



United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
FOR OIL AND GAS EXPLORATION FACILITIES
ON THE OUTER CONTINENTAL SHELF AND CONTIGUOUS STATE WATERS

In compliance with the provisions of the Clean Water Act, 33 U.S.C. §1251 *et seq.*, as amended by the Water Quality Act of 1987, P.L. 100-4, the "Act", the following discharges:

<u>Discharge Number</u>	<u>Discharge Description</u>
001	Drilling Fluids and Drilling Cuttings
002	Deck Drainage
003	Sanitary Wastes
004	Domestic Wastes
005	Desalination Unit Wastes
006	Blowout Preventer Fluid
007	Boiler Blowdown
008	Fire Control System Test Water
009	Non-contact Cooling Water
010	Uncontaminated Ballast Water
011	Bilge Water
012	Excess Cement Slurry
013	Mud, Cuttings, Cement at Seafloor
014	Test Fluids

are authorized from **oil and gas exploratory facilities** to offshore areas Alaska located in or adjacent to the Beaufort Sea, Chukchi Sea, Hope, and Norton planning basins as defined in this permit as the Area of Coverage (see Section I.B) in accordance with the effluent limitations, monitoring requirements, and other conditions set forth herein.

This permit applies only to those facilities that have been authorized in accordance with the procedures described in Part I of this permit.

This permit shall become effective on **June 26, 2006**.

This permit and the authorization to discharge shall expire at midnight, **June 26, 2011**.

Signed this 16th day of May, 2006,

_____/s/_____
Michael F. Gearheard
Director
Office of Water and Watersheds, Region 10
U.S. Environmental Protection Agency

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I. **APPLICABILITY AND NOTIFICATION REQUIREMENTS**

- A. **Sources.** This general permit authorizes discharges from facilities engaged in field exploration and drilling activities under the Offshore Subcategory of the Oil and Gas Extraction Point Source Category (40 CFR 435 Subpart A). This general permit does not authorize discharges from “new sources” as defined in Part VII of this general permit.
- B. **Area of Coverage.** This general permit covers the area of federal and State waters of the U.S. in the Beaufort Sea, Chukchi Sea, Hope Basin, and Northern Norton Basin located seaward from the shoreline (MLLW) at the 64.5° N latitude (Cape Rodney) to the U.S. and Russia border and extending northward to the Alaska, USA and Yukon, Canada border as shown in Figure 1.
- C. **Prohibited Areas of Discharge.** [reserved]
- D. **Authorization to Discharge.**
1. Applicants seeking coverage under this general permit shall submit to the Director and the Alaska Department of Environmental Conservation (ADEC), at the addresses provided in Section I.G (Submission of Information), a written notice of intent (NOI) to be covered by this general permit. The permittee must clearly identify in the NOI the discharges for which they are applying under this general permit. Applicants may request a zone of deposit (ZOD) from ADEC by completing the ZOD section of the NOI. Applicants may request a mixing zone for sanitary and domestic wastes from ADEC. Applicants requesting a mixing zone must demonstrate that other disposal means are not economically feasible.
 2. Applicants must submit a complete NOI to the Director at least 45 days prior to initiation of discharges. A complete NOI will contain the information provided in Attachment 1 of this general permit. The applicant may use the NOI information sheet in Attachment 1 as part of their NOI submittal. The NOI shall be signed in accordance with the Signatory Requirements of Section VI.E of this general permit.
 3. Applicants will be authorized to discharge as of the date of written notification that the Director has authorized the discharge and assigned a permit number under this general permit. [note: EPA will normally authorize a discharge only after receiving 401 cert from ADEC, which would include the State’s mixing zone determination.] The authorized

permittee will be allowed to discharge during the effective period of this general permit within the limits and subject to the conditions set forth herein. This permit authorizes the discharge of only those pollutants resulting from facility processes, waste streams, and operations that have been clearly identified in the permit application process.

4. A source excluded from a general permit solely because it already has an individual permit may request that the individual permit be revoked, and that it be covered by the general permit. If the Director determines the source may be covered under this general permit, the general permit shall apply to the source upon revocation of the individual permit.
5. Mobile facilities may operate in an area, rather than at a specific location, only if the applicant requests this type of discharge in their NOI, provide a map and description of the area of coverage, and the latitude and longitude of the initial location of the facility. Mobile operations will be limited to a lease sale block. The discharger will be required to notify the Director, in writing, 7 days prior to moving the facility, provide the latitude and longitude of the new location, and certify that the new discharge location is not within 200 meters of any previous discharge or any other discharge.

E. Transfers.

1. Authorization under this general permit is not transferable to any person except after notice to the Director.
2. Transfers under this general permit will only be authorized for an existing facility located at the site or area of the original NOI. If a different facility is built at or moved to an existing location authorized by the general permit, or if a currently authorized facility is moved to a location that was not previously authorized by the general permit, then permit authorization cannot be transferred because the facility will be considered a “new facility” and the discharger must submit a new NOI for coverage under this general permit.

F. Termination Notification.

1. **Operations.** Within 30 days of ceasing operations, the permittee shall notify the Director, in writing, when general permit coverage is no longer needed at a site or mobile area described by the NOI. The permittee must certify that it is not subject to any pending enforcement actions including citizen suits brought under State or Federal laws. The termination notice shall be signed in accordance with the Signatory Requirements of Section V.E of this general permit. This will terminate permit coverage at the site or within the mobile area. Termination of permit coverage shall be effective 30 days from the date of written notification from the Director that the permit coverage under this general permit has been terminated. The permittee is required to submit discharge monitoring reports (DMRs) until the effective date of termination.

2. **Wells.** The permittee shall notify the Director, in writing, within 30 days of ceasing drilling operations at a well. The notification must include the well name and number, the end-of-well report (Section II.B.9), and must be signed in accordance with the Signatory Requirements (Section V.E) of this general permit.

G. Submission of Information.

1. The discharger must submit legible originals of all NOIs and termination notices to the Director at the following address:

Director, Office of Water and Watersheds
United States Environmental Protection Agency, Region 10
1200 Sixth Avenue, **OWW-130**
Seattle, Washington 98101

2. The discharger must submit legible originals of all monitoring reports, other reports required by this permit, and notice of noncompliance to the Director at the following address:

Director, Office of Compliance and Enforcement
United States Environmental Protection Agency, Region 10
1200 Sixth Avenue, **OCE-133**
Seattle, Washington 98101

3. For discharges to state waters, the discharger must submit a copy of the information in paragraphs G.1 and G.2 of this Part to ADEC at the following address:

Alaska Department of Environmental Conservation (ADEC)
Attn: Division of Water Quality
555 Cordova Street
Anchorage, Alaska 99501

H. Requirements for an Individual Permit.

1. The Director may require any permittee discharging under the authority of this permit to apply for and obtain an individual NPDES permit when any one of the following conditions exists:
 - a. The discharger is not in compliance with the conditions of this general NPDES permit;
 - b. A change has occurred in the availability of demonstrated technology or practices for the control or abatement of pollutants applicable to the point source;
 - c. Circumstances have changed since the time of the request to be covered so that the discharger is no longer appropriately controlled under this general permit; or
 - d. The discharge(s) is a significant contributor of pollutants.
2. The Director may require any owner or operator authorized by this general permit to apply for an individual NPDES permit only if the permittee has been notified in writing that an individual permit application is required.
3. Any permittee authorized by this general permit may request to be excluded from the coverage of the general permit by applying for an individual permit. The permittee shall submit an individual permit application with reasons supporting the request to the Director no later than 90 days after the publication by the Director of the general permit in the Federal Register. Upon issuance of an individual NPDES permit, the permittee's coverage under this general permit will be automatically terminated on the effective date of the individual permit.

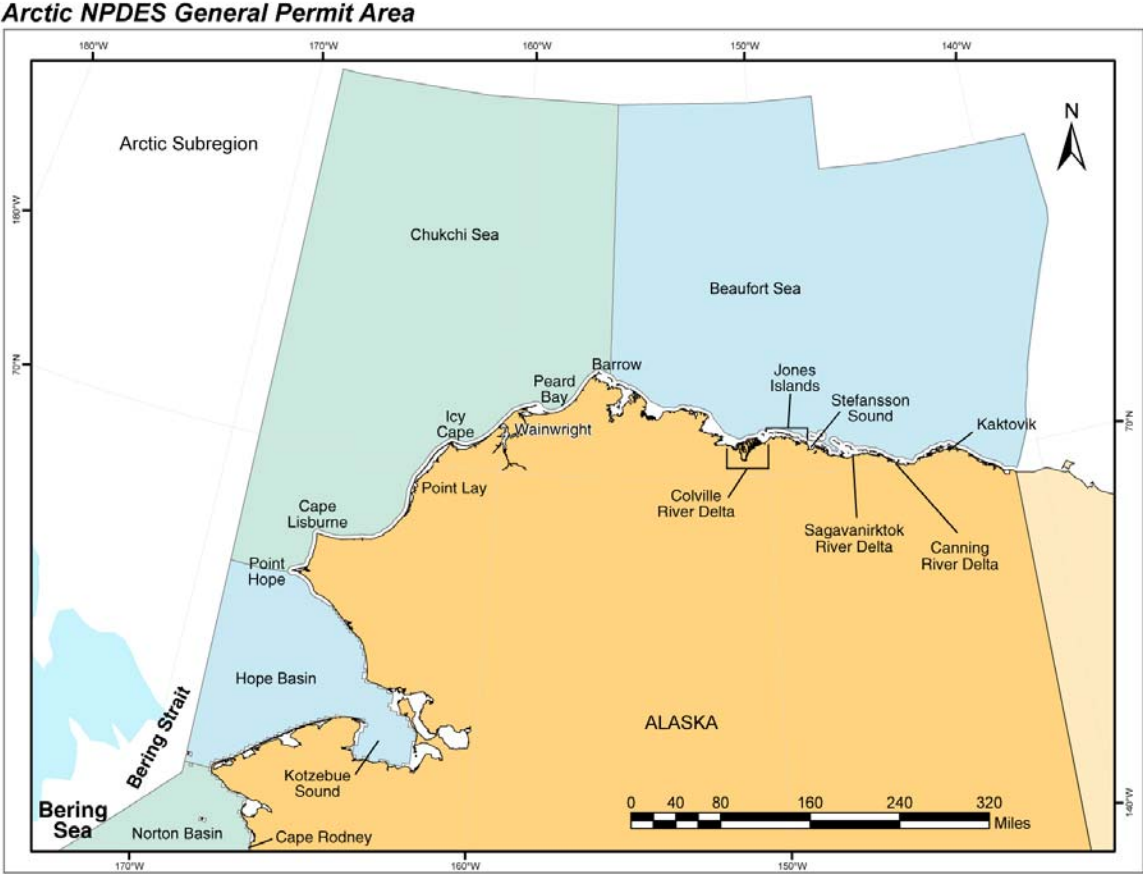


Figure 1. Area of Coverage for Offshore Oil and Gas Exploration Facilities on the Outer Continental Shelf and Contiguous State Waters

II. **LIMITATIONS AND MONITORING REQUIREMENTS**

A. **Requirements for All Discharges.**

1. During the effective period of this permit, the permittee is authorized to discharge pollutants from those discharges indicated in their discharge authorization to the Beaufort and Chukchi Seas, Hope and Northern Norton Basins, and adjacent Alaska waters (see Figure 1), within the limits and subject to the conditions set forth herein. This permit authorizes the discharge of only those pollutants resulting from facility processes, waste streams, and operations that have been clearly identified in the NOI.
2. The permittee must collect all effluent samples from the effluent stream of each discharge after the last treatment unit prior to discharge into the receiving waters.
3. The permittee must comply with the effluent limits in this general permit at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
4. Unless specifically addressed in this general permit, the permittee must not discharge floating solids, debris, sludge, deposits, foam, scum, or other residues of any kind in concentrations causing nuisance, objectionable, or detrimental conditions or that make the water unfit or unsafe for the use.
5. The permittee must minimize the discharge of surfactants, dispersants, and detergents except as necessary to comply with the safety requirements of the Occupational Health and Safety Administration and the Minerals Management Service (MMS). The discharge of dispersants to marine waters in response to oil or other hazardous waste spills is not authorized by this permit. The permittee must report all discharges of surfactants, dispersants, and detergents in accordance with Section III.G of this permit.
6. The permittee is not required to conduct monitoring for the facility if it is not staffed. The permittee must provide the Director and ADEC written notification that the facility is no longer staffed 30 days prior to terminating monitoring requirements.
7. The permittee shall not discharge diesel oil, halogenated phenol compounds, trisodium nitrilotriacetic acid, sodium chromate, or sodium dichromate.

8. If any discharges are commingled, the most stringent effluent limitations for each individual discharge are applied to the resulting discharge. If the individual discharge is not authorized, the commingled discharge is not authorized.
9. The permittee must maintain the pH range of all discharges to be not less than 6.5 or greater than 8.5 standard units. The permittee must monitor pH in all discharges monthly, unless indicated otherwise in this permit.
10. The permittee must conduct visual monitoring of the receiving water surface in the vicinity of the outfall(s) at a time of maximum estimated or measured discharge.

B. Requirements for Drilling Fluids and Drilling Cuttings (Discharge 001).

1. If authorized in the coverage letter, the permittee may discharge drilling fluids and drilling cuttings subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 001 as specified in Table 1. The permittee must comply with the effluent limits in Table 1 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. The permittee must limit and monitor the discharge volume of drilling fluids and drilling cuttings under open water, broken ice, and stable ice conditions as specified in Table 2 and in accordance with the restrictions specified in paragraphs B.3 and B.4 of this Part.
3. **Area Restrictions.** The permittee is prohibited from discharging:
 - a. In areas with water depths that is less than 5 m (as measured from mean lower low water);
 - b. Between the shore (mainland and the barrier islands) and the 5 meter isobath;
 - c. Within 1000 meters of the Steffansson Sound Boulder Patch (near the mouth of the Sagavanirktok River) or between individual units of the Boulder Patch where the separation between units is greater than 2000 meters but less than 5000 meters;
 - d. Within Omalik Lagoon;

- e. Within Kasegaluk Lagoon; or
- f. Within 3 miles of the following passes of Kasegaluk Lagoon:
 - (1) Kukpowruk Pass,
 - (2) Akunik Pass,
 - (3) Utukok Pass,
 - (4) Icy Cape Pass,
 - (5) Alokiaakat Pass,
 - (6) Naokok Pass, and
 - (7) Pingaorarak Pass.

4. **Seasonal Restrictions.**

- a. **Open-water restrictions.** The permittee is prohibited from discharging:
 - (1) at depths greater than 1 meter below the surface of the receiving water between the 5 and 20 meters isobaths as measured from the MLLW during open-water conditions.
 - (2) within 1000 meters of river mouths or deltas; or
 - (3) within Alaska State waters unless a zone of deposit (ZOD) has been authorized for the discharge by ADEC and the permittee conducts the environmental monitoring required under paragraph B.5 of this part.
- b. **Unstable or broken ice restrictions.** The permittee is prohibited from discharging:
 - (1) within 1000 meters of river mouths or deltas or
 - (2) shoreward of the 20 meter isobath as measured from the MLLW during unstable or broken ice conditions except:
 - (a) when the discharge is prediluted to a 9:1 ratio of seawater to drilling fluids and cuttings, and
 - (b) the permittee conducts the environmental monitoring required under paragraph B.5 of this part.

c. Stable ice restrictions.

- (1) The permittee is prohibited from discharging below the ice and shall avoid, to the maximum extent possible, areas of sea ice cracking or major stress fracturing unless authorized otherwise from the Director.
- (2) The permittee is prohibited from discharging below the ice within Alaska State waters unless a zone of deposit (ZOD) has been authorized for the discharge by ADEC and the permittee conducts the environmental monitoring required under paragraph B.5 of this part.

5. Environmental Monitoring Requirements.

a. The permittee must conduct the environmental monitoring requirements of this section when the authorization to discharge is within 4,000 meters of the prohibited areas identified in paragraph II.B.3 or as otherwise required by this permit.

b. The permittee must submit a plan of study for the environmental monitoring program to the Director and ADEC for review with the NOI. The permittee must incorporate any changes required by the Director or ADEC in the monitoring program's design. A copy of the final study plan must be sent to the North Slope Borough at the following address:

North Slope Borough Office
P.O. Box 69
Barrow, AK 99723

c. The permittee must include the following information in the environmental monitoring study plan:

- (1) the monitoring objectives (see paragraph II.B.5.d);
- (2) the appropriate null and alternate test hypotheses,
- (3) a statistically valid sampling design,
- (4) all monitoring procedures and methods,
- (5) a quality assurance project plan (see Section IV.B),
- (6) a detailed discussion of how data will be used to meet, test, and evaluate the monitoring objectives, and
- (7) a summary of the results of previous environmental monitoring as they apply to the proposed study plan.

- d. The permittee must ensure that the environmental monitoring study plan meets the following objectives:
- (1) monitor for discharge-related impacts,
 - (2) determine statistically significant changes in sediment pollutant concentrations and sediment toxicity with time and distance from the discharge,
 - (3) monitor for discharge related impacts to the benthic community,
 - (4) assess whether any impacts warrant an adjustment of the monitoring program, and
 - (5) provide information for permit reissuance.
- e. The permittee must include in the environmental monitoring study plan relevant hydrographic, sediment hydrocarbon, and heavy metal data from surveys conducted before and during drilling fluid disposal operations and up to at least one year after drilling operations cease.
- f. The permittee must submit an annual report to the Director by March 1st of the following year. Copies of the report must be sent to ADEC and the North Slope Borough. The annual report must contain the following information:
- (1) a summary of the data analysis;
 - (2) a discussion of how the environmental monitoring objectives were accomplished;
 - (3) analytical test methods used for data analysis;
 - (4) a description of any impacts of the effluent on observed sediment pollutant concentration, sediment quality, water quality, and the benthic community; and
 - (5) all relevant quality assurance/quality control information including, but not limited to, laboratory instrumentation, laboratory procedures, analytical method detection limits, analytical method precision requirements, and sample collection methodology.
- g. If the Director or ADEC require revisions to the annual report, the permittee must complete the revisions and submit a final report to the Director within 60 days of the date of the request. Copies of the final report must be sent to ADEC and the North Slope Borough.

mineral oil pill and at least a 50 bbl buffer of drilling fluid on either side of the pill are removed from the circulating drilling fluid system and not discharged to the waters of the United States. In the event that more than one pill is applied to a single well, the previous pill and buffer shall be removed prior to application of a subsequent pill.

- b. Residual mineral oil concentration in the discharged drilling fluid shall not exceed 2% v/v as determined by the procedure in Attachment 9 of this permit. Should drilling fluid containing residual mineral oil pill (after pill and buffer removal) be discharged, the permittee shall report the following information within 60 days of discharge:
- (1) dates of pill application, recovery, and discharge;
 - (2) results of the SPP Toxicity Test (see Table 1) on samples of:
 - (a) the drilling fluid before each pill is added; and
 - (b) the drilling fluid after removal of each pill and buffer (taken when residual mineral oil pill concentration is expected to be greatest).
 - (3) name of spotting compound and mineral oil products used;
 - (4) volumes of spotting compound, mineral oil, water, and barite in the pill;
 - (5) total volume of drilling fluid circulating prior to pill application, volume of pill formulated, and volume of pill circulated;
 - (6) volume of pill recovered, volume of drilling fluid buffer recovered, and volume of drilling fluid circulating after pill and buffer recovery;
 - (7) percent recovery of the pill (include calculations);
 - (8) estimated concentrations of residual spotting compound and mineral oil in the sample of drilling fluid discharged, as determined from amounts added and total drilling fluid volume circulating prior to pill application;
 - (9) measured oil content of the drilling fluid samples, as determined by the API retort method (see Attachment 9); and
 - (10) an itemization of other drilling fluid specialty additives contained in the discharged drilling fluid.

9. The permittee is required to submit an end-of-well report within 90 days of well completion. The permittee shall report the following for each drilling fluid system in the end-of-well report:
 - a. well name, number, latitude, longitude, beginning drill date, and well completion date;
 - b. a precise chemical inventory of all constituents other than drilling fluids added downhole, including, but not limited to, all drilling fluid additives used to meet specific drilling requirements;
 - c. the base drilling fluid type;
 - d. the name, maximum concentration, and total amount of each constituent in the discharged drilling fluid;
 - e. the total volume of each drilling fluid created and added downhole;
 - f. the total volumes of each drilling fluid discharged to surface waters; and
 - g. any diesel oil analysis conducted on the well, including the spectra from the GC or GC/MS analysis.

Table 1. Effluent Limitations and Monitoring Requirements for Drilling Fluids and Drilling Cuttings (Discharge 001)

Discharge	Pollutant Parameter	Effluent Limitation		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Measurement Frequency	Sample Type
Water-based fluids and cuttings	SPP toxicity ^{note 1}	Minimum 96-hour LC ₅₀ of 30,000 ppm		Monthly ^{note 17}	Grab
	Drilling fluids	No discharge ^{note 2}		Daily	Grab
	Free oil	No discharge ^{notes 3 & 4}		Daily	Visual
	Diesel oil	No discharge ^{note 19}		Once per well ^{note 18}	Grab
	Mercury	1 mg/kg ^{note 5}		Annual	Grab
	Cadmium	3 mg/kg ^{note 5}		Annual	Grab
	Chromium VI	--- (µg/L)		Once per well	Grab ^{Note 20}
	Silver	--- (µg/L)		Once per well	Grab ^{Note 20}
	Thallium	--- (µg/L)		Once per well	Grab ^{Note 20}
	Total aqueous hydrocarbons (TAqH)	--- (µg/L)		Once per well ^{note 15}	Grab
	Total aromatic hydrocarbons (TAH)	--- (µg/L)		Once per well ^{note 16}	Grab
	Total Volume	See II.B.6		Monthly	Estimate
Non-aqueous fluids	Drilling fluids	No discharge		Daily	Grab
Non-aqueous stock base fluid (C ₁₆ -C ₁₈ internal olefin, C ₁₂ -C ₁₄ ester or C ₈ ester)	Mercury	1 mg/kg ^{note 5}		Annual	Grab
	Cadmium	3 mg/kg ^{note 5}		Annual	Grab
	PAH ^{note 6}	mass ratio ^{note 7} < 1x10 ⁻⁵		Annual	Grab
	Sediment toxicity	ratio ^{note 8} < 1.0		Annual	Grab
	Biodegradation rate	ratio ^{note 9} < 1.0		Annual	Grab

Table 1. Effluent Limitations and Monitoring Requirements for Drilling Fluids and Drilling Cuttings (Discharge 001)

Discharge	Pollutant Parameter	Effluent Limitation		Monitoring Requirements	
		Average Monthly Limit	Measurement Frequency	Sample Type	
Non-aqueous cuttings	Drilling Fluids	No discharge ^{note 3 & 4}		Daily	Grab
	Diesel oil	No discharge ^{note 18}		Once per well ^{note 19}	Grab
	SPP toxicity ^{note 1}	Minimum 96-hour LC ₅₀ of 30,000 ppm		Monthly	Grab
	Sediment toxicity	Drilling fluid sediment toxicity ratio ^{note 10} < 1.0		Annual	Grab
	Formation oil	No discharge ^{note 11}		Daily	Grab
	Base fluid averaged over all well sections (C ₁₆ -C ₁₈ internal olefin stock ^{note 12})	6.9 g NAF base fluid/100 g wet drill cuttings ^{note 13}		Annual	Grab
	Base fluid ^{note 14} (C ₁₂ -C ₁₄ ester or C ₈ ester stock)	9.4 g NAF base Fluid/100 g wet drill cuttings ^{note 13}		Annual	Grab
	Total aqueous hydrocarbons (TAqH)	--- (µg/L)		Once per well ^{note 15}	Grab
	Total aromatic hydrocarbons (TAH)	--- (µg/L)		Once per well ^{note 16}	Grab
	Total Volume	See II.B.6		Monthly	Estimate

Footnotes:

- 1 As determined by the 96-hour suspended particulate phase (SPP) toxicity test in Attachment 4 of this permit.
- 2 Only upon failure of the static sheen test defined in Attachment 3 of this permit.
- 3 As determine by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen).
- 4 As determined by the static sheen test defined in Attachment 3 of this permit.
- 5 Dry weight in the stock barite. Analysis shall be conducted by atomic absorption spectrophotometry. The permittee shall analyze a representative sample of stock barite once prior to drilling each well and submit the results with the DMR for the month in which drilling operations commence for the respective well. If the permittee uses the same supply of stock barite to drill subsequent wells, the permittee may submit the same analysis for those subsequent wells.
- 6 Polynuclear Aromatic Hydrocarbons.
- 7 PAH mass ratio = [mass (g) of PAH (as phenanthrene)] ÷ [mass (g) of stock base fluid] as determined by EPA method 1654, Revision A, entitled "PAH Content of Oil by HPLC/UV," December 1992.
- 8 Base fluid sediment toxicity ratio = [10-day LC₅₀ of C₁₆-C₁₈ internal olefin, C₁₂-C₁₄ ester or C₈ ester] ÷ [10-day LC₅₀ of stock base fluid] as determined by ASTM E 1367-92 method: "Standard Guide for Conducting 10-day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods," 1992, after preparing the sediment according to the method specified in Attachment 5 of this permit.

Footnotes (cont.):

- 9 Biodegradation rate ratio = [cumulative gas production (ml) of C₁₆-C₁₈ internal olefin, C₁₂-C₁₄ ester or C₈ ester] ÷ [cumulative gas production (ml) of stock base fluid], both at 275 days as determined by ISO 11734:1995 method: "Water quality - Evaluation of the 'ultimate' anaerobic biodegradability of organic compounds in digested sludge-- Method by measurement of the biogas production (1995 edition)" as modified for the marine environment (Attachment 6 of this permit).
- 10 Drilling fluid sediment toxicity ratio = [4-day LC₅₀ of C₁₆-C₁₈ internal olefin] ÷ [4-day LC₅₀ of drilling fluid removed from drill cuttings at the solids control equipment] as determined by ASTM E 1367-92 method: "Standard Guide for Conducting 10-day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods," 1992, after preparing the sediment according to the method specified in Attachment 5 of this permit.
- 11 As determined before drilling fluids are shipped offshore by the GC/MS compliance assurance method (Attachment 7 of this permit), and as determined prior to discharge by the Reverse Phase Extraction (RPE) method (Attachment 8 of this permit) applied to drilling fluid removed from drill cuttings. If the operator wishes to confirm the results of the RPE method, the operator may use the GC/MS compliance assurance method (Attachment 7 of this permit). Results from the GC/MS compliance assurance method shall supersede the results of the RPE method.
- 12 This limitation is applicable only when the NAF base fluid meets the stock limitations defined in this table.
- 13 As determined by the American Petroleum Institute (API) report method (Attachment 9 of this permit).
- 14 Averaged over all well sections.
- 15 As determined by summing the results of EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons to measure TAH and EPA Method 610 to quantify polynuclear aromatic hydrocarbons. Sample must be collected at the same time as the SPP toxicity test, to the extent practicable.
- 16 As determined by EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons. Sample must be collected at the same time as the SPP toxicity test, to the extent practicable.
- 17 See requirement of paragraph II.B.8.b (Mineral Oil Pill).
- 18 Or upon failure of the static sheen test.
- 19 Compliance will be demonstrated by gas chromatograph (GC) analysis of drilling fluid collected from the drilling fluid used at the greatest well depth ("end-of-well" sample) and of any drilling fluids or cuttings which fail the static sheen test compared to GC analysis of diesel oil in storage at the facility. The method for GC analysis shall be that described in "Analysis of Diesel Oil in Drilling Fluids and Drill Cuttings" (CENTEC, 1985) available from EPA, Region 10. Gas chromatography/mass spectrometry (GC/MS) may be used if an instance should arise where the operator and the Director determine that greater resolution of the drilling fluid "fingerprint" is needed for a particular drilling mud sample.
- 20 Sample must be collected when the drilling fluid is expected to have the highest concentration of metal (e.g., after formulation and prior to use). The sample is to be collected from the water phase of the drilling fluid with the purpose of obtaining partitioning of metals from drilling fluid to the receiving water. The drilling fluid must also be analyzed for the total metal concentration (chromium must be analyzed as total chromium, not total chromium VI). Samples must be analyzed using an EPA approved method quantifiable at or below the Alaska Water Quality Standard.

Table 2. Flow Limitations and Monitoring Requirements for Drilling Fluids and Drilling Cuttings (Discharge 001) ^{note 1}			
Water Depth ^{note 2}	Flow Limitation	Measurement Frequency	Sample Type
0 to 5 meters	no discharge	hourly during discharge ^{note 3}	estimate
>5 to 20 meters	500 bbl/hr		
>20 to 40 meters	750 bbl/hr		
>40 meters	1000 bbl/hr		

Footnotes:

- 1 Flow limitations do not apply during stable ice conditions.
- 2 As measured from the mean lower low water (MLLW).
- 3 The maximum daily limit is the maximum hourly rate recorded in any calendar day within the month.
The monthly average limit is the average of the maximum daily hourly rate for each calendar day.

