SHELL Gulf of Mexico Inc. & M-I SWACO 2015 Drilling Fluids Plan (DFP)
NPDES AKG-28-8100 Permit for Chukchi Sea Exploration Drilling
Shell Burger Prospect

M-I SWACO Address:

6411 A Street, Anchorage, Alaska 99518

M-I SWACO Key Contacts and Phone Numbers:

Peter Nelson, NPDES Compliance Supervisor	M-I SWACO, A Schlumberger Company	Office (907) 273-4747
John Candler, Manager Environmental Affairs	M-I SWACO, A Schlumberger Company	Office (281) 561-1320
Rig Mud Engineer	M-I SWACO, A Schlumberger Company	Rig Phone

Shell Key Contacts and Phone Numbers:

Tony Harris, Drilling Superintendent - Discoverer	Shell Exploration and Production	Office (907)770-3700
Eric Whatley, Drilling Superintendent - Polar Pioneer	Shell Exploration and Production	Office (907)770-3700
Jason Smith, Drilling Engineer Team Lead	Shell Exploration and Production	Office (907)770-3700
Rig Drilling Supervisor	Shell Exploration and Production	Rig Phone

Operation Identification:

Possible Drill Sites for the Chukchi Sea Exploration Drilling Program, Burger Prospect, Chukchi Sea OCS at water depths less than 200 ft. (MLLW)

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

Drilling Fluids Plan

Summary Shell 2015 Chukchi Exploration Program

Shell Gulf of Mexico Inc. (Shell) will perform exploratory drilling on leases in the outer continental shelf area of the Chukchi Sea the summer of 2015. Six potential exploratory well sites have been identified and are located in the Burger Prospect.

Summary of Drilling Fluids to be used in 2015 Chukchi Exploration Program

Toxicity Minimization Objective and Procedures

Drilling fluid systems and products were selected from the best available technology with three basic objectives:

1. Select highly effective products to increase drilling efficiency and minimize volumes of contaminants. Product performance evaluation is based on the data and experience in the M-I SWACO well file database and technical information on the product performance.
2. Select products with the lowest level of toxicity that meet the performance evaluation requirements. Toxicity evaluation is based on the in-house toxicity data on each product and the available field toxicity experience with the product in its historical use.
3. Select products with a favorable HSE profile that enhance safe drilling operations. HSE performance evaluation is based on product knowledge and MSDS information.

Drilling fluids will be recycled to the extent practical based upon operational considerations (e.g., whether mud properties have deteriorated to the point where the fluid cannot be effectively used further) by carrying drilling fluids forward from one interval to the next.

Drilling Fluid Type and Discharge Rates

Drill Site	Drilling Fluid Type	Discharge Rate
Burger A	Water based (brine, fresh water, gel, barite, inhibitors, biopolymers)	Maximum < 1000 bbls/hr
Burger F	Water based (brine, fresh water, gel, barite, inhibitors, biopolymers)	Maximum < 1000 bbls/hr
Burger J	Water based (brine, fresh water, gel, barite, inhibitors, biopolymers)	Maximum < 1000 bbls/hr
Burger R	Water based (brine, fresh water, gel, barite, inhibitors, biopolymers)	Maximum < 1000 bbls/hr
Burger S	Water based (brine, fresh water, gel, barite, inhibitors, biopolymers)	Maximum < 1000 bbls/hr
Burger V	Water based (brine, fresh water, gel, barite, inhibitors, biopolymers)	Maximum < 1000 bbls/hr

Drilling Fluids Plan

Drilling and Abandonment Fluid Components

A current list of the components that may be added to the drilling and abandonment fluid is provided in TAB 1, TAB 2, and TAB 3 on a per well basis. The component lists and the respective volumes have been designed for drilling from the mud line cellar (MLC) to proposed total depth. The summary chart listed below relates the mud system description to the hole size, casing size and the Tab containing the additive lists.

Interval and Drilling Fluids Summary

Hole Size(in)	Casing Size (in)	Mud System	Mud Weight (lb/gal)	Products & Toxicity information, Criteria for Contingency additives***
42	36	Riserless Gel / Polymer Sweeps	8.6 – 9.2	TAB 1
		Weighted Gel / Polymer Mud	8.6 – 9.1	TAB 1
26	22	Riserless Gel / Polymer Sweeps	10.0 – 10.6	TAB 1
		Weighted Gel / Polymer Mud	8.6 – 10.0	TAB 1
17-1/2	13-3/8	KLA-SHIELD –Inhibitive WBM	10.0 – 10.6	TAB 2
12-1/4	9-5/8	KLA-SHIELD – Inhibitive WBM	10.0 – 12.0	TAB 2
8-1/2	N/A	KLA-SHIELD – Inhibitive WBM	12.0 – 15.0	TAB 2
	All	KLA-SHIELD Abandonment Fluid	10.0 – 15.0	TAB 3

Criteria for Product Additions

Listed Products – Prior to adding products listed in TABs 1, 2, or 3 for treatment, the current active system product concentration will be reviewed to verify maximum concentrations will not be exceeded with the new additions. Maximum concentrations as listed in TABs 1 - 3 shall not be exceeded at any given time without Drilling Engineer Team Lead approval. Increasing concentration of product greater than the concentration listed on the proposed mud inventories will be evaluated using available data along with the M-I SWACO ENV ALC50 program for estimating toxicity and, to the maximum extent practicable, with lab tested samples, prior to exceeding the listed concentrations.

Product concentration shall be calculated based on the volume of the active circulating system, concentration of product already in the active system and the amount of product and water added each day. These results are

calculated and documented in the M-I SWACO ONE-TRAX software program and summarized at the end of the well (see sample product concentration report in Appendix A). For mud products that are disproportionately depleted, but can be verified by means of titration, the concentration in the mud system will be adjusted after field tests confirm the actual concentration in the mud system. These results will be documented in M-I SWACO ONE-TRAX software program and labeled as active concentration.

See Appendix A - Sample ONE-TRAX Product Concentration Report

Drilling Fluids Plan

TAB 1 PROPOSED INVENTORY: Gel / Polymer sweeps

Generic Description	Product Name	Max Concentration
Base Mud		
Biopolymer	DUOVIS/FLOWZAN	5 lb/bbl
Bentonite	M-I GEL	35 lb/bbl
Bentonite extender	GELEX	0.05 lb/bbl
Polyanionic cellulose	POLYPAC UL/ POLYPAC Supreme UL	5 lb/bbl
Additives		
Crushed nut hulls	NUT PLUG	20 lb/bbl
Contingency Products		
Barite	M-I WATE	160 lb/bbl
Defoamer	DEFOAM-X	0.3 lb/bbl
Dye	Sodium Fluoresceine Green Dye	.5 gal/bbl in seawater
Caustic soda	stock product	8 lb/bbl
Citric acid	stock product	5 lb/bbl
Mixture	LUBE 945	3% v/v
Sodium acid pyrophosphate (SAPP)	stock product	0.5 lb/bbl
Soda ash	stock product	13 lb/bbl
Biocide	Busan 1060	0.4 lb/bbl

Sweeps are to be built and pumped in 40-70 bbls increments as needed to remove cuttings from the hole. These materials are all relatively inert. Experience, supported with laboratory toxicity data, indicates that the mud's LC 50 results will remain above the permitted toxicity limit (i.e., exhibit 96-hr LC50 of greater than 30,000 ppm SPP).

