita Smith – ICAS Natural Resource Director
21 January	Point Hope	Rex Rock Sr. – NSB Assembly Member and Tikigaq Corporation President
27 January	Kotzebue	Jackie Hill – Maniilaq Association Representative
27 January	Kotzebue	Martha Whiting – Mayor of the NWAB
27 January	Kotzebue	NWAB Assembly Meeting
27 January	Kotzebue	Chuck Greene, EJ Doll Garoutte, Walter Sampson, Gladys Pungowiyi - NANA Representatives
2 February	Barrow	NSB Assembly Workshop
2 February	Barrow	Plan of Cooperation Public Meeting
3 February	Barrow	Janice Meadows – AEWG Executive Director
3 February	Barrow	Vera Williams – Native Village of Barrow Realty Director Joseph Sage – Native Village of Barrow Wildlife Director
4-5 March	Anchorage	AEWG 2009 CAA Negotiations
24 March	Point Hope	Plan of Cooperation Public Meeting
25 March	Kotzebue	Plan of Cooperation Public Meeting
25 March	Kotzebue	NSB/NWAB Joint Planning Commission Meeting
26 March	Wainwright	Plan of Cooperation Public Meeting
2 April	Barrow	ICAS Monthly Meeting
20 April	Barrow	Native Village of Barrow Meeting
22 April	Point Lay	Plan of Cooperation Public Meeting
23 April	Kivalina	Community Meeting

Table 11.0-1 Dates and Locations of Meetings Held Regarding Shell's Chukchi Sea Exploration Drilling Program for the Development of the POC

2010	Meeting Location	Meeting Attendees – Position
14 January	Barrow	ICAS Monthly Meeting
15 January	Anchorage	Eugene Brower – Barrow Whaling Captains Association President
22 January	Anchorage	George Oleuman – Deputy Mayor Eugene Brower – NSB Assembly President Taquilik Hepa – NSB Wildlife Director Bessie O'Rouke – NSB Law Department Marvin Olson – NSB Director Public Works Dan Forster – NSB Planning Director
24 February	Barrow	Plan of Cooperation Public Meeting
25 February	Point Hope	Plan of Cooperation Public Meeting
26 February	Barrow	Edward Itta – Mayor of the NSB
1 March	Wainwright	Plan of Cooperation Public Meeting
2 March	Kotzebue	Community Meeting
5 March	Point Hope	Plan of Cooperation Public Meeting
1 April	Point Lay	Plan of Cooperation Public Meeting
8 April	Barrow	Martha Whiting – Mayor of the NWAB Walter Sampson – NWAB Assembly President
30 April	Barrow	Edward Itta – Mayor of the NSB
1 June	Barrow	NSB Assembly Meeting
1 June	Point Lay	Point Lay Community Meeting
2 June	Barrow	Barrow Community Meeting
8 June	Barrow	Utqiagvik Agviqsuqtit Aganangich Meeting
8 June	Barrow	Barrow Whaling Captains Association Meeting
24 June	Barrow	NWAB/NSB Joint Planning Commission Meeting
19 July	Barrow	Edward Itta – Mayor of the NSB
30 July	Kotzebue	NWAB Assembly Meeting
3 August	Barrow	NSB Assembly Meeting
7 September	Barrow	NSB Assembly Meeting
24 September	Barrow	Plan of Cooperation Public Meeting
8 November	Anchorage	Alaska Beluga Whale Committee Meeting
6 December	Anchorage	Alaska Beluga Whale Committee Members Ice Seal Committee Members Alaska Nanuq Commission Members Eskimo Walrus Commission Members
2011	Meeting Location	Meeting Attendees – Position
27 January	Barrow	Barrow Whaling Captains Association Meeting
27 February – 2 March	Dutch Harbor	Edith Vorderstrasse – UIC UMIAQ General Manager Ray Koonuk, Sr. – Whaling Captain Christopher Oktollik – Whaling Captain John Long, Jr. – Native Village of Point Hope Council Member Joseph Frankson – Whaling Captain Franklin Sage – Native Village of Point Hope Council Member Caroline Cannon – Native Village of Point Hope President Luke Koonook, Sr. – Elder and Whaling Captain Alzred Oomittuk – City of Point Hope Council Member Bessie Kowunna – Shell Point Hope Community Liaison, Tikigaq Board Member, and City Council Member Theodore Frankson – Native Village of Point Hope Staff Aaron Oktollik – AEWK Commissioner for Point Hope and Whaling Captain Carl Brower – Whaling Captain Dora Leavitt – City of Nuiqsut Council Member Thomas Napageak – City of Nuiqsut Mayor and Whaling Captain Edgar Kagak – Wainwright Health Board Oliver Peetook – City of Wainwright Vice Mayor Sandra Peetook – City of Wainwright Council Member

Table 11.0-1 Dates and Locations of Meetings Held Regarding Shell's Chukchi Sea Exploration Drilling Program for the Development of the POC

		Joseph Kaleak – AEWK Commissioner for Kaktovik and Whaling Captain George Tagarook – NSB Fire Department Fire Chief and Whaling Captain
28 February – 3 March	Dutch Harbor	William Tracey, Sr. – NSB Planning Commissioner and Point Lay Fire Chief Marie Tracey – NSB Village Liaison Emma Ahvakana – NWAB Assembly Member Enoch Mitchell – Noatak IRA President Ronald Moto, Sr. – Nana Board Member and City of Deering Mayor Cole Schaeffer – Kikiktagruk Inupiat Corporation President & CEO Nellie Wesley – NWAB Planning Commission EPA Assistant Anthony Edwardsen – UIC President/CEO Troy Izat – Tikigaq Corporation COO Susan Harvey – Harvey Consulting, LLC and Consultant to the NSB Thomas Nageak – Barrow Whaling Captain and NSB Cultural Resource Specialist Roy Nageak Jr. – Native Village of Barrow Natural Resource Technician Michael Shults – Barrow City Council Mary Sage – NSBSD School Board Member, Iisagvik College Board Member, and Native Village of Barrow Council Member Robert Suydam – NSB Wildlife Biologist Qaiyaan Opie – ICAS Environmental Director Lloyd Leavitt – City of Barrow Council Member Robert Nageak – City of Barrow Council Member Johnny Aiken – AEWK Executive Director Harry Brower, Jr. – AEWK Chairman
7-8 March	Anchorage	Arctic Open Water Meeting
21 March	Barrow	Plan of Cooperation Public Meeting
23 March	Wainwright	Plan of Cooperation Public Meeting
23 March	Wainwright	Rossmann Peetok – AEWK Commissioner for Wainwright Jason Ahmaogak – Wainwright Whaling Captain
25 March	Point Lay	Plan of Cooperation Public Meeting
28 March	Point Hope	Plan of Cooperation Public Meeting
29 March	Kiana	Community Meeting
30 March	Kotzebue	Community Meeting
31 March	Kivalina	Community Meeting
2 April	Nome	Vera Metcalf – Eskimo Walrus Commission Charlie Johnson – Alaska Nanuuq Commission
5 April	Barrow	NSB Assembly Meeting
7 April	Kotzebue/ Anchorage (Teleconference)	Willie Goodwin – Alaska Beluga Whale Committee
8 April	Anchorage	John Goodwin – Ice Seal Committee
15 April	Anchorage	Vera Metcalf – Eskimo Walrus Commission
25 April	Savoonga	Community Meeting
26 April	Shishmaref	Community Meeting
27 April	Gambell	Community Meeting

¹ AEWK = Alaska Eskimo Whaling Commission, ASRC = Arctic Slope Regional Corporation ICAS = Inupiat Community of the Arctic Slope, LCMF = LCMF Incorporated. A subsidiary of Ukpeagvik Inupiat Corporation, NSB = North Slope Borough, NWAB = Northwest Arctic Borough, UIC = Ukpeagvik Inupiat Corporation

Marine Mammal Co-Management Groups

Shell facilitated quarterly meetings with the co-management groups including the AEWK, Alaska Beluga Whale Committee, the Alaska Eskimo Walrus Commission, the Ice Seal Commission, and the Alaska Nanuuq Commission beginning in June 2006, and continues to meet with these groups. Shell met with representatives of these co-management groups again in 2011 to discuss the revised exploration drilling program as indicated above in Table 11.0-1 to inform them of our planned activities and discuss potential

conflicts that could arise with regards to the siting, timing, and method of the planned operations as well as mitigation measures designed to avoid or minimize any such effects. Shell also attends the Open Water Meetings held annually, which include the co-management groups AEWC, NMFS, BOEMRE, USFWS, and other industry participants. Shell attended the Open Water Meeting for 2011 in Anchorage on 7-8 March 2011, at which time details regarding the exploration drilling program described in the revised Chukchi Sea EP were discussed.

Stipulation No. 6 - Pre-Booming Requirements for Fuel Transfers

Fuel transfers (excluding gasoline transfers) of 100 barrels or more will require pre-booming of the fuel barge(s). The fuel barge must be surrounded by an oil-spill-containment boom during the entire transfer operation to help reduce any adverse effects from a fuel spill. The lessee's oil-spill-response plans must include procedures for the pre-transfer booming of the fuel barge(s).

Shell Proposed Action:

A copy of Shell's Fuel Transfer Plan (Alaska Fuel Operating Condition and Standard) is provided in Appendix M. On 7 December 2009, BOEMRE approved the booming configuration presented in the Fuel Transfer Plan submitted with the approved initial Chukchi Sea EP, which is the same as is presented in the attached Fuel Transfer Plan in Appendix M of this revised Chukchi Sea EP. Additional details for fuel transfers are provided in Appendix D of the Chukchi Sea Regional ODPCP. Under Shell's procedures all vessel-to-vessel, and dock-to-vessel transfers of fuel will be pre-boomed during the planned exploration drilling program covered by this revised Chukchi Sea EP.