C. Requirements for Deck Drainage (Discharge 002).

1. If authorized in the coverage letter, the permittee may discharge deck drainage subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 002 as specified in Table 3. The permittee must comply with the effluent limits in Table 3 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. The permittee must ensure that deck drainage contaminated with oil and grease is processed through an oil-water separator prior to discharge.

Table 3. Effluent Limitations and Monitoring Requirements for Deck Drainage (Discharge 002)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free oil	---	No discharge ^{note 1}		Once per discharge event	Grab
Total volume	gal	---		Monthly	Estimated
Total aqueous hydrocarbons (TAQH)	µg/L	---		Once per discharge event ^{note 2}	Grab ^{note 4}
Total aromatic hydrocarbons (TAH)	µg/L	---		Once per discharge event ^{note 3}	Grab ^{note 4}

Footnotes:

- 1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in Attachment 3. For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature that approximates surface water temperatures after breakup shall be used.
- 2 As determined by summing the results of EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons to measure TAH and EPA Method 610 to quantify polynuclear aromatic hydrocarbons.
- 3 As determined by EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons.
- 4 Sample must be collected during drilling operations.

D. Requirements for Sanitary and Domestic Wastes (Discharges 003 and 004).

1. If authorized in the coverage letter, the permittee may discharge sanitary and domestic wastes subject to the effluent limitations and requirements herein. The permittee must comply with the appropriate effluent limits in this section at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. If the discharge is to Alaska State waters, the permittee must limit and monitor Discharges 003 and 004 as specified in Table 4a unless a mixing zone has been authorized by ADEC. If ADEC has authorized a mixing zone, the permittee must limit and monitor Discharges 003 and 004 as specified in Table 4b.
3. If the discharge is to federal waters (i.e., beyond Alaska State waters) the permittee must limit and monitor Discharges 003 and 004 as specified in Tables 5 and 6.
4. For any facility using a marine sanitation device (MSD), the permittee must conduct annual testing of the MSD to ensure that the unit is operating properly. The permittee must note on the December DMR the results of the test.
5. In cases where the sanitary and domestic wastes are mixed prior to discharge, and sampling of the sanitary waste component of the discharge is infeasible, the discharge may be sampled after mixing, however, the most stringent discharge limitations for both discharges (Discharge 003 and Discharge 004) shall apply to the mixed waste stream.

Table 4a. Effluent Limitations and Monitoring Requirements for Sanitary and Domestic Wastes in Alaska Waters with no Mixing Zone (Discharges 003 and 004)							
Effluent Parameter	Units	Effluent Limitations				Monitoring Requirements	
		Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Minimum Daily Limit	Sample Frequency	Sample Type
Flow	mgd	---	---	0.01	---	Daily	Measured/ recorded
BOD ₅	mg/L	30	45	60	---	Monthly	Grab ^{note 1}
TSS	mg/L	30	45	60	---	Monthly	Grab ^{note 1}
Floating Solids & Garbage		no discharge				Daily	Visual
Foam		no discharge				Daily	Visual
Oily Sheen		no discharge				Daily	Visual
pH	s.u.	6.5 – 8.5				Monthly	Grab
Fecal Coliform Bacteria	colonies/ 100 mL	14 ^{note 2}	---	43	---	Monthly	Grab
Total Residual Chlorine ^{note 3}	mg/L	---	---	0.0075	---	Weekly	Grab
Dissolved Oxygen	mg/L	---	---	17	6	Weekly	Grab

Footnotes:

- 1 Composite samples may be collected in lieu of grab samples and must consist of at least four equal volume grab samples, two of which must be taken during periods of peak flow.
- 2 Must be reported as the geometric mean.
- 3 The analytical detection limit for this parameter is 0.1 mg/L. Residual chlorine may be monitored according to test procedures approved under 40 CFR Part 136 or using a Hach Test Kit capable of measuring free chlorine in the range of 0-3.5 mg/L with a sensitivity of 0.1 mg/L or better. Monitoring is not required if chlorine is not used as a disinfectant or for facilities serving fewer than 10 persons.

Table 4b. Effluent Limitations and Monitoring Requirements for Sanitary and Domestic Wastes in Alaska Waters with 100 Meter Mixing Zone⁴ (Discharges 003 and 004)							
Effluent Parameter	Units	Effluent Limitations				Monitoring Requirements	
		Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Minimum Daily Limit	Sample Frequency	Sample Type
Flow	mgd	---	---	0.01	---	Daily	Measured/ recorded
BOD ₅	mg/L	30	45	60	---	Weekly	Grab ^{note 1}
TSS	mg/L	30	45	60	---	Weekly	Grab ^{note 1}
Floating Solids & Garbage		no discharge				Daily	Visual
Foam		no discharge				Daily	Visual
Oily Sheen		no discharge				Daily	Visual
pH	s.u.	6.0 – 9.0				Monthly	Grab
Fecal Coliform Bacteria	colonies/ 100 mL	100 ^{note 2}	---	200	---	Monthly	Grab
Total Residual Chlorine ^{note 3}	mg/L	0.5	---	1.0	---	Weekly	Grab
Dissolved Oxygen	mg/L	---	---	17	2	Weekly	Grab

Footnotes:

- 1 Composite samples may be collected in lieu of grab samples and must consist of at least four equal volume grab samples, two of which must be taken during periods of peak flow.
- 2 Must be reported as the geometric mean.
- 3 The analytical detection limit for this parameter is 0.1 mg/L. Residual chlorine may be monitored according to test procedures approved under 40 CFR Part 136 or using a Hach Test Kit capable of measuring free chlorine in the range of 0-3.5 mg/L with a sensitivity of 0.1 mg/L or better. Monitoring is not required if chlorine is not used as a disinfectant.
- 4 Facilities must apply for and obtain a mixing zone authorization from ADEC (refer to Section I.D.1 of this permit) in order to be subject to the requirements in this table.

Table 5. Effluent Limitations and Monitoring Requirements for Sanitary Wastes beyond Alaska Waters (Discharge 003)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Flow	mgd	---	---	Daily	Measured/ recorded
BOD ₅	mg/L	30	60	Weekly	Grab or composite ^{note 1}
TSS	mg/L	30	60	Weekly	Grab or composite ^{note 1}
Floating Solids & Garbage		no discharge		Daily	Visual
Foam		no discharge		Daily	Visual
Oily Sheen		no discharge		Daily	Visual
pH	s.u.	6.0 – 9.0		Monthly	Grab
Fecal Coliform Bacteria	colonies/ 100 mL	100 ^{note 2}	200	Monthly	Grab
Total Residual Chlorine ^{note 3}	mg/L	0.5	1.0	Weekly	Grab

Footnotes:

- 1 Composite samples must consist of at least four equal volume grab samples, two of which must be taken during periods of peak flow.
- 2 Must be reported as the geometric mean.
- 3 The analytical detection limit for this parameter is 0.1 mg/L. Residual chlorine may be monitored according to test procedures approved under 40 CFR Part 136 or using a Hach Test Kit capable of measuring free chlorine in the range of 0-3.5 mg/L with a sensitivity of 0.1 mg/L or better. Monitoring is not required if chlorine is not used as a disinfectant or for facilities serving fewer than 10 persons.

Table 6. Effluent Limitations and Monitoring Requirements for Domestic Wastes beyond Alaska Waters (Discharge 004)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Floating solids, garbage, or foam	---	No discharge		Daily ^{note 1}	Visual
Flow	mgd	---		Monthly	Estimated

Footnote:

1 Monitoring is only required when discharge occurs.

E. Requirements for Desalination Unit Wastes (Discharge 005).

1. If authorized in the coverage letter, the permittee may discharge desalination unit wastes subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 005 as specified in Table 7. The permittee must comply with the effluent limits in Table 7 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.

2. The permittee must maintain an annual inventory of the quantities and rates of chemicals (other than water or seawater) added to the desalination water system. Each annual inventory must be assembled for the calendar year and submitted to the Director by March 1 of the following calendar year.

Table 7. Effluent Limitations and Monitoring Requirements for Desalination Unit Wastes (Discharge 005)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in Attachment 3. For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

F. **Requirements for Blowout Preventer Fluid (Discharge 006).** If authorized in the coverage letter, the permittee may discharge blowout preventer fluid subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 006 as specified in Table 8. The permittee must comply with the effluent limits in Table 8 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.

Table 8. Effluent Limitations and Monitoring Requirements for Blowout Preventer Fluid (Discharge 006)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see Attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

G. Requirements for Boiler Blowdown (Discharge 007).

1. If authorized in the coverage letter, the permittee may discharge boiler blowdown subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 007 as specified in Table 9. The permittee must comply with the effluent limits in Table 9 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. The permittee must maintain an annual inventory of the type (product name) and quantity of biocides and chemicals (other than water or seawater) added to the boiler system. Each annual inventory must be assembled for the calendar year and submitted to the Director by March 1 of the following calendar year.

Table 9. Effluent Limitations and Monitoring Requirements for Boiler Blowdown (Discharge 007)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

- 1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see Attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

H. Requirements for Fire Control System Test Water (Discharge 008).

1. If authorized in the coverage letter, the permittee may discharge fire control system test water subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 008 as specified in Table 10. The permittee must comply with the effluent limits in Table 10 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. The permittee must maintain an annual inventory of the type (product name) and quantity of biocides and chemicals (other than water or seawater) added to the fire control system. Each annual inventory must be

assembled for the calendar year and submitted to the Director by March 1 of the following calendar year.

Table 10. Effluent Limitations and Monitoring Requirements for Fire Control System Test Water (Discharge 008)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

I. Requirements for Non-contact Cooling Water (Discharge 009).

1. If authorized in the coverage letter, the permittee may discharge non-contact cooling water subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 009 as specified in Table 11. The permittee must comply with the effluent limits in Table 11 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. The permittee must maintain an annual inventory of the type and quantity of biocides and chemicals added to non-contact cooling water. Each annual inventory must be assembled for the calendar year and submitted to the Director by March 1 of the following calendar year.

Table 11. Effluent Limitations and Monitoring Requirements for Non-contact Cooling Water (Discharge 009)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

- As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

J. Requirements for Uncontaminated Ballast Water (Discharge 010). If authorized in the coverage letter, the permittee may discharge uncontaminated ballast water subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 010 as specified in Table 12. The permittee must comply with the effluent limits in Table 12 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.

Table 12. Effluent Limitations and Monitoring Requirements for Uncontaminated Ballast Water (Discharge 010)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

- As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

K. Requirements for Bilge Water (Discharge 011).

1. If authorized in the coverage letter, the permittee may discharge bilge water subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 011 as specified in Table 13. The permittee must comply with the effluent limits in Table 13 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.
2. The permittee shall process all bilge water through an oil-water separator prior to discharge.

Table 13. Effluent Limitations and Monitoring Requirements for Bilge Water (Discharge 011)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

- 1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

- L. Requirements for Excess Cement Slurry (Discharge 012).** If authorized in the coverage letter, the permittee may discharge excess cement slurry subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 012 as specified in Table 14. The permittee must comply with the effluent limits in Table 14 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.

Table 14. Effluent Limitations and Monitoring Requirements for Excess Cement Slurry (Discharge 012)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

M. Requirements for Mud, Cuttings, and Cement at the Seafloor (Discharge 013). If authorized in the coverage letter, the permittee may discharge mud, cuttings and cement at the seafloor subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 013 as specified in Table 15. The permittee must comply with the effluent limits in Table 15 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.

Table 15. Effluent Limitations and Monitoring Requirements for Muds, Cuttings, and Cement at the Seafloor (Discharge 013)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Total Volume	gal	---		Monthly	Estimated

Footnote:

1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.

N. **Requirements for Test Fluids (Discharge 014).** If authorized in the coverage letter, the permittee may discharge test fluids subject to the effluent limitations and requirements herein. The permittee must limit and monitor Discharge 014 as specified in Table 16. The permittee must comply with the effluent limits in Table 16 at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.

Table 16. Effluent Limitations and Monitoring Requirements for Test Fluids (Discharge 014)					
Effluent Parameter	Units	Effluent Limitations		Monitoring Requirements	
		Average Monthly Limit	Maximum Daily Limit	Sample Frequency	Sample Type
Free Oil	---	No discharge ^{Note 1}		Once/discharge	Visual
Oil and Grease	mg/L	29	42	Once/discharge	Grab
pH	s.u.	6.5 – 8.5 ^{Note 2}		Monthly	Grab
Total Volume	bbl	---		Monthly	Estimated ^{Note 3}
Total aqueous hydrocarbons (TAqH)	µg/L	---		Once per discharge well ^{note 4}	Grab
Total aromatic hydrocarbons (TAH)	µg/L	---		Once per discharge well ^{note 5}	Grab

Footnotes:

- 1 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen) using the static sheen test defined in appendix 1 to 40 CFR part 435, subpart A (see attachment 3). For discharges during stable ice, below ice, to unstable ice or broken ice conditions, a water temperature instead of approximate surface water temperatures after breakup shall be used.
- 2 Any spent acidic test fluids shall be neutralized before discharge such that the pH at the point of discharge shall not be less than 6.5 or greater than 8.5.
- 3 Volume will be reported as the number of barrels of fluids sent downhole during testing and the number of barrels discharged. The chemical composition of the fluids sent downhole will also be reported.
- 4 As determined by summing the results of EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons to measure TAH and EPA Method 610 to quantify polynuclear aromatic hydrocarbons.
- 5 As determined by EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons.

III. **MONITORING, RECORDING AND REPORTING REQUIREMENTS**

A. **Representative Sampling (Routine and Non-Routine Discharges).**

1. The permittee must ensure that samples and measurements taken for the purpose of monitoring are representative of the monitored activity.
2. In order to ensure that the effluent limits set forth in this permit are not violated at times other than when routine samples are taken, the permittee must collect additional samples whenever any discharge occurs that may reasonably be expected to cause or contribute to a violation that is unlikely to be detected by a routine sample. The permittee must analyze the additional samples for those parameters limited in Part I of this permit that are likely to be affected by the discharge.
3. The permittee must collect such additional samples as soon as the spill, discharge, or bypassed effluent reaches the outfall. The samples must be analyzed in accordance with Section III.C (“Monitoring Procedures”). The permittee must report all additional monitoring in accordance with Section III.D (“Additional Monitoring by Permittee”).

B. **Reporting of Monitoring Results.** The permittee must summarize monitoring results each month on the DMR form (EPA No. 3320-1) or equivalent. The permittee must submit reports monthly, postmarked by the 10th day of the following month. Annual sampling results must be reported on the January DMR unless otherwise indicated by this permit. The permittee must sign and certify all DMRs, and all other reports, in accordance with the requirements of Section VI.E (“Signatory Requirements”) of this permit. The permittee must submit legible originals of these documents to the Director, Office of Water, with copies to ADEC at the addresses in Section I.G (“Submission of Information”).

C. **Monitoring Procedures.** The permittee must conduct monitoring according to test procedures approved under 40 CFR 136, unless other test procedures have been specified in this permit.

D. **Additional Monitoring by Permittee.**

1. If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the permittee must include the results of this monitoring in the calculation and reporting of the data submitted in the DMR.

2. Upon request by the Director, the permittee must submit results of any other sampling, regardless of the test method used.

E. **Records Contents.** The permittee must ensure that records of monitoring information include:

1. the date, exact place, and time of sampling or measurements;
2. the name(s) of the individual(s) who performed the sampling or measurements;
3. the date(s) analyses were performed;
4. the names of the individual(s) who performed the analyses;
5. the analytical techniques or methods used; and
6. the results of such analyses.

F. **Retention of Records.** The permittee must retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, copies of DMRs; a copy of this NPDES permit, and records of all data used to complete the application for this permit, for a period of at least five years from the date of the sample, measurement, report or application. This period may be extended by request of the Director or ADEC at any time.

G. **Noncompliance Reporting**

1. **Twenty-four Hour Notice of Noncompliance Reporting.**

- a. The permittee must report to the Director the following occurrences of noncompliance by telephone within 24 hours from the time the permittee becomes aware of the following circumstances:
 - (1) any noncompliance that may endanger health or the environment;
 - (2) any unanticipated bypass that exceeds any effluent limitation in the permit (See Section V.F, "Bypass of Treatment Facilities");

- (3) any upset that exceeds any effluent limitation in the permit (See Section V.G, “Upset Conditions”); or
 - (4) any violation of a maximum daily discharge limitation for any of the pollutants in Part I of the permit requiring 24-hour reporting.
 - b. The permittee must also provide a written submission to the Director and ADEC within five days of the time that the permittee becomes aware of any event required to be reported under paragraph III.G.1. The permittee must report all other forms of noncompliance to ADEC within seven days of the time that the permittee becomes aware of any event. Permittees may use the noncompliance notification sheet in Attachment 2 to report noncompliance. For events required to be reported under paragraph III.G.1, the written submission must contain:
 - (1) a description of the noncompliance and its cause;
 - (2) the period of noncompliance, including exact dates and times;
 - (3) the estimated time noncompliance is expected to continue if it has not been corrected;
 - (4) steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance;
 - (5) a detailed description of the event, including quantities and types of materials involved;
 - (6) details of any actual or potential impact on the receiving environment or public health; and
 - (7) details of actions taken or to be taken to correct any damage resulting from the event.
 - c. The Director may waive the written report required for paragraph III.G.1 on a case-by-case basis if the oral report has been received within 24 hours by the NPDES Compliance Hotline in Seattle, Washington, by telephone, (206) 553-1846.
 - d. The permittee must submit reports to the addresses in Section III.B (“Reporting of Monitoring Results”).
2. **Other Noncompliance Reporting.** The permittee must report all instances of noncompliance not required to be reported within 24 hours, at the time that monitoring reports for Section III.B (“Reporting of Monitoring Results”) are submitted. The reports must contain the

information listed in Section I.G (“Submission of Information”) of this permit.

- H. **Changes in Discharge of Toxic Substances.** The permittee must notify the Director and ADEC as soon as it knows, or has reason to believe:
1. That any activity has occurred or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant that is not limited in the permit, if that discharge will exceed the highest of the following “notification levels”:
 - a. One hundred micrograms per liter (100 µg/l);
 - b. Two hundred micrograms per liter (200 µg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
 - c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or
 - d. The level established by the Director in accordance with 40 CFR 122.44(f).
 2. That any activity has occurred or will occur that would result in any discharge, on a non-routine or infrequent basis, of any toxic pollutant that is not limited in the permit, if that discharge may reasonably be expected to exceed the highest of the following “notification level”:
 - a. Five hundred micrograms per liter (500 µg/l);
 - b. One milligram per liter (1 mg/L); for antimony;
 - c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or
 - d. The level established by the Director in accordance with 40 CFR 122.44(f).

IV. SPECIAL CONDITIONS

A. Quality Assurance Plan Requirements.

1. Within 90 days following written notification that the Director has authorized discharge under this permit, the permittee must develop a Quality Assurance Plan (QAP) and notify the Director and ADEC, in writing, that the QAP is complete.
2. The QAP shall address the monitoring activities required by this permit. At a minimum, the following information must be provided in the QAP:
 - a. Sample locations (map and physical description, which includes station identification number, latitude, and longitude);
 - b. Sample frequency;
 - c. Sample handling, storage, transport, and Chain-of-Custody procedures;
 - d. Parameters, preparation and analysis methods, detection limits, and volume of sample required for each analyte in each medium (i.e., water or sediment);
 - e. Number of QC samples, spikes and replicates required for analysis (for precision accuracy);
 - f. Documentation requirements for the laboratory (i.e., retention or holding time, QA/QC procedures for test methods, volume of sample collected, field test blanks, etc.);
 - g. Organizational responsibilities - who is responsible for QA/QC activities (i.e., who takes samples, who reviews the data analysis, etc.); and
 - h. Name(s), address(es), and phone number(s) of laboratories used or proposed to be used by the permittee.

note: The document *Guidance for Preparation of Quality Assurance Project Plans*, EPA, Region 10, Quality and Data Management Program, QA/G-5, can be used as a helpful reference guide in preparing the QAP. This document is available in Adobe Acrobat format at <http://www.epa.gov/r10earth/offices/oea/qaindex.htm>.

3. The permittee is responsible for reviewing and updating the QAP to ensure all material is current and applicable.
4. The permittee must amend the QAP whenever there is a modification in the sample collection, sample analysis, or conditions or requirements of the QAP.
5. The permittee must keep copies of the most current QAP on site and must make the QAP available to the Director and ADEC upon request.

B. Best Management Practices Plan Requirements.

1. The permittee shall, during the term of this permit, operate the facility in accordance with its current Best Management Practices (BMP) Plan or in accordance with subsequent amendments to the Plan. The permittee shall notify the Director and ADEC that the BMP Plan is complete and on-site at least 7 days prior to discharge. The permittee shall ensure that the BMP Plan incorporates practices to achieve the objectives and specific requirements listed below.
2. Through implementation of the BMP Plan, the permittee shall:
 - a. Prevent or minimize the generation and the potential for the release of pollutants from the facility to the waters of the United States through normal operations and ancillary activities; and
 - b. Ensure that methods of pollution prevention, control, and treatment will be applied to all wastes and other substances discharged.
3. The permittee shall develop and amend the BMP Plan consistent with the following objectives for the control of pollutants.
 - a. The number and quantity of pollutants and the toxicity of effluent generated, discharged or potentially discharged at the facility shall be minimized by the permittee to the extent feasible by managing each waste stream in the most appropriate manner.
 - b. Under the BMP Plan, and any Standard Operating Procedures (SOPs) included in the Plan, the permittee shall ensure proper operation and maintenance of the facility.
 - c. The permittee shall establish specific objectives for the control of pollutants by conducting the following evaluations.

- (1) Each facility component or system shall be examined for its waste minimization opportunities and its potential for causing a release of significant amounts of pollutants to waters of the United States due to equipment failure, improper operation, and natural phenomena such as rain or snowfall, etc. The examination shall include all normal operations and ancillary activities including loading or unloading operations or spillage or leaks.
 - (2) Where experience indicates a reasonable potential for equipment failure, natural condition (e.g., precipitation), or other circumstances to result in significant amounts of pollutants reaching surface waters, the program should include a prediction of the direction, rate of flow and total quantity of pollutants which could be discharged from the facility as a result of each condition or circumstance.
4. The BMP Plan shall be consistent with the objectives listed above and the general guidance contained in the publication entitled *Guidance Manual for Developing Best Management Practices (BMPs)* (USEPA, 1993) or any subsequent revisions to the guidance document. The BMP Plan shall:
- a. Be documented in narrative form, shall include any necessary plot plans, drawings or maps, and shall be developed in accordance with good engineering practices. The BMP Plan shall be organized and written with the following structure:
 - (1) Name and location of the facility.
 - (2) Statement of BMP policy.
 - (3) Structure, functions, and procedures of the BMP Committee.
 - (4) Specific management practices and standard operating procedures to achieve the above objectives, including, but not limited to, the following:
 - (a) modification of equipment, facilities, technology, processes, and procedures,
 - (b) reformulation or redesign of products,
 - (c) substitution of materials, and
 - (d) improvement in management, inventory control, materials handling or general operational phases of the facility.

- (5) Risk identification and assessment.
 - (6) Reporting of BMP incidents.
 - (7) Materials compatibility.
 - (8) Good housekeeping.
 - (9) Preventative maintenance.
 - (10) On-ice disposal methods
 - (11) Inspections and records.
 - (12) Security.
 - (13) Employee training.
- b. Include the following provisions concerning BMP Plan review:
- (1) Be reviewed by facility engineering staff and the facility manager.
 - (2) Be reviewed and endorsed by the permittee's BMP Committee.
 - (3) Include a statement that the above reviews have been completed and that the BMP Plan fulfills the requirements set forth in this permit. The statement shall be certified by the dated signature of each BMP Committee member.
- c. Establish specific best management practices to meet the objectives identified above, addressing each component or system capable of generating or causing a release of significant amounts of pollutants, and identifying specific preventative or remedial measures to be implemented.
- d. Establish specific best management practices or other measures which ensure that the following specific requirements are met:
- (1) Ensure proper management of solid and hazardous waste in accordance with the regulations promulgated under the Resource Conservation and Recovery Act (RCRA). Management practices required under RCRA regulations shall be referenced in the BMP Plan.
 - (2) Reflect requirements for Spill Prevention, Control, and Countermeasure (SPCC) plans under Section 311 of the Act and 40 CFR Part 112 and may incorporate any part of such plans into the BMP Plan by reference.
 - (3) Reflect requirements for storm water control under Section 402(p) of the Act and the regulations at 40 CFR 122.26 and

122.44, and otherwise eliminate to the extent practicable, contamination of storm water runoff.

- (4) Reflect requirements for air emissions under 18 AAC 50.
- (5) Address on-ice disposal methods, including on-ice spacing of discharge piles and height of accumulated drilling fluids and cuttings piles.

e. Include the following specific BMPs:

- (1) Ensure that solids, sludges, or other pollutants removed in the course of treatment or control of water and wastewaters are disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.
- (2) Separate used motor oil from deck drainage collection systems.
- (3) Minimize wastewater treatment system upsets by the controlled usage of deck washdown detergents.
- (4) Reduce oil spillage and oil leaks from pump bearings and seals through the use of good prevention techniques such as drip pans and other handling and collection methods.
- (5) If oil is used as a spotting fluid, careful attention to the operation of the drilling fluid system could result in the segregation from the main drilling fluid system of the spotting fluid and contaminated drilling fluid. Once segregated, the contaminated drilling fluid can be disposed of in an environmentally acceptable manner.
- (6) When possible, substitute standard drill pipe threading compound (pipe dope) with “toxic metals free” pipe dope.
- (7) Careful application of standard drill pipe dope to minimize contamination of receiving water and drilling fluids.
- (8) Substitute diesel oil with less toxic mineral oil or synthetic-based material in drilling fluid applications.
- (9) When possible, substitute standard drilling fluid additives with less toxic additives.
- (10) Careful handling of drilling fluid materials and treatment chemicals to prevent spills.
- (11) Use of local containment devices such as liners, dikes and drip pans where chemicals are being unpackaged and where wastes are being stored and transferred.
- (12) Install treatment devices for deck drainage to reduce or remove pollutants in the discharges (e.g., skim tanks, oil/water separators, sediment tanks/basins, or detention ponds).

5. The permittee shall maintain a copy of the BMP Plan at the facility and shall make the plan available to the Director and ADEC upon request.
6. The permittee shall amend the BMP Plan whenever there is a change in the facility or in the operation of the facility that materially increases the generation of pollutants or their release or potential release to the receiving waters. The permittee shall also amend the Plan, as appropriate, when facility operations covered by the BMP Plan change. Any such changes to the BMP Plan shall be consistent with the objectives and specific requirement listed above. All changes in the BMP Plan shall be reported to the Director and ADEC in writing.
7. At any time, if the BMP Plan proves to be ineffective in achieving the general objective of preventing and minimizing the generation of pollutants and their release and potential release to the receiving waters and/or the specific requirements above, the permit and/or the BMP Plan shall be subject to modification to incorporate revised BMP requirements.

C. Drilling Fluid Plan Requirements.

1. The permittee shall develop and have on-site at all times a written procedural plan for the formulation and control of drilling fluid/additive systems for each well. The mud plan must specify the drilling fluid/additive systems to be used. The plan shall be implemented during drilling operations. An example drilling fluid plan is provided in Attachment 11.
2. The drilling fluid plan shall be available to the Agency upon request. Seven (7) days prior to commencement of discharges from a given well, the permittee shall notify the Director, in writing, that the drilling fluid plan for the well is complete and provide the well and drilling fluid information required by the NOI information sheet in Attachment 1 of this permit.
3. At a minimum, the drilling fluid plan shall provide the following information:
 - a. Types of drilling fluids proposed for discharge, the well name, well number, NPDES permit number, and drilling fluid types as basic plan identification for each well drilled.

- b. Specific for use at each well and drilling fluid type, a list including commercial product names, descriptions of the products, and the maximum proposed discharge concentrations for each product. Concentrations shall be commonly stated in appropriate terms (e.g., lb/bbl, gal/bbl, % (wt), or % v/v (% volume oil per volume drilling fluid)). Each drilling fluid or additive system shall be clearly labeled with respect to drilling fluid type (e.g., KCl/polymer drilling fluid, freshwater lignosulfonate drilling fluid). Components of the basic drilling fluid shall be listed separately from specialty or contingency additives which may be used.
- c. A record of the operator's determination of how discharge is expected to comply with the 30,000 ppm SPP toxicity limitation. Operator's determination must be based upon, but not limited to, the following criteria:
 - (1) Estimate of worst-case cumulative discharge toxicity based on additive toxicity estimations or commercially calculated discharge toxicity estimations;
 - (2) Estimations of discharge toxicity based on the use of mineral oil pills and subsequent discharge of residual mineral oil concentrations must be estimated separately from the proposed drilling fluid or additive system; and
 - (3) Description of how overall toxicity is minimized, where possible.
- d. A clearly stated procedure for determining whether or not an additive not originally planned for or included in toxicity estimations may be used and discharged.
- e. An outline of the drilling fluid planning process which shall be consistent with other permit requirements. Names and titles of personnel responsible for the drilling fluid planning process shall be included in the drilling fluid plan.