Mineral oil-based pills will be not used in the drilling fluids during the 2015 drilling campaign.

A kill-weight mud system will be on-hand while drilling the riserless hole sections as a contingency fluid for well control and hole stability situations.

Contingency Products

M-I WATE (barite) would be used as a weighting agent. Once total depth is reached, a viscosified mud system will be spotted in the open hole for stability purposes while running the 36" and 22" casing. **M-I WATE (barite)** will be added to the system, if needed, to increase mud weight and hydrostatic pressure in the well as a contingency for bore hole stability.

Sodium Fluoresceine Green Dye will be used as a marker to be circulated down the hole and back to the mud line cellar to act as a caliper to measure open-hole volume. This will be used to improve accuracy in determining the amount of cement that needs to be pumped in order to cement the 36" and 22" casing strings without pumping out more excess cement to the mud line cellar than necessary.

Defoam-X will be used to control airing of the fluid and help maximize density.

Caustic soda, citric acid, and soda ash may be used to control the pH

Drilling Fluids Plan

Rotary torque issues and lubricity – If the drill string is sticking while drilling creating elevated rotary torque, LUBE 945 will be added to the mud system as a lubricant.

Biocide may be used if the fluid needs to be stored for an extended period of time to mitigate bacteria growth.

Sodium acid pyrophosphate (SAPP) may be used as an anti-accretion agent to clear sticky clays from the inside of the mud line cellar (MLC) bit.

Drilling Fluids Plan

Toxicity Estimation

(Method 1) Formulated mud using products at anticipated concentrations

Method 1 testing data documents the maximum expected product concentration in the active drilling fluid system thru 96 HR LC 50 range finding method to meet the toxicity limitation. These are the expected maximum concentrations for the individual products that will be used in the mud system under normal conditions.

Shell Chukchi LC 50 Testing

Prepared by M-I SWACO Technical Service lab ID code 120315F.003, Lab Master No. 20120965

Weighted Gel / Polymer Sweep Fluid Formulations

Lab sample ID		ES-6699
96-hr LC 50 Results		>500,000 ppm
Formula		
Water	bbl	0.881
M-I Gel	ppb	30.0
Soda ash	ppb	0.5
Polypac Supreme UL	ppb	2.0
Defoam-X	ppb	0.25
Busan 1060	ppb	0.4
Gelex	ppb	0.01
M-I WATE	ppb	124

Lab sample ID		ES-6699 Surface A	ES-6700 Surface B	ES-6701 Surface C
96-hr LC 50 Results		>500,000 ppm	>500,000 ppm	>500,000 ppm
Formula				
Water	bbl	0.881	0.881	0.881
M-I GEL	ppb	30	15	3
Soda ash	ppb	.5	.5	.5
POLYPAC SUPREME UL	ppb	2	2	2
DUOVIS	ppb	1	2	3
DEFOAM-X	ppb	.25	.25	.25
BUSAN 1060	ppb	.4	.4	.4
M-I WATE	ppb	124	136	146
GELEX		.01	.01	.01

Drilling Fluids Plan

(Method 2) Individual Product Evaluations using maximum concentrations

Method 2 testing data documents that maximum concentrations for individual mud products are proven to meet the toxicity limitation. These are the maximum concentrations for the individual products that will be used in the mud system without further testing and evaluation.

Base mud products range in LC 50 values from 261,440 to > 500,000 ppm.
Additive mud product LC 50 value is > 500,000 ppm.
Contingency products range in LC 50 values from 328,470 to > 1,000,000 ppm.

Product	LC50	@	In	ES #	Title
DEFOAM-X	827,371	0.3 ppb	GM7	1280	DEFOAM-X @ 0.1 LBS/BBL in Generic Mud # 7
DUOVIS	261,440	5 ppb	GM7	6523	5 ppb DUO-VIS in Generic Mud # 7
Sodium chloride (saturated brine)	178,000	100 ppb	GM7	1680	Saturated NaCl mud
POLYPAC SUPREME UL	445,600	4 ppb	GM7	4253	4.0 ppb POLYPAC SUPREME UL (Lot 58523)in Generic Mud # 7
Flowzan	>500,000	3 ppb	GM 7	6535	3 ppb Flowzan in Generic Mud #7
M-I GEL	>500,000	35 ppb	GM7	5743	Generic Mud # 7 - Base Formulation
GELEX	>500,000	0.01 ppb	GM7	6378	0.01 ppb GELEX in GM 7
M-I WATE (to a 12ppg)	>500,000	160 ppb	GM7	5743	Generic Mud # 7 - Base Formulation
NUT PLUG Fine	> 500,000	40 ppb	GM 7	6536	40 ppb Pecan Nut Plug Fine in Generic Mud #7
NUT PLUG Med	> 500,000	40 ppb	GM7	6537	40 ppb Pecan Nut Plug medium in Generic Mud #7
Sodium Fluoresceine Green Dye	328,470	0.12% v/v	Synthetic Seawater	ID-120625-1	96 hr acute Drilling Fluid Toxicity Test with Americamysis bahia
Sodium acid pyrophosphate (SAPP)	>1,000,000	0.5 ppb	Ref mud	676	SAPP @ 0.5 ppb
Caustic soda	>1,000,000	8 ppb	GM7	2601	8 PPB Caustic Soda in Generic Mud #7
Citric acid	>1,000,000	5 ppb	GM7	5417	Acute Toxicity Of A Drilling Fluid 5 ppb Citric Acid in Generic Mud # 7

Drilling Fluids Plan

TAB 2 PROPOSED INVENTORY: KLA-SHIELD - Mud

Generic Description	Product Name(s)	Maximum Concentration
Base Mud		
Soda ash	stock product	12 lb/bbl
Acrylic Polymer	IDCAP D	5 lb/bbl
Shale/Clay Inhibitor	EMI-2009	20 lbs/bbl
Shale/Clay Inhibitor	KLA-STOP	20 lbs/bbl
Biopolymer	DUOVIS	2 lb/bbl
Biopolymer	Flowzan	2 lb/bbl
Polyanionic Cellulose	POLYPAC SUPREME UL	5 lb/bbl
Sodium Hydroxide	Caustic Soda	8 lb/bbl
Barite	M-I WATE	160 lb/ bbl
Sodium Chloride in brine	Salt/NaCl	100 lb/bbl
Additives		
Copolymeric shale stabilizer	POROSEAL	19 lb/bbl
Deflocculant	CF Desco®II	4 lb/ bbl
Sodium Bicarbonate	stock product	10 lb/bbl
Citric Acid	stock product	4 lb/bbl
Biocide	Busan 1060	0.4 lb/bbl
Liquid defoamer	DEFOAM-X	0.3 lb/bbl
Liquid defoamer	DF-9065	0.3 lb/bbl
Crushed nut hulls	NUT PLUG MED	40 lb/bbl
Crushed nut hulls	NUT PLUG FINE	40 lb/bbl
Vegetable, polymer fiber blend	MI SEAL	40 lb/bbl
Cellulose fiber	MIX II Fine	25 lb/bbl
Cellulose fiber	MIX II MED	25 lb/bbl
Graphite	G-SEAL	10 lb/bbl
Calcium carbonate	SAFECARB-20	200 lb/bbl
Calcium carbonate	SAFECARB-40	200 lb/bbl
Calcium carbonate	SAFECARB-250	200 lb/bbl
Sodium Chloride	stock product	100 lb/bbl
Resinated Lignite	RESINEX	10 lb/bbl
Sulfonated Asphalt	ASPHASOL SUPREME	8 lb/bbl
Contingencies		
Mixture	FORM-A-BLOK	40 lb/bbl
Cellulose	FORM-A-SET AK	Formulation pill
Zinc oxide	Sulf-X	2.5 lb/bbl
Mixture	Pipelax ENV WH	4% v/v
Mixture	LUBE 945	3% v/v
Mixture	CLEAN SPOT	4% v/v
Surfactant	SCREENKLEEN	2% v/v
Mixture	SAFE-SCAV HS	0.1 lb/bbl
Mixture	SAFE-SCAV HSW	0.1 lb/bbl