Stipulation No. 7 - Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider

This stipulation will minimize the likelihood that spectacled and Steller's eiders will strike drilling structures or vessels. The stipulation also provides additional protection to eiders within the blocks listed below and Federal waters landward of the sale area, including the Ledyard Bay Critical Habitat Area, during times when eiders are present.

(A) General conditions: *The following conditions apply to all exploration activities.*

(1) An EP must include a plan for recording and reporting bird strikes. All bird collisions (with vessels, aircraft, or drilling structures) shall be documented and reported within 3 days to MMS. Minimum information will include species, date/time, location, weather, identification of the vessel, and aircraft or drilling structure involved and its operational status when the strike occurred. Bird photographs are not required, but would be helpful in verifying species. Lessees are advised that the USFWS does not recommend recovery or transport of dead or injured birds due to avian influenza concerns.

(2) The following conditions apply to operations conducted in support of exploratory and delineation drilling.

(a) Surface vessels (e.g., boats, barges) associated with exploration and delineation drilling operations should avoid operating within or traversing the listed blocks or Federal waters between the listed blocks and the coastline between April 15 and June 10, to the maximum extent practicable. If surface vessels must traverse this area during this period, the surface vessel operator will have ready access to wildlife hazing equipment

(including at least three Breco buoys or similar devices) and personnel trained in its use; hazing equipment may located onboard the vessel or on a nearby oil spill response vessel, or in Point Lay or Wainwright. Lessees are required to provide information regarding their operations within the area upon request of MMS. The MMS may request information regarding number of vessels and their dates of operation within the area.

(b) Except for emergencies or human/navigation safety, surface vessels associated with exploration and delineation drilling operations will avoid travel within the Ledyard Bay Critical Habitat Area between July 1 and November 15. Vessel travel within the Ledyard Bay Critical Habitat Area for emergencies or human/navigation safety shall be reported within 24 hours to MMS.

(c) Aircraft supporting drilling operations will avoid operating below 1,500 feet above sea level over the listed blocks or Federal waters between the listed blocks and the coastline between April 15 and June 10, or the Ledyard Bay Critical Habitat Area between July 1 and November 15, to the maximum extent practicable. If weather prevents attaining this altitude, aircraft will use pre-designated flight routes. Predesignated flight routes will be established by the lessee and MMS, in collaboration with the USFWS, during review of the EP. Route or altitude deviations for emergencies or human safety shall be reported within 24 hours to MMS.

(B) Lighting Protocols. *The following lighting requirements apply to activities conducted between April 15 and November 15 of each year.*

(1) Drilling Structures: *Lessees must adhere to lighting requirements for all exploration or delineation drilling structures so as to minimize the likelihood that migrating marine and coastal birds will strike these structures. Lessees are required to implement lighting requirements aimed at minimizing the radiation of light outward from exploration or delineation drilling structures to minimize the likelihood that birds will strike those structures. These requirements establish a coordinated process for a performance-based objective rather than pre-determined prescriptive requirements. The performance-based objective is to minimize the radiation of light outward from exploration/delineation structures while operating on a lease or if staged within nearshore Federal waters pending lease deployment.*

Measures to be considered include but need not be limited to the following:

- *Shading and/or light fixture placement to direct light inward and downward to living and work structures while minimizing light radiating upward and outward;*
- *Types of lights;*
- *Adjustment of the number and intensity of lights as needed during specific activities;*
- *Dark paint colors for selected surfaces;*
- *Low-reflecting finishes or coverings for selected surfaces; and*
- *Facility or equipment configuration.*

Lessees are encouraged to consider other technical, operational, and management approaches that could be applied to their specific facilities and operations to reduce outward light radiation. Lessees must provide MMS with a written statement of measures that will be or have been taken to meet the lighting objective, and must submit this information with an EP when it is submitted for regulatory review and approval pursuant to 30 CFR 250.203.

(2) Support Vessels: *Surface support vessels will minimize the use of high-intensity work lights, especially when traversing the listed blocks and federal waters between the listed blocks and the coastline. Exterior lights will be used only as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather (such as rain or fog), otherwise they will be turned off. Interior lights and lights used during navigation could remain on for safety.*

For the purpose of this stipulation, the listed blocks are as follows:

NR02-06, Chukchi Sea

6624, 6625, 6674, 6675, 6723-6725, 6773-6775, 6822, 6823, 6872

NR03-02, Posey

6872, 6873, 6918-6923, 6967-6973, 7016-7023, 7063-7073, 7112-7123

NR03-03, Colbert

6674, 6723, 6724, 6771-6774, 6820-6824, 6869-6874, 6918-6924, 6966-6974, 7015-7024, 7064-7074, 7113-7124

NR03-04, Solivik Island

6011-6023, 6060-6073, 6109-6122, 6157-6171, 6206-6219, 6255-6268, 6305-6317, 6354-6365, 6403-6414, 6453-6462, 6502-6511, 6552-6560, 6601-6609, 6651-6658, 6701-6707, 6751-6756, 6801-6805, 6851-6854, 6901-6903, 6951, 6952, 7001

NR03-05, Point Lay West

6014-6024, 6062-6073, 6111-6122, 6160-6171, 6209-6221, 6258-6269, 6307-6317, 6356-6365, 6406-6414, 6455-6462, 6503-6510, 6552-6558, 6602-6606, 6652-6655, 6702, 6703

NR04-01, Hanna Shoal

6223, 6267-6273, 6315-6323, 6363-6373, 6411-6423, 6459-6473, 6507-6523, 6556-6573, 6605-6623, 6654-6671, 6703-6721, 6752-6771, 6801-6819, 6851-6868, 6901-6916, 6951-6964, 7001-7010, 7051-7059, 7101-7107

NR04-02, Barrow

6003-6022, 6052-6068, 6102-6118, 6151-6164, 6201-6214, 6251-6262, 6301-6312, 6351-6359, 6401-6409, 6451-6456, 6501-6506, 6551, 6552, 6601, 6602

NR04-03, Wainwright

6002-6006, 6052, 6053

NS04-08, (Unnamed)

6816-6822, 6861-6872, 6910-6922, 6958-6972, 7007-7022, 7055-7072, 7104-7122

Nothing in this stipulation is intended to reduce personnel safety or prevent compliance with other regulatory requirements (e.g., U.S. Coast Guard (USCG) or Occupational Safety and Health Administration) for marking or lighting of equipment and work areas.

Shell Proposed Actions:

Stipulation No.7 has 4 parts. Part A(1) mandates that EP's for exploration drilling anywhere in the Chukchi include a plan for recording and reporting bird strikes, and therefore applies to Shell. Parts A(2)

and B(2) place restrictions and lighting requirements on vessel and aircraft operations in certain listed blocks, in federal waters shoreward of those blocks, and in the Ledyard Bay Critical Habitat Unit (LBCHU), during specific dates, and these restrictions would apply to any activities associated with Shell's EP that would take place in these areas during these dates. Part B(1) places lighting requirements on drilling structures and applies to the use of drilling structures anywhere in the Chukchi Sea, and therefore applies to Shell's EP. Part B(2) also places restrictions on the use of lights on support vessels in the listed blocks and federal waters shoreward of these blocks, and these restrictions would apply to any vessel traffic associated with Shell's EP that would occur in these specific areas.

Shell has developed a Bird Strike Avoidance and Lighting Plan (Appendix I) that covers the planned exploration drilling program in the revised Chukchi Sea EP. In development of the plan, Shell considered all the measures identified for consideration in the stipulation, and selected the most proven and practical measures to minimize the likelihood that marine birds will strike the drillship or support vessels. Shell's plan includes:

- Bird strike monitoring will include recording and reporting bird strikes for the collection of information on bird strikes and lighting configuration. This information can be used to better understand methods to reduce bird strikes.
- Avian monitoring including visual observations and radar assessments to determine bird use of the prospect areas during the drilling season.
- Installing shading and directing some drillship lights inward and downward to living and work structures to minimize the amount of light radiating from the drillship.
- Lighting modifications including replacing some lights on the drillship with ClearSky light technology where applicable to reduce the amount of red light output.
- Minimizing the use of high-intensity work lights on support vessels.
- Restricting aircraft and vessel traffic such as restrictions on travel routes and flight altitudes, including: the avoidance of travel within the LBCHU between 1 July and 15 November by the drillship and all support vessels.

In addition, Shell plans to conduct both visual and radar assessments of the numbers and species of birds around the drill sites during the operations, and investigate the reactions of the birds to the vessels. This data should aid in the assessment of risk for future programs and provide some indication of the efficacy of the mitigation measures. The risk of Shell's exploration drilling program having an effect on marine birds, especially Steller's eiders and spectacled eiders, due to collisions, is minimal because exploration drilling would occur after the spring migration of most of these species, and more than 64 statute mi (103 km) offshore where the bird presence is relatively low.

SECTION 12.0 ENVIRONMENTAL MITIGATION MEASURE INFORMATION

a) Permits and Authorizations

The General Information section (Section 2.0) identifies the permits and authorizations required for the planned exploration drilling program. Shell will work within the mitigation measures written into these permits and authorizations, and therefore will be working within all regulatory requirements. In addition to the permits and authorizations, Shell has met with marine mammal co-management groups, including the AEWC, Whaling Captains Associations, NSB and NWAB community members, to discuss their concerns regarding marine mammal subsistence resources including the bowhead whale, beluga whale, walrus, ice seal, and polar bear.

b) Protected Species

Species that occur within the northeastern Chukchi Sea and are listed under the ESA as either threatened or endangered are listed below in Table 12.b-1. The Kittlitz's murrelet, yellow-billed loon, bearded seal, ringed seal, and Pacific walrus are included in the table only as candidate species. Populations of ringed seals and bearded seals found in the Chukchi Sea were proposed for listing under the ESA by NMFS on 10 December 2010 but have not been listed to date; no critical habitat has been proposed for these species.