V. COMPLIANCE RESPONSIBILITIES

- A. **Duty to Comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

B. Penalties for Violations of Permit Conditions.

1. **Civil Penalties.** Pursuant to 40 CFR 19 and the Act, any person who violates Section 301, 302, 306, 307, 308, 318, or 405 of the Act, or any permit condition or limitation implementing any such Sections in a permit issued under Section 402, or any requirement imposed in a pretreatment program approved under Sections 402(a)(3) or 402(b)(8) of the Act is subject to a civil penalty not to exceed the maximum amounts authorized by Section 309(d) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461 note) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701 note) [currently \$32,500 per day for each violation].

2. **Administrative Penalties.** Any person may be assessed an administrative penalty by the Administrator for violating Section 301, 302, 306, 307, 308, 318, or 405 of the Act, or any permit condition or limitation implementing any of such Sections in a permit issued under Section 402 of the Act. Pursuant to 40 CFR 19 and the Act, administrative penalties for Class I violations are not to exceed the maximum amounts authorized by Section 309(g)(2)(A) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461 note) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701 note) [currently \$11,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed \$32,500]. Pursuant to 40 CFR 19 and the Act, penalties for Class II violations are not to exceed the maximum amounts authorized by Section 309(g)(2)(B) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S.C. § 2461 note) as amended by the Debt Collection Improvement Act (31 U.S.C. § 3701 note) [currently \$11,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed \$157,500].

3. **Criminal Penalties.**

- a. **Negligent Violations.** The Act provides that any person who negligently violates Section 301, 302, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such Sections in a permit issued under Section 402 of the Act, or any requirement imposed in a pretreatment program approved under Section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of \$2,500 to \$25,000 per day of violation, or imprisonment of not more than one year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than \$50,000 per day of violation, or by imprisonment of not more than two years, or both.
- b. **Knowing Violations.** The Act provides that any person who knowingly violates Section 301, 302, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such Sections in a permit issued under Section 402 of the Act, or any requirement imposed in a pretreatment program approved under Section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of \$5,000 to \$50,000 per day of violation, or imprisonment for not more than three years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than \$100,000 per day of violation, or imprisonment of not more than six years, or both.
- c. **Knowing Endangerment.** The Act provides that any person who knowingly violates Section 301, 302, 303, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such Sections in a permit issued under Section 402 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than \$250,000 or imprisonment of not more than 15 years, or both. In the case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than \$500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in Section 309(c)(3)(B)(iii) of the Act, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than \$1,000,000 and can be fined up to \$2,000,000 for a second or subsequent convictions.

- d. **False Statements.** The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000, or by imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than \$20,000 per day of violation, or by imprisonment of not more than four years, or both. The Act further provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six months per violation, or by both.
- C. **Need to Halt or Reduce Activity not a Defense.** It shall not be a defense for the permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with this permit.
- D. **Duty to Mitigate.** The permittee must take all reasonable steps to minimize or prevent any discharge in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.
- E. **Proper Operation and Maintenance.** The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of the permit.
- F. **Bypass of Treatment Facilities.**
 1. **Byapass not exceeding limitations.** The permittee may allow any bypass to occur that does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs F.2 and F.3 of this Part.

2. **Notice.**

- a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it must submit prior notice, if possible at least 10 days before the date of the bypass.
- b. Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required under Section III.G (“Twenty-four Hour Notice of Noncompliance Reporting”).

3. **Prohibition of bypass.**

- a. Bypass is prohibited, and the Director or ADEC may take enforcement action against the permittee for a bypass, unless:
 - (1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
 - (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and
 - (3) The permittee submitted notices as required under paragraph F.2 of this Part.
- b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph F.3.a of this Part.

G. **Upset Conditions.**

1. **Effect of an upset.** An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the permittee meets the requirements of paragraph G.2 of this Part. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
2. **Conditions necessary for a demonstration of upset.** To establish the affirmative defense of upset, the permittee must demonstrate, through

properly signed, contemporaneous operating logs, or other relevant evidence that:

- a. An upset occurred and that the permittee can identify the cause(s) of the upset;
- b. The permitted facility was at the time being properly operated;
- c. The permittee submitted notice of the upset as required under Part III.G (“Twenty-four Hour Notice of Noncompliance Reporting”); and
- d. The permittee complied with any remedial measures required under Section V.D (“Duty to Mitigate”).

3. **Burden of proof.** In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

H. **Toxic Pollutants.** The permittee must comply with effluent standards or prohibitions established under section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

I. **Planned Changes.** The permittee must give notice to the Director and ADEC as soon as possible of any planned physical alterations or additions to the permitted facility whenever:

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source as determined in 40 CFR 122.29(b); or
2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are subject neither to effluent limitations in the permit, nor to notification requirements under Section III.I (“Changes in Discharge of Toxic Substances”).

J. **Anticipated Noncompliance.** The permittee must give advance notice to the Director and ADEC of any planned changes in the permitted facility or activity that may result in noncompliance with this permit.

VI. GENERAL PROVISIONS

- A. **Permit Actions.** This permit or coverage under this permit may be modified, revoked and reissued, or terminated for cause as specified in 40 CFR 122.62, 122.64, or 124.5. The filing of a request by the permittee for a permit modification, revocation and reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.
- B. **Duty to Reapply.** If the permittee intends to continue an activity regulated by this general permit after the expiration date of this permit, the permittee must either apply for and obtain an individual permit or submit an NOI to be covered under a new general permit. In accordance with 40 CFR 122.21(d), and unless permission for the application to be submitted at a later date has been granted by the Director, the permittee must submit an application for an individual permit or submit a new NOI at least 180 days before the expiration date of this permit.
- C. **Duty to Provide Information.** The permittee must furnish to the Director and ADEC, within any reasonable time specified in the request, any information that the Director or ADEC may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee must also furnish to the Director or ADEC, upon request, copies of records required to be kept by this permit.
- D. **Other Information.** When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or that it submitted incorrect information in a permit application or in any report to the Director or ADEC, it must promptly submit such facts or information.
- E. **Signatory Requirements.** All applications, reports or information submitted to the Director and ADEC must be signed and certified as follows:
1. All permit applications must be signed as follows:
 - a. For a corporation: by a responsible corporate officer.
 - b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.
 - c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official.
 2. All reports required by the permit and other information requested by the Director or ADEC must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

- a. The authorization is made in writing by a person described above;
- b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company; and
- c. The written authorization is submitted to the Director and ADEC.

3. **Changes to authorization.** If an authorization under paragraph V.E.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph V.E.2 must be submitted to the Director and ADEC prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. **Certification.** Any person signing a document under this Part must make the following certification:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

F. **Availability of Reports.** In accordance with 40 CFR 2, information submitted to the Director pursuant to this permit may be claimed as confidential by the permittee. In accordance with the Act, permit applications, permits and effluent data are not considered confidential. Any confidentiality claim must be asserted at the time of submission by stamping the words “confidential business information” on each page containing such information. If no claim is made at the time of submission, the Director may make the information available to the public without further notice to the permittee. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR 2, Subpart B (Public Information) and 41 Fed. Reg. 36924 (September 1, 1976), as amended.

- G. **Inspection and Entry.** The permittee must allow the Director or an authorized representative (including an authorized contractor acting as a representative of the Administrator), upon the presentation of credentials and other documents as may be required by law, to:
1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
 2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
 3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
 4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.
- H. **Property Rights.** The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to persons or property or invasion of other private rights, nor any infringement of state or local laws or regulations.
- I. **State Laws.** Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Act.

VII. DEFINITIONS

Act means the Clean Water Act.

Acute toxic unit (TUa) is a measure of acute toxicity. TUa is the reciprocal of the effluent concentration that causes no observable effect on the test organisms by the end of the acute exposure period (i.e., 100/LC50).

ADEC means Alaska Department of Environmental Conservation.

Administrator means the Administrator of the EPA, or an authorized representative.

Average Monthly Limit (AML) means the highest allowable average of “daily discharges” over a calendar month, calculated as the sum of all “daily discharges” measured during a calendar month divided by the number of “daily discharges” measured during that month.

Average Weekly Limit (AWL) means the highest allowable average of “daily discharges” over a calendar week, calculated as the sum of all “daily discharges” measured during a calendar week divided by the number of “daily discharges” measured during that week.

Ballast water means harbor or seawater added or removed to maintain the proper ballast floater level and ship draft.

Best Management Practices (BMPs) means schedules of activities, prohibitions or practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage areas.

Bilge water means water which collects in the lower internal parts of the drilling vessel hull.

Biocide means any chemical agent used for controlling the growth of or destroying nuisance organisms (e.g., bacteria, algae, and fungi).

Blowout preventer fluid means fluid used to actuate hydraulic equipment on the blowout preventer.

BOD means biochemical oxygen demand.

Boiler blowdown means the discharge of water and minerals drained from boiler drums.

Boulder Patch is defined as an area that has more than 10 percent of a one-hundred-square-meter area covered by boulders to which kelp is attached.

Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

Cooling water means once-through non-contact cooling water.

Daily discharge means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the “daily discharge” is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the “daily discharge” is calculated as the average measurement of the pollutant over the day.

Deck drainage means any waste resulting from platform washings, deck washings, spillage, rainwater, and runoff from curbs, gutters, and drains including drip pans and work areas within facilities subject to this permit.

Desalination unit wastes means wastewater associated with the process of creating fresh water from seawater.

Diesel oil means the grade of distillate fuel, as specified in the American Society for Testing and Materials (ASTM) Standard Specifications for Diesel Fuel Oils D975-81, that is typically used as the continuous phase in conventional oil-based drilling fluids, which contains a number of toxic pollutants. For the purpose of this permit, “diesel oil” includes the fuel oil present at the facility.

Director means the Director of the Office of Water, EPA, or an authorized representative.

DMR means discharge monitoring report.

Domestic waste means materials discharged from sinks, showers, laundries, safety showers, eye-wash stations, hand-wash stations, fish cleaning stations, and galleys.

Drill cuttings means particles generated by drilling into subsurface geological formations and carried out from the wellbore with the drilling fluid. Examples of drill cuttings include small pieces of rock varying in size and texture from fine silt to gravel. Drill cuttings are generally generated from solids control equipment and settle out and accumulate in quiescent areas in the solids control equipment or other equipment processing drilling fluid.

Drilling fluid means the circulating fluid (mud) used in the rotary drilling of wells to clean and condition the hole and to counterbalance formation pressure. The classes of drilling fluids are water-based fluid and non-aqueous drilling fluid.

End of Well means after the exploratory facility has been removed from the location and a sea floor bottom survey has been completed.

Enhanced mineral oil, for the purposes of this permit, means a petroleum distillate which has been highly purified and is distinguished from diesel oil and conventional mineral oil in having a lower polycyclic aromatic hydrocarbon (PAH) content. Typically, conventional mineral oils have a PAH content on the order of 0.35 weight percent expressed as phenanthrene, whereas enhanced mineral oils typically have a PAH content of 0.001 or lower weight percent PAH expressed as phenanthrene.

Enhanced mineral oil-based drilling fluid means “drilling fluid” that has an enhanced mineral oil as its continuous phase with water as the dispersed phase.

EPA means the United States Environmental Protection Agency.

Excess cement slurry means the excess cement and wastes from equipment washdown after a cementing operation.

Exploratory facility, for the purposes of this permit, means any fixed or mobile structure that is engaged in the drilling of wells to determine the nature of potential hydrocarbon reservoirs.

Filter Backwash means wastewater generated when filters are cleaned and maintained.

Fire control system test water means the water released during the training of personnel in fire protection and the testing and maintenance of fire protection equipment.

Garbage means all kinds of victual, domestic, and operational waste, excluding fresh fish and part thereof, generated during the normal operation and liable to be disposed of continuously or periodically except dishwater, graywater, and those substances that are defined or listed in other Annexes to MARPOL 73/78.

Grab sample is an individual sample collected over a period of time not exceeding 15 minutes.

Hydrotest water is filtered sea water, or occasionally fresh water, used to test the integrity of unused produced water lines, or produced water lines which are suspected of leaking or which have recently been repaired.

Marine sanitation device (MSD) means a sanitary wastewater treatment system specifically designed to meet U.S. Coast Guard requirements.

Maximum daily limit (MDL) means the highest allowable “daily discharge.”

Mineral oil means a class of low volatility petroleum product, generally of lower aromatic hydrocarbon content and lower toxicity than diesel oil.

Mineral oil pills (also called mineral oil spots) are formulated and circulated in the drilling fluid system as a slug in attempt to free stuck pipe. Pills generally consist of two parts; a spotting compound and mineral oil.

MMS is the Minerals Management Service.

Muds, cuttings, cement at sea floor means the materials discharged at the surface of the ocean floor in the early phases of drilling operations, before the well casing is set, and during well abandonment and plugging.

New Source, for the purposes of this permit, means any facility or activity that is in the process of surveying, clearing or preparing an area of the water body floor for the purpose of constructing or placing a development or production facility on or over the site.

Non-aqueous drilling fluid (NAF) means “drilling fluid” that has water-immiscible fluid as its continuous phase and the suspending medium for solids, such as oleaginous materials (e.g., mineral oil, enhanced mineral oil, paraffinic oil, C₁₆-C₁₈ internal olefins, and C₈-C₁₆ fatty acid/2-ethylhexyl esters). Types of non-aqueous drilling fluids include oil-based fluid, enhanced mineral oil-based fluid, and synthetic-based fluid.

Oil-based drilling fluid means “drilling fluid” that has diesel oil, mineral oil, or some other oil, but neither a synthetic material nor enhanced mineral oil, as its continuous phase with water as the dispersed phase.

OCS means the Outer Continental Shelf.

Plastic means any garbage that is solid material, that contains as an essential ingredient one or more synthetic organic high polymers, and that is formed or shaped either during the manufacture of the polymer or polymers or during fabrication into a finished product by heat or pressure or both. “Degradable” plastics, which are composed of combinations of degradable starches and are either synthetically produced or naturally produced but harvested and adapted for use, are plastics for the purposes of this permit. Naturally produced plastics such as crabshells and other types of shells, which appear normally in the marine environment, are not plastics for the purposes of this permit.

QA/QC means quality assurance/quality control.

Sanitary wastes means human body waste discharged from toilets and urinals.

Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

Sidetracked well means a new hole drilled from a main well to a different bottom-hole location.

Site means the single, specific geographical location where a mobile drilling facility (jackup rig, semisubmersible, or arctic mobile rig) conducts its activity, including the area beneath the facility, or to a location of a single gravel island.

Solids control equipment means shale shakers, centrifuges, mud cleaners, and other equipment used to separate drill cuttings and/or stock barite solids from drilling fluid recovered from the wellbore.

Stable ice means ice that is stable enough to support discharged muds and cuttings.

Static sheen test means the standard test procedures in appendix 1 to subpart A of 40 CFR part 435 that have been developed for this industrial subcategory for the purpose of demonstrating compliance with the requirement of no discharge of free oil.

Step-out well means a new hole drilled from a main well to a different bottom-hole location.

Stock barite means the barite that was used to formulate a drilling fluid.

Stock base fluid means the base fluid that was used to formulate a drilling fluid.

Synthetic-based drilling fluid means “drilling fluid” that has a synthetic material or a combination of synthetic materials as its continuous phase with water as the dispersed phase.

Synthetic material as applied to synthetic-based drilling fluid means material produced by the reaction of specific purified chemical feedstock, as opposed to the traditional base fluids such as diesel and mineral oil which are derived from crude oil solely through physical separation processes.

Test fluid means the discharge that would occur should hydrocarbons be located during exploratory drilling and tested for formation pressure and content. This would consist of fluids sent downhole during testing along with water from the formation.

Unstable or broken ice conditions means greater than 25 percent ice coverage within a one (1) mile radius of the discharge site after spring breakup or after the start of ice formation in the fall, but not stable ice.

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

Victual waste means any spoiled or unspoiled food waste.

Water-based drilling fluid means “drilling fluid” that has water as its continuous phase and the suspending medium for solids, whether or not oil is present.

Water depth means the depth of the water between the surface and the seafloor as measured at mean lower low water.

4-day LC₅₀ as applied to the sediment toxicity means the concentration (milligrams/kilogram dry sediment) of the drilling fluid in sediment that is lethal to 50 percent of the *Leptocheirus plumulosus* test organisms exposed to that concentration of the drilling fluids after four days of constant exposure.

10-day LC₅₀ as applied to the sediment toxicity means the concentration (milligrams/kilogram dry sediment) of the drilling fluid in sediment that is lethal to 50 percent of the *Leptocheirus plumulosus* test organisms exposed to that concentration of the drilling fluids after ten days of constant exposure.

96-hour LC₅₀ means the concentration (parts per million) or percent of the suspended particulate phase (SPP) from a sample that is lethal to 50 percent of the test organisms exposed to that concentration of the SPP after 96 hours of constant exposure.

C₁₂-C₁₄ ester and *C₈ ester* means the fatty acid/2-ethylhexyl esters with carbon chain lengths ranging from 8 to 16 and represented by the Chemical Abstracts Service (CAS) No. 135800-37-2.

C₁₆-C₁₈ internal olefin means a 65/35 blend, proportioned by mass, of hexadecene and octadecene, respectively. Hexadecene is an unsaturated hydrocarbon with a carbon chain length of 15, and internal double carbon bond, and is represented by the Chemical Abstracts Service (CAS) No. 27070-58-2.

C₁₆-C₁₈ internal olefin drilling fluid means a C₁₆-C₁₈ internal olefin drilling fluid formulated as specified in Appendix 8 of subpart A of 40 CFR Part 435 (See Attachment 9 of this permit).

ATTACHMENT 3**APPENDIX 1 TO SUBPART A OF PART 435 – STATIC SHEEN TEST**

1. Scope and Application

This method is to be used as a compliance test for the “no discharge of free oil” requirement for discharges of drilling fluids, drill cuttings, produced sand, and well treatment, completion and work over fluids. “Free oil” refers to any oil contained in a waste stream that when discharged will cause a film or sheen upon or a discoloration of the surface of the receiving water.

2. Summary of Method

15-mL samples of drilling fluids or well treatment, completion, and work over fluids, and 15-g samples (wet weight basis) of drill cuttings or produced sand are introduced into ambient seawater in a container having an air-to-liquid interface area of 1000 cm² (155.5 in²). Samples are dispersed within the container and observations made no more than one hour later to ascertain if these materials cause a sheen, iridescence, gloss, or increased reflectance on the surface of the test seawater. The occurrence of any of these visual observations will constitute a demonstration that the tested material contains “free oil,” and therefore results in a prohibition of its discharge into receiving waters.

3. Interferences

Residual “free oil” adhering to sampling containers, the magnetic stirring bar used to mix the sample, and the stainless steel spatula used to mix the sample will be the principal sources of contamination problems. These problems should only occur if improperly washed and cleaned equipment are used for the test. The use of disposable equipment minimizes the potential for similar contamination from pipettes and the test container.

4. Apparatus, Materials, and Reagents

4.1 Apparatus

- 4.1.1 Sampling Containers: 1-liter polyethylene beakers and 1-liter glass beakers
- 4.1.2 Graduated cylinder: 100-mL graduated cylinder required only for operations where predilection of mud discharges is required.
- 4.1.3 Plastic disposable weighing boats.
- 4.1.4 Triple-beam scale
- 4.1.5 Disposable pipettes: 25 mL disposable pipettes
- 4.1.6 Magnetic stirrer and stirring bar.
- 4.1.7 Stainless steel spatula

- 4.1.8 Test container: Open plastic container whose internal cross-section parallel to its opening has an area of $1000 \text{ cm}^2 \pm 50 \text{ cm}^2$ ($155.5 \pm 7.75 \text{ in}^2$), and a depth of at least 13 cm (5 inches) and no more than 30 cm (11.8 inches).
- 4.2 Materials and Reagents.
- 4.2.1 Plastic liners for the test container: Oil-free, heavy-duty plastic trash can liners that do not inhibit the spreading of an oil film. Liners must be of sufficient size to completely cover the interior surface of the test container. Permittees must determine an appropriate local source of liners that do not inhibit the spreading of 0.05 mL of diesel fuel added to the lined test container under the test conditions and protocol described below.
- 4.2.2 Ambient receiving water.
5. Calibration
- None currently specified.
6. Quality Control Procedures
- None currently specified.
7. Sample Collection and Handling
- 7.1 Sampling containers must be thoroughly washed with detergent, rinsed a minimum of three times with fresh water, and allowed to air dry before samples are collected.
- 7.2 Samples of drilling fluid to be tested shall be taken at the shale shaker after cuttings have been removed. The sample volume should range between 200 mL and 500 mL.
- 7.3 Samples of drill cuttings will be taken from the shale shaker screens with a clean spatula or similar instrument and placed in a glass beaker. Cuttings samples shall be collected prior to the addition of any washdown water and should range between 200 g and 500 g.
- 7.4 Samples of produced sand must be obtained from the solids control equipment from which the discharge occurs on any given day and shall be collected prior to the addition of any washdown water; samples should range between 200 g and 500 g.
- 7.5 Samples of well treatment completion and work over fluids must be obtained from the holding facility prior to discharge; the sample volume should range between 200 mL and 500 mL.
- 7.6 Samples must be tested no later than 1 hour after collection.
- 7.7 Drilling fluid samples must be mixed in their sampling containers for 5 minutes prior to the test using a magnetic bar stirrer. If predilection is imposed as a permit condition, the sample must be mixed at the same ratio with the same prediluting water as the discharged muds and stirred for 5 minutes.
- 7.8 Drill cuttings must be stirred and well mixed by hand in their sampling containers prior to testing, using a stainless steel spatula.

8. Procedure
 - 8.1 Ambient receiving water must be used as the “receiving water” in the test. The temperature of the test water shall be as close as practicable to the ambient conditions in the receiving water, not the room temperature of the observation facility. The test container must have an air-to-liquid interface area of $1000 \pm 50 \text{ cm}^2$. The surface of the water should be no more than 1.27 cm (.5 inch) below the top of the test container.
 - 8.2 Plastic liners shall be used, one per test container, and discarded afterwards. Some liners may inhibit spreading of added oil; operators shall determine an appropriate local source of liners that do not inhibit the spreading of the oil film.
 - 8.3 1 15-mL sample of drilling fluid or well treatment, completion, and workover fluids must be introduced by pipette into the test container 1 cm below the water surface. Pipettes must be filled and discharged with test material prior to the transfer of test material and its introduction into test containers. The test water/test material mixture must be stirred using the pipette to distribute the test material homogeneously throughout the test water. The pipette must be used only once for a test and then discarded.
 - 8.4 Drill cuttings or produced sand should be weighed on plastic weighing boats; 15-g samples must be transferred by scraping test material into the test water with a stainless steel spatula. Drill cuttings shall not be prediluted prior to testing. Also, drilling fluids and cuttings will be tested separately. The weighing boat must be immersed in the test water and scraped with the spatula to transfer any residual material to the test container. The drill cuttings or produced sand must be stirred with the spatula to an even distribution of solids on the bottom of the test container.
 - 8.5 Observations must be made no later than 1 hour after the test material is transferred to test container. Viewing points above the test container should be made from at least three sides of the test container at viewing angles of approximately 60° and 30° from the horizontal. Illumination of the test container must be representative of adequate lighting for a working environment to conduct routine laboratory procedures. It is recommended that the water surface of the test container be observed under a fluorescent light source such as a dissecting microscope light. The light source shall be positioned above and directed over the entire surface of the pan.
 - 8.6 Detection of a “silvery” or “metallic” sheen or gloss, increased reflectivity, visual color, iridescence, or an oil slick on the water surface of the test container surface shall constitute a demonstration of “free oil.” These visual observations include patches, streaks, or sheets of such altered surface characteristics. If the free oil content of the sample approaches or exceeds 10%, the water surface of the test container may lack color, a sheen, or iridescence, due to the increased thickness of the film; thus, the observation for an oil slick is required. The surface of the test container shall not be disturbed in any manner that reduces the size of any sheen or slick that may be present.

If an oil sheen or slick occurs on less than one-half of the surface area after the sample is introduced to the test container, observations will continue for up to 1 hour. If the sheen or slick increases in size and covers greater than one-half of the surface area of the test container during the observation period, the discharge of the material shall cease. If the sheen or slick does not increase in size to cover greater than one-half of the test container surface area after one hour of observation, discharge may continue and additional sampling is not required. If a sheen or slick occurs on greater than one-half of the surface area of the test container after the test material is introduced, discharge of the tested material shall cease. The permittee may retest the material causing the sheen or slick. If subsequent tests do not result in a sheen or slick covering greater than one-half of the surface area of the test container, discharge may continue.

ATTACHMENT 4**APPENDIX 2 SUBPART A OF PART 435 – DRILLING FLUIDS TOXICITY TEST***I. Sample Collection*

The collection and preservation methods for drilling fluids (muds) and water samples presented here are designed to minimize sample contamination and alteration of the physical or chemical properties of the samples due to freezing, air oxidation, or drying.

I-A. Apparatus

(1) The following items are required for water and drilling mud sampling and storage:

- a. Acid-rinsed linear-polyethylene bottles or other appropriate non-contaminating drilling mud sampler.
- b. Acid-rinsed linear-polyethylene bottles or other appropriate non-contaminating water sampler.
- c. Acid-rinsed linear-polyethylene bottles or other appropriate non-contaminated vessels for water and mud samples.
- d. Ice chests for preservation and shipping of mud and water samples.

I-B. Water Sampling

- (1) Collection of water samples shall be made with appropriate acid-rinsed linear-polyethylene bottles or other appropriate non-contaminating water sampling devices. Special care shall be taken to avoid the introduction of contaminants from the sampling devices and containers. Prior to use, the sampling devices and containers should be thoroughly cleaned with a detergent solution, rinsed with tap water, soaked in 10-percent hydrochloric acid (HCl) for 4 hours, and then thoroughly rinsed with glass-distilled water.

I-C. Drilling Mud Sampling

- (1) Drilling mud formulations to be tested shall be collected from active field systems. Obtain a well-mixed sample from beneath the shale shaker after the mud has passed through the screens. Samples shall be stored in polyethylene containers or in other appropriate uncontaminated vessels. prior to sealing the sample containers on the platform, flush as much air out of the container by filling it with drilling fluid sample, leaving a one inch space at the top.
- (2) Mud samples shall be immediately shipped to the testing facility on blue or wet ice (do not use dry ice) and continuously maintained at 0-4 °C until the time of testing.
- (3) Bulk mud samples shall be thoroughly mixed in the laboratory using a 1000 rpm high shear mixer and then subdivided into individual, small wide-mouthed (e.g., one or two liter) non-contaminating containers for storage.

- (4) The drilling muds stored in the laboratory shall have any excess air removed by flushing the storage containers with nitrogen under pressure anytime the containers are opened. Moreover, the sample in any container opened for testing must be thoroughly stirred using a 1000 rpm high shear mixer prior to use.
- (5) Most drilling mud samples may be stored for periods of time longer than 2 weeks prior to toxicity testing provided that proper containers are used and proper condition are maintained.

II. *Suspended Particulate Phase Sample Preparation*

- (1) Mud samples that have been stored under specified conditions in this protocol shall be prepared for tests within three months after collection. The SPP shall be prepared as detailed below.

II-A *Apparatus*

- (1) The following items are required:
 - a. Magnetic stir plates and bars.
 - b. Several graduated cylinders, ranging in volume from 10 mL to 1L.
 - c. Large (15 cm) powder funnels.
 - d. Several 2-liter graduated cylinders.
 - e. Several 2-liter large mouth graduated Erlenmeyer flasks.
- (2) Prior to use, all glassware shall be thoroughly cleaned. Wash all glassware with detergent, rinse five times with tap water, rinse once with acetone, rinse several times with distilled or de-ionized water, place in a clean 10-percent (or stronger) HCl acid bath for a minimum of 4 hours, rinse five times with tap water, and then rinse five times with distilled or de-ionized water. For test samples containing mineral oil or diesel oil, glassware should be washed with petroleum ether to assure removal of all residual oil.
NOTE: If the glassware with nytex cups soaks in acid solution longer than 24 hours, then an equally long de-ionized water soak should be performed.

II-B. *Test Seawater Sample Preparation*

- (1) Diluent seawater and exposure seawater samples are prepared by filtration through a 1.0 micrometer filter prior to analysis.
- (2) Artificial seawater may be used as long as the seawater has been prepared by standard methods or ASTM methods, has been properly “seasoned,” filtered, and has been diluted with distilled water to the same specified 20 ± 2 ppt salinity and 20 ± 2 °C temperature as the “natural” seawater.