Drilling Fluids Plan

Maximum concentrations shall not be exceeded at any given time in this mud without approval from the drilling engineer team lead. Maximum concentration is monitored using M-I SWACO ONE-TRAX database. Product concentration calculations take into account the amount of mud circulating, dilution water added, concentration of product already in the mud and the amount of product added each day.

Toxicity Estimation

(Method 1) Formulated mud using anticipated products

Experience, supported with laboratory toxicity data, indicates that the mud's LC 50 results will be in compliance with the permitted toxicity limit (i.e., exhibit 96-hr LC 50 of greater than 30,000 ppm SPP).

Mineral oil-based pills will be not used in the drilling fluids during the 2015 drilling campaign.

See Appendix B - Shell Chukchi LC 50 Testing

Contingency Products

Differentially stuck pipe – PIPELAX ENV WH or CLEAN SPOT may be used if the drilling apparatus becomes differentially stuck and other conventional methods fail to free the pipe. PIPELAX ENV WH and CLEAN SPOT are low-toxicity products that are spotted in order to penetrate between the wall cake and the drill string and act as a lubricant to allow the drilling apparatus to break free.

Bit balling – Bit balling occurs when drill solids, usually clays, adhere to the drilling apparatus which slows or and eventually stops forward progress. If bit balling is observed, Pecan Nut Plug sweeps will be used to remove build-up from the bit. SCREENKLEEN will be added if other measures to prevent bit-balling fail. SCREENKLEEN added to the mud will act as an anti-accretion agent by helping to remove drill solids and prevent further build-up. It also helps solids move efficiently through the rig's surface solids control equipment.

Hydrogen sulfide gas – Hydrogen sulfide (H_2S) is a naturally occurring poisonous gas that can be found at dangerous concentrations while drilling exploration wells. If H_2S is encountered, zinc oxide or SAFE-SCAV HS/HSW will be applied to the active system to help neutralize the gas.

pH Control – In the event that the mud pH becomes too high or too low, then caustic soda, citric acid, or soda ash will be used to control pH.

Rotary torque issues and lubricity – If the drill string is sticking while drilling, LUBE 945 will be added to the system as a lubricant.

Total loss of drill fluids to the formation – FORM-A-BLOK and FORM-A-SET AK will be used as a plug if total circulation is lost to the formation.

(Method 2) Individual Product Evaluations using maximum concentrations

Method 2 testing data documents that maximum concentrations for individual mud products are proven to meet the toxicity limitation. These are the maximum concentrations for the individual products that will be used in the mud system without further testing and evaluation.

Base mud products range in LC 50 values from 178,000 to > 500,000 ppm.
Additive mud products range in LC 50 values from 142,000 to > 1,000,000 ppm.
Contingency products range in LC 50 values from 117,275 to > 500,000 ppm

Drilling Fluids Plan

Products	LC50	@	in	ES #	Title
Asphasol Supreme	557,538	8.0 ppb	GM7	4651	8 ppb Asphasol Supreme in GM # 7
Busan 1060	>500,000	.4 ppb	GM 7	6538	Busan 1060 - in Generic Mud #7
Caustic soda	1,000,000	8 ppb	GM7	2601	8 PPB caustic soda in Generic Mud # 7
CF DESCO II	> 500,000	3 ppb	GM 7	6534	3 ppb CF Desco II in Generic Mud # 7
Citric acid	1,000,000	5 ppb	GM7	5417	Acute Toxicity Of A Drilling Fluid 5 ppb Citric Acid in Generic Mud # 7
CLEAN SPOT	161,600	4% v/v	GM7	5221	4% (14ppb) Clean Spot in Generic Mud # 7
DEFOAM-X	827,371	0.3 ppb	GM7	1280	DEFOAM-X @ 0.1 LBS/BBL in Generic Mud # 7
DRILZONE	>500,000	7% v/v	GM7	4975	7% Drilzone (EMI 712) in Generic Mud # 7
DUOVIS	261,440	5 ppb	GM7	6523	5 ppb DUO-VIS in Generic Mud # 7
EMI-2009	>500,000	7% v:v	GM7	6051	7% (v/v) EMI 2009 in Generic Mud # 7
Flowzan	>500,000	3 ppb	GM 7	6535	3 ppb Flowzan in Generic Mud #7
FORM-A-BLOK	>500,000	40 ppb	GM7	6504	40 ppb FORM-A-BLOK in Generic Mud # 7
FORM-A-SET AK	148,000	12.68 ppb	GM7	5425	12.68 ppg FORM-A-SET AK Slurry with Crosslinker
G SEAL	>1,000,000	10 ppb	GM7	4707	Acute Toxicity of a Drilling Fluid 10.0 ppb G- Seal in Generic Mud # 7
GELEX	>500,000	0.01 ppb	GM7	6378	0.01 ppb GELEX in Generic Mud # 7
IDCAP D	>500,000	2 ppb	GM7	5416	S-2702 (C) - 2 ppb ID Cap Din Generic Mud # 7
KLASTOP	345,008	7% v/v	GM7	5685	96 hr range finder test ES 5858
LUBE 945	462,937	3% v/v	GM7	5731	S-2957 (G) – 3% Lube 945 in Generic Mud # 7
M-I GEL	>500,000	35 ppb	GM7	5743	Generic Mud # 7 - Base Formulation
MI SEAL	206,000	40 ppb	GM7	6532	40 ppb M-I SEAL medium in Generic Mud # 7
M-I WATE (to a 12ppg)	>500,000	160 ppb	GM7	5743	Generic Mud # 7 - Base Formulation
MIX II FINE	>500,000	25 ppb	GM7	6238	25 ppb MIX Fine (Argentina) in Generic Mud # 7
MIX II MED	>500,000	25 ppb	GM7	6237	25 ppb MIX medium (Argentina) in Generic Mud # 7
NUT PLUG Fine	> 500,000	40 ppb	GM 7	6536	40 ppb Pecan Nut Plug Fine in Generic Mud # 7
NUT PLUG Med	> 500,000	40 ppb	GM7	6537	40 ppb Pecan Nut Plug medium in Generic Mud #7