Potential effects on these species due to activities associated with the planned exploration drilling program are analyzed in the EIA provided in Appendix F and with the proposed mitigation measures, are expected to be negligible to minor consisting of brief behavioral disturbances. The proposed mitigation measures, which have been designed to avoid or minimize any effects on these species, are described below in Section 12.0(c).

Table 12.b-1 Species Found in the Northeastern Chukchi Sea and ¹Protected Under the ESA

Common Name	Scientific Name	ESA Status	Extralimital (Yes/No)
spectacled eider	<i>Somateria fischeri</i>	threatened	No
Steller's eider	<i>Polysticta stelleri</i>	threatened	No
Kittlitz's murrelet	<i>Brachyramphus brevirostris</i>	candidate	No
yellow-billed loon	<i>Gavia adamsii</i>	candidate	No
bearded seal	<i>Erignathus barbatus</i>	candidate	No
ringed seal	<i>Phoca hispida</i>	candidate	No
Pacific walrus	<i>Odobenus rosmarus divergens</i>	candidate	No
polar bear	<i>Ursus maritimus</i>	threatened	No
bowhead whale	<i>Balaena mysticetus</i>	endangered	No
fin whale	<i>Balaenoptera physalus</i>	endangered	Yes
humpback whale	<i>Megaptera novaeangliae</i>	endangered	Yes

¹ Kittlitz's murrelet, yellow-billed loon, bearded seal, ringed seal, and Pacific walrus are included in table only as a candidate species, which receive no protection under the ESA.

No critical habitat has been designated for the fin whale or humpback whale. Critical habitat has been designated for the Steller's eider but none is located in the Chukchi Sea. Critical habitat has been designated for the spectacled eider, with the nearest critical habitat being located in Ledyard Bay more than 54 mi (87 km) from the Burger Prospect.

The USFWS issued a final rule on 7 December 2010 designating three types of critical habitat for the polar bear, sea ice habitat, barrier island habitat, and terrestrial denning habitat. The Burger Prospect is located within areas designated as sea ice critical habitat for polar bears. Potential effects on critical habitat due to

activities associated with the planned exploration drilling program are analyzed in the EIA provided in Appendix F. The planned exploration drilling program would have no effect on spectacled eider critical habitat, and negligible effect on polar bear critical habitat.

Table 12.b-2 Marine Mammals¹ Found in the Northeastern Chukchi Sea and Protected Under the MMPA

Common Name	Scientific Name	ESA Status	MMPA Status	Extralimital (Yes/No)
beluga whale ¹	<i>Delphinapterus leucas</i>	not listed	--	No
narwhal	<i>Monodon monoceros</i>	not listed	--	Yes
killer whale	<i>Orcinus orca</i>	not listed	--	No
harbor porpoise	<i>Phocoena phocoena</i>	not listed	--	No
bowhead whale	<i>Balaena mysticetus</i>	endangered	depleted	No
gray whale	<i>Eschrichtius robustus</i>	not listed	--	Yes
fin whale	<i>Balaenoptera physalus</i>	endangered	depleted	Yes
minke whale	<i>Balaenoptera acutorostrata</i>	not listed	--	Yes
humpback whale	<i>Megaptera novaeangliae</i>	endangered	depleted	Yes
bearded seal ²	<i>Erignathus barbatus</i>	candidate	--	No
spotted seal ¹	<i>Phoca largha</i>	not listed	--	No
ringed seal ²	<i>Phoca hispida</i>	candidate	--	No
ribbon seal	<i>Histiophoca fasciata</i>	not listed	--	No
Pacific walrus ³	<i>Odobenus rosmarus divergens</i>	candidate	--	No
polar bear	<i>Ursus maritimus</i>	threatened	--	No

¹ Populations of some species identified as not listed, such as beluga and spotted seal, are listed but are not found in the Chukchi Sea; populations of these species that are found in the Chukchi Sea are not listed.

² Bearded seal and ringed seal have been petitioned for listing under ESA, have undergone status reviews, and are currently proposed for listing – and are therefore considered candidate species by NMFS.

³ Pacific walrus has been petitioned for listing under ESA, has undergone status review, and listing was found to be warranted but precluded by higher priorities – and is therefore considered a candidate species by USFWS.

The planned exploration drilling program will likely involve the non-lethal incidental take of marine mammals. The projected incidental takes are provided in Section 10.0 of this document. Shell is applying to NMFS for an IHA for the incidental take of whales and seals, and to USFWS for an LOA for the non-lethal incidental take of polar bears and Pacific walrus and intentional take of polar bears. Copies of the IHA and LOA applications are provided in Appendix C and E respectively. The IHA application contains a 4MP, which is attached in Appendix D. The LOA application contains a bear and walrus avoidance and human encounter / interaction plan. Shell has also developed and will implement a Bird Strike Avoidance and Lighting Plan (Appendix I). All three of these documents describe mitigation measures that Shell will implement to minimize any effects on protected species. The authorizations may also contain added mitigation measures to help avoid or minimize incidental takes. A summary of mitigation measures that will be undertaken by Shell is provided below.

c) Mitigation Measures

The permits and authorizations table included in Section 2.0 lists the authorizations and necessary permits to conduct the planned exploration drilling program. Shell will adopt the mitigation measures written into these authorizations, and will therefore be working within regulatory requirements.

In addition to meeting all regulatory requirements, Shell is committed to other mitigation measures including those that will decrease any potential conflicts between exploration drilling activities and subsistence harvests. For the Chukchi Sea exploration drilling program, these mitigation measures include:

Communications

- Shell has developed a Communication Plan and will implement this plan before initiating exploration drilling operations to coordinate activities with local subsistence users, as well as Village Whaling Captains' Associations, to minimize the risk of interfering with subsistence hunting activities, and keep current as to the timing and status of the bowhead whale hunt and other subsistence hunts. The Communication Plan includes procedures for coordination with Com Centers to be located in coastal villages along the Chukchi and Beaufort Seas during Shell's proposed exploration drilling activities.
- Shell will employ local SAs from the Beaufort and Chukchi Sea villages that are potentially impacted by Shell's exploration drilling activities. The SAs will provide consultation and guidance regarding the whale migration and subsistence activities. There will be one per village, working approximately 8-hr per day and 40-hr per week during each drilling season. The subsistence advisor will use local knowledge (Traditional Knowledge) to gather data on subsistence lifestyle within the community and to advise in ways to minimize and mitigate potential negative impacts to subsistence resources during each drilling season. Responsibilities include reporting any subsistence concerns or conflicts; coordinating with subsistence users; reporting subsistence-related comments, concerns, and information; coordinating with the Com and Call Center personnel; and advising how to avoid subsistence conflicts. SAs will have a handbook that will specify work tasks in more detail.

Aircraft Travel

- Aircraft shall not operate below 1,500 ft (457 m) unless the aircraft is engaged in marine mammal monitoring, approaching, landing or taking off, in poor weather (fog or low ceilings), or in an emergency situation, while over land or sea to minimize disturbance to mammals and birds. Aircraft engaged in marine mammal monitoring shall not operate below 1,500 ft (457 m) in areas of active whaling; such areas to be identified through communications with the Com Centers.
- Aircraft will not operate within 0.5 mi (0.8 km) of walrus or polar bears when observed on land or ice.
- Shell will also implement non-MMO flight restrictions prohibiting aircraft from flying within 1,000 ft (300 m) of marine mammals or below 1,500 ft (457 m) altitude (except during takeoffs and landings or in emergency situations) while over land or sea. This flight will also help avoid disturbance of and collisions with birds.

Vessel Travel

- The *Discoverer* and support vessels will enter the Chukchi Sea through the Bering Strait on or after July 1, minimizing effects on marine mammals and birds that frequent open leads and minimizing effects on spring and early summer bowhead whale hunting.
- Drillship and support vessel transit routes will avoid known fragile ecosystems and the Ledyard Bay Critical Habitat Unit, and will include coordination through Com Centers.
- To minimize impacts on marine mammals and subsistence hunting activities, the drillship and support fleet will transit through the Chukchi Sea along a route that lies offshore of the polynya zone. In the event the transit outside of the polynya zone results in Shell having to break ice (as opposed to managing ice by pushing it out of the way), the drillship and support vessels will enter into the polynya zone far enough so that ice breaking is not necessary. If it is necessary to move into the polynya zone, Shell will notify the local communities of the change in the transit route through the Com Centers. As soon as the fleet transits past the ice, it will exit the polynya zone and continue a path in the open sea toward the drill sites.

- MMOs will be aboard the *Discoverer* and all support vessels (see the 4MP in Appendix D of the revised Chukchi Sea EP).
- Vessels will not operate within 0.5 mi (0.8 km) of walrus or polar bears when observed on land or ice.
- When within 900 ft (274 m) of marine mammals, vessels will reduce speed, avoid separating members from a group and avoid multiple changes of direction.
- Vessel speed is to be reduced during inclement weather conditions in order to avoid collisions with marine mammals.
- Shell will communicate and coordinate with the Com Centers regarding all vessel transit.
- Lighting on the drillship will be shaded and some have been replaced with ClearSky lighting. ClearSky lighting is designed to minimize the disorientation and attraction of birds to the lighted drillship to reduce the possibility of a bird collision (see the Bird Strike Avoidance and Lighting Plan in Appendix I of the revised Chukchi Sea EP).