II-C. *Sample Preparation*

- (1) The pH of the mud shall be tested prior to its use. If the pH is less than 9, if black spots have appeared on the walls of the sample container, or if the mud sample has a foul odor, that sample shall be discarded. Subsample a manageable aliquot of mud from the well-

mixed original sample. Mix the mud and filtered test seawater in a volumetric mud-to-water ratio of 1 to 9. This is best done by the method of volumetric displacement in a 2-L, large mouth, graduated Erlenmeyer flask. Place 1000 mL of seawater into the graduated Erlenmeyer flask. The mud subsample is then carefully added via a powder funnel to obtain a total volume of 1200 mL (A 200 mL volume of the mud will now be in the flask).

The 2-L large mouth, graduated Erlenmeyer flask is then filled to the 2000 mL mark with 800 mL of seawater, which produces a slurry with a final ratio of one volume drilling mud to nine volumes water. If the volume of SPP required for testing or analysis exceeds 1500 to 1600 mL, the initial volumes should be proportionately increased. Alternatively, several 2-L drill mud/water slurries may be prepared as outlined above and combined to provide sufficient SPP.

- (2) Mix this mud/water slurry with magnetic stirrers for 5 minutes. Measure the pH and, if necessary, adjust (decrease) the pH of the slurry to within 0.2 units of the seawater by adding 6N HCl while stirring the slurry. Then allow the slurry to settle for 1 hour. Record the amount of HCl added.
- (3) At the end of the settling period, carefully decant (do not siphon) the Suspended Particulate Phase (SPP) into an appropriate container. Decanting the SPP is one continuous action. In some cases no clear interface will be present; that is, there will be no solid phase that has settled to the bottom. For those samples the entire SPP solution should be used when preparing test concentrations. However, in those cases when no clear interface is present, the sample must be remixed for five minutes. This insures the homogeneity of the mixture prior to the preparation of the test concentrations. In other cases, there will be samples with two or more phases, including a solid phase. For those samples, carefully and continuously decant the supernatant until the solid phase of the bottom of the flask is reached. The decanted solution is defined to be 100 percent SPP. Any other concentration of SPP is obtained by volumetrically mixing 100 percent SPP with seawater.
- (4) SPP samples to be used in toxicity tests shall be mixed for 5 minutes and must not be preserved or stored.
- (5) Measure the filterable and unfilterable residue of each SPP prepared for testing. Measure the dissolved oxygen (DO) and pH of the SPP. If the DO is less than 4.9 ppm, aerate the SPP to at least 4.9 ppm which is 65 percent of saturation. Maximum allowable aeration time is 5 minutes using a generic commercial air pump and air stone. Neutralize the pH of the SPP to a pH 7.8 ± 1 using a dilute HCl solution. If too much acid is added to lower the pH saturated NaOH may be used to raise the pH to 7.8 ± 1 units. Record the amount of acid or NaOH needed to lower/raise to the appropriate pH. Three repeated DO and pH measurements are needed to insure homogeneity and stability of the SPP. Preparation of test concentrations may begin after this step is complete.
- (6) Add the appropriate volume of 100 percent SPP to the appropriate volume of seawater to obtain the desired SPP concentration. The control is seawater only. Mix all concentrations and the control for 5 minutes by using magnetic stirrers. Record the time; and, measure DO and pH for Day 0. Then, the animals shall be randomly selected and placed in the dishes in order to begin the 96-hour toxicity test.

III. *Guidance for Performing Suspended Particulate Phase Toxicity Tests Using *Mysidopsis bahia**

III-A. *Apparatus*

- (1) Items listed by Borthwick [1] are required for each test series, which consists of one set of control and test containers, with three replicates of each.

III-B. *Sample Collection Preservation*

- (1) Drilling muds and water samples are collected and stored, and the suspended

III-C. *Species Selection*

- (1) The Suspended Particulate Phase (SPP) tests on drilling muds shall utilize the test species *Mysidopsis bahia*. Test animals shall be 3 to 6 days old on the first day of exposure. Whatever the source of the animals, collection and handling should be as gentle as possible. Transportation to the laboratory should be in well-aerated water from the animal culture site at the temperature and salinity from which they were cultured. Methods for handling, acclimating, and sizing bioassay organisms given by Borthwick [1] and Nimmo [2] shall be followed in matters for which no guidance is given here.

III-D. *Experimental Conditions*

- (1) Suspended particulate phase (SPP) tests should be conducted at the salinity of 20 ± 2 ppt. Experimental temperature should be 20 ± 2 °C. Dissolved oxygen in the SPP shall be raised to or maintained above 65 percent of saturation prior to preparation of the test concentrations. Under these conditions of temperature and salinity, 65 percent saturation is a DO of 5.3 ppm. Beginning at Day-0 before the animals are placed in the test containers DO temperature, salinity, and pH shall be measured every 24 hours. DO should be reported in milligrams per liter.
- (2) Aeration of test media is required during the entire test with a rate estimated to be 50-140 cubic centimeters/minute. This air flow to each test dish may be achieved through polyethylene tubing (0.045-inch inner diameter and 0.062-inch outer diameter) by a small generic aquarium pump. The delivery method, surface area of the aeration stone, and flow characteristics shall be documented. All treatments, including control, shall be the same.
- (3) Light intensity shall be 1200 microwatts/cm² using cool white fluorescent bulbs with a 14-hr light and 10-hr dark cycle. This light/dark cycle shall also be maintained during the acclimation period and the test.

III-E. *Experimental Procedure*

- (1) Wash all glassware with detergent, rinse five times with tap water, rinse once with acetone, rinse several times with distilled or de-ionized water, place in a clean 10

- percent HCl acid bath for a minimum of 4 hours, rinse five times with tap water, and then rinse five times with distilled water.
- (2) Establish the definitive test concentration based on results of a range finding test. A minimum of five test concentrations plus a negative and positive reference toxicant control is required for the definitive test. To estimate the LC-50, two concentrations shall be chosen that give (other than zero and 100 percent) mortality above and below 50 percent.
 - (3) Twenty organisms are exposed in each test dish. Nytex® cups shall be inserted into every test dish prior to adding the animals. These “nylon mesh screen” nytex holding cups are fabricated by gluing a collar of 363-micrometer mesh nylon screen to a 15-centimeter wide Petri dish with silicone sealant. The nylon screen collar is approximately 5 centimeters high. The animals are then placed into the test concentration within the confines of the Nytex cups.
 - (4) Individual organisms shall be randomly assigned to treatment. A randomization procedure is presented in section V of this protocol. Make every attempt to expose animals of approximately equal size. The technique described by Borthwick [1], or other suitable substitutes, should be used for transferring specimens. Throughout the test period, mysids shall be fed daily with approximately 50 *Artemia* (brine shrimp) nauplii per mysid. This will reduce stress and decrease cannibalism.
 - (5) Cover the dishes, aerate, and incubate the test containers in an appropriate test chamber. Positioning of the test containers holding various concentrations of test solution should be randomized if incubator arrangement indicates potential position difference. The test medium is not replaced during the 96-hour test.
 - (6) Observations may be attempted at 4, 6 and 8 hours; they must be attempted at 0, 24, 48, and 72 hours and must be made at 96 hours. Attempts at observations refers to placing a test dish on a light table and visually counting the animals. Do not lift the “nylon mesh screen” cup out of the test dish to make the observation. No unnecessary handling of the animals should occur during the 96 hour test period. DO and pH measurements must be made at 0, 24, 48, 72 and 96 hours. Take and replace the test medium necessary for the DO and pH measurements outside of the nytex cups to minimize stresses on the animals.
 - (7) At the end of 96 hours, all live animals must be counted. Death is the end point, so the number of living organisms is recorded. Death is determined by lack of spontaneous movement. All crustaceans molt at regular intervals, shedding a complete exoskeleton. Care should be taken not to count on exoskeleton. Dead animals might decompose or be eaten between observations. Therefore, always count living, not dead animals. If daily observations are made, remove dead organisms and molted exoskeletons with pipette or forceps. Care must be taken not to disturb living organisms and to minimize the amount of liquid withdrawn.

IV. Methods for Positive Control Tests (Reference Toxicant)

- (1) Sodium lauryl sulfate (dodecyl sodium sulfate) is used as a reference toxicant for the positive control. The chemical used should be approximately 95 percent pure. The source, lot number, and percent purity shall be reported.
- (2) Test methods are those used for the drilling fluid tests, except that the test material was prepared by weighing one grain sodium lauryl sulfate on an analytical balance, adding the chemical to a 100-milliliter volumetric flask, and bringing the flask to volume with deionized water. After mixing this stock solution, the test mixtures are prepared by adding 0.1 milliliter of the stock solution for each part per million desired to one liter of seawater.
- (3) The mixtures are stirred briefly, water quality is measured, animals are added to holding cups, and the test begins. Incubation and monitoring procedures are the same as those for the drilling fluids.

*V. Randomization Procedure**V-A. Purpose and Procedure*

- (1) The purpose of this procedure is to assure that mysids are impartially selected and randomly assigned to six test treatments (five drilling fluid or reference toxicant concentrations and a control) and impartially counted at the end of the 96-hour test. Thus, each setup, as specified in the randomization procedure, consists of 3 replicates of 20 animals for each of the six treatments, i.e., 360 animals per test. Figure 1 [INSERT?] is a flow diagram that depicts the procedure schematically and should be reviewed to understand the over-all operation. The following tasks shall be performed in the order listed.
- (2) Mysids are cultured in the laboratory in appropriate units. If mysids are purchased, go to Task 3.
- (3) Remove mysids from culture tanks (6,5,4, and 3 days before the test will begin, i.e., Tuesday, Wednesday, Thursday, and Friday if the test will begin on Monday) and place them in suitably large maintenance containers so that they can swim about freely and be fed.

NOTE: Not every detail (the definition of suitably large containers, for example) is provided here. Training and experience in aquatic animal culture and testing will be required to successfully complete these tests.

- (4) Remove mysids from maintenance containers and place all animals in a single container. The intent is to have a homogenous test population of mysids of a known age (3-6 days old).
- (5) For each toxicity test, assign two suitable containers (500-milliliter (mL) beakers are recommended) for mysid separation/enumeration. Label each container (A1, A2, B1, B2, and C1, C2 for example, if two drilling fluid tests and a reference toxicant test are to be set up on one day). The purpose of this task is to allow the

investigator to obtain a close estimate of the number of animals available for testing and to prevent unnecessary crowding of the mysids while they are being counted and assigned to test containers. Transfer the mysids from the large test population container to the labeled separation and enumeration containers but do not place more than 20 mysids in a 500-mL beaker. Be impartial in transferring the mysids; place approximately equal numbers of animals (10-15 mysids is convenient) in each container in a cyclic manner rather than placing the maximum number each container at one time.

NOTE: It is important that the animals not be unduly stressed during this selection and assignment procedure. Therefore, it will probably be necessary to place all animals (except the batch immediately being assigned to test containers) in mesh cups with flowing seawater or in large volume containers with aeration. The idea is to provide the animals with near optimal conditions to avoid additional stress.

- (6) Place the mysids from the two labeled enumeration containers assigned to a specific test into one or more suitable containers to be used as counting dishes (2-liter Carolina dishes are suggested). Because of the time required to separate, count, and assign mysids, two or more people may be involved in completing this task. If this is done, two or more counting dishes may be used, but the investigator must make sure that approximately equal numbers of mysids from each labeled container are placed in each counting dish.
- (7) By using a large-bore, smooth-tip glass pipette, select mysids from the counting dish(es) and place them in the 36 individually numbered distribution containers (10-ml beakers are suggested). The mysids are assigned two at a time to the 36 containers by using randomization schedule similar to the one presented below. At the end of selection/assignment round 1, each container will contain two mysids; at the end of round 2, they will contain four mysids; and so on until each contains ten mysids.

EXAMPLE OF A RANDOMIZATION SCHEDULE

Selection/assignment round (2 mysids each)	Place mysid in the numbered distribution containers in the random order shown
1.....	8,21,6,28,33,32,1,3,10,9,4,14,23,2,34,22,36,27,5,30,35,24,12,25,11,17,19,26,31,7,20,15,18,13,16,29.
2.....	35,18,5,12,32,24,22,3,9,16,26,13,20,28,6,21,24,30,8,31,7,23,2,15,25,17,1,11,27,4,19,36,10,33,14,29.
3.....	7,19,14,11,34,21,25,27,17,18,6,16,29,2,32,10,4,20,3,9,1,5,28,34,31,15,22,13,33,26,36,12,8,30,35,23.
4.....	30,2,18,5,27,10,25,4,20,26,15,31,36,35,23,11,29,16,17,28,1,33,14,9,34,7,3,12,22,21,6,19,24,32,13.
5.....	34,28,16,17,10,12,1,36,20,18,15,22,2,4,19,23,27,29,25,21,30,3,9,33,32,6,14,11,35,24,26,7,31,5,13,8

- (8) Transfer mysids from the 36 distribution containers to 18 labeled test containers in random order. A label is assigned to each of the three replicates (A, B, or C) or the six test concentrations. Count and record the 96 hour response in an impartial order.
- (9) Repeat tasks 5-7 for each toxicity test. A new random schedule should be followed in Tasks 6 and 7 for each test.

NOTE: If a partial toxicity test is conducted, the procedures described above are appropriate and should be used to prepare the single test concentration and control, along with the reference toxicant test.

V-B. *Data Analysis and Interpretation*

- (1) Complete survival data in all test containers at each observation time shall be presented in tabular form. If greater than 10 percent mortality occurs in the controls, all data shall be discarded and the experiment repeated. Unacceptably high control mortality indicates the presence of important stresses on the organisms other than the material being tested, such as injury or disease, stressful physical or chemical conditions in the containers, or improper handling, acclimation, or feeding. If 10 percent mortality or less occurs in the controls, the data may be evaluated and reported.
- (2) A definitive, full bioassay conducted according to the EPA protocol is used to estimate the concentration that is lethal to 50 percent of the test organisms that do not die naturally. This toxicity measure is known as the median lethal concentration, or LC-50. The LC-50 is adjusted for natural mortality or natural responsiveness. The maximum likelihood estimation procedure with the adjustments for natural responsiveness as given by D.J. Finney, in *Probit Analysis* 3rd edition, 1971, Cambridge University press, chapter 7, can be used to obtain the probit model estimate of the LC-50 and the 95 percent fiducial (confidence) limits for the LC-50. These estimates are obtained using the logarithmic transform of the concentration. The heterogeneity factor (Finney 1971, pages 70-72) is not used. For a test material to pass the toxicity test, according to the requirements stated in the offshore oil and gas extraction industry BAT effluent limitations and NSPS, the LC-50, adjusted for natural responsiveness, must be greater than 3 percent suspended particulate phase (SPP) concentration by volume unadjusted for the 1 to 9 dilution. Other toxicity test models may be used to obtain toxicity estimates provided the modeled mathematical expression for the lethality rate must increase continuously with concentration. The lethality rate is modeled to increase with concentration even though the observed lethality may not increase uniformly because of the unpredictable animal response fluctuations.
- (3) The range finding test is used to establish a reasonable set of test concentrations in order to run the definitive test. However, if the lethality rate changes rapidly over a narrow range of concentrations, the range finding assay may be too coarse to establish an adequate set of test concentrations for a definitive test.
- (4) The EPA Environmental Research Laboratory in Gulf Breeze, Florida prepared a Research and Development Report entitled Acute Toxicity of Eight Drilling Fluids to Mysid Shrimp (*Mysidopsis bahia*), May 1984 EPA-600/3-84-067. The Gulf

Breeze data for drilling fluid number 1 are displayed in Table 1 for purposes of an example of the probit analysis described above. [INSERT TABLE 1?] The SAS Probit Procedure (SAS Institute, Statistical Analysis System, Cary, North Carolina, 1982), was used to analyze these data. The 96-hour LC50 adjusted for the estimated spontaneous mortality rate is 3.3 percent SPP with 95 percent limits of 3.0 and 3.5 percent SPP with the 1 to 9 dilution. The estimated spontaneous mortality rate based on all of the data is 9.6 percent.

V-C. The Partial Toxicity Test for Evaluation of Test Material

- (1) A partial test conducted according to EPA protocol can be used economically to demonstrate that a test material passes the toxicity test. The partial test cannot be used to estimate the LC-50 adjusted for natural response.
- (2) To conduct a partial test follow the test protocol for preparation of the test material and organisms. Prepare the control (zero concentration), one test concentration (3 percent suspended particulate phase) and the reference toxicant according to the methods of the full test. A range finding test is not used for the partial test.
- (3) Sixty test organisms are used for each test concentration. Find the number of test organisms killed in the control (zero percent SPP) concentration in the column labeled X_0 of Table 2. If the number of organisms in the control (zero percent SPP) exceeds the table values, then the test is unacceptable and must be repeated. If the number of organisms killed in the 3 percent test concentration is less than or equal to corresponding number in the column labeled X_1 then the test material passes the partial toxicity test. Otherwise the test material fails the toxicity test.
- (4) Data shall be reported as percent suspended particulate phase.

TABLE 2

X_0	X_1
0.....	22
1.....	22
2.....	23
3.....	23
4.....	24
5.....	24
6.....	25

VI. *References*

1. Borthwick, Patrick W. 1978. Methods for acute static toxicity tests with mysid shrimp (*Mysidopsis bahia*). Bioassay Procedures for the Ocean Disposal Permit Program, [EPA-600/9-78-010:] March.
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3. American Public Health Association et al. 1980. Standard Methods for the Examination of Water and Wastewater. Washington, DC, 15th Edition: 90-99.
4. U.S. Environmental Protection Agency, September 1991. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. EPA/600/4-90/027. Washington DC, 4th Edition.
5. Finney, D.J. Probit Analysis. Cambridge University Press; 1971.
6. U.S. Environmental Protection Agency, May 1984. Acute Toxicity of Eight Drilling Fluids to Mysid Shrimp (*Mysidopsis bahia*), EPA-600/3-84-067.

ATTACHMENT 5**APPENDIX 3 TO SUBPART A OF PART 435 – PROCEDURE FOR MIXING
BASE FLUIDS WITH SEDIMENTS**

This procedure describes a method for amending uncontaminated and nontoxic (control) sediments with the base fluids that are used to formulate synthetic-based drilling fluids and other non-aqueous drilling fluids. Initially, control sediments shall be press-sieved through a 2000 micron mesh sieve to remove large debris. Then press sieve the sediment through a 500 micron sieve to remove indigenous organisms that may prey on the test species or otherwise confound test results. Homogenize control sediment to limit the effects of settling that may have occurred during storage. Sediments should be homogenized before density determinations and addition of base fluid to control sediment. Because base fluids are strongly hydrophobic and do not readily mix with sediment, care must be taken to ensure base fluids are thoroughly homogenized within the sediment. All concentrations are weight-to-weight (mg of base fluid to kg of dry control sediment). Sediment and base fluid mixing shall be accomplished by using the following method.

1. Determine the wet to dry ratio for the control sediment by weighing approximately 10g subsamples of the screened and homogenized wet sediment into tared aluminum weigh pans. Dry sediment at 105 °C for 18-24 h. Remove sediment and cool in a desiccator until a constant weight is achieved. Reweigh the samples to determine the dry weight. Determine the wet/dry ratio by dividing the net wet weight by the net dry weight:

$$[\text{Wet Sediment Weight (g)}] / [\text{Dry Sediment Weight (g)}] = \text{Wet to Dry Ratio} \quad [1]$$

2. Determine the density (g/mL) of the wet control or dilution sediment. This shall be used to determine total volume of wet sediment needed for the various test treatments.

$$[\text{Mean Wet Sediment Weight (g)}] / [\text{Mean Wet Sediment Volume (mL)}] = \text{Wet Sediment Density (g/mL)} \quad [2]$$

3. To determine the amount of base fluid needed to obtain a test concentration of 500 mg base fluid per kg dry sediment use the following formulas:

Determine the amount of wet sediment required:

$$[\text{Wet Sediment Density (g/mL)}] \times [\text{Volume of Sediment Required per Concentration (mL)}] = \text{Weight Sediment Required per Conc. (g)} \quad [3]$$

Determine the amount of dry sediment in kilograms (kg) required for each concentration:

$$\{[\text{Wet Sediment per Concentration (g)}]/[\text{Mean Wet to Dry Ratio}]\} \times (1\text{kg}/1000\text{g}) \\ = \text{Dry Weight Sediment (kg)} \quad [4]$$

Finally determine the amount of base fluid required to spike the control sediment at each concentration:

$$[\text{Conc. Desired (mg/kg)}] \times [\text{Dry Weight Sediment (kg)}] = \text{Base Fluid Required (mg)} \quad [5]$$

For spiking test substances other than pure base fluids (e.g., whole mud formulations), determine the spike amount as follows:

$$[\text{Conc. Desired (mL/kg)}] \times [\text{Dry Weight Sediment (kg)}] \times [\text{Test Substance Density (g/mL)}] = \text{Test Substance Required (g)} \quad [6]$$

4. For primary mixing, place appropriate amounts of weighed base fluid into stainless mixing bowls, tare the vessel weight, then add sediment and mix with a high-shear dispersing impeller for 9 minutes. The concentration of base fluid in sediment from this mix, rather than the nominal concentration, shall be used in calculating LC₅₀ values.
5. Tests for homogeneity of base fluid in sediment are to be performed during the procedure development phase. Because of difficulty of homogeneously mixing base fluid with sediment, it is important to demonstrate that the base fluid is evenly mixed with sediment. The sediment shall be analyzed for total petroleum hydrocarbons (TPH) using EPA Methods 3550A and 8015M, with samples taken both prior to and after distribution to replicate test containers. Base-fluid content is measured as TPH. After mixing the sediment, a minimum of three replicate sediment samples shall be taken prior to distribution into test containers. After the test sediment is distributed to test containers, an additional three sediment samples shall be taken from three test containers to ensure proper distribution of base fluid within test containers. Base-fluid content results shall be reported within 48 hours of mixing. The coefficient of variation (CV) for the replicate samples must be less than 20%. If base-fluid content results are not within the 20% CV limit, the test sediment shall be remixed. Tests shall not begin until the CV is determined to be below the maximum limit of 20%. During the test, a minimum of three replicate containers shall be sampled to determine base-fluid content during each sampling period.
6. Mix enough sediment in this way to allow for its use in the preparation of all test concentrations and as a negative control. When commencing the sediment toxicity test, range-finding tests may be required to determine the concentrations that produce a toxic effect if these data are otherwise unavailable. The definitive

test shall bracket the LC₅₀, which is the desired endpoint. The results for the base fluids shall be reported in mg base fluid per kg of dry sediment.

REFERENCES

American Society for Testing and Materials (ASTM). 1996. Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing. ASTM KE 1391-94. Annual Book of ASTM Standards, Volume 11.05, pp. 805-825.

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[66 FR 6901, Jan. 22, 2001]

ATTACHMENT 6**APPENDIX 4 TO SUBPART A OF PART 435 – DETERMINATION OF BIODEGRADATION OF SYNTHETIC BASE FLUIDS IN A MARINE CLOSED BOTTLE TEST SYSTEM: SUMMARY OF MODIFICATIONS TO ISO 11734:1995**

The six modifications specified in this Appendix shall apply to the determination of the biodegradability of synthetic base fluids as measured by ISO 11734:1995. These modifications make the test more applicable to a marine environment and are listed below:

1. The laboratory shall use sea water in place of freshwater media.
 - 1.1 The sea water may be either natural or synthetic. The allowable salinity range is 20-30 ppt.
 - 1.2 To reduce the shock to the microorganisms in the sediment, the salinity of the sediment's porewater shall be between 20-30 ppt.
2. The laboratory shall use natural marine or estuarine sediments in place of digested sludge as an inoculum. The VS of the sediments must be no less than 2%.
 - 2.1 Sediment should be used for testing as soon as possible after field collection. If required, the laboratory can store the sediment for a maximum period of two months prior to use. The test sediment shall be stored in the dark at 4 °C.
 - 2.2 The laboratory shall use the sediment mixing procedure specified in Appendix 3 to Subpart A of part 435 to spike the test sediment with base fluids. The final concentration will be 2000 mg carbon/Kg dry weight sediment. No less than 25 g dry weight of the spiked sediment shall be used per 125 ml serum bottle. The volume of sediment and seawater in the bottle shall be 75 ml.
3. The temperature of incubation shall be 29±1 °C.
4. The pH is maintained at the level of natural sea water, not at 7.0 as referenced in ISO 11734:1995.
5. The optional use of a trace metals solution as specified in method ISO 11734:1995 shall not be used as part of these test modifications.
6. The laboratory shall conduct the test for 275 days. The laboratory may seek approval of alternate test durations under the approval procedures specified at 40 CFR 136.4 and 136.5. Any modification of this method, beyond those expressly permitted, shall be considered a major modification subject to application and approval of alternate test procedures under 40 CFR 136.4 and 136.5.

[66 FR 6901, Jan. 22 2001]

ATTACHMENT 7

APPENDIX 5 TO SUBPART A OF PART 435 – DETERMINATION OF CRUDE OIL CONTAMINATION IN NON-AQUEOUS DRILLING FLUIDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

1.0 SCOPE AND APPLICATION

- 1.1 This method determines crude (formation) oil contamination, or other petroleum oil contamination, in non-aqueous drilling fluids (NAFs) by comparing the gas chromatography/mass spectrometry (GC/MS) fingerprint scan and extracted ion scans of the test sample to that of an uncontaminated sample.
- 1.2 This method can be used for monitoring oil contamination of NAFs or monitoring oil contamination of the base fluid used in the NAF formulations.
- 1.3 Any modification of this method beyond those expressly permitted shall be considered as a major modification subject to application and approval of alternative test procedures under 40 CFR 136.4 and 136.5.
- 1.4 The gas chromatography/mass spectrometry portions of this method are restricted to use by, or under the supervision of analysts experienced in the use of GC/MS and in the interpretation of gas chromatograms and extracted ion scans. Each laboratory that uses this method must generate acceptable results using the procedures described in Sections 7, 9.2, and 12 of this appendix.

2.0 SUMMARY OF METHOD

- 2.1 Analysis of NAF for crude oil contamination is a step-wise process. The analyst first performs a qualitative assessment of the presence or absence of crude oil in the sample. If crude oil is detected during this qualitative assessment, the analyst must perform a quantitative analysis of the crude oil concentration.
- 2.2 A sample of NAF is centrifuged to obtain a solids free supernate.
- 2.3 The test sample is prepared by removing an aliquot of the solids free supernate, spiking it with internal standard, and analyzing it using GC/MS techniques. The components are separated by the gas chromatograph and detected by the mass spectrometer.
- 2.4 Qualitative identification of crude oil contamination is performed by comparing the Total Ion Chromatograph (TIC) scans and Extracted Ion Profile (EIP) scans of test sample to that of uncontaminated base fluids, and examining the profiles for chromatographic signatures diagnostic of oil contamination.
- 2.5 The presence or absence of crude oil contamination observed in the full scan profiles and selected extracted ion profiles determines further sample quantitation and reporting requirements.
- 2.6 If crude oil is detected in the qualitative analysis, quantitative analysis must be performed by calibrating the GC/MS using a designated NAF spiked with known concentrations of a designated oil.
- 2.7 Quality is assured through reproducible calibration and testing of GC/MS system and through analysis of quality control samples.

3.0 DEFINITIONS

- 3.1 A NAF is one in which the continuous—phase is a water immiscible fluid such as an oleaginous material (e.g., mineral oil, enhance mineral oil, paraffinic oil, or synthetic material such as olefins and vegetable esters).
- 3.2 TIC – Total Ion Chromatograph.
- 3.3 EIP – Extracted Ion Profile.
- 3.4 TCB – 1,3, 5-trichlorobenzene is used as the internal standard in this method.
- 3.5 SPTM – System Performance Test Mix standards are used to establish retention times and monitor detection levels.

4.0 INTERFERENCES AND LIMITATIONS

- 4.1 Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or elevated baselines causing misinterpretation of chromatograms.
- 4.2 All Materials used in the analysis shall be demonstrated to be free from interferences by running method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required.
- 4.3 Glassware shall be cleaned by rinsing with solvent and baking at 400 °C for a minimum of 1 hour.
- 4.4 Interferences may vary from source to source, depending on the diversity of the samples being tested.
- 4.5 Variations in and additions of base fluids and/or drilling fluid additives (emulsifiers, dispersants, fluid loss control agents, etc.) might also cause interferences and misinterpretation of chromatograms.
- 4.6 Difference in light crude oils, medium crude oils, and heavy crude oils will result in different responses and thus different interpretation of scans and calculated percentages.

5.0 SAFETY

- 5.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however each chemical shall be treated as potential health hazard. Exposure to these chemicals should be reduced to the lowest possible level.
- 5.2 Unknown samples may contain high concentration of volatile toxic compounds. Sample containers should be opened in a hood and handled with gloves to prevent exposure. In addition, all sample preparation should be conducted in a fume hood to limit the potential exposure to harmful contaminants.
- 5.3 This method does not address all safety issues associated with its use. The laboratory is responsible for maintaining a safe work environment and a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material safety data sheets (MSDSs) shall be available to all personnel involved in these analyses. Additional references to laboratory safety can be found in References 16.1 through 16.3.
- 5.4 NAF base fluids may cause skin irritation, protective gloves are recommended while handling these samples.