Drilling Fluids Plan

Products	LC50	@	in	ES #	Title
Pipelax ENV WH	293,000	4% v/v	GM7	6556	4% Pipelax Env WH in Generic Mud # 7
POLYPAC R	833,800	5 ppb	GM7	4413	Lab Sample 5 ppb Polypac in Generic Mud # 7, ES-4413
POLYPAC SUPREME UL	445,600	4 ppb	GM7	4253	4.0 ppb POLYPAC SUPREME UL (Lot 58523)in Generic Mud # 7
POROSEAL	>500,000	10.5 ppb	GM7	6,082	3% (v/v) Poroseal S 3316 (B)(pH 9.2) in Generic Mud # 7
RESINEX	>518,766	10 ppb	GM7	1723	10 ppb Resinex in GM# 7
SAFECARB-20	>1,000,000	200 ppb	GM7	4980	Acute Toxicity of a Drilling Fluid Safe Carb 20
SAFECARB-40	>1,000,000	200 ppb	GM7	4978	Acute Toxicity of a Drilling Fluid Safe Carb 40
SAFECARB-250	>1,000,000	200 ppb	GM7	4981	Acute Toxicity of a Drilling Fluid Safe Carb 250
SCREENKLEEN	>500,000	2% v/v	GM7	6164	2% (v/v) SCREENKLEEN in Generic Mud #7
SAFE-SCAV HS	>500,000	0.1 ppb	GM7	6503	O.1 ppb SAFE-SCAV HS in GM # 7
SAFE-SCAV HSW	TBD	0.1 ppb	GM7	TBD	O.1 ppb SAFE-SCAV HS in GM # 7
Soda ash	391,155	13 ppb	GM7	2552	13 PPB Soda Ash in Generic Mud # 7
Sodium bicarbonate	446,915	10 ppb	GM7	2518	10 PPB Sodium Bicarbonate in Generic Mud # 7
Sodium chloride	178,000	100 ppb	GM7	1680	Saturated NaCl Mud
Sodium Metabisulfite	142,000	.5 ppb	AF #A	6707	0.5 ppb Abandonment Fluid A – Shell Chukchi LC-50 testing
X cide 207	600,000	0.175 ppb	GM7	1414	BacBan III at .175 ppb
Zinc oxide	117,275	2.5 ppb	HTLM	1471	SULF-X @ 2.5 LBS/BBL IN A HIGH TEMPERATURE LAB MUD

Drilling Fluids Plan

TAB 3 PROPOSED INVENTORY: KLA-SHIELD – Abandonment Mud

Generic Description	Product Name(s)	Maximum Concentration
Base Mud		
Soda ash	stock product	12 lb/bbl
Biopolymer	DUOVIS	2 lb/bbl
Sodium Hydroxide	Caustic Soda	8 lb/bbl
Barite	M-I WATE	160 lb/ bbl
Sodium Chloride in brine	Salt/NaCl	40 lb/bbl
Corrosion inhibitor	Conqor 404	0.5 lb/bbl
Corrosion inhibitor	Conqor 404 WH	0.5 lb/bbl
Hydrogen Sulfide Scavenger	SAFE-SCAV HS	0.1 lb/bbl
Hydrogen Sulfide Scavenger	SAFE-SCAV HSW	0.1 lb/bbl
Oxygen Scavenger	Sodium Metabisulfite	0.5 lb/bbl
Pre-existing Additives		
Acrylic Polymer	IDCAP D	5 lb/bbl
Shale/Clay Inhibitor	KLA-STOP/EMI-2009	20 lbs/bbl
Polyanionic Cellulose	POLYPAC SUPREME UL	5 lb/bbl
Copolymeric shale stabilizer	POROSEAL	19 lb/bbl
Deflocculant	CF Desco II	4 lb/ bbl
Sodium Bicarbonate	stock product	10 lb/bbl
Citric Acid	stock product	4 lb/bbl
Biocide	Busan 1060	0.4 lb/bbl
Liquid defoamer	DEFOAM-X	0.3 lb/bbl
Calcium carbonate	SAFECARB-20	200 lb/bbl
Calcium carbonate	SAFECARB-40	200 lb/bbl
Sodium Chloride	stock product	100 lb/bbl
Resinated Lignite	RESINEX	8 lb/bbl
Sulfonated Asphalt	ASPHASOL SUPREME	8 lb/bbl
Contingency Additives		
Sodium Bromide Brine	NaBr	212 lb/bbl

Abandonment fluid is fluid that is left in the well prior to cementing off the well after operations are complete. The well may be temporarily or permanently abandoned. Maximum concentrations shall not be exceeded at any given time in this mud without approval from the drilling engineer team lead. Maximum concentration is monitored using M-I SWACO ONE-TRAX database. Product concentration calculations take into account the amount of mud circulating, dilution water added, concentration of product already in the mud and the amount of product added each day.

Toxicity Estimation
(Method 1) Formulated mud using anticipated products

Experience, supported with laboratory toxicity data, indicates that the mud's LC 50 results will be in compliance with the permitted toxicity limit (i.e., exhibit 96-hr LC50 of greater than 30,000 ppm SPP).

Drilling Fluids Plan

Mineral oil-based pills will be not used in the drilling fluids during the 2015 drilling campaign.

See Appendix B - Shell Chukchi LC50 Testing

(Method 2) Individual Product Evaluations using maximum concentrations

Method 2 testing data documents that maximum concentrations for individual mud products are proven to meet the toxicity limitation. These are the maximum concentrations for the individual products that will be used in the mud system without further testing and evaluation.

Base mud products range in LC 50 values from 178,000 to > 1,000,000 ppm.
Additive mud products range in LC 50 values from 446,915 to > 1,000,000 ppm.

Products	LC50	@	in	ES #	Title
ASPHASOL SUPREME	557,538	8.0 ppb	GM7	4651	8 ppb Asphasol Supreme in GM # 7
Busan 1060	>500,000	.4 ppb	GM 7	6538	Busan 1060 - in Generic Mud #7
Caustic soda	1,000,000	8 ppb	GM7	2601	8 PPB caustic soda in Generic Mud # 7
CF DESCO II	> 500,000	3 ppb	GM 7	6534	3 ppb CF Desco II in Generic Mud # 7
Citric acid	1,000,000	5 ppb	GM7	5417	Acute Toxicity Of A Drilling Fluid 5 ppb Citric Acid in Generic Mud # 7
CLEAN SPOT	161,600	4% v/v	GM7	5221	4% (14ppb) Clean Spot in Generic Mud # 7
CONQOR 404	> 1,000,000	1.5 ppb	GM 7	4515	1.5 ppb Conqor 404 in a Generic Mud #7
CONQOR 404 WH	> 1,000,000	0.4 ppb	GM 7	6936	0.4 ppb Conqor 404 in a Generic Mud #7
DEFOAM-X	827,371	0.3 ppb	GM7	1280	DEFOAM-X @ 0.1 LBS/BBL in Generic Mud # 7
DUOVIS	261,440	5 ppb	GM7	6523	5 ppb DUO-VIS in Generic Mud # 7
EMI-2009	>500,000	7% v/v	GM7	6051	7% (v/v) EMI 2009 in Generic Mud # 7
IDCAP D	>500,000	2 ppb	GM7	5416	S-2702 (C) - 2 ppb ID Cap Din Generic Mud # 7
KLASTOP	345,008	7% v/v	GM7	5685	96 hr range finder test ES 5858
LUBE 945	462,937	3% v/v	GM7	5731	S-2957 (G) – 3% Lube 945 in Generic Mud # 7
M-I GEL	>500,000	35 ppb	GM7	5743	Generic Mud # 7 - Base Formulation
M-I WATE (to 12ppg)	>500,000	160 ppb	GM7	5743	Generic Mud # 7 - Base Formulation
PIPELAX ENV WH	293,000	4% v/v	GM7	6556	4% Pipelax Env WH in Generic Mud # 7
POLYPAC R	833,800	5 ppb	GM7	4413	Lab Sample 5ppb Polypac in Generic Mud # 7, ES-4413
POLYPAC SUPREME UL	445,600	4 ppb	GM7	4253	4.0 ppb POLYPAC SUPREME UL (Lot 58523)in Generic Mud # 7
POROSEAL	>500,000	10.5 ppb	GM7	6,082	3% (v/v) Poroseal S 3316 (B)(pH 9.2) in Generic Mud # 7
RESINEX	>518,766	10 ppb	GM7	1723	10 ppb Resinex in GM# 7