Exploration Drilling Operations

- Drilling mud will be cooled to mitigate any potential permafrost thawing or thermal dissociation of any methane hydrates encountered during exploration drilling, if such materials are present at the drill site.
- Drilling muds will be recycled to the extent practicable based on operational considerations (e.g., whether mud properties have deteriorated to the point where they cannot be used further) so that the volume of the spent mud is reduced.
- Critical operations will not be started if potential hazards (ice floe, inclement weather, etc.) are in the vicinity and there is not sufficient time to finish the critical operation before the arrival of the hazard at the drill site (see COCP in Appendix J of the revised Chukchi Sea EP).
- All casing and cementing programs will be certified by a registered professional engineer.
- Airgun arrays will be ramped up slowly during ZVSPs to warn cetaceans and pinnipeds in the vicinity of the airguns and provide time for them to leave the area and avoid potential injury or impairment of their hearing abilities. Ramp ups from a cold start when no airguns have been firing will begin by firing a single airgun in the array. A ramp up to the required airgun array volume will not begin until there has been a minimum of 30 min of observation of the safety zone by MMOs to assure that no marine mammals are present. The safety zone is the extent of the 180 dB radius for cetaceans and 190 dB for pinnipeds. The entire safety zone must be visible during the 30-min lead-in to an array ramp up. If a marine mammal(s) is sighted within the safety zone during the 30-min watch prior to ramp up, ramp up will be delayed until the marine mammal(s) is sighted outside of the safety zone or the animal(s) is not sighted for at least 15-30 min: 15 min for small odontocetes and pinnipeds, or 30 min for baleen whales and large odontocetes.
- The blowout prevention program will be enhanced through the use of two sets of blind/shear rams, increased frequency of BOP performance tests from 14 to 7 days, a remotely operated vehicle (ROV) control panel on the seafloor with sufficient pressured water-based fluid to operate the BOP, a containment system that includes capping stack equipment, treatment and flaring capabilities, a fully-designed relief well drilling plan, and provisions for a second relief well drilling vessel (*Kulluk*) to be available to drill the relief well if the primary drilling vessel is disabled and not capable of drilling its own relief well.

Ice Management

- Ice management will involve preferentially redirecting, rather than breaking, ice floes while the floes are well away from the drill site (see the Ice Management Plan in Appendix K of the revised Chukchi Sea EP).
- Real time ice and weather forecasting will be from the Shell Ice and Weather Advisory Center (SIWAC).

Oil Spill Response

- The primary OSR vessel will be on standby at all times when drilling into zones containing oil to ensure that oil spill response capability is available within one hour, if needed.
- Shell will deploy an OSR fleet that is capable of collecting oil on the water up to the WCD planning scenario which is greater than the calculated WCD flowrate of a blowout in the unlikely event that one should occur. The primary OSR vessel will be on standby when drilling into zones containing oil to ensure that oil spill response capability is available within one hour, if needed. The remainder of the OSR fleet will be fully engaged within 72 hours.
- In addition to the OSR fleet, oil spill containment equipment will be available for use in the unlikely event of a blowout. The containment barge will be centrally located in the Beaufort Sea or Chukchi Sea and supported by an Invader Class Tug and possibly an anchor handler. The containment equipment will be designed for conditions found in the Arctic including ice and cold temperatures. This equipment will also be designed for maximum reliability, ease of operation, flexibility and robustness so it could be used for a variety of blowout situations.
- Capping stack equipment will be stored as equipment aboard one of the ice management vessels and will be available for immediate deployment in the unlikely event of a blowout. Capping stack equipment consist of subsea devices assembled to provide direct surface intervention capability with the following priorities:
 - Attaching a device or series of devices to the well to affect a seal capable of withstanding the MAWP and closing the assembly to completely seal the well against further flows (commonly called “capping and killing”)
 - Attaching a device or series of devices to the well and diverting flow to surface vessel(s) equipped for separation and disposal of hydrocarbons (commonly called “capping and diverting”)
- A polar bear culvert trap has been constructed in anticipation of OSR needs and will be available prior to commencing the exploration drilling operations.
- Pre-booming is required for all fuel transfers between vessels.

Air Emissions

- Primary generators on the *Discoverer* have been retrofitted with selective catalytic reduction SCR devices to reduce NO_x emissions to under 0.5 grams/kilowatt-hour (g/kW-hr), and OxyCat to reduce CO by at least 80 percent, volatile organic compounds VOCs by at least 70 percent, and PM₁₀ by at least 50 percent
- All other engines on *Discoverer* will either be Tier 3 (low emissions) or have been retrofitted with CDPF devices to reduce CO, VOCs, and hazardous air pollutants (HAPs) by at least 90 percent and fine particulate matter by at least 85 percent
- Propulsion and generation engines on the ice management vessel and anchor handler will have SCR devices to reduce NO_x emissions to under 1.6 g/kW-hr, and OxyCat devices to reduce CO by at least 80 percent, VOCs by at least 70 percent, and PM₁₀ to under 0.25 g/kW-hr
- ULSD (0.0015 percent sulfur by weight) fuel will be purchased for the *Discoverer* and for support vessels, which will reduce SO₂ emissions by more than 97%.

SECTION 13.0 SUPPORT VESSELS AND AIRCRAFT INFORMATION

a) Planned Chukchi Sea Drillship and Aircraft List

- Drillship - M/V *Noble Discoverer*
- Ice management vessel - M/V *Fennica* (or similar)
- Anchor handler M/V *Tor Viking* (or similar)
- Two offshore supply vessels (OSVs) - for drillship resupply of drilling materials
- Shallow water landing craft
- OSR vessel M/V *Nanuq* (or similar)
- OSR barge and tug
- Arctic oil storage tanker (OST)
- Containment barge with tug and anchor handler for the containment system
- S-61/S-92/EC225 (or similar) helicopter (1) for search and rescue
- S-92/EC225 (or similar) helicopter (1) for crew rotations
- Fixed wing aircraft (1) for crew transport
- Fixed wing aircraft (1) for MMO flights

Vessels

The drillship *Discoverer* will be supported by an ice management vessel, an anchor handler, two OSVs and a shallow water landing craft. Specifications are provided in Table 13.a-1 for some vessels that may be used. The actual vessels to be used are not yet contracted and may be these vessels or similar vessels. Photographs of some of these vessels are provided below with brief descriptions of their function and use.

Table 13.a-1 Specifications of Support Vessels

Specification	Ice Management Vessel ¹	Anchor Handler ²	OSV ³	OSV ⁴	Shallow Water Landing Craft ⁵
Length	380 ft 116 m	275 ft 83.7 m	280 ft 85.3 m	280 ft 85.3 m	134 ft 40.8 m
Width	85 ft 26 m	59 ft 18.0 m	60 ft 18.3 m	60 ft 18.3 m	32 ft 9.7 m
Draft	27 ft 8.4 m	20 ft 6.0 m	15.9 ft 4.9 m	19 ft 5.8 m	7 ft 2.1 m
Accommodations	82 berths	64 berths	37	29 berths	22 berths
Maximum Speed	16 knots	16 knots 30 km/hr	13 knots 24 km/hr	13 knots 24 km/hr	10 knots 18 km/hr
Fuel Storage	11,070 bbl 1,760 m ³	7,484 bbl 1,190 m ³	6,233 bbl	7,217 bbl 1,147 m ³	667 bbl 106 m ³

¹ Based on *Fennica* or similar vessel

² Based on *Tor Viking* or similar vessel

³ Based on the *Harvey Spirit* or similar vessel

⁴ Based on *C-Leader* or similar vessel

⁵ Based on the *Arctic Seal*

Photograph 13-1 Ice Management Vessel

The M/V *Fennica* (Photograph 13-1), or a similar vessel, will serve as the ice management vessel in support of the *Discoverer*. This vessel will enter and exit the Chukchi Sea with the *Discoverer* and will remain at a location approximately 25 mi (40 km) upwind and upcurrent of the drillship when not in use. Any ice management would be expected to occur at a distance of 3-12 mi (5-19 km) upwind/upcurrent of the drillship.

Photograph 13-2 Anchor Handler

The M/V *Tor Viking* or a similar vessel will serve as the primary anchor handling vessel in support of the *Discoverer*. The vessel will enter and exit the Chukchi Sea with the *Discoverer* and will remain at a location approximately 25 mi (40 km) upwind and upcurrent of the drillship when not in use. Any ice management would be expected to occur within 0.6-6.0 mi (1.0-9.6 km) upwind from the *Discoverer*. The *Tor Viking* is depicted in Photograph 13-2.

The planned exploration drilling operations will require two OSVs to resupply the *Discoverer* with drilling materials and supplies from facilities in Dutch Harbor and fuel. The OSVs may be vessels such as the M/V *Harvey Spirit* and the M/V *C-Leader* depicted in Photographs 13-3 and 13-4 respectively, or similar offshore supply boats.

Photograph 13-3 OSV**Photograph 13-4 OSV****Photograph 13-5 Shallow Water Landing Craft**

Shell may use a shallow water landing craft for the occasional transport of supplies or crews between offshore vessels and the marine support shorebase facilities on Wainwright. The vessel would be a relatively small vessel capable of entering shallow water, similar to the Arctic Seal pictured in Photograph 13-5.

Oil Spill Response Vessels

The OSR fleet supporting the exploration drilling program will include a dedicated offshore OSR barge and OSR vessel that has associated smaller workboats, an OST, and a deck barge. There will be an additional vessel of opportunity (VOSS) from outside the theater, and a second OST will also be available to Shell if required. A second ice-strengthened OSR barge with skimming capability and storage capacity will mobilize to the nearshore zone of the Chukchi Sea if needed. Specifications for the OSR barge and OST, based on the types of vessels that might be contracted, are provided below in Table 13.a-2.