6.0 APPRATUS AND MATERIALS

NOTE: Brand names, suppliers, and part numbers for illustrative purposes only. No endorsement is implied. Equivalent performance may be achieved using apparatus and materials other than those specified here, but demonstration of equivalent performance meeting the requirements of this method is the responsibility of the laboratory.

- 6.1 Equipment for glassware cleaning.
 - 6.1.1 Laboratory sink with overhead fume hood.
 - 6.1.2 Kiln – Capable of reaching 450 °C within 2 hours and holding 450 °C within ±10 °C, with temperature controller and safety switch (Cress Manufacturing Co., Santa Fe Springs, CA B31H or X31TS or equivalent).
Equipment for sample preparation.
 - 6.2.1 Laboratory fume hood.
 - 6.2.2 Analytical balance --- Capable of weighing 0.1 mg.
 - 6.2.3 Glassware.
 - 6.2.3.1 Disposable pipettes – Pasteur, 150 mm long by 5 mm ID (Fisher Scientific 13-678-6A, or equivalent) baked at 400 °C for a minimum of 1 hour.
 - 6.2.3.2 Glass volumetric pipettes or gas tight syringes – 1.0 mL ±1% and 0.5 mL ±1%.
 - 6.2.3.3 Volumetric flasks – Glass, class A, 10-mL, 50-mL and 100-mL.
 - 6.2.3.4-Sample vials–Glass, 1- to 3-mL (baked at 400 °C for a minimum of 1 hour) with PTFE-lined screw or crimp cap.
 - 6.2.3.5 Centrifuge and centrifuge tubes – Centrifuge capable of 10,000 rpm, or better, (International Equipment Co., IEC Centra MP4 or equivalent) and 50 mL centrifuge tubes (Nalgene, Ultratube, Thin Wall 25x89 mm #3410-2539).
- 6.3 Gas Chromatograph/Mass Spectrometer (GC/MS):
 - 6.3.1 Gas Chromatograph—An analytical system complete with a temperature-programmable gas chromatograph suitable for split/splitless injection and all required accessories, including syringes, analytical columns, and gases.
 - 6.3.1.1 Column—30 m (Or 60 m) x 0.32 mm ID (or 0.25 mm ID) 1µm film thickness) silicone-coated fused-silica capillary column (J&W Scientific DB-5 or equivalent).
 - 6.3.2 Mass Spectrometer—Capable of scanning from 35 to 500 amu every 1 sec or less, using 70 volts (nominal) ionization mode (Hewlett Packard 5970MS or comparable).
 - 6.3.3 GC/MS interface—the interface is a capillary-direct interface from the GC to the MS.
 - 6.3.4—Data system—A computer system must be interfaced to the mass spectrometer. The system must allow the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that can search any GC/MS data file for ions of a specific mass and that can plot such ion abundance versus retention time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EIP). Software must also be available that allows integrating the abundance in any total ion chromatogram (TIC) or EIP between specified retention time or scan-number limits. It is advisable that the most recent version of the EPA/NIST Mass Spectral Library be available.

7.0 REAGENTS AND STANDARDS

- 7.1 Methylene chloride—Pesticide grade or equivalent. Use when necessary for sample dilution.
- 7.2 Standards—Prepare from pure individual standard materials or purchase as certified solutions. If compound purity is 96% or greater, the weight may be used without correction to compute the concentration of the standard.
 - 7.2.1 Crude Oil Reference—Obtain a sample of a crude oil with a known API gravity. This oil shall be used in the calibration procedures.
 - 7.2.2 Synthetic Base Fluid—Obtain a sample of clean internal olefin (IO) Lab drilling fluid (as sent from the supplier—has not been circulated downhole). This drilling fluid shall be used in the calibration procedures.
 - 7.2.3 Internal standard—Prepare a 0.01 g/mL solution of 1,3,5-trichlorobenzene (TCB). Dissolve 1.0g of TCB in methylene chloride and dilute to volume in a 100-mL volumetric flask. Stopper, vortex, and transfer the solution to a 150-mL bottle with PTFE-lined cap. Label appropriately, and store at -5°C . Mark the level of the meniscus on the bottle to detect solvent loss.
 - 7.2.4 GC/MS system performance test mix (SPTM) standards—The SPTM standards shall contain octane, decane, dodecane, tetradecane, tetradecene, toluene, ethylbenzene, 1,2,4-trimethylbenzene, 1-methelnaphthalene and 1,3-dimethylnaphthalene. These compounds can be purchased individually or obtained as a mixture (i.e. Supelco, Catalog No. 4-7300). Prepare a high concentration of the SPTM standard at 1.25 mg/mL by transferring 1.0 mL of the 62.5 mg/mL solution into a 50 mL volumetric flask and diluting to the mark with methylene chloride. Finally, prepare a low concentration SPTM standard at 0.125 mg/mL by transferring 1.0mL of the 1.25 mg/mL solution into a 10-mL volumetric flask and diluting to the mark with methylene chloride.
 - 7.2.5 Crude oil/drilling fluid calibration standards—Prepare a 4-point crude oil/drilling fluid calibration at concentrations of 0% (no spike—clean drilling fluid), 0.5%, 1.0%, and 2.0% by weight according to the procedures outline in this appendix using the Reference Crude Oil:
 - 7.2.5.1 Label 4 jars with the following identification: Jar 1—0%Ref-IOLab, Jar 2—0.5%Ref-IOLab, Jar 3—1%Ref-IOLab, and Jar 4--2%RefIOLab.
 - 7.2.5.2 Weigh 4, 50-g aliquots of well mixed IO Lab drilling fluid into each of the 4 jars.
 - 7.2.5.3 Add Reference Oil at 0.5%, 1.0%, and 2.0% by weight to jars 2, 3, and 4 respectively. Jar 1 shall not be spiked with Reference Oil in order to retain a “0%” oil concentration.
 - 7.2.5.4 Thoroughly mix the contents of each of the 4 jars, using clean galss stirring rods.
 - 7.2.5.5 Transfer (weigh) a 30-g aliquot from Jar 1 to a labeled centrifuge tube. Centrifuge the aliquot for minimum of 15 min at approximately 15,000 rpm, in order to obtain a solids free supernate. Weigh 0.5g of the supernate directly into a tared and appropriately labeled GC straight vial. Spike the 0.5-g supernate with 500 μL of the 0.01g/mL 1,3,5-trichlorobenzene internal standard solution (see Section 7.2.3 of this appendix), cap with Teflon lined crimp cap, and vortex for ca. 10 sec.
 - 7.2.5.6 Repeat step 7.2.5.5 except use an aliquot from Jar 2.
 - 7.2.5.7 Repeat step 7.2.5.5 except use an aliquot from Jar 3.
 - 7.2.5.8 Repeat step 7.2.5.5 except use an aliquot from Jar 4.
 - 7.2.5.9 These 4 crude/oil drilling fluid calibration standards are now used for qualitative and quantitative GC/MS analysis.

- 7.2.6 Precision and recovery standard (mid level crude oil/drilling fluid calibration standard— Prepare a mid point crude oil/drilling fluid calibration using IO Lab drilling fluid and Reference Oil at a concentration of 1.0% by weight. Prepare this standard according to the procedures outlined in Section 7.2.5.1 through 7.2.5.5 of this appendix, with the exception that only “Jar 3” needs to be prepared. Remove and spike with internal standard, as many 0.5-g aliquots as needed to complete the GC/MS analysis (see Section 11.6 of this appendix—bracketing authentic samples every 12 hours with precision and recovery standard) and the initial demonstration exercise described in Section 9.2 of this appendix..
- 7.2.7 Stability of standards.
- 7.2.7.1 When not used, standards shall be stored in the dark, at –5 to – 20 °C in screw-capped vials with PTFE-lined lids. Place a mark on the vial at the level of the solution so that solvent loss by evaporation can be detected. Bring the vial to room temperature prior to use.
- 7.2.7.2 Solutions used for quantitative purposes shall be analyzed within 48 hours of preparation and on a monthly basis thereafter for signs of degradation. A standard shall remain acceptable if the peak area remains within $\pm 15\%$ of the area obtained in the initial analysis of the standard.

8.0 SAMPLE COLLECTION PRESERVATION AND STORAGE

- 8.1 Collect NAF and base fluid samples in 100- to 200-mL glass bottles with PTFE- or aluminum foil lined caps.
- 8.2 Samples collected in the field shall be stored refrigerated until time of preparation.
- 8.3 Sample and extract holding times for this method have not yet been established. However, based on initial experience with the method, samples should be analyzed within seven to ten days of collection and extracts should be analyzed within seven days of preparation.
- 8.4 After completion of GC/MS analysis, extracts shall be refrigerated at 4 °C until further notification of sample disposal.

9.0 QUALITY CONTROL

- 9.1 Each laboratory that uses this method is required to operate a formal quality assurance program (Reference 16.4). The minimum requirements of this program shall consist of an initial demonstration of laboratory capability, and ongoing analysis of standards, and blanks a test of continued performance, analyses of spiked samples to assess accuracy and analysis of duplicates to assess precision. Laboratory performance shall be compared to established performance criteria to determine if the results of analyses meet the performance characteristics of the method.
- 9.1.1 The analyst shall make an initial demonstration of the ability to generate acceptable accuracy and precision with this method. This ability shall be established as described in Section 9.2 of this appendix.
- 9.1.2 The analyst is permitted to modify this method to improve separations or lower the cost of measurements, provided all performance requirements are met. Each time a modification is made to the method, the analyst is required to repeat the calibration

- (Section 10.4 of this appendix) and to repeat the initial demonstration procedure described in Section 9.2 of this appendix.
- 9.1.3 Analyses of blanks are required to demonstrate freedom from contamination. The procedures and criteria for analysis of a blank are described in Section 9.3 of this appendix.
 - 9.1.4 Analysis of a matrix spike sample is required to demonstrate method accuracy. The procedure and QC criteria for spiking are described in Section 9.4 of this appendix.
 - 9.1.5 Analysis of a duplicate field sample is required to demonstrate method precision. The procedure and QC criteria for duplicates are described in Section 9.5 of this appendix.
 - 9.1.6 Analysis of a sample of the clean NAF(s) (as sent from the supplier—i.e., has not been circulated downhole) used in the drilling operations is required.
 - 9.1.7 The laboratory shall, on an ongoing basis, demonstrate through calibration verification and the analysis of the precision and recovery standard (Section 7.2.6 of this appendix) that the analysis system is in control. These procedures are described in Section 11.6 of this appendix.
 - 9.1.8 The laboratory shall maintain records to define the quality of data that is generated.
 - 9.2 Initial precision and accuracy—The initial precision and recovery test shall be performed using the precision and recovery standard (1% by weight Reference Oil in IO Lab drilling fluid). The laboratory shall generate acceptable precision and recovery by performing the following operations.
 - 9.2.1 Prepare four separate aliquots of the precision and recovery standard using the procedure outlined in Section 7.2.6 of this appendix. Analyze these aliquots using the procedures outlined in Section 11 of this appendix.
 - 9.2.2 Using the results of the set of four analyses, compute the average recovery (X) in weight percent and the standard deviation of the recovery(s) for each sample.
 - 9.2.3 If s and X meet the acceptance criteria of 80% to 110% system performance is acceptable and analysis of samples may begin. If, however, s exceeds the precision limit or X falls outside the range for accuracy, system performance is unacceptable. In this event, review this method, correct the problem, and repeat the test.
 - 9.2.4 Accuracy and precision—The average percent recovery (P) and the standard deviation of the percent recovery (S_p) Express the accuracy assessment as a percent recovery interval from $P-2S_p$ to $P+2S_p$. For example, if $P=90\%$ and $S_p=10\%$ for four analyses of crude oil in NAF, the accuracy interval is expressed as 70% to 110%. Update the accuracy assessment on a regular basis.
 - 9.3 Blanks—Rinse glassware and centrifuge tubes used in the method with 30mL of methylene chloride, remove a 0.5g aliquot of the solvent, spike it with the 500 μ L of the internal standard solution (Section 7.2.3 of this appendix) and analyze a 1- μ L aliquot of the blank sample using the procedures in Section 11 of this appendix. Compute results per Section 12 of this appendix.
 - 9.4 Matrix spike sample—Prepare a matrix spike sample according to procedure outline in Section 7.2.6 of this appendix. Analyze the sample and calculate the concentration (% oil) in the drilling fluid and % recovery of oil from the spiked drilling fluid using the methods described in Sections 11 and 12 of this appendix.
 - 9.5 Duplicates—A duplicate field sample shall be prepared according to procedures outlined in Section 7.3 this appendix and analyzed according to Section 11 of this appendix. The relative percent difference (RPD) of the calculated concentrations shall be less than 15%.

- 9.5.1 Analyze each of the duplicates per the procedure in Section 11 of this appendix and compute the results per Section 12 of this appendix.
- 9.5.2 Calculate the relative percent difference (RPD) between the two results per the following equation:

$$\text{RPD} = [D_1 - D_2] / [(D_1 + D_2) / 2] \times 100 \quad [1]$$

where:

D_1 = Concentration of crude oil in the sample; and
 D_2 = Concentration of crude oil in the duplicate sample

- 9.5.3 If the RPD criteria are not met, the analytical system shall be judged to be out of control, and the problem must be immediately identified and corrected, and the sample batch re-analyzed.
- 9.6 Prepare the clean NAF sample according to procedures outlined in Section 7.3 of this appendix. Ultimately the oil-equivalent concentration from the TIC or EIP signal measured in the clean NAF sample shall be subtracted from the corresponding authentic field samples (*see* Section 12 of this appendix).
- 9.7 The specifications contained in this method can be met if the apparatus used is calibrated properly, and maintained in a calibrated properly, and maintained in a calibrated state. The standards used for initial precision and recovery (Section 9.2 of this appendix) and ongoing precision and recovery (Section 11.6 of this appendix) shall be identical, so that the most precise results will be obtained. The GC/MS instrument will provide the most reproducible results if dedicated to the setting and conditions required for the analyses given in this method.
- 9.8 Depending on specific program requirements, field replicates and field spikes of crude oil into samples may be required when this method is used to assess the precision and accuracy of the sampling and sample transporting techniques.

10.0 CALIBRATION

- 10.1 Establish gas chromatographic/mass spectrometer operating conditions given in Table 1 of this appendix. Perform the GC/MS system hardware-tune as outlined by the manufacture. The gas chromatograph shall be calibrated using the internal standard technique.

NOTE: *Because each GC is slightly different, it may be necessary to adjust the operating conditions (carrier gas flow rate and column temperature and temperature program) slightly until the retention times in Table 2 of this appendix are met.*

TABLE 1. – GAS CHROMATOGRAPH/MASS SPECTROMETER (GC/MS)
OPERATION CONDITIONS

Parameter	Setting
Injection pot.....	280 °C
Transfer line.....	280 °C
Detector.....	280 °C
Initial Temperature.....	50 °C
Initial Time.....	5 minutes
Ramp.....	50 to 300 °C @ 5 °C per minute
Final Temperature.....	300 °C
Final Hold.....	20 minutes or until all peaks have eluted
Carrier Gas.....	Helium
Flow rate.....	As required for standard operation
Split ratio.....	As required to meet performance criteria (--1:100)
Mass range.....	30 to 600 amu

TABLE 2. – APPROXIMATE RETENTION TIME FOR COMPOUNDS

Compound	Approximate retention time (minutes)
Toluene	5.6
Octane, n – C ₈	7.2
Ethylbenzene	10.3
1,2,4 – Trimethylbenzene	16.0
Decane, - C ₁₀	16.1
TCB (Internal Standard)	21.3
Dodecane, - C ₁₂	22.9
1-Methylnaphthalene	26.7
1-Tetradecene	28.4
Tetradecene, - C ₁₄	28.7
1,3 – Dimethylnaphthalene	29.7

- 10.2 Internal standard calibration procedure—1,3,5-trichlorobenzene (TCB) has been shown to be free of interferences from diesel and crude oils and is a suitable internal standard.
- 10.3 The system performance test mix standards prepared in Section 7.2.4 of this appendix shall be used to establish retention times and establish qualitative detection limits.
- 10.3.1 Spike a 500-mL aliquot of the 1.25 mg/mL SPTM standard with 500µL of the TCB internal standard solution.
- 10.3.2 Inject 1.0 µL of this spiked SPTM standard onto the GC/MS in order to demonstrate proper retention times. For the GC/MS used in the development of this method, the ten compounds in the mixture had typical retention times shown in Table 2 of this appendix. Extracted ion scans for m/z 91 and 105 showed a maximum abundance of 400,000.
- 10.3.3 Spike a 500-mL aliquot of the 0.125 mg/mL SPTM standard with 500 µL of the TCB internal standard solution.
- 10.3.4 Inject 1.0 µL of this spiked SPTM standard onto the GC/MS to monitor detectable levels. For the GC/MS used in the development of this test, all ten compounds showed a

- minimum peak height of three times signal to noise. Extracted ion scans for m/z 91 and 105 showed a maximum abundance of 40,000.
- 10.4 GC/MS crude oil/drilling fluid calibration—There are two methods of quantification: Total Area Integration (C₈—C₁₃) and EIP Area Integration using m/z's 91 and 105. The Total Area Integration method should be used as the primary technique for quantifying crude oil in NAFs. The EIP Area Integration method shall be used as the primary method for quantifying oil in enhanced mineral oil (EMO) based drilling fluid. Inject 1.0 µL of each of the four crude oil/drilling fluid calibration standards prepared in Section 7.2.5 of this appendix into the GC/MS. The internal standard should elute approximately 21-22 minutes after injection. For the GC/MS used in the development of this method, the internal standard peak was (35 to 40 % of full scale at an abundance of about 3.5e+07.
- 10.4.1 Total Area Integration Method--For each of the four calibration standards obtain the following: Using a straight baseline integration technique, obtain the total ion chromatogram (TIC) area from C₈ to C₁₃. Obtain the IC area of the internal standard (TCB). Subtract the TCB area from the C₈—C₁₃ and TCB areas, and known internal standard concentration, generate a linear regression calibration using the internal standard method. The r² value for the linear regression curve shall be greater than or equal to 0.998. Some synthetic fluids might have peaks that elute in the window and would interfere with the analysis. In this case the integration window can be shifted to other areas of scan where there are no interfering peaks from the synthetic base fluid.
- 10.4.2 EIP Area Integration—For each of the four calibration standards generate Extracted Ion Profiles (EIPs) from m/z 91 and 105. Using straight baseline integration techniques, obtain the following EIP areas:
- 10.4.2.1 For m/z integrate the area under the curve from approximately 9 minutes to 21-22 minutes, just prior to but not including the internal standard.
- 10.4.2.2 For m/z 105 integrate the area under the curve from approximately 10.5 minutes to 26.5 minutes.
- 10.4.2.3 Obtain the internal standard area from the TCB in each of the four calibration standards, using m/z 180.
- 10.4.2.4 Using the EIP areas for TCB, m/z 91 and m/z 105, and the known concentration of internal standard, generate linear regression calibration curves for the target ions 91 and 105 using the internal standard method. The r² value for each of the EIP linear regression curves shall be greater than or equal to 0.998.
- 10.4.2.5 Some base fluids might produce a background level that would show up on the extracted ion profiles, but there should not be any real peaks (signal to noise ratio of 1:3) from the clean base fluids.

11.0 PROCEDURE

- 11.1 Sample Preparation—
- 11.1.1 Mix the authentic field sample (drilling fluid) well. Transfer (weigh) a 30-g aliquot of the sample to a labeled centrifuge tube.
- 11.1.2 Centrifuge the aliquot for a minimum of 15 min at approximately 15,000 rpm, in order to obtain a solids free supernate.
- 11.1.3 Weigh 0.5g of the supernate directly into a tared and appropriately labeled GC straight vial.

- 11.1.4 Spike the 0.5-g supernate with 500 μL of the 0.01g/mL 1,3,5-trichlorobenzene internal standard solution (*see* Section 7.2.3 of this appendix), cap with a Teflon lined crimp cap, and vortex for ca. 10 sec.
- 11.1.5 The sample is ready for GC/MS analysis.
- 11.2 Gas Chromatography.
- Table 1 of this appendix summarizes the recommended operating conditions for the GC/MS. Retention times for the n-alkanes obtained under these conditions are given in Table 2 of this appendix. Other columns, chromatographic conditions, or detectors may be used if initial precision and accuracy requirements (Section 9.2 of this appendix) are met. The system shall be calibrated according to the procedures outlined in Section 10 of this appendix, and verified every 12 hours according to Section 11.6 of this appendix.
- 11.2.1 Samples shall be prepared (extracted) in a batch of no more than 20 samples. The batch shall consist of 20 authentic samples, 1 blank (Section 9.3 of this appendix), 1 matrix spike sample (9.4), and 1 duplicate field sample (9.5), and a prepared sample of the corresponding clean NAF used in the drilling process.
- 11.2.2 An analytical sequence shall be analyzed on the GC/MS where the 3 SPTM standards (Section 7.2.4 of this appendix) containing internal standard are analyzed first, followed by analysis of the four GC/MS crude oil/drilling fluid calibration standards (Section 7.2.5 of this appendix), analysis of the blank, matrix spike sample, the duplicate sample, the clean NAF sample, followed by the authentic samples.
- 11.2.3 Samples requiring dilution due to excessive signal shall be diluted using methylene chloride.
- 11.2.4 Inject 1.0 μL of the test sample or standard into the GC, using the conditions in Table 1 of this appendix.
- 11.2.5 Begin data collection and the temperature program at the time of injection.
- 11.2.6 Obtain a TIC and EIP fingerprint scans of the sample (Table 3 of this appendix).
- 11.2.7 If the area of the C_8 — C_{13} peaks exceeds the calibration range of the system, dilute a fresh aliquot of the test sample weighing 0.50-g and re-analyze.
- 11.2.8 Determine the C_8 to C_{13} to TIC area, the TCB internal standard area, and the areas for the m/z91 and 105 EIPs. These shall be used in the calculation of oil concentration in the samples (*see* Section 12 of this appendix).

TABLE 3. – RECOMMENDED ION MASS NUMBERS

Selected ion mass numbers	Corresponding aromatic compounds	Typical retention time (minutes)
91.....	Methylbenzene.....	6.0
	Ethylbenzene.....	10.3
	1,4-	10.9
	Dimethylbenzene	
	1,3-	10.9
	1,2	11.9
	Dimethylbenzene	
105.....	1,3,5-	15.1
	Trimethylbenzene	
	1,2,4-	16.0
	Trimethylbenzene	
	1,2,3-	17.4
156.....	2,6	28.9
	Dimethylnaphthalene	
	1,2-	29.4
	1,3	29.7
	Dimethylnaphthalene	

- 11.2.9 Observe the presence of peaks in the EIPs that would confirm the presence of any target aromatic compounds. Using the EIP areas and EIP linear regression calibrations compare the abundance of the aromatic peaks, and if appropriate, determine approximate crude oil contamination in the sample for each of the target ions.
- 11.3 Qualitative Identification—See Section 17 of this appendix for schematic flow-chart.
- 11.3.1 Qualitative identification shall be accomplished by comparison of the TIC and EIP area data from an authentic sample to the TIC and EIP area data from the calibration standards (Section 12.4 of this appendix). Crude oil shall be identified by the presence of C₁₀ to C₁₃ n-alkanes and corresponding target aromatics.
- 11.3.2 Using the calibration data, establish the identity of the C₈ to C₁₃ peaks in the chromatogram of the sample. Using the calibration data, establish the identity of any target aromatics present on the extracted ion scans.
- 11.3.3 Crude oil is not present in a detectable amount in the sample if there are no target aromatics seen on the extracted ion scans. The experience of the analyst shall weigh heavily on the determination of the presence of peaks at a signal-to-noise ratio of 3 or greater.
- 11.3.4 If the chromatogram shows n-alkanes from C₈ to C₁₃ and target aromatics to be present, contamination by crude oil or diesel shall be determined. If there are no n-alkanes present that are not seen on the blank, and no target aromatics are seen, the sample can be considered to be free of contamination.
- 11.4 Quantitative Identification—
- 11.4.1 Determine the area of the peaks from C₈ to C₁₃ as outlined in the calibration section (10.4.1 of this appendix). If the area of the peaks for the sample is greater than that for the clean NAF (base fluid) use the crude oil/drilling fluid calibration TIC linear regression curve to determine approximate crude oil contamination.

- 11.4.2 Using the EIPs outlined in Section 10.4.2 of this appendix, determine the presence of any target aromatics. Using the integration techniques outlined in Section 10.4.2 of this appendix, obtain the EIP areas for m/z 91 and 105. Use the crude oil/drilling fluid calibration EIP linear regression curves to determine approximate crude oil contamination.
- 11.5 Complex Samples—
- 11.5.1 The most common interferences in the determination of crude oil can be from mineral oil, diesel oil, and proprietary additives in drilling fluids.
- 11.5.2 Mineral oil can typically be identified by its lower target aromatic content, and narrow range of strong peaks.
- 11.5.3 Diesel oil can typically be identified by low amounts in n-alkanes from C₇ to C₉, and the absence of n-alkanes greater than C₂₅.
- 11.5.4 Crude oils can usually be distinguished by the presence of high aromatics, increased intensities of C₈ to C₁₃ peaks, and/or the presence of higher hydrocarbons of C₂₅ and greater (which may be difficult to see in some synthetic fluids at low contamination levels).
- 11.5.4.1 Oil condensates from gas wells are low in molecular weight and will normally produce strong chromatographic peaks in the C₈ to C₁₃ range. If a sample of the gas condensate crude oil from the formation is available, the oil can be distinguished from other potential sources of contamination by using it to prepare a calibration standard.
- 11.5.4.2 Asphaltene crude oils with API gravity 20 may not produce chromatographic peaks strong enough to show contamination at levels of the calibration. Extracted ion peaks should be easier to see than increased intensities for the C₈ to C₁₃ peaks. If a sample of asphaltene crude from the formation is available, a calibration standard shall be prepared.
- 11.6 System and Laboratory Performance—
- 11.6.1 At the beginning of each 8-hour shift during which analyses are performed, GC crude oil/drilling fluid calibration and system performance test mixes shall be verified. For these tests, analysis of the medium-level calibration standard (1- % Reference Oil in IO Lab drilling fluid, and 1.25 mg/mL SPTM with internal standard) shall be used to verify all performance criteria. Adjustments and/or re-calibration (per Section 10 of this appendix) shall be performed until all the performance criteria are met. Only after all performance criteria are met may samples and blanks be analyzed.
- 11.6.2 Inject 1.0 µL of the medium-level GC/MS crude oil/drilling fluid calibration standard into the GC instrument according to the procedures in Section 11.2 of this appendix. Verify that the linear regression curves for both TIC area and EIP areas are still valid using this continuing calibration standard.
- 11.6.3 After this analysis is complete, inject 10 µL of the 1.25 mg/mL SPTM (containing internal standard) into the GC instrument and verify the proper retention times are met (*see* Table 2 of this appendix.)
- 11.6.4 Retention times—Retention time of the internal standard. The absolute retention time of the TCB internal standard shall be within the range 21.0 ± 0.5 minutes. Relative retention times of the n-alkanes relative to TCB internal standard shall be similar to those given in Table 2 of this appendix.

12.0 CALCULATIONS

The concentration of oil in NAFs drilling fluids shall be computed relative to peak areas between C₈ and C₁₃ (using the Total Area Integration method) or total peak areas from extracted ion profiles (using the Extracted Ion Profile Method). In either case, there is measurable amount of peak area, even in clean drilling fluid samples, due to spurious peaks and electrometer “noise” that contributes to the total signal measured using either of the quantification methods. In this procedure, a correction for this signal is applied, using the blank or clean sample correction technique described in American Society for Testing Materials (ASTM) Method D-3328-90, Comparison of Waterbourne Oil by Gas Chromatography. In this method, the “oil equivalents” measured in a blank sample by total area gas chromatography are subtracted from that determined for a field sample to arrive at the most accurate measure of oil residue in the authentic sample.

12.1 Total Area Integration Method

12.1.1 Using C₈ to C₁₃ TIC area, the TCB area in the clean NAF sample and the TIC linear regression curve, compute the oil equivalent concentration of the C₈ to C₁₃ retention time range in the clean NAF.

NOTE: The actual TIC area of the C₈ to C₁₃ area minus the area of the TCB.

12.1.2 Using the corresponding information for the authentic sample, compute the oil equivalent concentration of the C₈ to C₁₃ retention time range in the authentic sample.

12.1.3 Calculate the concentration (% oil) of oil in the sample by subtracting the oil equivalent concentration (% oil) found in the clean NAF from the oil equivalent concentration (% oil) found in the authentic sample.