Drilling Fluids Plan

Products	LC50	@	in	ES #	Title
SAFECARB-20	>1,000,000	200 ppb	GM7	4980	Acute Toxicity of a Drilling Fluid Safe Carb 20
SAFECARB-40	>1,000,000	200 ppb	GM7	4978	Acute Toxicity of a Drilling Fluid Safe Carb 40
SAFECARB-250	>1,000,000	200 ppb	GM7	4981	Acute Toxicity of a Drilling Fluid Safe Carb 250
SCREENKLEEN	>500,000	2% v/v	GM7	6164	2% (v/v) SCREENKLEEN in Generic Mud #7
SAFE-SCAV HS	>500,000	0.1 ppb	GM7	6503	0.1 ppb SAFE-SCAV HS in GM # 7
SAFE-SCAV HSW	TBD	0.1 ppb	GM7	TBD	0.1 ppb SAFE-SCAV HS in GM # 7
Soda ash	391,155	13 ppb	GM7	2552	13 PPB Soda Ash in Generic Mud # 7
Sodium bicarbonate	446,915	10 ppb	GM7	2518	10 PPB Sodium Bicarbonate in Generic Mud # 7
Sodium bromide/Sodium chloride brine	275,400	212 ppb	water	4510	NaCl/NaBr blend in water
Sodium chloride	178,000	100 ppb	GM7	1680	Saturated NaCl Mud
Sodium metabisulfite	142,000	.5 ppb	AF #A	6707	0.5 ppb Abandonment Fluid A – Shell Chukchi LC-50 testing
X cide 207	600,000	0.175 ppb	GM7	1414	BacBan III at .175 ppb
Zinc oxide	117,275	2.5 ppb	HTLB	1471	SULF-X @ 2.5 LBS/BBL IN A HIGH TEMPERATURE LAB MUD

Drilling Fluids Plan

TAB 4 –ALTERNATIVE METHOD FOR ESTIMATING FORMULA TOXICITY: M-I SWACO ALC 50 Program

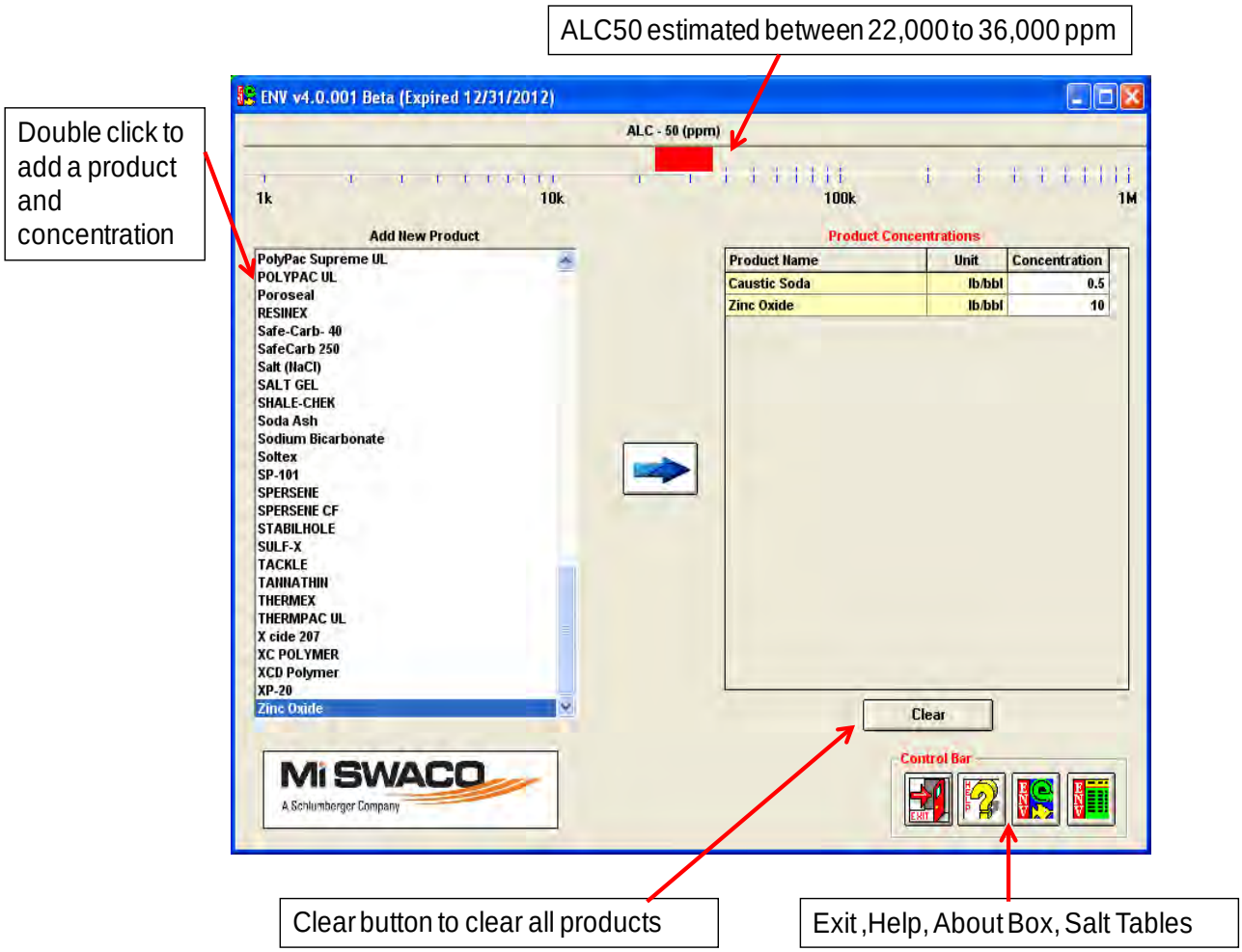
M-I SWACO ALC 50 program

In order to address worst-case cumulative discharge toxicity assessments, the procedure for determining and documenting the cumulative discharge toxicity estimations will be accomplished using the M-I SWACO ALC 50 program. If products are added outside of the maximum concentrations listed in Method 1, then the ALC 50 program will be run before listed products and concentrations of products are added to the active mud system. The results of the program will estimate the expected toxicity based on product concentrations.

Specific instructions for operating the ALC 50 program are listed below.