Table 13.a-2 Specifications of the Major Oil Spill Response Vessels

Specification	OSR Vessel ^{1,2}	OSR Barge ¹		OST ^{1,4}	Containment Barge ^{1,5}		
		Barge ³	Tug ³		Barge	Tug	Anchor Handler
Length	301 ft (91.9 m)	350 ft (106.7 m)	126 ft (38.4 m)	853 ft (260 m)	400 ft (122 m)	136 ft (41.5 m)	275 ft (83.7 m)
Width	60 ft (18.3 m)	76 ft (23.1 m)	34 ft (10.4 m)	112 ft (34 m)	100 ft (30.5 m)	36 ft (11.1 m)	59 ft (18.0 m)
Fuel Storage	6,867 bbl (1,092 m ³)	390 bbl (62 m ³)	1,786 bbl (284 m ³)	221,408 bbl (35,200 m ³)	--	3,690 bbl (587 m ³)	7,484 bbl (1190 m ³)
Liquid Storage	12,690 bbl (2,017 m ³)	76,900 bbl (12,226 m ³)	--	543,000 bbl (86,328 m ³)	--	--	--
Accommodations	41	--	6	25	--	10	64
Maximum Speed	16 knots	--	5 knots	16 knots	--	10 knots	16 knots
Workboats	(3) 34 ft work boats	(1) skim boat 47 ft (14 m) (3) work boats 34 ft (10 m) (4) mini-barges	--	--	--	--	--

¹ Or similar vessel

² Based on the *Nanuq*

³ Based on the barge *Klamath* and the tug *Crowley Sea Robin*

⁴ Based on the *Mikhail Ulyanov*, the OST will have a minimum storage capacity of 513,000 bbl

⁵ Based on a standard deck barge, Crowley Invader class ocean going tug, and the *Vidar Viking* anchor handler

Photograph 13-6 OSR Vessel



An OSR vessel such as the *Nanuq* (Photograph 13-6) will be staged in the vicinity of the drillship when the *Discoverer* is drilling in liquid hydrocarbon bearing zones to immediately respond to a spill and provide containment, recovery, and storage for the initial operational period following a spill event.

Photograph 13-7 OSR Barge



An OSR barge, such as the *Klamath*, similar to the one in Photograph 13-7, or a similar vessel, and a tug, such as the *Crowley Sea Robin*, will be staged offshore in the vicinity of the drillship. Together with the OSR vessel, it will have sufficient containment, recovery, and storage capacity for the initial operational period in the event of a spill. It will carry a 47-ft (14-m) skimming vessel, three 34-ft (10-m) workboats, four mini-barges, and boom and duplex skimming units for nearshore recovery.

Photograph 13-8 Arctic OST

An OST such as the *Mikhail Ulyanov* (Photograph 13-8) or similar vessel with a minimum liquid storage capacity of 513,000 bbl will be staged such that it would arrive at a recovery site, if needed, within 24 hours of departure from their staging location.

The *Nanuq* or similar vessel will be paired with an OST such as the *Mikhail Ulyanov* and used to assist refueling the *Discoverer* and support vessels, if necessary.

A deck barge similar to the one pictured in Photograph 13-9 will be used to house Shell's oil spill containment system. The barge will have an associated ocean-going tug similar to the one pictured in Photograph 13-10 and an anchor handler such as the *Vidar Viking*. This anchor handler is similar to the *Tor Viking* pictured above. The barge, tug, and anchor handler will be stationed offshore, where it can be mobilized to the drill site when needed.

Photograph 13-9 Containment Barge**Photograph 13-10 Ocean-going Tug****Aircraft**

Offshore operations will be serviced by helicopters operated out of onshore support base locations. The helicopters are not yet contracted. A Sikorsky S-92 or Eurocopter EC225 capable of transporting 10-12 persons will be used to transport crews between the onshore support base and the drillship. The helicopters will also be used to haul small amounts of food, materials, equipment, and waste between vessels and the shorebase. The flight corridors over the onshore and nearshore areas are indicated on Figure 2.2-1. The helicopter will be housed at facilities at the Barrow airport. Shell will have a second helicopter for Search and Rescue (SAR). The SAR helicopter is expected to be a Sikorsky S-61, S-92, or Eurocopter EC225, or a similar model. This aircraft will stay grounded at the Barrow shorebase location except during training drills, emergencies, and other non-routine events.

A fixed wing propeller or turboprop aircraft, such as Saab 340-B 30-seat, Beechcraft 1900 19-seat, or De Havilland Dash 8 30-seat, will be used to routinely transport crews, materials, and equipment between the shorebase and hub airports such as Barrow or Fairbanks. A fixed wing aircraft, De Havilland Twin Otter (DHC-6), will be used for MMO flights.

Fuel Storage Information and Frequency of Trips

The frequencies of trips the above-referenced marine vessels and aircraft would be expected to make during the planned exploration drilling program are listed below in Table 13.a-3.

Table 13.a-3 Fuel Storage Capacity and Trip Information for Support Vessels and Aircraft

Vessel Type	Maximum Fuel Tank Storage Capacity	Trip Frequency or Duration
Marine Support Vessels (or similar)		
Ice management vessel – <i>Fennica</i> ¹	11,070 bbl (1,760 m ³)	Will remain generally upwind of the <i>Discoverer</i> from 3-25 mi away throughout the 2010 Chukchi exploration drilling program
Anchor handler – <i>Tor Viking</i> ¹	7,484 bbl (1,190 m ³)	Stays in the area of <i>Discoverer</i> throughout the drilling season
Offshore supply boat – <i>Harvey Spirit</i> ¹	6,233 bbl (991 m ³)	Up to 17 round trips (combined for both OSVs) for resupply between drillship and Dutch Harbor during the drilling season, and 4-6 refuel trips (combined for both OSVs) between OST and drillship during the drilling season
Offshore supply vessel – <i>C-Leader</i> ¹	7,217 bbl (1,147 m ³)	
Shallow water landing craft	667 bbl (106 m ³)	Occasional trips as needed between offshore vessels & Wainwright during drilling season
OSR Vessels (or similar)		
OSR vessel – <i>Nanuq</i>	6,867 bbl (1,092 m ³)	Stays in vicinity of the drillship throughout the drilling season
OSR barge ¹	1,786 bbl (284 m ³) on tug	Will be located in the vicinity of the drillship throughout the exploration drilling program
OSR work boats	7 bbl (1.1 m ³)	12 round trips / week for 2 months for OSR drills & training – between Wainwright shorebase and OSR barge
OST – <i>Mikhail Ulyanov</i> ¹	221,408 bbl (86,330 m ³)	Will be staged such that it can be on location within 24 hours
Containment barge and tug	3,690 bbl (587 m ³)	No trips – remains in a location from where it can respond if needed
Containment anchor handler	7,484 bbl (1,190 m ³)	No trips - remains with the containment barge
Aircraft (or similar)		
(1) Saab 340 B, Beechcraft 1900, or Dash 8 fixed-wing or similar – transport from shorebase to regional jet service in Deadhorse or Barrow	9 bbl (1.4 m ³)	Up to 4 trips / week between Wainwright and Barrow or Anchorage
(1) Helicopter – S-92, EC225 – for crew rotation & groceries/supply	18 bbl (2.9 m ³)	Approximately 12 trips/ week between the shorebase and the prospect (approximately 3.0 hr/trip)
(1) Helicopter S-61, S-92, EC225, or similar – search-and-rescue	18 bbl (2.9 m ³)	Stationed in Barrow – 40 hr/week for proficiency training & trips made in emergency

¹ Or similar vessel

b) Air Emissions

Projected air emissions from support vessels are indicated below in Table 13.b-1 and are discussed in more detail in Section 7.0 of this document and in the air quality permit application.

Table 13.b-1 Project Annual Air Pollutant Emissions (TPY) from Support Vessels Associated with the Drillship *Discoverer* for the revised Chukchi Sea Exploration Drilling Program

Vessels	NO _x	PM _{2.5}	PM ₁₀	CO	SO ₂	VOC
Ice Management	37.2	6.1	6.3	29.1	0.27	6.8
Anchor Handler	37.8	6.3	6.5	29.5	0.27	6.9
OSV Resupply	50.7	1.4	1.4	10.9	0.02	4.0
OSR Vessel	98.1	1.0	1.4	27.6	0.27	9.7
OSR Workboats	19.1	1.3	1.3	4.1	6.89E-03	1.5

c) Drilling Fluids and Chemical Products Transportation

The *Discoverer* will be preloaded with drilling fluids and other chemicals to be used for the exploration drilling of a single well before it is mobilized to the Burger Prospect at the start of each drilling season. Drilling fluids will be recycled to the extent practicable based on operational considerations (e.g. whether mud properties have deteriorated to the point where they can no longer be used) and used for subsequent wells during the same drilling season. Any required additional drilling fluid components will be transported to the drillship from a storage area in Dutch Harbor via an OSV. Quantities to be on the *Discoverer* at loadout are listed in Table 6.c-1 In Section 6.0 (c).

d) Solid and Liquid Wastes Transportation

An incinerator will be aboard the *Discoverer* and will be used to dispose of combustibles. Authorized wastes will be discharged to the Chukchi Sea under the NPDES General Permit. The remaining wastes will be transported out of the Chukchi Sea by OSVs and disposed of at a permitted and regulated facility. Food wastes associated with the *Discoverer* will be incinerated. Descriptions of the transportation methods and a brief description of the composition, quantities, and destinations of the solid and liquid wastes to be transported by vessel from the *Discoverer* are provided below in Table 13.d-1.