12.2 EIP Area Integration Method

12.2.1 Using either m/z 91 or 105 EIP areas, the TCB area in the clean NAF sample, and the appropriate EIP linear regression curve, compute the oil equivalent concentration of the in the NAF.

12.2.2 Using the corresponding information for the authentic sample, compute its oil equivalent concentration.

12.2.3 Calculate the concentration (% oil) of oil in the sample by subtracting the oil equivalent concentration (% oil) found in the clean NAF from the oil equivalent concentration (% oil) found in the authentic sample.

13.0 METHOD PERFORMANCE

13.1 Specifications in this method are adopted from EPA Method 1663. Differentiation of Diesel and Crude Oil by GC/FID (Reference 16.5).

13.2 Single laboratory method performance using an Internal Olefin (IO) drilling fluid fortified at 0.5% oil using 35 API gravity oil was:

Precision and accuracy $9^{\pm 4}\%$

Accuracy interval—86.3% to 102%

Relative percent difference in duplicate analysis—6.2%

14.0 POLLUTION PREVENTION

- 14.1 The solvent used in this method poses little threat to the environment when recycled and managed properly.

15.0 WASTE MANAGEMENT

- 15.1 It is the laboratory's responsibility to comply with all federal, state, and local regulations governing waste management, particularly the hazardous waste identification rules and land disposal restriction, and to protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Compliance with all sewage discharge permits and regulations is also required.
- 15.2 All authentic samples (drilling fluids) failing the RPE (fluorescence) test (indicated by the presence of fluorescence) shall be retained and classified as contaminated samples. Treatment and ultimate fate of these samples is not outlined in this SOP.
- 15.3 For further information on waste management, consult "The Waste Management Manual for Laboratory Personnel", and "Less is Better: Laboratory Chemical Management for Waste Reduction", both available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th Street NW, Washington, DC 20036.

16.0 REFERENCES

- 16.1 Carcinogens—"Working with Carcinogens," Department of Health, Education, and Welfare, Public Health Service, Centers for Disease Control (available through National Technical Information Systems, 5285 Port Royal Road, Springfield, VA 22161, document no. PB-277256): August 1977.
- 16.2 "OSHA Safety and Health Standards, General Industry [29 CFR 1910] Revised." Occupational Safety and Health Administration, OSHA 2206. Washington, DC: January 1976.
- 16.3 "Handbook of Analytical Quality Control in Water and Wastewater Laboratories," USEPA, EMSSL-CI, EPA-600/4-79-019, Cincinnati, OH: March 1979.
- 16.4 "Method 1663, Differentiation of Diesel and Crude Oil by GC/FID, Methods for the Determination of Diesel, Mineral, and Crude Oils in Offshore Oil and Gas Industry Discharges, EPA 821-R-92-008, Office of Water Engineering and Analysis Division, Washington, DC: December 1992.

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ATTACHMENT 8

APPENDIX 6 TO SUBPART A OF PART 435—REVERSE PHASE EXTRACTION (RPE) METHOD FOR DETECTION OF OIL CONTAMINATION IN NON-AQUEOUS DRILLING FLUIDS (NAF)

1.0 SCOPE AND APPLICATION

- 1.1 This method is used for determination of crude or formation oil, or other petroleum oil contamination, in non-aqueous drilling fluids (NAFs).
- 1.2 This method is intended as a positive/negative test to determine a presence of crude oil in NAF prior to discharging drill cuttings from offshore production platforms.
- 1.3 This method is for use in the Environmental Protection Agency's (EPA's) survey and monitoring programs under the Clean Water Act, including monitoring of compliance with the Gulf of Mexico NPDES General Permit for monitoring of oil contamination in drilling fluids.
- 1.4 This method has been designed to show positive contamination for 5% of representative crude oils at a concentration of 0.1% in drilling fluid (vol/vol), 50% of representative crude oils at a concentration of 0.5%, and 95% of representative crude oils at a concentration of 1%.
- 1.5 Any modification of this method, beyond those expressly permitted, shall be considered a major modification subject to application and approval of alternate test procedures under 40 CFR Parts 136.4 and 136.5.
- 1.6 Each laboratory that uses this method must demonstrate the ability to generate acceptable results using the procedure in Section 9.2 of this appendix.

2.0 SUMMARY OF METHOD

- 2.1 An aliquot of drilling fluid is extracted using isopropyl alcohol.
- 2.2 The mixture is allowed to settle and then filtered to separate out residual solids.
- 2.3 An aliquot of the filtered extract is charged onto a reverse phase extraction (RPE) cartridge.
- 2.4 The cartridge is eluted with isopropyl alcohol.
- 2.5 Crude oil contaminants are retained on the cartridge and their presence (or absence) is detected based on observed fluorescence using a black light.

3.0 DEFINITIONS

- 3.1 A NAF is one in which the continuous phase is a water immiscible fluid such as an oleaginous material (e.g., mineral oil, enhance mineral oil, paraffinic oil, or synthetic material such as olefins and vegetable esters).

4.0 INTERFERENCES

- 4.1 Solvents, reagents, glassware, and other sample-processing hardware may yield artifacts that affect results. Specific selection of reagents and purification of solvents may be required.

- 4.2 All materials used in the analysis shall be demonstrated to be free from interferences under the conditions of analysis by running laboratory reagent blanks as described in Section 9.5 of this appendix.

5.0 SAFETY

- 5.1 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical shall be treated as a potential health hazard. Exposure to these chemicals should be reduced to the lowest possible level. Material Safety Data Sheets (MSDSs) shall be available for all reagents.
- 5.2 Isopropyl alcohol is flammable and should be used in a well-ventilated area.
- 5.3 Unknown samples may contain high concentration of volatile toxic compounds. Sample containers should be opened in a hood and handled with gloves to prevent exposure. In addition, all sample preparation should be conducted in a well-ventilated area to limit the potential exposure to harmful contaminants. Drilling fluid samples should be handled with the same precautions used in the drilling fluid handling areas of the drilling rig.
- 5.4 This method does not address all safety issues associated with its use. The laboratory is responsible for maintaining a safe work environment and a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material safety data sheets (MSDSs) shall be available to all personnel involved in these analyses. Additional information on laboratory safety can be found in References 16.1–16.2.

6.0 EQUIPMENT AND SUPPLIES

NOTE: Brand names, suppliers, and part numbers are for illustrative purposes only. No endorsement is implied. Equivalent performance may be achieved using apparatus and materials other than those specified here, but demonstration of equivalent performance that meets the requirements of this method is the responsibility of the laboratory.

- 6.1 Sampling equipment.
- 6.1.1 Sample collection bottles/jars—New, pre-cleaned bottles/jars, lot-ertified to be free of artifacts. Glass preferable, plastic acceptable, wide mouth approximately 1–L, with Teflon-lined screw cap.
- 6.2 Equipment for glassware cleaning.
- 6.2.1 Laboratory sink.
- 6.2.2 Oven—Capable of maintaining a temperature within ± 5 °C in the range of 100–250 °C.
- 6.3 Equipment for sample extraction.
- 6.3.1 Vials—Glass, 25 mL and 4 mL, with Teflon-lined screw caps, baked at 200–250 °C for 1–h minimum prior to use.
- 6.3.2 Gas-tight syringes—Glass, various sizes, 0.5 mL to 2.5 mL (if spiking of drilling fluids with oils is to occur).
- 6.3.3 Auto pipetters—various sizes, 0.1 mL, 0.5 mL, 1 to 5 mL delivery, and 10 mL delivery, with appropriate size disposable pipette tips, calibrated to within $\pm 0.5\%$.
- 6.3.4 Glass stirring rod.
- 6.3.5 Vortex mixer.
- 6.3.6 Disposable syringes—Plastic, 5 mL.

- 6.3.7 Teflon syringe filter, 25-mm, 0.45 μ m pore size—Acrodisc[®]CR Teflon (or equivalent).
- 6.3.8 Reverse Phase Extraction C18 Cartridge—Waters Sep-Pak[®]Plus, C18 Cartridge, 360 mg of sorbent (or equivalent).
- 6.3.9 SPE vacuum manifold—Supelco Brand, 12 unit (or equivalent). Used as support for cartridge/syringe assembly only. Vacuum apparatus not required.
- 6.4 Equipment for fluorescence detection.
- 6.4.1 Black light—UV Lamp, Model UVG 11, Mineral Light Lamp, Shortwave 254 nm, or Longwave 365 nm, 15 volts, 60 Hz, 0.16 amps (or equivalent).
- 6.4.2 Black box—cartridge viewing area. A commercially available ultraviolet viewing cabinet with viewing lamp, or alternatively, a cardboard box or equivalent, approximately 14"x7.5"x7.5" in size and painted flat black inside. Lamp positioned in fitted and sealed slot in center on top of box. Sample cartridges sit in a tray, ca. 6" from lamp. Cardboard flaps cut on top panel and side of front panel for sample viewing and sample cartridge introduction, respectively.
- 6.4.3 Viewing platform for cartridges. Simple support (hand made vial tray—black in color) for cartridges so that they do not move during the fluorescence testing.

7.0 REAGENTS AND STANDARDS

- 7.1 Isopropyl alcohol—99% purity.
- 7.2 NAF—Appropriate NAF as sent from the supplier (has not been circulated downhole). Use the clean NAF corresponding to the NAF being used in the current drilling operation.
- 7.3 Standard crude oil—NIST SRM 1582 petroleum crude oil.

8.0 SAMPLE COLLECTION, PRESERVATION, AND STORAGE

- 8.1 Collect approximately one liter of representative sample (NAF, which has been circulated downhole) in a glass bottle or jar. Cover with a Teflon lined cap. To allow for a potential need to re-analyze and/or re-process the sample, it is recommended that a second sample aliquot be collected.
- 8.2 Label the sample appropriately.
- 8.3 All samples must be refrigerated at 0–4 °C from the time of collection until extraction (40 CFR Part 136, Table II).
- 8.4 All samples must be analyzed within 28 days of the date and time of collection (40 CFR Part 136, Table II).

9.0 QUALITY CONTROL

- 9.1 Each laboratory that uses this method is required to operate a formal quality assurance program (Reference 16.3). The minimum requirements of this program consist of an initial demonstration of laboratory capability, and ongoing analyses of blanks and spiked duplicates to assess accuracy and precision and to demonstrate continued performance. Each field sample is analyzed in duplicate to demonstrate representativeness.
- 9.1.1 The analyst shall make an initial demonstration of the ability to generate acceptable accuracy and precision with this method. This ability is established as described in Section 9.2 of this appendix.

- 9.1.2 Preparation and analysis of a set of spiked duplicate samples to document accuracy and precision. The procedure for the preparation and analysis of these samples is described in Section 9.4 of this appendix.
- 9.1.3 Analyses of laboratory reagent blanks are required to demonstrate freedom from contamination. The procedure and criteria for preparation and analysis of a reagent blank are described in Section 9.5 of this appendix.
- 9.1.4 The laboratory shall maintain records to define the quality of the data that is generated.
- 9.1.5 Accompanying QC for the determination of oil in NAF is required per analytical batch. An analytical batch is a set of samples extracted at the same time, to a maximum of 10 samples. Each analytical batch of 10 or fewer samples must be accompanied by a laboratory reagent blank (Section 9.5 of this appendix), corresponding NAF reference blanks (Section 9.6 of this appendix), a set of spiked duplicate samples blank (Section 9.4 of this appendix), and duplicate analysis of each field sample. If greater than 10 samples are to be extracted at one time, the samples must be separated into analytical batches of 10 or fewer samples.
- 9.2 Initial demonstration of laboratory capability. To demonstrate the capability to perform the test, the analyst shall analyze two representative unused drilling fluids (e.g., internal olefin-based drilling fluid, vegetable ester-based drilling fluid), each prepared separately containing 0.1%, 1%, and 2% or a representative oil. Each drilling fluid/concentration combination shall be analyzed 10 times, and successful demonstration will yield the following average results for the data set:
 - 0.1% oil—Detected in <20% of samples
 - 1% oil—Detected in >75% of samples
 - 2% oil—Detected in >90% of samples
- 9.3 Sample duplicates.
 - 9.3.1 The laboratory shall prepare and analyze (Section 11.2 and 11.4 of this appendix) each authentic sample in duplicate, from a given sampling site or, if for compliance monitoring, from a given discharge.
 - 9.3.2 The duplicate samples must be compared versus the prepared corresponding NAF blank.
 - 9.3.3 Prepare and analyze the duplicate samples according to procedures outlined in Section 11 of this appendix.
 - 9.3.4 The results of the duplicate analyses are acceptable if each of the results give the same response (fluorescence or no fluorescence). If the results are different, sample non-homogeneity issues may be a concern. Prepare the samples again, ensuring a well mixed sample prior to extraction. Analyze the samples once again.
 - 9.3.5 If different results are obtained for the duplicate a second time, the analytical system is judged to be out of control and the problem shall be identified and corrected, and the samples re-analyzed.
- 9.4 Spiked duplicates—Laboratory prepared spiked duplicates are analyzed to demonstrate acceptable accuracy and precision.
 - 9.4.1 Preparation and analysis of a set of spiked duplicate samples with each set of no more than 10 field samples is required to demonstrate method accuracy and precision and to monitor matrix interferences (interferences caused by the sample matrix). A field NAF sample expected to contain less than 0.5% crude oil (and documented to not fluoresce as part of the sample batch analysis) shall be spiked with 1% (by volume) of suitable reference crude oil

and analyzed as field samples, as described in Section 11 of this appendix. If no low-level drilling fluid is available, then the unused NAF can be used as the drilling fluid sample.

- 9.5 Laboratory reagent blanks—Laboratory reagent blanks are analyzed to demonstrate freedom from contamination.
- 9.5.1 A reagent blank is prepared by passing 4 mL of the isopropyl alcohol through a Teflon syringe filter and collecting the filtrate in a 4-mL glass vial. A Sep PaçC18 cartridge is then preconditioned with 3 mL of isopropyl alcohol. A 0.5-mL aliquot of the filtered isopropyl alcohol is added to the syringe barrel along with 3.0 mL of isopropyl alcohol. The solvent is passed through the preconditioned Sep Paçcartridge. An additional 2-mL of isopropyl alcohol is eluted through the cartridge. The cartridge is now considered the “reagent blank” cartridge and is ready for viewing (analysis). Check the reagent blank cartridge under the black light for fluorescence. If the isopropyl alcohol and filter are clean, no fluorescence will be observed.
- 9.5.2 If fluorescence is detected in the reagent blank cartridge, analysis of the samples is halted until the source of contamination is eliminated and a prepared reagent blank shows no fluorescence under a black light. All samples shall be associated with an uncontaminated method blank before the results may be reported for regulatory compliance purposes.
- 9.6 NAF reference blanks—NAF reference blanks are prepared from the NAFs sent from the supplier (NAF that has not been circulated downhole) and used as the reference when viewing the fluorescence of the test samples.
- 9.6.1 A NAF reference blank is prepared identically to the authentic samples. Place a 0.1 mL aliquot of the “clean” NAF into a 25-mL glass vial. Add 10 mL of isopropyl alcohol to the vial. Cap the vial. Vortex the vial for approximately 10 sec. Allow the solids to settle for approximately 15 minutes. Using a 5-mL syringe, draw up 4 mL of the extract and filter it through a PTFE syringe filter, collecting the filtrate in a 4-mL glass vial. Precondition a Sep PaçC18 cartridge with 3 mL of isopropyl alcohol. Add a 0.5-mL aliquot of the filtered extract to the syringe barrel along with 3.0 mL of isopropyl alcohol. Pass the extract and solvent through the preconditioned Sep Paçcartridge. Pass an additional 2-mL of isopropyl alcohol through the cartridge. The cartridge is now considered the NAF blank cartridge and is ready for viewing (analysis). This cartridge is used as the reference cartridge for determining the absence or presence of fluorescence in all authentic drilling fluid samples that originate from the same NAF. That is, the specific NAF reference blank cartridge is put under the black light along with a prepared cartridge of an authentic sample originating from the same NAF material. The fluorescence or absence of fluorescence in the authentic sample cartridge is determined relative to the NAF reference cartridge.
- 9.6.2 Positive control solution, equivalent to 1% crude oil contaminated mud extract, is prepared by dissolving 87 mg of standard crude oil into 10.00 mL of methylene chloride. Then mix 40 µL of this solution into 10.00 mL of IPA. Transfer 0.5 mL of this solution into a preconditioned C18 cartridge, followed by 2 ml of IPA.

10.0 CALIBRATION AND STANDARDIZATION

- 10.1 Calibration and standardization methods are not employed for this procedure.

11.0 PROCEDURE

This method is a screening-level test. Precise and accurate results can be obtained only by strict adherence to all details.

11.1 Preparation of the analytical batch.

11.1.1 Bring the analytical batch of samples to room temperature.

11.1.2 Using a large glass stirring rod, mix the authentic sample thoroughly.

11.1.3 Using a large glass stirring rod, mix the clean NAF (sent from the supplier) thoroughly.

11.2 Extraction.

11.2.1 Using an automatic positive displacement pipetter and a disposable pipette tip transfer 0.1-mL of the authentic sample into a 25-mL vial.

11.2.2 Using an automatic pipetter and a disposable pipette tip dispense a 10-mL aliquot of solvent grade isopropyl alcohol (IPA) into the 25 mL vial.

11.2.3 Cap the vial and vortex the vial for ca. 10–15 seconds.

11.2.4 Let the sample extract stand for approximately 5 minutes, allowing the solids to separate.

11.2.5 Using a 5-mL disposable plastic syringe remove 4 mL of the extract from the 25-mL vial.

11.2.6 Filter 4 mL of extract through a Teflon syringe filter (25-mm diameter, 0.45 μ m pore size), collecting the filtrate in a labeled 4-mL vial.

11.2.7 Dispose of the PFTE syringe filter.

11.2.8 Using a black permanent marker, label a Sep Pa \checkmark C18 cartridge with the sample identification.

11.2.9 Place the labeled Sep Pa \checkmark C18 cartridge onto the head of a SPE vacuum manifold.

11.2.10 Using a 5-mL disposable plastic syringe, draw up exactly 3-mL (air free) of isopropyl alcohol.

11.2.11 Attach the syringe tip to the top of the C18 cartridge.

11.2.12 Condition the C18 cartridge with the 3-mL of isopropyl alcohol by depressing the plunger slowly.

NOTE: Depress the plunger just to the point when no liquid remains in the syringe barrel. Do not force air through the cartridge. Collect the eluate in a waste vial.

11.2.13 Remove the syringe temporarily from the top of the cartridge, then remove the plunger, and finally reattach the syringe barrel to the top of the C18 cartridge.

11.2.14 Using automatic pipettors and disposable pipette tips, transfer 0.5 mL of the filtered extract into the syringe barrel, followed by a 3.0-mL transfer of isopropyl alcohol to the syringe barrel.

11.2.15 Insert the plunger and slowly depress it to pass only the extract and solvent through the preconditioned C18 cartridge.

NOTE: Depress the plunger just to the point when no liquid remains in the syringe barrel. Do not force air through the cartridge. Collect the eluate in a waste vial.

11.2.16 Remove the syringe temporarily from the top of the cartridge, then remove the plunger, and finally reattach the syringe barrel to the top of the C18 cartridge.

- 11.2.17 Using an automatic pipetter and disposable pipette tip, transfer 2.0 mL of isopropyl alcohol to the syringe barrel.
- 11.2.18 Insert the plunger and slowly depress it to pass the solvent through the C18 cartridge.

***NOTE:** Depress the plunger just to the point when no liquid remains in the syringe barrel. Do not force air through the cartridge. Collect the eluate in a waste vial.*

- 11.2.19 Remove the syringe and labeled C18 cartridge from the top of the SPE vacuum manifold.
- 11.2.20 Prepare a reagent blank according to the procedures outlined in Section 9.5 of this appendix.
- 11.2.21 Prepare the necessary NAF reference blanks for each type of NAF encountered in the field samples according to the procedures outlined in Section 9.6 of this appendix.
- 11.2.22 Prepare the positive control (1% crude oil equivalent) according to Section 9.6.2 of this appendix.
- 11.3 Reagent blank fluorescence testing.
 - 11.3.1 Place the reagent blank cartridge in a black box, under a black light.
 - 11.3.2 Determine the presence or absence of fluorescence for the reagent blank cartridge. If fluorescence is detected in the blank, analysis of the samples is halted until the source of contamination is eliminated and a prepared reagent blank shows no fluorescence under a black light. All samples must be associated with an uncontaminated method blank before the results may be reported for regulatory compliance purposes.
- 11.4 Sample fluorescence testing.
 - 11.4.1 Place the respective NAF reference blank (Section 9.6 of this appendix) onto the tray inside the black box.
 - 11.4.2 Place the authentic field sample cartridge (derived from the same NAF as the NAF reference blank) onto the tray, adjacent and to the right of the NAF reference blank.
 - 11.4.3 Turn on the black light.
 - 11.4.4 Compare the fluorescence of the sample cartridge with that of the negative control cartridge (NAF blank, Section 9.6.1 of this appendix) and positive control cartridge (1% crude oil equivalent, Section 9.6.2 of this appendix).
 - 11.4.5 If the fluorescence of the sample cartridge is equal to or brighter than the positive control cartridge (1% crude oil equivalent, Section 9.6.2 of this appendix), the sample is considered contaminated. Otherwise, the sample is clean.

12.0 DATA ANALYSIS AND CALCULATIONS

Specific data analysis techniques and calculations are not performed in this SOP.

13.0 METHOD PERFORMANCE

This method was validated through a single laboratory study, conducted with rigorous statistical experimental design and interpretation (Reference 16.4).

14.0 POLLUTION PREVENTION

- 14.1 The solvent used in this method poses little threat to the environment when recycled and managed properly.

15.0 WASTE MANAGEMENT

- 15.1 It is the laboratory's responsibility to comply with all Federal, State, and local regulations governing waste management, particularly the hazardous waste identification rules and land disposal restriction, and to protect the air, water, and land by minimizing and controlling all releases from bench operations. Compliance with all sewage discharge permits and regulations is also required.
- 15.2 All authentic samples (drilling fluids) failing the fluorescence test (indicated by the presence of fluorescence) shall be retained and classified as contaminated samples. Treatment and ultimate fate of these samples is not outlined in this SOP.
- 15.3 For further information on waste management, consult "The Waste Management Manual for Laboratory Personnel," and "Less is Better: Laboratory Chemical Management for Waste Reduction," both available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th Street, NW, Washington, DC 20036.

16.0 REFERENCES

- 16.1 "Carcinogen—Working with Carcinogens," Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Publication No. 77-206, August 1977.
- 16.2 "OSHA Safety and Health Standards, General Industry," (29 CFR 1910), Occupational Safety and Health Administration, OSHA 2206 (Revised, January 1976).
- 16.3 "Handbook of Analytical Quality Control in Water and Wastewater Laboratories," USEPA, EMSL-Ci, Cincinnati, OH 45268, EPA-600/4-79-019, March 1979.
- 16.4 Report of the Laboratory Evaluation of Static Sheen Test Replacements—Reverse Phase Extraction (RPE) Method for Detecting Oil Contamination in Synthetic Based Mud (SBM). October 1998. Available from API, 1220 L Street, NW, Washington, DC 20005-4070, 202-682-8000.

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ATTACHMENT 9**APPENDIX 7 TO SUBPART A OF PART 435—API RECOMMENDED PRACTICE 13B–2****1. DESCRIPTION**

- a. This procedure is specifically intended to measure the amount of non-aqueous drilling fluid (NAF) base fluid from cuttings generated during a drilling operation. This procedure is a retort test which measures all oily material (NAF base fluid) and water released from a cuttings sample when heated in a calibrated and properly operating “Retort” instrument.
- b. In this retort test a known mass of cuttings is heated in the retort chamber to vaporize the liquids associated with the sample. The NAF base fluid and water vapors are then condensed, collected, and measured in a precision graduated receiver.

NOTE: Obtaining a representative sample requires special attention to the details of sample handling (e.g., location, method, frequency). See Addendum A and B for minimum requirements for collecting representative samples. Additional sampling procedures in a given area may be specified by the NPDES permit controlling authority.

2. EQUIPMENT

- a. Retort instrument—The recommended retort instrument has a 50-cm³ volume with an external heating jacket.
Retort Specifications:
 1. Retort assembly—retort body, cup and lid.
 - (a) Material: 303 stainless steel or equivalent.
 - (b) Volume: Retort cup with lid.
Cup Volume: 50-cm³.
Precision: ±0.25-cm³.
 2. Condenser—capable of cooling the oil and water vapors below their liquification temperature.
 3. Heating jacket—nominal 350 watts.
 4. Temperature control—capable of limiting temperature of retort to at least 930 °F (500 °C) and enough to boil off all NAFs.
- b. Liquid receiver (10-cm³, 20-cm³)—the 10-cm³ and 20-cm³ receivers are specially designed cylindrical glassware with rounded bottom to facilitate cleaning and funnel-shaped top to catch falling drops. For compliance monitoring under the NPDES program, the analyst shall use the 10-cm³ liquid receiver with 0.1 ml graduations to achieve greater accuracy.
 1. Receiver specifications:

Total volume: 10-cm³, 20-cm³.
Precision (0 to 100%): ±0.05 cm³, ±0.05 cm³.
Outside diameter: 10-mm, 13-mm.
Wall thickness: 1.5±0.1mm, 1.2±0.1mm.
Frequency of graduation marks (0 to 100%): 0.10-cm³, 0.10-cm³.
Calibration: To contain “TC” @ 20 °C.
Scale: cm³, cm³
 2. Material—Pyrex® or equivalent glass.

- c. Toploading balance—capable of weighing 2000 g and precision of at least 0.1 g. Unless motion is a problem, the analyst shall use an electronic balance. Where motion is a problem, the analyst may use a triple beam balance.
- d. Fine steel wool (No. 000)—for packing retort body.
- e. Thread sealant lubricant: high temperature lubricant, e.g. Never-Seez® equivalent.
- f. Pipe cleaners—to clean condenser and retort stem.
- g. Brush—to clean receivers.
- h. Retort spatula—to clean retort cup.
- i. Corkscrew—to remove spent steel wool.

3. PROCEDURE

- a. Clean and dry the retort assembly and condenser.
- b. Pack the retort body with steel wool.
- c. Apply lubricant/sealant to threads of retort cup and retort stem.
- d. Weigh and record the total mass of the retort cup, lid, and retort body with steel wool. This is mass (A), grams.
- e. Collect a representative cuttings sample (*see* NOTE in Section 1 of this appendix).
- f. Partially fill the retort cup with cuttings and place the lid on the cup.
- g. Screw the retort cup (with lid) onto the retort body, weigh and record the total mass. This is mass (B), grams.
- h. Attach the condenser. Place the retort assembly into the heating jacket.
- i. Weigh and record the mass of the clean and dry liquid receiver. This is mass (C), grams. Place the receiver below condenser outlet.
- j. Turn on the retort. Allow it to run a minimum of 1 hour.

NOTE: If solids boil over into receiver, the test shall be rerun. Pack the retort body with a greater amount of steel wool and repeat the test.

- k. Remove the liquid receiver. Allow it to cool. Record the volume of water recovered. This is (V), cm³.

NOTE: If an emulsion interface is present between the oil and water phases, heating the interface may break the emulsion. As a suggestion, remove the retort assembly from the heating jacket by grasping the condenser. Carefully heat the receiver along the emulsion band by gently touching the receiver for short intervals with the hot retort assembly. Avoid boiling the liquids. After the emulsion interface is broken, allow the liquid receiver to cool. Read the water volume at the lowest point of the meniscus.

- l. Weigh and record the mass of the receiver and its liquid contents (oil plus water). This is mass (D), grams.
- m. Turn off the retort. Remove the retort assembly and condenser from the heating jacket and allow them to cool. Remove the condenser.
- n. Weigh and record the mass of the cooled retort assembly without the condenser. This is mass (E), grams.
- o. Clean the retort assembly and condenser.

4. CALCULATIONS

a. Calculate the mass of oil (NAF base fluid) from the cuttings as follows:

1. Mass of the wet cuttings sample (M_w) equals the mass of the retort assembly with the wet cuttings sample (B) minus the mass of the empty retort assembly (A).

$$M_w = B - A \quad [1]$$

2. Mass of the dry retorted cuttings (M_D) equals the mass of the cooled retort assembly (E) minus the mass of the empty retort assembly (A).

$$M_D = E - A \quad [2]$$

3. Mass of the NAF base fluid (M_{BF}) equals, the mass of the liquid receiver with its contents (D) minus the sum of the mass of the dry receiver (C) and the mass of the water (V).

$$M_{BF} = D - (C + V) \quad [3]$$

NOTE: Assuming the density of water is 1 g/cm³, the volume of water is equivalent to the mass of the water.

b. Mass balance requirement:

The sum of M_D , M_{BF} , and V shall be within 5% of the mass of the wet sample.

$$(M_D + M_{BF} + V)/M_w = 0.95 \text{ to } 1.05 \quad [4]$$

The procedure shall be repeated if this requirement is not met.

c. Reporting oil from cuttings:

1. Assume that all oil recovered is NAF base fluid.
2. The mass percent NAF base fluid retained on the cuttings ($\%BF_i$) for the sampled discharge ‘i’ is equal to 100 times the mass of the NAF base fluid (M_{BF}) divided by the mass of the wet cuttings sample (M_w).

$$\%BF_i = (M_{BF}/M_w) \times 100 \quad [5]$$

Operators discharging small volume NAF-cuttings discharges which do not occur during a NAF-cuttings discharge sampling interval (i.e., displaced interfaces, accumulated solids in sand traps, pit clean-out solids, or centrifuge discharges while cutting mud weight) shall either: (a) Measure the mass percent NAF base fluid retained on the cuttings ($\%BF_{SVD}$) for each small volume NAF-cuttings discharges; or (b) use a default value of 25% NAF base fluid retained on the cuttings.