Click to start ENV

Drilling Fluids Plan



TAB 5 – CRITERIA FOR UNLISTED CONTINGENCY ADDITIVES

If any additive or additive concentration needed for any of the mud described in this plan is not listed on the currently proposed inventory for that mud (TABs 1 - 3), it may not be used without first considering the following criteria:

1. Is there an alternative product already on the proposed inventory and in stock that will have the same affect in the mud? Double check this. Products already in stock will be used before special shipments of other products are arranged. Special shipments require approval of the Shell Drilling Supervisor.
2. What is the nature of the additive? Is it relatively inert with respect to toxicity?
    a. Product additives considered "relatively inert" based on past LC 50 test evaluations >500,000 may be applied to mud as required to achieve specific mud characteristics and/or performance.
3. Discharge of any drilling product containing diesel oil is not allowed.
4. Some estimate of toxicity of the discharged whole mud/additive system is required as part of this mud plan. Shell has set-up the following process for all Burger operations:

    Calculate estimate of cumulative discharge toxicity. A laptop PC in the rig mud lab is loaded with M-I SWACO One-Trax database for the proposed mud systems' product concentration tracking. Products will be used at concentrations below the maximum concentration tested in Method 2 of the toxicity evaluations.

    Provide bioassay data for the new additive as indicated in the mud plan. **DO NOT FORGET to save, print, and attach an initialed & dated copy of the re-estimation to this mud plan!**

    Obtain bioassay information for the additive(s) under consideration from Shell's mud contractor's environmental office.

    Try to locate bioassay data that represents the same concentration of product for which you propose to use bioassay data. If data is not available for the exact concentration, data on a greater concentration should be used. For instance: need to use 0.5 lb/bbl and bioassay data is only available for 0.1 lb/bbl and 1.0 lb/bbl concentrations, then use the bioassay based on 1.0 lb/bbl concentration. This requirement is based on the assumption that drilling mud toxicity is additive.

    Shell and M-I SWACO have agreed that it is acceptable to use bioassay data that represents mixtures of additives that may contain the additive needed. List the 'extra' additives and their concentrations as indicated in the mud plan. This documents the conservative nature of the estimate – in that more additives are represented than will be used.

    1) No mud additive concentration shall be applied if the tested concentration of the mud additive's LC 50 value is less (i.e. more lethal) than the permitted limit of 30,000 ppm SPP (See NPDES AKG-28-0000 permit Section IV.C.3.c.
    2) An additive may be applied if the estimated or tested LC 50 value is higher (i.e. less lethal) than the permitted limit of 30,000 ppm SPP with approval by the Drilling Supervisor.

Drilling Fluids Plan

TEST/REPORT	SAMPLE	WHEN TO...	WHERE TO...
Reports			
Mud inventories	Muds only	• Whenever a sample is taken for bioassay • Whenever muds are changed over • At end-of-well for all muds	
SPP Toxicity	Drilling Fluid	Weekly and End-of-Well	
Metal Test (Cr, Cd, Hg, Ag, Th)	Drilling Fluid	Once for surface interval (riserless section) and once per intermediate interval (risered drilling) (after drilling starts)	
pH	Drilling Fluid	Once per well (after drilling starts)	
TAqH	Drilling Fluid	Once per well (after drilling starts)	
TAH	Drilling Fluid	Once per well (after drilling starts)	
Total Volume	Drilling Fluid and Cuttings	Monthly	
Sheen Reports	Daily while discharging	Monthly as attachment to DMR	See table for Static Sheen, attached
Barite Mercury/Cadmium (from Lab or M-I SWACO)	On stock barite only	At End-of-Well	Attach to DMRs
End-of-well Report	As per NPDES General Permit # AKG-28-8100, Section II.A.14.	Shell Regulatory Affairs will compile final report after individual pieces (bioassays, lab results, etc.) arrive from M-I SWACO and the Drilling Supervisors & Engineer team lead.	

Records and Procedures

M-I SWACO has written standard operating procedures (SOPs) and retains records for conducting Static Sheen Observations. SOP 2004 covers the procedures for Decontamination of Equipment used in the observation test. SOP 3004 provides the methodology for the qualitative (pass/fail) analysis of drill fluids or drill cuttings for static sheen observation. The permit is the reference document used to determine sampling and testing requirements. The QAPP is the reference document used to provide specific instructions on preparing and shipping samples.

TAB 6 – PROCEDURE FOR COLLECTING BARITE SAMPLES

Sample procedures for barite samples are included in the supplier Barite Certification program. If the Barite Mercury and Cadmium Samples are samples at the grinding plant they will follow the standard procedures used in the supplier barite certification program. If the samples of barite are collected from a tank on the rig or from a tank prior to arriving at location, the sample collection procedures listed below will be used to collect the samples. The chain of custody and other shipping and testing requirements are described in the QAPP for the project.

Sampling method for barite in a tank

(As an example: barite collected from drilling rig)

When bulk barite is sampled from a tank the following procedure will be used to sample.

a) The top hatch of the storage tank will be opened and three samples will be taken from the top surface of barite in the tank. A scoop with a handle will be required to take the samples.

b) Using the scoop, make a trench in the surface of the barite about 18 inched long and six to eight inches deep. Then clean the scoop and take about three pounds of sample. Repeat the process two more times.

c) If possible obtain a sample from the bottom of the tank after lines have been cleared.

d) Composite the samples using either the inflated bag technique or coning method

Inflated Bag Technique

Use a large, heavy duty bag (such as two layers of kitchen trash bags) for the mixing. Place the samples in the bag and inflate the bag with air to a firm feel. Twist the bag shut, and shake the bag for three to four minutes until the barite is uniformly mixed.

Coning Method

Place all of the samples on a large, clean, flat surface in the shape of a cone. Using the scoop, remove scoops from the bottom of the cone and pour them on top of the cone. Continue all around the cone at least three times to ensure a uniform mix. When a scoopful is taken, the front tip of the scoop must be at least at the center of the cone.

e) Split the sample into the amount required by the laboratory using riffling or coning and quartering.

Coning and quartering Method

On a large, clean, flat surface, create a cone. Using a spatula, flatten the cone into a circle and divide it into equal pie shaped sections. Remove a section for the sample to send to the laboratory. The size of the pie is based on the amount of barite required for analysis (usually 100 grams).

Drilling Fluids Plan

Sample / Production Identification

Each sample will be labeled with the sample identification, the date and time of collection, the name of the person collecting the sample and the location of sample collection. The same information must also be recorded on the chain of custody and the final laboratory report for the composite sample.

Example sample label:

Company name: M-I Drilling Fluids

Sample Identification: AM697-G1

Sample location: mill 4 cyclone

Date of sample: 6/18/97

Time of sample 2:15 pm

Person collecting sample: John Candler

A sample identification number should be the barite shipment number, or in the case of a composite production sample, a production lot number.

TAB 7 – DOCUMENTATION FORM FOR UNLISTED CONTINGENCY ADDITIVES

If an unlisted contingency additive is required, or a product concentration must be exceeded then the following form will be used to document the decision and approval:

Required Modification description: _____

Calculate estimate of cumulative discharge toxicity. (See Tab 4 for Criteria for Unlisted Contingency Additives)

_____

Shell Approval Title: _____
Name: _____
Signature: _____
Date: _____

TAB 8 – FEDERALLY REGULATED ADDITIVES

Two products, which will be used in the drilling fluids, are Federally Regulated.