Table 13.d-1 Onshore Waste Disposal Facilities, Waste Type, Amount, Rate, and Disposal Method

Name/Location of Disposal Facilities	Type of Waste	Amount	Rate	Disposal Method
Waste Management Inc. Columbia Ridge Recycling & Landfill, Arlington, OR - or Dutch Harbor Municipal Landfill Dutch Harbor, AK	Non-hazardous trash and debris oily rags & filters, etc.	300 bbl/month	10 bbl/day	Land-farmed and/or incinerated
Waste Management Inc. Columbia Ridge Recycling & Landfill, Arlington, OR - or Emerald Alaska, Anchorage - to Emerald Services, Seattle, WA or Clean Harbor Environmental Services, Aragonite, UT	Paint, solvents, unused chemicals, batteries, lamps, etc.	10 bbl/well	0.3 bbl/day	Hazardous waste disposal in Class 1 injection well or approved treatment/ disposal site
Waste Management Inc. Columbia Ridge Recycling & Landfill, Arlington, OR - or Emerald Alaska, Anchorage - to Emerald Services, Seattle, WA or Clean Harbor Environmental Services, Aragonite, UT	Used oil, oily water, & glycol	40 bbl/well	1.2 bbl/day	Land-farmed and/or incinerated

e) Vicinity Map and Travel Routes

The locations of the planned exploration drilling activities relative to the shoreline and shorebase facilities and the primary route of the drillship and routes of support vessels when entering and exiting the Chukchi Sea are indicated in Figure 13.e-1. The routes smaller vessels would follow to access the shorebase and Burger Prospect are also shown. The flight corridors that helicopters would take between the shorebase and the prospect are indicated in Figure 13.e-2. The primary helicopter route between shorebase and the Burger Prospect is from the Barrow airport where they would be housed, directly offshore to the Burger Prospect. Helicopters would alternatively travel between Wainwright and the Burger Prospect under special circumstances. The planned use of Wainwright as a shorebase facility is only for the drilling seasons covered in the revised Chukchi Sea EP, and do not reflect Shell's planned shorebase operations in the extended term.

f) Aircraft Waste Transportation

No drilling wastes will be transported via aircraft.

Figure 13.e-1 Marine Vessel Routes

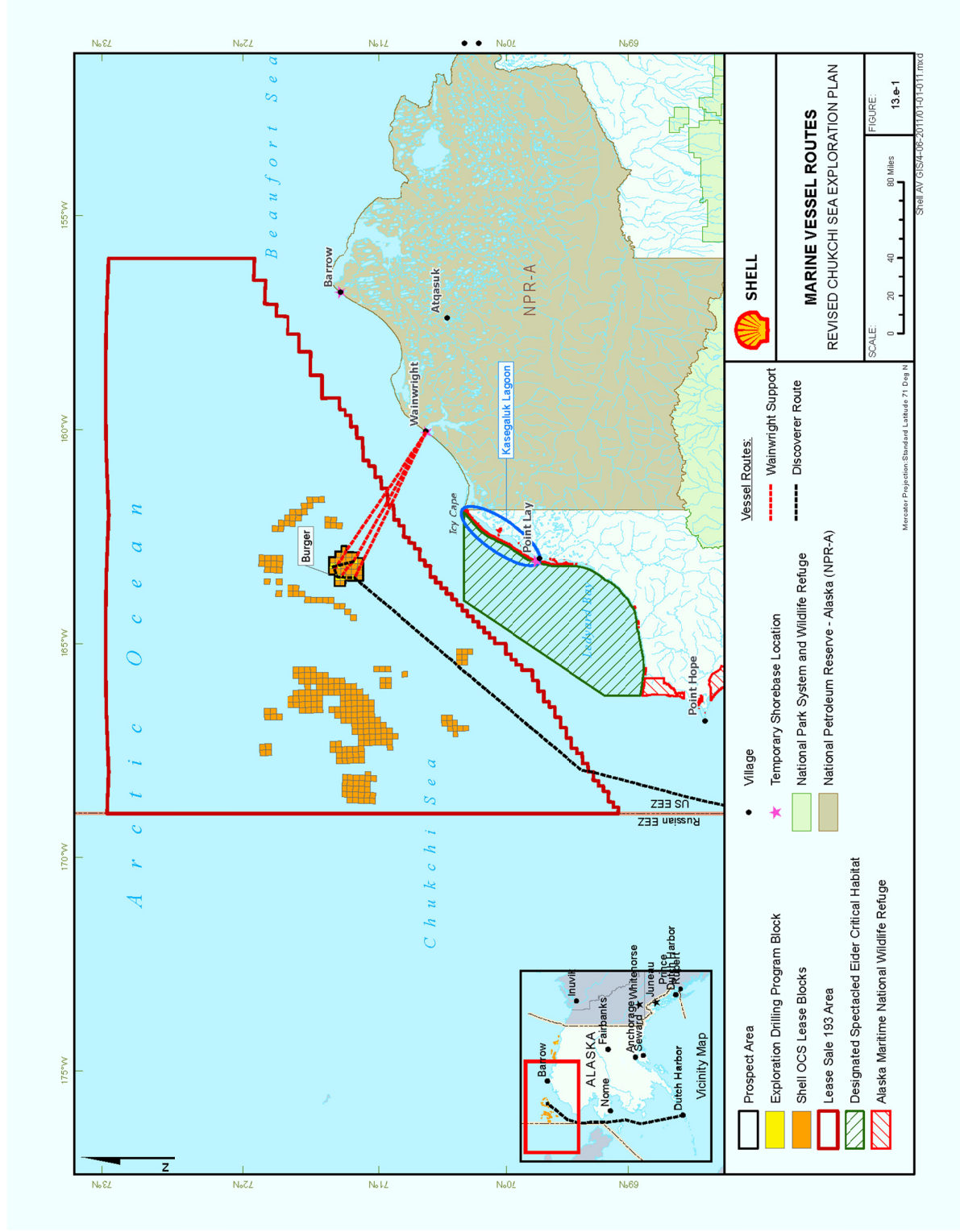
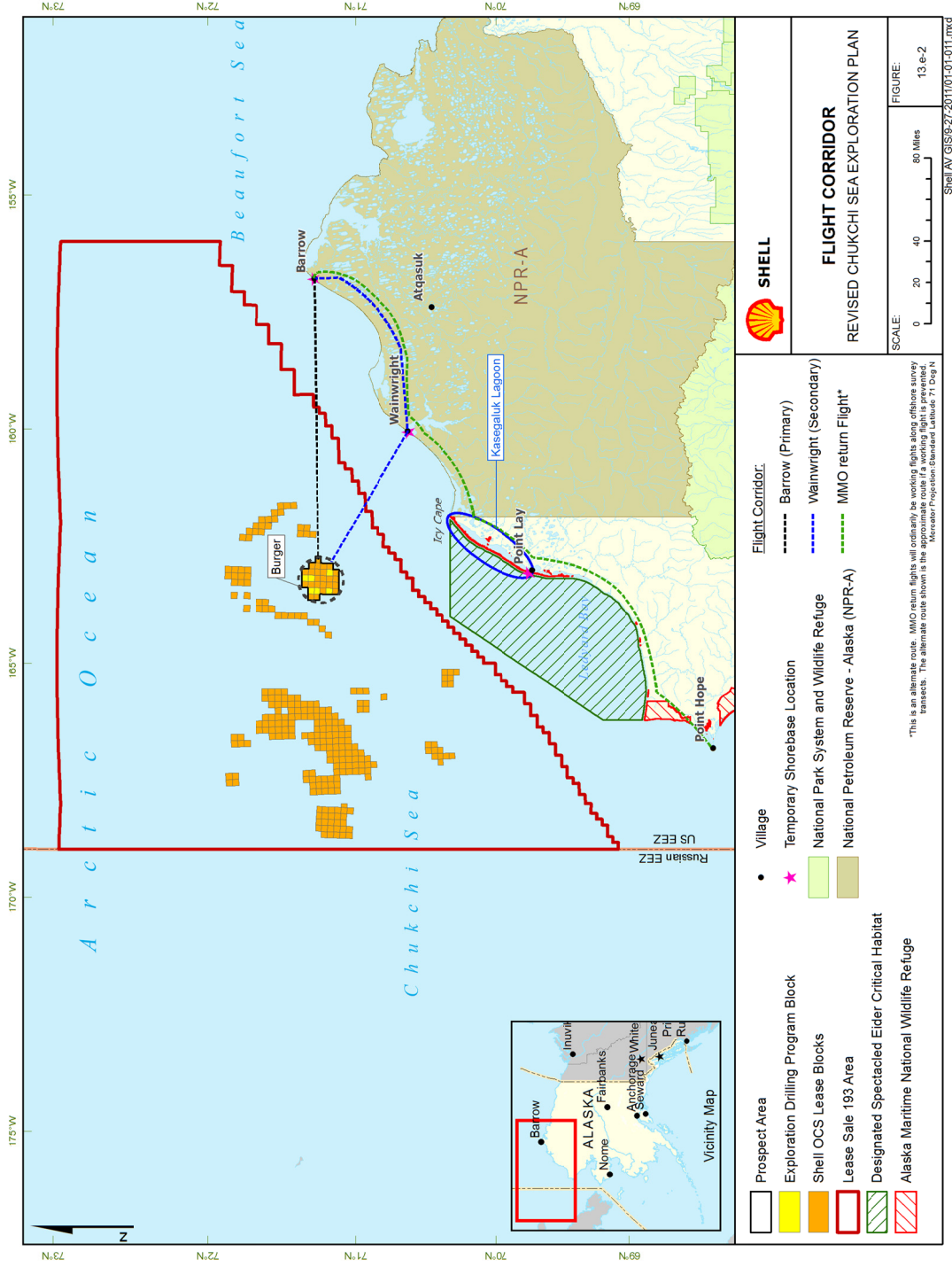


Figure 13.e-2 Flight Corridor



**THIS PAGE
INTENTIONALLY
LEFT BLANK**

SECTION 14.0 ONSHORE SUPPORT FACILITIES INFORMATION

a) General

Shell plans to temporarily establish aviation shorebase facilities potentially at two locations and use these facilities for the duration of the exploration drilling program considered in the revised Chukchi Sea EP. Shorebase facilities for air support will be located in Barrow at the State-owned and operated Barrow Wiley Post Will Rogers Memorial Airport (Barrow Airport). A secondary aviation shorebase may be established in Wainwright. The Barrow Airport has a 6,500 x 150 ft (1,980 x 46 m) paved runway, hangar and service facilities, passenger terminal, and jet service. The Wainwright airstrip is gravel, 4,494 x 90 ft (1,370 x 27 m), and maintained year round.