3. The mass percent NAF base fluid retained on the cuttings is determined for all cuttings waste-streams and includes fines discharges and any accumulated solids discharged [see Section 4.c.6 of this appendix for procedures on measuring or estimating the mass percent NAF base fluid retained on the cuttings ($\%BF$) for dual

- gradient drilling seafloor discharges performed to ensure proper operation of subsea pumps].
4. A mass NAF-cuttings discharge fraction (X , unitless) is calculated for all NAF-cuttings, fines, or accumulated solids discharges every time a set of retorts is performed (*see* Section 4.c.6 of this appendix for procedures on measuring or estimating the mass NAF-cuttings discharge fraction (X) for dual gradient drilling seafloor discharges performed to ensure proper operation of subsea pumps). The mass NAF-cuttings discharge fraction (X) combines the mass of NAF-cuttings, fines, or accumulated solids discharged from a particular discharge over a set period of time with the total mass of NAF-cuttings, fines, or accumulated solids discharged into the ocean during the same period of time (*see* Addendum A and B of this appendix). The mass NAF-cuttings discharge fraction (X) for each discharge is calculated by direct measurement as:

$$X_i = (F_i)/(G) \quad [6]$$

where:

X_i = Mass NAF-cuttings discharge fraction for NAF-cuttings, fines, or accumulated solids discharge “ i ”, (unitless)

F_i = Mass of NAF-cuttings discharged from NAF-cuttings, fines, or accumulated solids discharge “ i ” over a specified period of time (*see* Addendum A and B of this appendix), (kg)

G = Mass of all NAF-cuttings discharges into the ocean during the same period of time as used to calculate F_i , (kg)

If an operator has more than one point of NAF-cuttings discharge, the mass fraction (X_i) must be determined by: (a) Direct measurement (*see* Equation 6 of this Appendix); (b) using the following default values of 0.85 and 0.15 for the cuttings dryer (e.g., horizontal centrifuge, vertical centrifuge, squeeze press, High-G linear shakers) and fines removal unit (e.g., decanting centrifuges, mud cleaners), respectively, when the operator is only discharging from the cuttings dryer and the fines removal unit; or (c) using direct measurement of “ F_i ” (*see* Equation 6 of this Appendix) for fines and accumulated solids, using Equation 6A of this Appendix to calculate “ G_{EST} ” for use as “ G ” in Equation 6 of this Appendix, and calculating the mass (kg) of NAF-cuttings discharged from the cuttings dryer (F_i) as the difference between the mass of “ G_{EST} ” calculated in Equation 6A of this appendix (kg) and the sum of all fines and accumulated solids mass directly measured (kg) (*see* Equation 6 of this Appendix).

G_{EST} = Estimated mass of all NAF-cuttings discharges into the ocean during the same period of time as used to calculate F_i (*see* Equation 6 of this Appendix), (kg)
[6A]

where:

G_{EST} = Hole Volume (bbl) x (396.9 kg/bbl) x (1 + Z/100)

Z = The base fluid retained on cuttings limitation or standard (%) which apply to the NAF being discharge (see §§ 435.13. and 435.15).

Hole Volume (bbl) = [Cross-Section Area of NAF interval (in²)] x Average Rate of Penetration (feet/hr) x period of time (min) used to calculate F_i (see Equation 6 of this Appendix), (1 x hr/60 min) x (1 bbl/5.61 ft³) x (1 ft/12in)²

Cross-Section Area of NAF interval (in²) = (3.14 x [Bit Diameter (in)]²)/4

Bit Diameter (in) = Diameter of drilling bit for the NAF interval producing drilling cuttings during the same period of time as used to calculate F_i (see Equation 6 of this Appendix)

Average Rate of Penetration (feet/hr) = Arithmetic average of rate of penetration into the formation during the same period of time as used to calculate F_i (see Equation 6 of this Appendix)

NOTE: Operators with one NAF-cuttings discharge may set the mass NAF-cuttings discharge fraction (X_i) equal to 1.0.

5. Each NAF-cuttings, fines, or accumulated solids discharge has an associated mass percent NAF base fluid retained on cuttings value (%BF) and mass NAF-cuttings discharge fraction (X) each time a set of retorts is performed. A single total mass percent NAF base fluid retained on cuttings value (%BF_T) is calculated every time a set of retorts is performed. The single total mass percent NAF base fluid retained on cuttings value (%BF_T) is calculated as:

$$\%BF_{Tj} = \sum (X_i) \times (\%BF_i) \quad [7]$$

where:

%BF_{Tj} = Total mass percent NAF base fluid retained on cuttings value for retort set "j" (unitless as percentage, %)

X_i = Mass NAF-cuttings discharge fraction for NAF-cuttings, fines, or accumulated solids discharge "i", (unitless)

%BF_i = Mass percent NAF base fluid retained on the cuttings for NAF-cuttings, fines, or accumulated solids discharge "i", (unitless as percentage, %)

NOTE: $\sum X_i = 1$.

6. Operators with one NAF-cuttings discharge may set %BF_{Tj} equal to %BF_i. Operators performing dual gradient drilling operations may require seafloor discharges of large cuttings (>1/4') to ensure the proper operation of subsea pumps (e.g., electrical submersible pumps). Operators performing dual gradient drilling operations which lead to seafloor discharges of large cuttings for the proper operation of subsea pumps shall either: (a) Measure the mass percent NAF base fluid retained on cuttings value (%BF) and mass NAF-cuttings discharge fraction (X) for seafloor discharges each time a set of retorts is performed; (b) use the following set of default values, (%BF=14%; X=0.15); or (c) use a combination of (a) and (b) (e.g., use a default value for %BF and measure X).

Additionally, operators performing dual gradient drilling operations which lead to seafloor discharges of large cuttings for the proper operation of subsea pumps shall also perform the following tasks:

- (a) Use side scan sonar or shallow seismic to determine the presence of high density chemosynthetic communities. Chemosynthetic communities are assemblages of tube worms, clams, mussels, and bacterial mats that occur at natural hydrocarbon seeps or vents, generally in water depths of 500 meters or deeper. Seafloor discharges of large cuttings for the proper operation of subsea pumps shall not be permitted within 1000 feet of a high density chemosynthetic community.
 - (b) Seafloor discharges of large cuttings for the proper operation of subsea pumps shall be visually monitored and documented by a Remotely Operated Vehicle (ROV) within the tether limit (approximately 300 feet). The visual monitoring shall be conducted prior to each time the discharge point is relocated (cuttings discharge hose) and conducted along the same direction as the discharge hose position. Near-seabed currents shall be obtained at the time of the visual monitoring.
 - (c) Seafloor discharges of large cuttings for the proper operation of subsea pumps shall be directed within a 150 foot radius of the wellbore.
7. The weighted mass ratio averaged over all NAF well sections (%BF_{well}) is the compliance value that is compared with the “maximum weighted mass ratio averaged over all NAF well sections” BAT discharge limitations (*see* the table in § 435.13 and footnote 5 of the table in § 435.43) or the “maximum weighted mass ratio averaged over all NAF well sections” NSPS discharge limitations (*see* the table in § 435.15 and footnote 5 of the table in § 435.45). The weighted mass ratio averaged over all NAF well sections (%BF_{well}) is calculated as the arithmetic average of all total mass percent NAF base fluid retained on cuttings values (%BF_{Tj}) and is given by the following expression:

$$\%BF_{well} = [j=1 \text{ to } j=n \Sigma \%BF_{Tj}]/n \quad [8]$$

where:

%BF_{well} = Weighted mass ratio averaged over all NAF well sections (unitless as percentage, %)

%BF_{Tj} = Total mass percent NAF base fluid retained on cuttings value for retort set “j” (unitless as percentage, %)

n = Total number of retort sets performed over all NAF well sections (unitless)

Small volume NAF-cuttings discharges which do not occur during a NAF-cuttings discharge sampling interval (i.e., displaced interfaces, accumulated solids in sand traps, pit clean-out solids, or centrifuge discharges while cutting mud weight) shall be mass averaged with the arithmetic average of all total mass percent NAF base fluid retained on cuttings values (see Equation 8 of this Appendix). An additional sampling interval shall be added to the calculation of the weighted mass ratio averaged over all NAF well sections (%BF_{well}). The mass fraction of the small volume NAF-cuttings discharges (X_{SVD}) will be determined by dividing the mass of

the small volume NAF-cuttings discharges (F_{SVD}) by the total mass of NAF-cuttings discharges for the well drilling operation ($G_{WELL} + F_{SVD}$).

$$X_{SVD} = F_{SVD} / (G_{WELL} + F_{SVD}) \quad [9]$$

where:

X_{SVD} = mass fraction of the small volume NAF-cuttings discharges (unitless)

F_{SVD} = mass of the small volume NAF-cuttings discharges (kg)

G_{WELL} = mass of total NAF-cuttings from the well (kg)

The mass of small volume NAF-cuttings discharges (F_{SVD}) shall be determined by multiplying the density of the small volume NAF-cuttings discharges (ρ_{svd}) times the volume of the small volume NAF-cuttings discharges (V_{SVD}).

$$F_{SVD} = \rho_{svd} \times V_{SVD} \quad [10]$$

where:

F_{SVD} = mass of small volume NAF-cuttings discharges (kg)

ρ_{svd} = density of the small volume NAF-cuttings discharges (kg/bbl)

V_{SVD} = volume of the small volume NAF-cuttings discharges (bbl)

The density of the small volume NAF-cuttings discharges shall be measured. The volume of small volume discharges (V_{SVD}) shall be either: (a) Be measured or (b) use default values of 10 bbl of SBF for each interface loss and 75 bbl of SBM for pit cleanout per well.

The total mass of NAF-cuttings discharges for the well (G_{WELL}) shall be either: (a) Measured; or (b) calculated by multiplying 1.0 plus the arithmetic average of all total mass percent NAF base fluid retained on cuttings values [see Equation 8 of this Appendix] times the total hole volume (V_{WELL}) for all NAF well sections times a default value for the density the formation of 2.5 g/cm^3 (396.9 kg/bbl).

$$G_{WELL} = (1 + (\sum_{i=1}^n (\%BF_{Tj}) / n)) \times V_{WELL} \text{ (bbl)} \times 396.9 \text{ (kg/bbl)} \quad [11]$$

where:

G_{WELL} = total mass of NAF-cuttings discharges for the well (kg)

$[\sum_{j=1}^n (\%BF_{Tj}) / n]$ = see Equation 8 of this Appendix (unitless as a percentage)

V_{WELL} = total hole volume (V_{WELL}) for all NAF well sections (bbl)

The total hole volume of NAF well sections (V_{WELL}) will be calculated as:

$$V_{WELL} \text{ (barrels)} = \sum \frac{\text{Bit diameter (in)}^2}{1029} \times \text{change in measured depth (ft)} \quad [12]$$

For wells where small volume discharges associated with cuttings are made, %BF_{WELL} becomes:

$$\%BF_{WELL} = ((1 - X_{SVD}) \times [i = 1 \text{ to } j = n \sum (\%BF_{T,j})/n]) + X_{SVD} \times \%BF_{SVD} \quad [13]$$

NOTE: See Addendum A and B to determine the sampling frequency to determine the total number of retort sets required for all NAF well sections.

8. The total number of retort sets (n) is increased by 1 for each sampling interval (*see* Section 2.4, Addendum A of this appendix) when all NAF-cuttings, fines, or accumulated solids for that sampling interval are retained for no discharge. A zero discharge interval shall be at least 500 feet up to a maximum of three per day. This action has the effect of setting the total mass percent NAF base fluid retained on cuttings value (%BF_T) at zero for that NAF sampling interval when all NAF-cuttings, fines, or accumulated solids are retained for no discharge.
9. Operators that elect to use the Best Management Practices (BMPs) for NAF-cuttings shall use the procedures outlined in Addendum B.

ADDENDUM A TO APPENDIX 7 TO SUBPART A OF PART 435—SAMPLING OF
CUTTINGS DISCHARGE STREAMS FOR USE WITH API RECOMMENDED
PRACTICE 13B-2

1.0 SAMPLING LOCATIONS

- 1.1 Each NAF-cuttings waste stream that discharges into the ocean shall be sampled and analyzed as detailed in Appendix 7. NAF-cuttings discharges to the ocean may include discharges from primary shakers, secondary shakers, cuttings dryer, fines removal unit, accumulated solids, and any other cuttings separation device whose NAF-cuttings waste is discharged to the ocean. NAF-cuttings wastestreams not directly discharged to the ocean (*e.g.*, NAF-cuttings generated from shake shakers and sent to a cuttings dryer for additional processing) do not require sampling and analysis.
- 1.2 The collected samples shall be representative of each NAF-cuttings discharge. Operators shall conduct sampling to avoid the serious consequences of error (*i.e.*, bias or inaccuracy). Operators shall collect NAF-cuttings samples near the point of origin and before the solids and liquid fractions of the stream have a chance to separate from one another. For example, operators shall collect shale shaker NAF-cuttings samples at the point where NAF-cuttings are coming off the shale shaker and not from a holding container downstream where separation of larger particles from the liquid can take place.
- 1.3 Operators shall provide a simple schematic diagram of the solids control system and sample locations to the NPDES permit controlling authority.

2.0 TYPE OF SAMPLE AND SAMPLING FREQUENCY

- 2.1 Each NAF-cuttings, fines, or accumulated solids discharge has an associated mass percent NAF base fluid retained on cuttings value (%BF) and mass NAF-cuttings discharge fraction (X) for each sampling interval (*see* Section 2.4 of this addendum). Operators shall collect a single discrete NAF-cuttings sample for each NAF-cuttings wastestream discharged to the ocean during every sampling interval.
- 2.2 Operators shall use measured depth in feet from the Kelly bushing when samples are collected.
- 2.3 The NAF-cuttings samples collected for the mass fraction analysis (*see* Equation 6, Appendix 7 of Subpart A of this part) shall also be used for the retort analysis (*see* Equations 1-5, Appendix 7 of Subpart A of this part).
- 2.4 Operators shall collect and analyze at least one set of NAF-cuttings samples per day while discharging. Operators engaged in fast drilling (*i.e.*, greater than 500 linear NAF feet advancement of drill bit per day) shall collect and analyze one set of NAF-cuttings samples per 500 linear NAF feet of footage drilled. Operators are not required to collect and analyze more than three sets of NAF-cuttings samples per day (*i.e.*, three sampling intervals). Operators performing zero discharge of all NAF-cuttings (*i.e.*, all NAF-cuttings, fines, or accumulated solids retained for no discharge) shall use the following periods to count sampling intervals: (1) One sampling interval per day when drilling is less than 500 linear NAF feet advancement of drill bit per day; and (2) one sampling interval per 500 linear NAF feet of footage drilled with a maximum of three sampling intervals per day.

- 2.5 The operator shall measure the individual masses (F_i , kg) and sum total mass (G , kg) (*see* Equation 6, Appendix 7 of subpart A of this part) over a representative period of time (*e.g.*, <10 minutes) during steady-state conditions for each sampling interval (*see* Section 2.4 of this addendum). The operator shall ensure that all NAF-cuttings are capture for mass analysis during the same sampling time period (*e.g.*, <10 minutes) at approximately the same time (*i.e.*, all individual mass samples collected within one hour of each other).
- 2.6 Operators using Best Management Practices (BMPs) to control NAF-cuttings discharges shall follow the procedures in Addendum B to Appendix 7 of subpart A of 40 CFR 435.

3.0 SAMPLE SIZE AND HANDLING

- 3.1 The volume of each sample depends on the volumetric flow rate (cm^3/s) of the NAF-cuttings stream and the sampling time period (*e.g.*, <10 minutes). Consequently, different solids control equipment units producing different NAF-cuttings wastestreams at different volumetric flow rates will produce different size samples for the same period of time. Operators shall use appropriately sized sample containers for each NAF-cuttings waste stream to ensure no NAF-cuttings are spilled during sample collection. Operators shall use the same time period (*e.g.*, <10 minutes) to collect NAF-cuttings samples from each NAF-cuttings waste stream. Each NAF-cuttings sample size shall be at least one gallon. Operators shall clearly mark each container to identify each NAF-cuttings sample.
- 3.2 Operators shall not decant, heat, wash, or towel the NAF-cuttings to remove NAF base fluid before mass and retort analysis.
- 3.3 Operators shall first calculate the mass of each NAF-cuttings sample and perform the mass ratio analysis (*see* Equation 6, Appendix 7 of subpart A of this part). Operators with only one NAF-cuttings discharge may skip this step (*see* Section 4.c.4, Appendix 7 of subpart A of this part).
- 3.4 Operators shall homogenize (*e.g.*, stirring, shaking) each NAF-cuttings sample prior to placing a sub-sample into the retort cup. The bottom of the NAF-cuttings sample container shall be examined to be sure that solids are not sticking to it.
- 3.5 Operators shall then calculate the NAF base fluid retained on cuttings using the retort procedure (*see* Equations 1–5, Appendix 7 of subpart A of this part). Operators shall start the retort analyses no more than two hours after collecting the first individual mass sample for the sampling interval.
- 3.6 Operators shall not discharge any sample before successfully completing the mass and retort analyses [*i.e.*, mass balance requirements (*see* Section 4.b, Appendix 7 of subpart A of this part) are satisfied]. Operators shall immediately re-run the retort analyses if the mass balance requirements (*see* Equation 4, Appendix 7 of subpart A of this part) are not within a tolerance of 5% (*see* Section 4.b, Equation 4, Appendix 7 of subpart A of this part).

4.0 CALCULATIONS

- 4.1 Operators shall calculate a set of mass percent NAF base fluid retained on cuttings values (%BF) and mass NAF-cuttings discharge fractions (X) for each NAF-cuttings wastestream (*see* Section 1.1 of this addendum) for each sampling interval (*see* Section 2.4 of this addendum) using the procedures outlined in Appendix 7 of subpart A of this part.

- 4.2 Operators shall tabulate the following data for each individual NAF-cuttings sample: (1) Date and time of NAF-cuttings sample collection; (2) time period of NAF-cuttings sample collection (*see* Section 3.1 of this addendum); (3) mass and volume of each NAF-cuttings sample; (4) measured depth (feet) at NAF-cuttings sample collection (*see* Section 2.2 of this addendum); (5) respective linear feet of hole drilled represented by the NAF-cuttings sample (feet); and (6) the drill bit diameter (inches) used to generate the NAF-cuttings sample cuttings.
- 4.3 Operators shall calculate a single total mass percent NAF base fluid retained on cuttings value (%BFT) for each sampling interval (*see* Section 2.4 of this addendum) using the procedures outlined in Appendix 7 of Subpart A of this part.
- 4.4 Operators shall tabulate the following data for each total mass percent NAF base fluid retained on cuttings value (%BFT) for each NAF-cuttings sampling interval: (1) Date and starting and stopping times of NAF-cuttings sample collection and retort analyses; (2) measured depth of well (feet) at start of NAF-cuttings sample collection (*see* Section 2.2 of this addendum); (3) respective linear feet of hole drilled represented by the NAF-cuttings sample (feet); (4) the drill bit diameter (inches) used to generate the NAF-cuttings sample cuttings; and (5) annotation when zero discharge of NAF-cuttings is performed.
- 4.5 Operators shall calculate the weighted mass ratio averaged over all NAF well sections (%BF_{well}) using the procedures outlined in Appendix 7 of Subpart A of this part.
- 4.6 Operators shall tabulate the following data for each weighted mass ratio averaged over all NAF well sections (%BF_{well}) for each NAF well: (1) Starting and stopping dates of NAF well sections; (2) measured depth (feet) of all NAF well sections; (3) total number of sampling intervals (*see* Section 2.4 and Section 2.6 of this addendum); (4) number of sampling intervals tabulated during any zero discharge operations; (5) total volume of zero discharged NAF-cuttings over entire NAF well sections; and (6) identification of whether BMPs were employed (*see* Addendum B of Appendix 7 of subpart A of this part).

ADDENDUM B TO APPENDIX 7 TO SUBPART A OF PART 435— BEST MANAGEMENT PRACTICES (BMPS) FOR USE WITH API RECOMMENDED PRACTICE 13B–2

1.0 OVERVIEW OF BMPS

- 1.1 Best Management Practices (BMPs) are inherently pollution prevention practices. BMPs may include the universe of pollution prevention encompassing production modifications, operational changes, material substitution, materials and water conservation, and other such measures. BMPs include methods to prevent toxic and hazardous pollutants from reaching receiving waters. Because BMPs are most effective when organized into a comprehensive facility BMP Plan, operators shall develop a BMP in accordance with the requirements in this addendum.
- 1.2 The BMP requirements contained in this appendix were compiled from several Regional permits, an EPA guidance document (i.e., Guidance Document for Developing Best Management Practices (BMP)’’ (EPA 833–B–93–004, U.S. EPA, 1993)), and draft industry BMPs. These common elements represent the appropriate mix of broad directions needed to complete a BMP Plan along with specific tasks common to all drilling operations.
- 1.3 Operators are not required to use BMPs if all NAF-cuttings discharges are monitored in accordance with Appendix 7 of Subpart A of this part.

2.0 BMP PLAN PURPOSE AND OBJECTIVES

- 2.1 Operators shall design the BMP Plan to prevent or minimize the generation and the potential for the discharge of NAF from the facility to the waters of the United States through normal operations and ancillary activities. The operator shall establish specific objectives for the control of NAF by conducting the following evaluations.
- 2.2 The operator shall identify and document each NAF well that uses BMPs before starting drilling operations and the anticipated total feet to be drilled with NAF for that particular well.
- 2.3 Each facility component or system controlled through use of BMPs shall be examined for its NAF-waste minimization opportunities and its potential for causing a discharge of NAF to waters of the United States due to equipment failure, improper operation, natural phenomena (e.g., rain, snowfall).
- 2.4 For each NAF wastestream controlled through BMPs where experience indicates a reasonable potential for equipment failure (e.g., a tank overflow or leakage), natural condition (e.g., precipitation), or other circumstances to result in NAF reaching surface waters, the BMP Plan shall include a prediction of the total quantity of NAF which could be discharged from the facility as a result of each condition or circumstance.

3.0 BMP PLAN REQUIREMENTS

- 3.1 The BMP Plan may reflect requirements within the pollution prevention requirements required by the Minerals Management Service (*see* 30 CFR 250.300) or other Federal or State requirements and incorporate any part of such plans into the BMP Plan by reference.

- 3.2 The operator shall certify that its BMP Plan is complete, on-site, and available upon request to EPA or the NPDES Permit controlling authority. This certification shall identify the NPDES permit number and be signed by an authorized representative of the operator. This certification shall be kept with the BMP Plan. For new or modified NPDES permits, the certification shall be made no later than the effective date of the new or modified permit. For existing NPDES permits, the certification shall be made within one year of permit issuance.
- 3.3 The BMP Plan shall:
- 3.3.1 Be documented in narrative form, and shall include any necessary plot plans, drawings or maps, and shall be developed in accordance with good engineering practices. At a minimum, the BMP Plan shall contain the planning, development and implementation, and evaluation/reevaluation components. Examples of these components are contained in “Guidance Document for Developing Best Management Practices (BMP)” (EPA 833-B-93-004, U.S. EPA, 1993).
- 3.3.2 Include the following provisions concerning BMP Plan review.
- 3.3.2.1 Be reviewed by permittee’s drilling engineer and offshore installation manager (OIM) to ensure compliance with the BMP Plan purpose and objectives set forth in Section 2.0.
- 3.3.2.2 Include a statement that the review has been completed and that the BMP Plan fulfills the BMP Plan purpose and objectives set forth in Section 2.0. This statement shall have dated signatures from the permittee’s drilling engineer and offshore installation manager and any other individuals responsible for development and implementation of the BMP Plan.
- 3.4 Address each component or system capable of generating or causing a release of significant amounts of NAF and identify specific preventative or remedial measures to be implemented.

4.0 BMP PLAN DOCUMENTATION

- 4.1 The operator shall maintain a copy of the BMP Plan and related documentation (e.g., training certifications, summary of the monitoring results, records of NAF-equipment spills, repairs, and maintenance) at the facility and shall make the BMP Plan and related documentation available to EPA or the NPDES Permit controlling authority upon request.

5.0 BMP PLAN MODIFICATION

- 5.1 For those NAF wastestreams controlled through BMPs, the operator shall amend the BMP Plan whenever there is a change in the facility or in the operation of the facility which materially increases the generation of those NAF-wastes or their release or potential release to the receiving waters.
- 5.2 At a minimum the BMP Plan shall be reviewed once every five years and amended within three months if warranted. Any such changes to the BMP Plan shall be consistent with the objectives and specific requirements listed in this addendum. All changes in the BMP Plan shall be reviewed by the permittee’s drilling engineer and offshore installation manager.
- 5.3 At any time, if the BMP Plan proves to be ineffective in achieving the general objective of preventing and minimizing the generation of NAF-wastes and their release and potential release to the receiving waters and/or the specific requirements in this addendum, the permit and/or the BMP Plan shall be subject to modification to incorporate revised BMP requirements.

6.0 SPECIFIC POLLUTION PREVENTION REQUIREMENTS
FOR NAF DISCHARGES ASSOCIATED
WITH CUTTINGS

- 6.1 The following specific pollution prevention activities are required in a BMP Plan when operators elect to control NAF discharges associated with cuttings by a set of BMPs.
- 6.2 Establishing programs for identifying, documenting, and repairing malfunctioning NAF equipment, tracking NAF equipment repairs, and training personnel to report and evaluate malfunctioning NAF equipment.
- 6.3 Establishing operating and maintenance procedures for each component in the solids control system in a manner consistent with the manufacturer's design criteria.
- 6.4 Using the most applicable spacers, flushes, pills, and displacement techniques in order to minimize contamination of drilling fluids when changing from water-based drilling fluids to NAF and vice versa.
- 6.5 A daily retort analysis shall be performed (in accordance with Appendix 7 to subpart A of Part 435) during the first 0.33 X feet drilled with NAF where X is the anticipated total feet to be drilled with NAF for that particular well. The retort analyses shall be documented in the well retort log. The operators shall use the calculation procedures detailed in Appendix 7 to subpart A of Part 435 (*see* Equations 1 through 8) to determine the arithmetic average (%BF_{well}) of the retort analyses taken during the first 0.33 X feet drilled with NAF.
- 6.5.1 When the arithmetic average (%BF_{well}) of the retort analyses taken during the first 0.33 X feet drilled with NAF is less than or equal to the base fluid retained on cuttings limitation or standard (*see* §§ 435.13 and 435.15), retort monitoring of cuttings may cease for that particular well. The same BMPs and drilling fluid used during the first 0.33 X feet shall be used for all remaining NAF sections for that particular well.
- 6.5.2 When the arithmetic average (%BF_{well}) of the retort analyses taken during the first 0.33 X feet drilled with NAF is greater the base fluid retained on cuttings limitation or standard (*see* §§ 435.13 and 435.15), retort monitoring shall continue for the following (second) 0.33 X feet drilled with NAF where X is the anticipated total feet to be drilled with NAF for that particular well. The retort analyses for the first and second 0.33 X feet shall be documented in the well retort log.
- 6.5.2.1 When the arithmetic average (%BF_{well}) of the retort analyses taken during the first 0.66 X feet (i.e., retort analyses taken from first and second 0.33 X feet) drilled with NAF is less than or equal to the base fluid retained on cuttings limitation or standard (*see* §§ 435.13 and 435.15), retort monitoring of cuttings may cease for that particular well. The same BMPs and drilling fluid used during the first 0.66 X feet shall be used for all remaining NAF sections for that particular well.
- 6.5.2.2 When the arithmetic average (%BF_{well}) of the retort analyses taken during the first 0.66 X feet (i.e., retort analyses taken from first and second 0.33 X feet) drilled with NAF is greater than the base fluid retained on cuttings limitation or standard (*see* §§ 435.13 and 435.15), retort monitoring shall continue for all remaining NAF sections for that particular well. The retort analyses for all NAF sections shall be documented in the well retort log.
- 6.5.3 When the arithmetic average (%BF_{well}) of the retort analyses taken over all NAF sections for the entire well is greater that the base fluid retained on cuttings limitation or standard (*see* §§ 435.13 and 435.15), the operator is in violation of the base fluid retained on cuttings limitation or standard and shall submit notification of these monitoring values in accordance

with NPDES permit requirements. Additionally, the operator shall, as part of the BMP Plan, initiate a reevaluation and modification to the BMP Plan in conjunction with equipment vendors and/or industry specialists.