Caustic Soda (sodium hydroxide) is a pH control additive used to increase the pH to prevent bacterial growth and enhance the drilling performance characteristics of the fluid. Caustic soda is considered a hazardous corrosive material and is subject to public disclosure under the substantive requirements as stated in Title III of the Superfund Amendments and Reauthorization Act of 1986 (Emergency Planning and Community Right to Know Act [EPCRA]) Sections 311 and 312. The Act requires for any hazardous chemical used or stored in the workplace, facilities must maintain a Safety Data Sheet (SDS). SDSs, or a list of chemicals, must be submitted to their State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC) and local fire department. Facilities must also report an annual inventory of these chemicals by March 1 of each year to their SERC, LEPC and local fire department. The information must be made available to the public. Note: Caustic Soda is considered an "Immediate (acute) health hazard" if this material is not used in accordance to the manufacturer's product use guidance.

BUSAN 1060 is a triazine-based biocide used to mitigate bacterial growth in the drilling fluid. This product is a registered pesticide (EPA Reg. No. 1448-243) and falls under the substantive requirements of the Federal Insecticide, Fungicide and Rodenticide Act of 1972 (FIFRA). While this product is not considered an acutely hazardous material, product use must be strictly followed in accordance to the manufacturer's product use guidance. Refer to the product Safety Data Sheet for further health exposure information.

References

- **Jones, Fredrick V., Arthur J.J. Leuterman and Zamora Mario "Computer model gauges drilling fluid toxicity" Offshore, April 1989**
- **Jones, Fredrick V. and Jardiolin, Ric A. "Field Evaluation of Toxicity of Drilling Fluid Using Computer Applications," paper presented at the Petro-Safe '91 Conference held in Houston, February 6-8, 1991.**
- **Bleier, Roger "Predicting Mud Toxicity" Journal of Petroleum Technology (October 1991) 1192.**

Drilling Fluids Plan

Appendix A - Sample ONE-TRAX Product Concentration Report

WATER-BASED MUD PRODUCT CONCENTRATIONS
DAILY REPORT (Active System)

Operator: Sample M-I Well No.:
Well Name: Sample Report No.: 11
Location: Land Spud Date: 08/4/2012

Date: 08/4/2012

Mud Weight (lb/gal) :

Depth(ft) : 7000

Water Added (bbl) :		Init Fluid Volume (bbl) :	1371
Whole Mud (bbl) :	130	Final Fluid Volume (bbl) :	1486
Added Vol Incr-Wt Matl (bbl) :		Volume Change (bbl) :	115

PRODUCT	Size	AMOUNT ADDED (Qty Unit)	ESTIMATED CONC (lb/bbl) Initial Change	Final
M-I BAR (4-PLY LINED BAG)	50 LB BG	0.00	2.55 -0.32	2.23
M-IWATEBULK	1LBBK	0.00	10.48 -1.30	9.18
PECANNUTPLUGMEDIUM	50 LB BG	8.00	0.36 0.21	0.57
SODA ASH	50 LB BG	0.00	0.03 0.00	0.02
SODIUM BICARBONATE	50 LB BG	0.00	0.29 -0.04	0.25
CFDESCOII	25LBBG	0.00	0.13 -0.02	0.12
POROSEAL	55GADM	0.00	9.98 0.22	10.21
PolyPac Supreme UL	50 LB BG	0.00	0.40 -0.02	0.39
IDCAP D	50 LB BG	0.00	4.02 0.65	4.67
PECANNUTPLUGFINE	50LBBG	0.00	0.03 0.00	0.02
CAUSTICSODA	50LBBG	0.00	0.13 -0.02	0.11
DUOVIS	25 LB BG	13.00	1.59 0.06	1.65
DEFOAMX	5 GACN	1.00	0.20 0.02	0.21
EMI-2009	1 Gal	480.00	6.45 2.81	9.26
DRILZONE	55 GADM	0.00	0.81 -0.10	0.71

Non Listed Products – Additives which are not included on the product and contingency inventories for each system (TABs 1 and 2) will be evaluated using 96 hr LC50 range finding tests with lab prepared samples prior to introduction to the mud system. Further, BEFORE putting any such additive into the mud, approval of the Drilling Engineer team lead will be noted on/in this document (including date & time of decision to add "unlisted" product).

Specific instructions, responsibilities and approval process for products not listed in TABs 1 and 2 or product concentrations above the concentrations listed in TABs 1 and 2 are included in TAB 4.

Drilling Fluids Plan

Appendix B - Shell Chukchi LC50 Testing

Prepared by M-I SWACO Technical Service lab ID code 120315F.003, Lab Master No. 20120965

LC50 = Test report ES-6514, ES-6515, ES-6516, Shell's Chukchi Drilling Mud with NaCl

Base Mud: Shell's drilling fluid contractor (M-I SWACO Mud) had 3 complete formulations of the proposed mud tested. The KLA-SHIELD basic formula was used with NaCl salt and barite in varied concentrations to achieve the target weight in the first two formulations. The third formulation was tested excluding two of the additive products.

Lab sample ID		ES-6514 (sample 1)	ES-6515 (sample 2)	ES-6516 (Sample 3)
96-hr LC50 Results		302,000 ppm	358,000 ppm	>500,000 ppm
Formula				
Water	bbl	0.691	0.719	0.769
M-I GEL	ppb	5.0	5.0	5.0
POLYPAC SUPREME UL	ppb	2.0	2.0	2.0
DUOVIS	ppb	2.0	2.0	2.0
EMI-2009	ppb	15.0	15.0	15.0
IDCAP	ppb	3.0	3.0	
DF-9065	ppb	0.25	0.25	0.25
BUSAN 1060	ppb	0.4	0.4	0.4
POROSEAL	ppb	14.0	14.0	
SAFECARB 20	ppb	20.0	20.0	20.0
SAFECARB 40	ppb	20.0	20.0	20.0
SODIUM CHLORIDE	ppb	88.0	27.95	29.92
M-I WATE	ppb	92.49	142.83	140.2

Drilling Fluids Plan

M-I SWACO also mixed and tested fluid systems with contingency products added at maximum expected concentrations.