The search and rescue (SAR) helicopter will be stationed and serviced in existing facilities at the Barrow airport. The crew change helicopter will be stationed at the Barrow airport. Offshore crewmembers will ordinarily be transported to shore at Barrow or possibly at Wainwright via helicopter. Those in Wainwright, if any, would then transport to Barrow or Anchorage using a fixed wing airplane. Helicopter flights returning to Barrow could be diverted to Wainwright due to weather or other emergencies and would then continue to Barrow when possible.

Shell currently leases office space in Barrow and will continue to use these facilities during the planned exploration drilling program. Additional office space may be leased for the exploration drilling program, but no development of new facilities or expansion of existing facilities in Barrow is planned. Existing accommodations such as hotels will be used as accommodations for the shorebase staff, which is expected to be approximately six to seven persons. If necessary, a camp will be established for a crew of 25-75 persons, which includes a small staff stationed at the location and accommodations for any crew members that are weathered-in. Existing accommodations in the village will be used to the extent possible. Temporary accommodations will be established on developed land if required.

Shorebase facilities for marine support will be temporarily established in Wainwright for the duration of the exploration drilling program in this revised Chukchi Sea EP. Community facilities in Wainwright include the city hall, police station, fire station, health clinic, community water and sewer systems, and airstrip. Shell will use the airstrip located in Wainwright, which is owned and operated by the North Slope Borough, for access by helicopters and fixed wing aircraft shuttling supplies and certain materials to the marine base. No expansions to the airstrip are planned; Shell may conduct improvements to the runway surface and conduct periodic maintenance throughout the exploration drilling program.

There currently are no docks in Wainwright. There are two earthen boat ramps (at the lagoon and at the lagoon entrance) connected to the village by gravel roads that would be used for marine access and support by shallow draft vessels. The primary ramp would be the lagoon ramp, and the primary use of the ramp would be to support OSR training. No new docks are planned for the exploration drilling program covered by the revised Chukchi Sea EP. Lifting may be accomplished by forklifts and other smaller pieces of equipment.

There is potential for aviation and marine fuel to be stored in Wainwright to support the marine base, and a secure yard will be established by the village corporation, Olgoonik Corporation, for storage of oil spill response equipment and load staging for the marine vessels. Shell will use an existing 30,000-gallon (113 m³) tank for diesel and potentially utilize three additional 50,000-gallon (189 m³) tanks for aviation fuel. All four tanks will be inspected, certified, double-walled tanks on gravel pads, with secondary containment capable of holding 110 percent of the tank volume.

The shorebase in Wainwright will be used as a base for the onshore oil spill response program. Training will be performed with the equipment including four landing craft. Marine support may be provided by these OSR workboats. Descriptions of these vessels and aircraft as well as estimates of the frequency of trips they are likely to make are provided in Section 13.0.

b) Air Emissions

Shell will lease existing facilities in Wainwright and Barrow for the shorebase and auxiliary support facilities. Any incremental increases in air emissions from sources at these locations (which will be functioning whether or not they are being used by Shell) that are associated with Shell's activities at the shorebase facilities, including air emissions associated with aircraft emissions, will be minimal and temporary.

c) Unusual Solid and Liquid Wastes

There will not be any unusual solid or liquid wastes generated at the shorebase facility.

d) Waste Disposal

The anticipated volumes and types of wastes that may be generated by the exploration drilling program and transported to shore for disposal are indicated below in Table 13.d-1 along with the disposal location / facility.

SECTION 15.0 COASTAL ZONE MANAGEMENT ACT

The State of Alaska did not pass legislation required to extend the ACMP, allowing the ACMP to sunset at 12:01 AM, Alaska Standard Time, on 1 July 2011. Therefore no Coastal Project Questionnaire and Certification Statement or Other Information required as part of CZMA is provided.

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

SECTION 16.0 ENVIRONMENTAL IMPACT ANALYSIS

The Environmental Impact Analysis is provided in Appendix F.

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

SECTION 17.0 ADMINISTRATIVE

a) Exempted Information (public information copies only)

The following information is considered proprietary and has been removed from the public copies of the revised Chukchi Sea EP:

- Drill sites and depths in the Form 137 OCS Plan Information Forms (Appendix A)
- All of Section 3 including
 - Geologic descriptions, surface location & bathymetry maps (Section 3.a)
 - Structure contour maps (Section 3.b)
 - Key seismic lines (Section 3.c)
 - Geologic cross-section maps (Section 3.d)
 - Shallow hazards reports (Section 3.e)
 - Shallow hazards assessments (Section 3.f)
 - High resolution seismic lines (Section 3.g)
 - Stratigraphic columns (Section 3.h)
 - Time/depth tables (Section 3.i)
 - Geochemical information (Section 3.j)
 - Future geological and geophysical activities (Section 3.k)
 - Basis for calculation of WCD (Section 3.l)

b) Bibliography

Appendix F, EIA has its own bibliography describing study reports, survey reports or other material used.

AECOM, Inc. 2009a. Wainwright near-term ambient air quality monitoring program first quarter data report November 2008 through January 2009 final. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.

AECOM, Inc. 2009b. Wainwright near-term ambient air quality monitoring program second quarter data report February through April 2009 final. Document No. 01865-104-3220 prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.

AECOM, Inc. 2009c. Wainwright near-term ambient air quality monitoring program third quarter data report May through July 2009 final. Document No. 01865-104-3230 prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.

AECOM, Inc. 2009d. Wainwright near-term ambient air quality monitoring program fourth quarter data report August through October 2009 final. Document No. 60136620-3240 prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, Alaska.

AECOM, Inc. 2010a. Wainwright near-term ambient air quality monitoring program annual data report November 2008 through November 2009 final. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.

AECOM, Inc. 2010b. Wainwright permanent ambient air quality monitoring program first quarter data report January through March 2010 final. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.

- AECOM, Inc. 2010c. Wainwright permanent ambient air quality monitoring program second quarter data report April through June 2010 draft. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.
- AECOM, Inc. 2010d. Wainwright permanent ambient air quality monitoring program third quarter data report July through September 2010 draft. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.
- AECOM, Inc. 2011a. Wainwright permanent ambient air quality monitoring program fourth quarter data report October through December 2010 draft. Unpublished report prepared by AECOM, Inc., for ConocoPhillips Alaska, Inc., Anchorage, AK.
- AECOM, Inc. 2011b. Wainwright permanent ambient air quality monitoring program annual data report January 2010 through December 2010 final. Unpublished report prepared by AECOM, Inc. for ConocoPhillips Alaska, Inc. Anchorage, Alaska.
- Air Sciences Inc. 2011. Discoverer impact evaluation for SO₂ and NO₂ using AERMOD, Shell Chukchi and Beaufort Seas, Alaska drilling program. Prepared for Shell Offshore Inc., Anchorage, AK by Air Sciences Inc.
- ASRC Energy Services. 2009. Subsistence advisor program summary, North Slope, Alaska. Report prepared for Shell Exploration and Production Company, Houston, TX by ASRC Energy Services, Anchorage, AK.
- ASRC Energy Services. 2010. 2009 Subsistence advisor program annual summary North Slope, Alaska. Prepared for Shell Exploration and Production Company. Anchorage, AK. by ASRC Energy Services, Anchorage, AK. December 2009
- Blanchard, A., H. Nichols, and C. Parris. 2010a. Benthic ecology of the Burger and Klondike survey areas: 2008 environmental studies program in the Chukchi Sea. Annual Report prepared for ConocoPhillips Alaska Inc., Anchorage, AK and Shell Exploration & Production Company, Anchorage, AK, by the Institute of Marine Science, University of Alaska, Fairbanks. 72 pp.
- Blanchard, A., C. Parris, and H. Nichols. 2010b. Benthic ecology of the Burger and Klondike survey areas: 2009 environmental studies program in the northeastern Chukchi Sea. Annual Report prepared for ConocoPhillips Alaska Inc., Anchorage, AK, Shell Exploration & Production Company, Anchorage, AK, and Statoil USA E&P, Anchorage, AK by the Institute of Marine Science, University of Alaska, Fairbanks. 86 pp.
- Boudreau, B. 1989. Biological clearance for Burger and Crackerjack Prospects. U.S. Govt. Memorandum, from Regional Supervisor, Field Operations, Minerals Management Service, Alaska OCS Region to District Office Supervisor.
- Brueggeman, J. 2009. Marine mammal surveys at the Klondike and Burger survey areas in the Chukchi Sea during the 2008 open water season. Prepared for ConocoPhillips Alaska, Inc. and Shell Exploration and Production, Anchorage, AK by Canyon Creek Consulting LLC, Seattle, WA. 46 pp.
- Brueggeman, J. 2010. Marine mammal surveys at the Klondike and Burger survey areas in the Chukchi Sea during the 2009 open water season. Prepared for ConocoPhillips Alaska, Inc. and Shell Exploration and Production, Anchorage, AK by Canyon Creek Consulting LLC, Seattle, WA. 55 pp.
- EPA. 2010. Statement of basis for proposed Outer Continental Shelf Prevention of Significant Deterioration Permit No. R10OCS/PSD-AK-09-01. Prepared by U.S. Environmental Protection Agency, Region 10, Seattle, WA. 129 pp.