LC50 = Test report ES-6589 (Shell Chukchi Drilling Mud with NaCl – 12.0 ppg base fluid), ES-6590 (LCM pill #1), ES-6591 (LCM Pill #2), ES-6592 (base fluid with 4%v/v Pipelax ENV WH)

Lab sample ID		ES-6589 (base fluid)	ES-6590 (LCM Pill 1)	ES-6591 (LCM Pill #2)	ES-6592 (Base w/ Pipelax ENV WH)
96-hr LC50 Results		289,860 ppm	309,380 ppm	336,220 ppm	>500,000 ppm
Formula					
Water	bbl	0.706	0.706	0.706	0.706
M-I GEL	ppb	5.0	5.0	5.0	5.0
POLYPAC SUPREME UL	ppb	2.0	2.0	2.0	2.0
DUOVIS	ppb	2.0	2.0	2.0	2.0
EMI-2009	ppb	15.0	15.0	15.0	15.0
DEFOAM-X	ppb	0.25	0.25	0.25	0.25
IDCAP-D	ppb	3.0	3.0	3.0	3.0
BUSAN 1060	ppb	0.4	0.4	0.4	0.4
POROSEAL	ppb	14.0	14.0	14.0	14.0
SAFECARB 20	ppb	20.0	20.0	20.0	20.0
SAFECARB 40	ppb	20.0	20.0	20.0	20.0
SODIUM CHLORIDE	ppb	88.0	88.0	88.0	88.0
M-I WATE	ppb	101.38	101.38	101.38	101.38
SAFECARB 40	ppb		10	20	
SAFECARB 250	ppb		10	20	
MIX II	ppb		10		
NUT PLUG med	ppb			10	
G-SEAL	ppb			10	
G-SEAL PLUS coarse	ppb			10	
PIPELAX ENV WH	% v/v				4

Drilling Fluids Plan

Shell Chukchi LC50 Testing

Prepared by M-I SWACO Technical Service lab ID code 141203F.001, Lab Master No. 20144281

Lab sample ID		ES-6589 (base fluid)	ES-6590 (LCM Pill 1)	ES-6591 (LCM Pill #2)
96-hr LC50 Results		303,618 ppm	159,487 ppm	348,887 ppm
Formula				
Water	bbl	0.706	0.706	0.706
POLYPAC UL	ppb	2.0	2.0	2.0
DUOVIS	ppb	2.0	2.0	2.0
EMI-2009	ppb	15.0	15.0	15.0
Caustic Soda	ppb	1.5	1.5	1.5
DEFOAM-X	ppb	0.25	0.25	0.25
IDCAP-D	ppb	3.0	3.0	3.0
BUSAN 1060	ppb	0.4	0.4	0.4
SAFECARB 20	ppb	20.0	20.0	20.0
SAFECARB 40	ppb	20.0	30.0	40.0
SAFECARB 250	ppb		10	20
SODIUM CHLORIDE	ppb	88.0	88.0	88.0
M-I WATE	ppb	100	100	100
MIX II	ppb		10	
NUT PLUG med	ppb			10
G-SEAL	ppb			10
G-SEAL PLUS coarse	ppb			10

Drilling Fluids Plan

Shell Chukchi LC50 Testing

Prepared by M-I SWACO Technical Service lab ID code 141203F.001, Lab Master No. 20144281

Lab sample ID		ES-6704 Intermediate C	ES-6592 Intermediate D	ES-6706 Intermediate E	ES-6707 Abandonment A
96-hr LC50 Results		272,298 ppm	148,069 ppm	149,852 ppm	158,483 ppm
Formula					
Water	bbl	0.749	0.749	0.749	0.683
POLYPAC UL	ppb	2.0	2.0	2.0	2
DUOVIS	ppb	2.0	2.0	2.0	2
EMI-2009	ppb	15.0	15.0	15.0	15.0
Caustic Soda	ppb	1.25	1.25	1.25	1.25
DEFOAM-X	ppb	0.25	0.25	0.25	0.25
IDCAP-D	ppb	3.0	3.0	3.0	3.0
BUSAN 1060	ppb	0.4	0.4	0.4	0.4
SAFECARB 20	ppb	20.0	20.0	20.0	20.0
SAFECARB 40	ppb	20.0	20.0	20.0	20.0
SAFECARB 250	ppb				
SODIUM CHLORIDE	ppb	88.0	88.0	88.0	
M-I WATE	ppb	90	90	90	123
LUBE 945	% v/v	2			
SCREENKLEEN	%v/v		2		
CLEANSPOT	%v/v			2	
SAFESCAV HSW	% v/v				0.1
Sodium Metabisulfite	ppb				0.5
CONQOR 404 WH	ppb				0.4

Drilling Fluids Plan

Shell Chukchi LC50 Testing

Prepared by M-I SWACO Technical Service lab ID code 120315F.003, Lab Master No. 20120965

Lab sample ID		ES-6699 Surface A	ES-6700 Surface B	ES-6701 Surface C
96-hr LC50 Results		>500,000 ppm	>500,000 ppm	>500,000 ppm
Formula				
Water	bbl	0.881	0.881	0.881
M-I GEL	ppb	30	15	3
Soda ash	ppb	.5	.5	.5
POLYPAC SUPREME UL	ppb	2	2	2
DUOVIS	ppb	1	2	3
DEFOAM-X	ppb	.25	.25	.25
BUSAN 1060	ppb	.4	.4	.4
M-I WATE	ppb	124	136	146
GELEX		.01	.01	.01

Lab sample ID		ES-6702 Intermediate A	ES-6703 Intermediate B
96-hr LC50 Results		365,000 ppm	137,000 ppm
Formula			
Water	bbl	0.749	0.749
M-I GEL	ppb	5	5
POLYPAC SUPREME UL	ppb	2	2
DUOVIS	ppb	2	2
KLA-STOP	ppb	15	15
DEFOAM-X	ppb	.25	.25
IDCAP-D	ppb	3	3
BUSAN 1060	ppb	.4	.4
SAFECARB 20	ppb	20	20
SAFECARB 40	ppb	20	20
SODIUM CHLORIDE	ppb	88	88
M-I WATE	ppb	89	89
ASPHASOL SUPREME	ppb	6	6
RESINEX	ppb	6	6
SCREENKLEEN	%v/v		2

Drilling Fluids Plan

Shell Chukchi LC50 Testing

Prepared by M-I SWACO Technical Service lab ID code 120315F.003, Lab Master No. 20120965

Lab sample ID		ES-6704 Intermediate C	ES-6592 Intermediate D	ES-6706 Intermediate E
96-hr LC50 Results		158,000 ppm	107,000 ppm	91,800 ppm
Formula				
Water	bbl	0.749	0.749	0.749
M-I GEL	ppb	5	5	5
POLYPAC SUPREME UL	ppb	2	2	2
DUOVIS	ppb	2	2	2
KLA-STOP	ppb	15	15	15
DEFOAM-X	ppb	.25	.25	.25
IDCAP-D	ppb	3	3	3
BUSAN 1060	ppb	.4	.4	.4
SAFECARB 20	ppb	20	20	20
SAFECARB 40	ppb	20	20	20
SODIUM CHLORIDE	ppb	88	88	88
M-I WATE	ppb	89	89	89
LUBE 945	%v/v	2		
SCREENKLEEN	%v/v		2	
CLEAN SPOT	%v/v			2

Drilling Fluids Plan

Shell Chukchi LC50 Testing

Prepared by M-I SWACO Technical Service lab ID code 120315F.003, Lab Master No. 20120965

Lab sample ID		ES-6707 Abandonment A
96-hr LC50 Results		142,000 ppm
Formula		
Water	bbl	0.683
Soda ash	ppb	.5
M-I GEL	ppb	5
POLYPAC SUPREME UL	ppb	2
DUOVIS	ppb	2
KLA-STOP	ppb	15
DEFOAM-X	ppb	0.25
IDCAP-D	ppb	3
BUSAN 1060	ppb	0.4
SAFECARB 20	ppb	20
SAFECARB 40	ppb	20
SODIUM CHLORIDE	ppb	40
M-I WATE	ppb	123
SAFE SCAV HS	%v/v	0.1
Sodium Metabisulfite	ppb	0.5
CONQOR 404	%v/v	0.5