- EPA. 2011. Supplemental statement of basis for proposed Outer Continental Shelf Prevention of Significant Deterioration permits, Noble Discoverer Drillship. Prepared by U.S. Environmental Protection Agency, Region 10, Seattle, WA. 70 pp.
- Exponent, Inc. 2010. Chukchi Sea environmental studies baseline program 2009 fish sampling – chemistry results. Final Report prepared for ConocoPhillips Alaska Inc., Anchorage, AK, Shell Exploration & Production Company, Anchorage, AK, and Statoil USA E&P Inc., Anchorage by Exponent Inc. 60 pp. plus app.
- Finney, H. 1989. Summary: Biological reconnaissance, Burger Prospect, Sale 109, Chukchi Sea, Alaska. Unpublished Report submitted by H. Finney, Fugro-McClelland Marine Geosciences, Inc., Houston, Texas to Shell Western E&P Inc., Houston Texas.
- Fugro GeoConsulting, Inc. 2010a. Shallow hazards and archaeological assessment Burger Site Survey 1 OCS Lease Sale 193 area Chukchi Sea, Alaska. Report No. 27.2009-2327 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010b. Drill site clearance letter proposed Burger A drill site Block 6764 OCS-Y-2280 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-1 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010c. Drill site clearance letter proposed Burger F drill site Block 6714 OCS-Y-2267 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-3 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010d. Drill site clearance letter proposed Burger S drill site Block 6762 OCS-Y-2278 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-4 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010e. Shallow hazards and archaeological assessment Burger Site Survey 3 OCS Lease Sale 193 area Chukchi Sea, Alaska. Report No. 27.2010-2342 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2010f. Drill site clearance letter proposed Burger V drill site Block 6915 OCS-Y-2324 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-6 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2011a. Shallow hazards and archaeological assessment Burger Site Survey 4 OCS Lease Sale 193 area Chukchi Sea, Alaska. Report No. 27.2010-2343, v. 1 & 2 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Fugro GeoConsulting, Inc. 2011b. Drill site clearance letter proposed Burger R drill site Block 6812 OCS-Y-2294 Posey Area, Chukchi Sea, Alaska. Report No. 27.2010-2375-7 prepared by Fugro GeoConsulting, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Funk, D. W., R. Rodrigues, D. S. Ireland, and W. R. Koski (eds.). 2007. Joint monitoring program in the Chukchi and Beaufort Seas, July-November 2006. LGL Alaska Report P891-2, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greeneridge Sciences, Inc., Bioacoustics Research Program, Cornell University, and Bio-Wave Inc. for Shell Offshore, Inc., ConocoPhillips Alaska, Inc., and GX Technology, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 316 pp. plus Appendices.
- Funk, D.W., D.S. Ireland, R. Rodrigues, and W.R. Koski (eds.). 2010. Joint monitoring program in the Chukchi and Beaufort seas, open-water seasons, 2006–2008. LGL Alaska Report P1050-2, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greeneridge Sciences, Inc., and JASCO Applied Sciences, for Shell Offshore, Inc. and Other Industry Contributors, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 462 pp. plus Appendices.

- Funk, D.W., D.S. Ireland, R. Rodrigues, and W.R. Koski (eds.). 2011. Joint monitoring program in the Chukchi and Beaufort seas, open-water seasons, 2006–2009. LGL Alaska Report P1050-2, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greeneridge Sciences, Inc., and JASCO Applied Sciences, for Shell Offshore, Inc. and Other Industry Contributors, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 462 pp. plus appendices.
- Gall, A. and R. Day. 2009. Distribution and abundance of seabirds in the northeastern Chukchi Sea, 2008. Final Report prepared for ConocoPhillips Alaska Inc., Anchorage, AK and Shell Exploration & Production Company, Anchorage, AK by ABR, Inc. – Environmental Research & Services, Fairbanks, AK. 55 pp.
- Gall, A. and R. Day. 2010. Distribution and abundance of seabirds in the northeastern Chukchi Sea, 2008-2009. Prepared for ConocoPhillips Alaska Inc., Anchorage, AK, Shell Exploration & Production Company, Anchorage, AK, and Statoil USA E&P, Inc., Anchorage, AK by ABR, Inc. – Environmental Research & Services, Fairbanks, AK. 68 pp.
- GEMS (Geoscience Earth & Marine Services, Inc.) 2009. Shallow hazards and archaeological assessment, Burger J Drill Site Posey Block NR03-02 6912, Chukchi Sea, Alaska. Prepared by Geoscience Earth & Marine Services, Inc., Houston, TX for Shell Gulf of Mexico Inc., Houston, TX.
- Hopcroft, B, J. Questel, and C. Clarke-Hopcroft. 2009. Oceanographic assessment of the planktonic communities in the Klondike and Burger survey areas of the Chukchi Sea: report for survey year 2008. Report prepared for ConocoPhillips Alaska Inc., Anchorage, AK and Shell Exploration & Production Company, Anchorage, AK by the Institute of Marine Science, University of Alaska, Fairbanks. 52 pp.
- Hopcroft, B, J. Questel, and C. Clarke-Hopcroft. 2010. Oceanographic assessment of the planktonic communities in the Klondike and Burger survey areas of the Chukchi Sea: report for survey year 2009. Report prepared for ConocoPhillips Alaska Inc., Anchorage, AK, Shell Exploration & Production Company, Anchorage, AK, and Statoil USA Exploration & Production Company, Anchorage, AK by the Institute of Marine Science, University of Alaska, Fairbanks. 54 pp.
- Ireland, D.S., D.W. Funk, R. Rodrigues, and W. R. Koski (eds.). 2008. Joint monitoring program in the Chukchi and Beaufort Seas, July-November 2007. LGL Alaska Report P1050-3, Report from LGL Alaska Research Associates, Inc., LGL, Ltd., Greeneridge Sciences, Inc., and JASCO Research, Ltd. and for Shell Offshore, Inc., ConocoPhillips Alaska, Inc., and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 445 pp. plus appendices.
- Neff, J., G. Durell, J. Trefry, and J. Brown. 2010. Environmental studies in the Chukchi Sea 2008: chemical characterization. Final Report prepared for ConocoPhillips Alaska Inc., Anchorage, AK and Shell Exploration & Production Company, Anchorage, AK by Battelle Memorial Institute, Exponent Inc., Florida Institute of Technology, and Neff & Associates. 135 pp.
- NMFS. 2001. Small takes of marine mammals incidental to specified activities; oil and gas exploration drilling activities in the Beaufort Sea/Notice of issuance of an incidental harassment authorization. Federal Register 66(26, 7 Feb.):9291-9298.
- Northern Economics. 2009. Economic analysis of future offshore oil and gas development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin. Report prepared by Northern Economics, Anchorage Alaska for Shell Exploration and Production, Houston, TX.
- Northern Economics, Inc. and Institute of Social and Economic Research. 2011. Potential National-Level Benefits of Alaska OCS Development. Report prepared by Northern Economics, Inc. and Institute of Social and Economic Research, Anchorage, AK for Shell Exploration & Production, Anchorage, AK.

- Shell Gulf of Mexico Inc. 2009. Exploration plan 2010 exploration drilling program Posey Blocks 6713, 6714, 6763, 6764, and 6912, Karo Blocks 6864 and 7007, Burger, Crackerjack, and SW Shoebill Prospects, OCS Lease Sale 193, Chukchi Sea, Alaska. Submitted to U.S. Department of Interior, Minerals Management Service, Alaska OCS Region by Shell Gulf of Mexico Inc., Anchorage, AK.
- Shell Gulf of Mexico Inc. 2011. Revised Chukchi Sea exploration plan OCS Lease Sale 193, Chukchi Sea, Alaska, exploration drilling program Posey Area Blocks 6714, 6762, 6764,6812, 6912, 6915. Submitted to U.S. Department of Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Alaska OCS Region by Shell Gulf of Mexico Inc., Anchorage, AK.
- Sherwood, K.W., J.D. Craig, J. Scherr, P.O. Johnson, and L.W. Cooke. 2001. Undiscovered oil and gas resources of the U.S. Arctic Alaska Outer Continental Shelves (abs): American Association of Petroleum Geologists, Annual International Meeting, St. Petersburg, Russia, Abstracts with Programs, July 15 – 18, 2001, St. Petersburg, Russia.
- Sound Enterprises and Associates, LLC. 2008. Shell Exploration and Production Company (SEPCO) Chukchi Village interview program. Report prepared for Shell Exploration and Production Company Houston, TX by Sound Enterprises, LLC, Bainbridge, WA.
- The Cornell Lab of Ornithology. 2010. Passive acoustic monitoring of marine mammals in the Chukchi Sea 9 September – 14 October 2008. Bioacoustics Research Program Technical Report 10-04 prepared for ConocoPhillips Alaska, Inc., Anchorage, AK by The Cornell Lab of Ornithology, Cornell University, Ithaca, NY. 49 pp.
- UMIAQ. 2011. 2010 Subsistence advisor program North Slope, Alaska. Report prepared by UMIAQ, Anchorage, AK for Shell Exploration & Production Company, Anchorage, AK 19 pp. + app.
- Weingartner, T. and S. Danielson. 2010. Physical oceanographic measurements in the Klondike and Burger survey areas of the Chukchi Sea: 2008 and 2009. Final Report prepared for ConocoPhillips Inc., Anchorage, AK, Shell Exploration & Production Company, Anchorage, AK, and Statoil, Inc., Anchorage, AK by the Institute of Marine Science, University of Alaska, Fairbanks. 50 pp.

**THIS PAGE
INTENTIONALLY
LEFT BLANK**

LIST OF APPENDICES

Appendix A	Outer Continental Shelf Plan Information Forms (Form 137)
Appendix B	National Pollutant Discharge Elimination System Notice of Intent
Appendix C	Application for National Marine Fisheries Service Incidental Harassment Authorization
Appendix D	Marine Mammal Monitoring and Mitigation Plan
Appendix E	Application for U.S. Fish & Wildlife Service Letter of Authorization
Appendix F	Environmental Impact Analysis
Appendix G	U.S. Army Corps of Engineers Nationwide Permit 8
Appendix H	Plan of Cooperation
Appendix I	Bird Strike Avoidance and Lighting Plan Chukchi Sea, Alaska
Appendix J	Critical Operations and Curtailment Plan
Appendix K	Ice Management Plan
Appendix L	Well Control Plan
Appendix M	Fuel Transfer Plan
Appendix N	H ₂ S Contingency Plan for <i>M/V Noble Discoverer</i>

**THIS PAGE
INTENTIONALLY
LEFT BLANK**