- 6.5.4 The operator shall include retort monitoring data and dates of retort-monitored and non-retort-monitored NAF-cuttings discharges managed by BMPs in their NPDES permit reports.
- 6.6 Establishing mud pit and equipment cleaning methods in such a way as to minimize the potential for building-up drill cuttings (including accumulated solids) in the active mud system and solids control equipment system. These cleaning methods shall include but are not limited to the following procedures.
 - 6.6.1 Ensuring proper operation and efficiency of mud pit agitation equipment.
 - 6.6.2 Using mud gun lines during mixing operations to provide agitation in dead spaces.
 - 6.6.3 Pumping drilling fluids off of drill cuttings (including accumulated solids) for use, recycle, or disposal before using wash water to dislodge solids.

[66 FR 6901, Jan. 22, 2001; 66 FR 30811, June 8, 2001]

ATTACHMENT 10

APPENDIX 8 TO SUBPART A OF PART 435—REFERENCE C₁₆–C₁₈ INTERNAL OLEFIN DRILLING FLUID FORMULATION

The reference C₁₆–C₁₈ internal olefin drilling fluid used to determine the drilling fluid sediment toxicity ratio and compliance with the BAT sediment toxicity discharge limitation (*see* § 435.13) and NSPS (*see* § 435.15) shall be formulated to meet the specifications in Table 1 of this appendix.

Drilling fluid sediment toxicity ratio = 4-day LC50 of C₁₆–C₁₈ internal olefin drilling fluid/4-day LC50 of drilling fluid removed from cuttings at the solids control equipment as determined by ASTM E1367–92 [incorporated by reference and specified at § 435.11 [e)] and supplemented with the sediment preparation procedure (Appendix 3 of subpart A of this part).

TABLE 1.—PROPERTIES FOR REFERENCE C₁₆–C₁₈ IOS SBF USED IN DISCHARGE SEDIMENT TOXICITY TESTING

Mud weight of SBF discharged with cuttings (pounds per gallon)	Reference C ₁₆ – C ₁₈ IOS SBF (pounds per gallon)	Reference C ₁₆ – C ₁₈ IOS SBF synthetic to water ratio (%)
8.5-11.....	9.0	75/25
11-14.....	11.5	80/20
>14.....	14.5	85/15
Plastic Viscosity (PV) centipoises (cp).....	12-30	
Yield Point (YP) pounds/100 sq ft.....	10-20	
10-second gel, pounds/100 sq ft.....	8-15	
10-minute gel, pounds/100 sq ft.....	12-30	
Electric stability, V.....	>300	

[66 FR 6901, Jan. 22, 2001]

ATTACHMENT 11

**EXAMPLE DRILLING FLUID (MUD) PLAN
FOR
REGION 10 OIL AND GAS NPDES PERMITS**

I. INTRODUCTION TO REGION 10 EXAMPLE Drilling Fluid PLAN

A. Background

Since 1984 and issuance of the first general NPDES permits based on BPJ/BAT, Region 10 has performed a separate evaluation for every individual drilling fluid/additive system that required discharge authorization under its oil & gas permits. During this period of time (roughly mid-1984 to 1992) the Region gathered bioassay data, chemical and product inventories of discharged drilling fluids and developed a considerable library of bioassay data on various drilling fluids, additives and systems. As bioassay data accumulated and as the technology of formulating drilling fluid/additive systems advanced, the task of evaluating each request for authorization got increasingly resource-intensive and time-consuming.

In 1992 the Region realized that the established process for drilling fluid/additive evaluation and authorization was no longer realistic in terms of time and resources. So, in July 1992 Region 10 held a technical meeting with oil & gas operators and drilling fluid companies working in Alaska to address the situation. Most agreed that the Region's conservative worst-case approach to toxicity evaluation had, in fact, motivated Alaskan operators to plan ahead for drilling fluid/additive systems that would most likely not exceed the Agency's toxicity criterion. This planning ahead resulted in proposals for (a) lower concentrations of products, (b) fewer components and additives, and (c) fewer last-minute changes to systems once drilling began. The tasks left to the Region were evaluation of bioassay data pertinent to the proposed system(s), documentation of qualifications and assumptions about the data or estimated toxicities, and compilation of the estimates as a basis for its best professional judgment (BPJ) regarding the discharge.

Region 10 believes that drilling fluid plans will be manageable for most operators if viewed in terms of steps or phases. The "planning ahead" phase is general standard procedure for Alaskan permittees. Procedures for estimating discharge toxicity are fairly straight-forward and can be easily managed by computer software. The final phase of documenting drilling fluid/additive decisions and their bases consumes the most time and will only get easier with experience.

With the advent of computerized record-keeping and the ability to locate information or bioassay data quickly, Region 10 believes the industry in Alaska is well equipped to proceed with developing Drilling Fluid Plans on a well-by-well basis.

B. Why have a Drilling Fluid Plan?

In 1993 the Region issued an individual NPDES permit for oil & gas exploration which was significantly different from previous permits in that it contained a requirement for a “mud plan.” The concept is that planning ahead will not only aid permittees and their mud contractors in meeting the effluent toxicity limit, but that writing the plan down (i.e., decision criteria for “what-if” and “what-to-do-when”) will ensure consistency with other permit requirements (for drilling fluids/cuttings) as well. In situations where permit limits are not met, the Drilling Fluid Plan will be a useful tool in helping both the permittee and the Agency ascertain some of the reason(s) for noncompliance.

II. EXAMPLE DRILLING FLUID PLAN BASIS

In late 1994 Region 10 proposed the Arctic general NPDES permit with a “mud plan” requirement. In response to the many comments made about the plan, the Region 10 Oil & Gas NPDES Permitting Team developed the following example of a drilling fluid plan for operators to use when they begin developing separate drilling fluid plans for actual use.

The Example Drilling Fluid Plan is based on actual evaluations of proposed drilling fluid/additive systems from past permits (all of which are a matter of public record). The key component to each drilling fluid/additive authorization is its accompanying BPJ/BAT evaluation, usually in the form of a memo to the NPDES permit file. The Example Mud Plan is based on the Region’s own style of evaluation and is compiled of information from several NPDES permit files, real and fictitious bioassay data. Region 10 also used end-of-well reports as a basis for organizing the information in this example. This is only a sample of how information required in a Drilling Fluid Plan may be organized. Region 10 expects permittees will develop a variety of styles and formats developed as they gain experience in preparing Drilling Fluid Plans.

DRILLING FLUID (MUD) PLAN

GOB Oil Company
123 Northwest A St., Suite #10
Anchorage, AK 99510

Contacts:	There will be two alternating shifts for the duration of this well	
Shift Spvsr.:	B.J. Fleur	(123) 555-1212
	B.J. Green	
Drilling Engr.:	T.M. Brown	(123) 555-1213
	N. Vermiel	
MY Drilling:	P.C. Handy	(123) 555-1214

Operation Identification

Well:	Thorglid #3	Latitude:	X° XX' XX.X"
NPDES #:	AKG28000X	Longitude:	Y° YY' YY.Y"
Receiving Water:	Beaufort Sea	Lease & Block:	OCS-&-1583, #3
		Water Depth:	75 ft (MLLW)

Summary of Drilling Fluids to be Used on this Well

1st Interval from Spud – 12” casing
 Salt water spud mud – details at ...
 Tab #1 – inventory & toxicity
 Tab #4 – criteria for contingency additives

2nd Interval from 12” – 9 5/8” casing
 Cook Inlet/Generic Mud 2 type – details at ...
 Tab #2 – inventory & toxicity
 Tab #4 – criteria for contingency additives

3rd Interval from 9 5/8” casing to target depth
 Custom potassium-chloride (KCl) fluid – details at ...
 Tab #3 – inventory & toxicity
 Tab #4 – criteria for contingency additives

*** To the GOB Oil Co. and in the context of this mud plan “contingency additives” means components of the mud/additive system that will be used only as needed (e.g., for stuck pipe, filtration control, general lubricity)

*** See Tab #4 for GOB Oil Co. policy regarding use of mud components or additives that are not included on separate inventories for each system (Tabs 1, 2 & 3). Further, it is GOB policy that, **BEFORE** putting any such additive into the mud, approval of the Drilling Engineer must be noted on/in this document (including date & time of decision to add “unlisted” product). These GOB policies likewise apply to any concentration of product that is greater than the amount listed on

Attachment 11: Example Drilling Fluid Plan

**Permit No.:
AKG280000**

proposed mud inventories.

TAB #1
Proposed Inventory: Saltwater Spud Mud

* **GOB requires that maximum concentration shall not be exceeded at any given time in this mud. Maximum concentration shall be calculated based on the amount of mud circulating, concentration of product already in the mud and the amount of product added each day.**

Basic Product	Product Name(s)	Maximum Concentration
<i>Base Mud</i>		
Bentonite	stock product	50 lb/bbl
Barite	MY Bar	180 lb/bbl
Soda ash/sodium bicarbonate	stock product	2 lb/bbl
Caustic (KOH <u>or</u> NaOH)	stock product	2 lb/bbl

Additives

Per GOB standard drilling operation policy, the additives are relatively inert and are unlikely to cause toxicity of discharged mud to exceed the permitted toxicity limit (i.e., exhibit 96-hr LC50 of less than 300,000 ppm SPP). Thus, the following may be added to saltwater/spud mud at concentrations shown without review/approval by the GOB Drilling Engineer:

Glass, plastic, teflon spheres		10 lb/bbl
Mica or crushed nut hulls		as needed
---	Torq-Trim II	6 lb/bbl

Toxicity Estimate(s): Saltwater Spud Mud

Used-Mud Bioassay Bases: the same mud formulation as above was used (& bioassayed) on previous GOB wells – bioassay citations are as follows:

- Thorglid #2, 96-hr LC50 = >1,000,000 ppm SPP (EPA Drilling Fluids Toxicity Test)
- Bioassay Citation: Marine Bioassay Labs for GOB Oil. MBL Report No. 93-1587, dated 12/5-9/93.
 - Sample # GOB/TK1-001A, taken 12/2/93.

- Thorglid #1, 96-hr LC50 = >1,000,000 ppm SPP (EPA Drilling Fluids Toxicity Test)
- Bioassay Citation: Espey, Huston & Assoc. for GOB Oil. EHA document # 825467, dated 12/15-19/92.

- Black Gulch #78, 96-hr LC50 = >895,000 ppm SPP (EPA Drilling Fluids Toxicity Test)
- Sample taken 7/3/89.
 - Bioassay Citation: E.A. Anon & Assoc. for GOB Oil, EAAAA #578928-GOB/BG, dated 7/4-9/89.

Note: Per GOB review, the muds cited above contained all of the mud components planned for use on Thorglid #3 (see Tab 1A). GOB will allow discharge of any/all of the proposed mud components/additives (as described) at maximum concentrations shown.

TAB #2

Proposed Inventory: Cook Inlet/Generic Mud 2 Type

- * **GOB requires that maximum concentrations shall not be exceeded at any given time in this mud. Maximum concentration shall be calculated based on the amount of mud circulating, concentration of product already in the mud and the amount of product added each day.**

Basic Product	Product Name(s)	Maximum Concentration
<i>Base Mud</i>		
Bentonite, attapulgate		50 lb/bbl
Barite	MY Bar	575 lb/bbl
Lignosulfonate	Spersene	15 lb/bbl
Lignite	Tannathin	10 lb/bbl
Caustic	Potash	5 lb/bbl
Bicarb	MY Bicarb	2 lb/bbl
PACs	Drispac UL	2 lb/bbl
	Drispac HL	1 lb/bbl
<i>Additives</i>		
Xanthan gum or welan gum	XC Polymer, Kelzan XCD Biozan	4.0 lb/bbl
Acrylic poly	EZ Mud DP	3.0 lb/bbl
---	Soltex, Baratrol	5.0 lb/bbl
---	Resinex, Poly RX, Durenex	4.0 lb/bbl
---	Defoam X	0.3 lb/bbl
Mica	stock product	as needed
Crushed nut hulls	stock product	as needed
Inert spheres	stock product	as needed
Mineral Oil Pill	Kwikspot w/Conoco LVT >>>SEE PERMIT<<< residual mineral oil after removal NTE 2% v/v	

Toxicity Estimate(s): Cook Inlet/Generic Mud 2 type

Used Mud Bioassays: GOB has used this mud on several occasions in Alaska. Note that each time the mud contained slightly different combinations and concentrations of base mud components and additives. So, the used-mud 96-hr LC50 values below create a range in which the discharge toxicity of this mud type on Thorgild #3 may reasonably be expected to fall.

Thorglid #1, 96-hr LC50 = 560,000 ppm SPP (EPA Drilling Fluids Toxicity Test)

- Sample #GOB/TG1-001B, taken 1/1/94 (before pill added)
- Bioassay citation: Marine Bioassay Labs for GOB Oil, MBL Report No. 94-0002, dated 1/6-11/94.

Attachment 11: Example Drilling Fluid Plan

**Permit No.:
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- Mud Contained following at time of sampling for bioassay:

45 lb/bbl	attapulgate
178 lb/bbl	barite
10 lb/bbl	chrome-free lignosulfonate
1.01 lb/bbl	caustic
3.8 lb/bbl	Soltex
3.3 lb/bbl	EX Mud DP

Thorglid #1, 96-hr LC50 = 75,348 ppm SPP (EPA Drilling Fluids Toxicity Test)

- Sample #GOB/TG1-001C, taken 1/2/94 (after removal of ~90% v/v of pill plus 50 bbl buffer before and after pill return – per permit requirements)
- Bioassay citation: MBL for GOB Oil, MBL Report No. 94-0002A, dated 1/6-11/94.
- Mud contained the following at time of sampling for bioassay:

45 lb/bbl	attapulgate
178 lb/bbl	barite
10 lb/bbl	chrome-gree lignosulfonate
1.01 lb/bbl	caustic
3.8 lb/bbl	Soltex
3.3 lb/bbl	EZ Mud DP
~10% v/v	Halliburton Pill (based estimated recovery of 90%)
1.2% v/v oil	Conoco LVT (by API Retort 13B)
5 lb/bbl	Halliburton MO-55
10 lb/bbl	Hyflow IV
10 lb/bbl	solids

Salmonid Well S-28 Redrill, 96-hr LC50 = 975,000 ppm SPP (EPA Drilling Fluids Toxicity Test)

- Sample #GOB/SS28RD-001, taken 6/23/93
- Bioassay citation: Baker/Hughes/Intech for GOB Oil, BHI Doc. 93012, dated 7/1/93
- Bioassayed mud contained the following:

45 lb/bbl	attapulgate
178 lb/bbl	barite
10 lb/bbl	chrome-free lignosulfonate
1.01 lb/bbl	caustic
1.2 lb/bbl	Drispac UL
0.08 lb/bbl	MaxPac

Estimates for Thorgild #3: Based on all proposed products being present at maximum proposed concentrations. Three cases (shown on attached spreadsheet) establish a range into which toxicity of discharged mud may be expected to fall. (See attached for re-estimation)

procedure, use spreadsheet “TG3_CL2.xls”

Given: Toxicity = 1/LC50 so, as toxicity increases the 96-hr LC50 value decreases. Permit limit is 30,000 ppm SPP (a 96-hr LC50 value)

in terms of toxicity:	1/30,000 > 1/75,000 > 1/1,000,000
in terms of 96-hr LC50s:	30,000 ppm < 75,000 ppm < 1,000,000 ppm SPP

Assumptions for estimates: Toxicity is additive & can be calculated as follows:

$$1/LC50_{total} = 1/LC50_{base\ mud} + 1/LC50_{additive\ 1} + \dots + 1/LC50_{additive\ n}$$

See attached spreadsheet “TG3_CL2.xls” dated 1/95. Three case estimates establish a range of estimated toxicity from 102,722 ppm SPP to 141,704 ppm SPP *without* a mineral oil pill. Each case represents a slightly different concentration of additives, depending on what was in the used mud as a basis for the case. For example, the before pill bioassay from Thorgild #1 contained Soltex while the Salmonid mud did not. So, the total concentration of Soltex represented in Case 2 (by Thorgild #1 before pill) is 9.8 lb/bbl while the total concentration represented in Case 3 (by Salmonid’s used mud) is only 6 lb/bbl. (See attached table “Total Additive Concentration in Toxicity Estimates: CL2 for Thorgild #3.”)

Mineral oil pills: Kwikspot is the pill in-stock for the Thorgild #3 well. So, in Cases 1-3, bioassay data for the Kwikspot formula is added and shows an estimated toxicity range between 38,472 and 42,643 ppm SPP. A fourth case, Case 4, is also shown on the spreadsheet because a pill was used on Thorgild #1, although not Kwikspot. In case a mineral oil pill is needed on Throgild #3, the after pill bioassay results from Thorgild #1 may be a reasonable basis for estimating toxicity because of pill/buffer removal and substantially similar base mud formulation.

Attachment 11: Example Drilling Fluid Plan

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Cook Inlet MudType 2 + Additives

Spreadsheet: "TG3_C12.xls"
Date(s) of Estimate(s): 1/1/95

Cumulative Toxicity Estimate
for
Muds Additives

Toxicity Estimates
(1/LC50a + 1/LC50b + ... = 1/LC50total)
Total Estimated Est. Discharge LC50
(ppm SPP)

Case Studies	Toxicity	Discharge LC50 (ppm SPP)
Case 1: EPA C12 Generic Mud		
Base Mud 1:	3.70370E-06	
Alaskan Mud Additives:	1.51057E-06	
Other Additives:	1.25207E-05	
Subtotal	1.77350E-05	56,386
Kwikspot m/o pill:	1.63834E-05	
Total	3.41284E-05	28,301
Case 2: Thorgild #1 Used C12 mud		
Base Mud 2:	1.78571E-06	
Alaskan Mud Additives:	1.51057E-06	
Other Additives:	1.25207E-05	
Subtotal	1.5917E-05	63,223
Kwikspot m/o pill:	1.63834E-05	
Total	3.22105E-05	31,046
Case 3: Salmonid Used C12 mud		
Base Mud 3:	1.02564E-06	
Alaska Mud Additives:	1.51057E-06	
Other Additives:	1.25207E-05	
Subtotal	1.50569E-05	66,415
Kwikspot m/o pill:	1.63834E-05	
Total	3.14504E-05	31,796
Case 4: Mineral Oil Pill Removed with buffers		
Thorgild #1 after pill C12 mud sample	Used	Proposed
	attapulgite clay	45
	barite	178
	lignosulfonate	10
	caustic (KOH)	1.01
	Soltex	3.8
	EZ Mud DP	3.3
	residual Halliburton pill	~10% v/v
	residual m/o did not exceed 2%	
	75,348 ppm SPP	
	MBL #94-0002A, 1/6-1/1/94	
	sampled 1/2/94, #GOB/TG-001C	

Bioassay Reference	Additive	Tested Conc.	Proposed Conc.	LC50 (ppm SPP)	1/LC50
Base Mud 1: EPA C12 Duke & Parrish, 6/64 (US EPA)	Generic mud 2			270,000	3.70E-06
	NOTE: This mud type is a compilation of generic muds 2, 7 & 8, originally tested in 1984 to determine baseline toxicities for generic muds. Since generic mud 2 of the later NPDES permits is comprised of 3 muds, the lowest toxicity of component muds from the 1984 report is used as a basis for toxicity estimation.				
Base Mud 2: Thorgild #1 MBL #94-0002 1/6-1/1/94	Soltex	3.800	5.000	560,000	1.7857E-06
	EZ Mud DP	3.300	3.000		
	Note: Also contained attapulgite, barite, Cr free lignosulfonate, caustic. This is a "before" pill mud sample.				
Base Mud 3: Salmonid S-28 RD BHI #93012 7/1/1/93	Drispac UL MaxPac	1.200 0.080	3.000	975,000	1.0256E-06
	Note: Also contained attapulgite, barite, Cr free lignosulfonate, caustic.				
	#GOB/SS28RD-001				
Additives					
ALASKAN MUD EHA #84399 May-84	Con Det Desco CF Benex (X-Tend II, Gelex) Resinex (Poly RX, Dure XC Polymer Bara Birne Defoam Soltex Pac-L	0.400 0.500 0.100 4.000 0.500 0.100 6.000 1.000	4.000 4.000 4.000 4.000 5.000	862,000	1.5106E-06
EHA #87807, 87-183, 7/85 MBL, #90746, 10/89	Defoam X EZ Mud DP	0.300 3.000	0.300 3.000	833,527 125,000	1.1987E-06 8.000E-06
	***** ADD NEW BIOASSAY DATA & INFO HERE!!! *****				
EHA #65764/6850, 7/85 Milpark #5337, 6/90 Core, #911252, 9/91	Biozan XC/SCD Polymer Xanvis	2.000 1.000 3.000	4.000 4.000 4.000	757,000 1,000,000 1,000,000	1.321E-06 1.00E-06 1.00E-06
	Note: Total concentration of xanthan & welan gum is 4.0 lb/bbl. Using all LC50s makes the total concentration represented by estimated LC50 for discharge 6.5 lb/bbl.				
Mineral Oil Pills EHA #65454/6504, 5/85	Kwikspot (% v/v)	3.000	residual	61,000	1.6393E-05
	Note: Kwikspot bioassayed in this mud at full 3% v/v concentration.				

**Total Additive Concentrations in Toxicity Estimates
CI2 for Thorgild #3**

This table does not include nut hulls, mica, cellophane flakes, and inert spheres. Concentrations shown are based on inventories attached to the bioassay reports.

		Case 1	Case 2	Case 3	Case 4
	Thorgild #3 MACs	EPA Mud CI2	Thorgild #1 (before pill)	Salmonid S-28RD	Thorgild #1 (after pill)
Bentonite, attapulgate	b	50	45	45	45
Barite	575	450	178	178	178
Lignosulfonate	15	15	10	10	10
Lignite	10	10			
Caustic	5	5	1.01	1.01	1.01
Sodium Bicarbonate	2	2			
Polyanionic cellulose polymers (PACs)	3 total	5.1 total	1 total	3.28 total	1 total
Xanthan gum Welan gum	4 total	6.5 total	6.5 total	6.5 total	6.5 total
EZ Mud DP	3	3	6.3	3	9.3
Soltex, Baratrol	5	6	9.8	6	6
Resinex, Durenex, Poly RX	4	4	4	4	4
Defoam X	0.3	0.3	0.3	0.3	0.3
Con Det		0.4	0.4	0.4	0.4
Desco CF		0.5	0.5	0.5	0.5
Benex (X-Tend II, Gelex)		0.1	0.1	0.1	0.1
Bara Brine Defoam		0.1	0.1	0.1	0.1
					~10% v/v Haliburton m/o pill

Note (Case 4): This case represents a single mud sample, no other bioassay data were added as they were for Cases 1-3.

TAB #3

Proposed Inventory: Custom KCl Mud (Flo-Pro)

* **GOB requires that maximum concentrations shall not be exceeded at any given time in this mud. Maximum concentration shall be calculated based on the amount of mud circulating, concentration of product already in the mud and the amount of product added each day.**

Basic Product	Product Name(s)	Maximum Concentration
<i>Base Mud</i>		
Xanthan gum	Xanvis	4.0 lb/bbl
KOH	stock product	1.0 lb/bbl
Potassium chloride	stock product	NTE 5% by volume or 22 lb/bbl
Sodium chloride		NTE 50,000 mg/L Cl in discharge or ### lb/bbl
Calcium carbonate	Lowate	75 lb/bbl
Starch	Morrex, FL7 Plus	3.0 lb/bbl
<i>Additives</i>		
Welan gum	Biozan	2.0 lb/bbl
Xanthan gums	XC, XC Polymer, Xanvis	3.0 lb/bbl

Toxicity Estimate(s): Custom KCl Mud (Flo-Pro)

Base Mud: GOB’s drilling fluid contractor (MY Muds) had the complete formulation of the proposed mud bioassayed with full concentrations of each base mud component (MY Labs., MY-0292, 9/92): the 96-hr LC50 for the custom mud formula was 73,000 ppm SPP. (See attached spreadsheet for re-estimation procedure, use spreadsheet “TG3_KCL.xls”)

Additives: In the event that welan or xanthan gums are needed to treat the circulating mud, they may be used (& discharged) based on the following:

Given: Toxicity = 1/LC50 so, as toxicity increases the 96-hr LC50 value decreases. Permit limit is 30,000 ppm SPP (a 96-hr LC50 value)

in terms of toxicity: $1/30,000 > 1/75,000 > 1/1,000,000$
 in terms of 96-hr LC50s: $30,000 \text{ ppm} < 75,000 \text{ ppm} < 1,000,000 \text{ ppm SPP}$

Assumption: Toxicity is additive & can be calculated as follows:

$$1/LC50_{total} = 1/LC50_{base \text{ mud}} + 1/LC50_{additive \ 1} + \dots + 1/LC50_{additive \ n}$$

See attached spreadsheet “TG3_KCL.xls” (Flo-Pro Custom). Estimated discharge toxicity is 62,418 ppm SPP based on addition of xanthan and welan gum polymers that were not bioassayed in the base mud.

Attachment 11: Example Drilling Fluid Plan

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Fiio-Pro Custom

Cummulative Toxicity Estimate for
Muds, Additives

Spreadsheet: "TG3_KCL.xls"
Date(s) of Estimate(s): 1/1/95

Case Studies	Toxicity	Est. Discharge LC50 (ppm SPP)
(1/LC50a + 1/LC50b) ÷ (1/LC50total)		
Case 1: Custom KCl Mud		
Base Mud 1:	1.36989E-05	
Other Additives:	2.32100E-06	
Subtotal	1.60209E-05	62,418

Bioassay Reference	Additive	Tested Conc.	Proposed Conc.	LC50 (ppm SPP)	1/LC50
Base Mud 1: Custom KCl	Custom Mud			72,993	1.370E-05
My Labs MY-0292, 9/82	NOTE: This mud bioassayed with all components & additives at maximum conc.				
	xanthan gum	4.000	4.000		
	KOH caustic	1.000	1.000		
	potassium chloride	22.00	22.00		
	sodium chloride (mg/L Cl)	50,000	50,000		
	calcium carbonate	75.00	75.00		
	starch	3.000	3.000		

Additives	Conc.	LC50 (ppm SPP)	1/LC50	
EHA #85764/6850, 7/85	2.000	4.000	757,000	1.321E-06
Core, #911252, 9/81	3.000	4.000	1,000,000	1.00E-06
Biozan				
Xanvis				

Note: Data for Biozan & Xanvis represent standard lignosulfonate mud WITHOUT KCl; however, no bioassay references could be found for these products in the Fiio-Pro mud.

***** ADD NEW BIOASSAY DATA & INFO HERE!!! *****

Mineral Oil Pills

none anticipated

TAB #4

GOB Oil – CRITERIA FOR CONTINGENCY ADDITIVES

IF any additive needed for any of the muds described in this plan are not listed on the 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. GOB’s operating policy is that products already in stock will be used before special shipments are arranged without approval by GOB Drilling Supervisor.
2. What is the nature of the additive? Is it relatively inert with respect to toxicity?
 - *For drilling operations & mud formulation in general.* GOB’s policy is based on past evaluations of mud/additive systems to consider the following as “relatively inert”: mica (as needed), cellophane flakes (as needed), nut hulls (as needed), inert spheres (as needed), SAPP (0.5 lb/bbl), calcium carbide (as needed), “vegetable plus polymer fibers, flakes, granules” (50 lb/bbl), zinc carbonate & lime (as needed), and zinc oxide (as needed). These additives may be applied to mud as required to achieve specific mud characteristics and/or performance.
 - *For potassium-based muds.* GOB’s policy is that only the following may be added to the mud without a toxicity estimation: aluminum stearate (0.2 lb/bbl), ammonium nitrate (200 mg/L nitrate or 0.05 lb/bbl), calcium carbide (as needed), cellophane flakes (as needed), mica (as needed), inert spheres (as needed), crushed nut hulls (as needed), SAPP (0.5 lb/bbl), “vegetable plus polymer fibers, flakes, and granules” (50 lb/bbl), zinc carbonate & lime (as needed), and zinc carbonate (as needed).
3. GOB will not allow discharge of any drilling product containing diesel oil or non-aqueous drilling fluids as required by the general NPDES permit.
4. Some estimate of toxicity of the discharged whole mud/additive system is required as part of this mud plan. GOB has set-up the following process for Thorgild #3 operations:

Calculate estimate of cumulative discharge toxicity. A laptop PC in mud room is loaded with a mud spreadsheet prepared by GOB for the proposed lignosulfonate mud (Cook Inlet type 2) and the custom KCl mud (Flo-Pro). Simply record bioassay data for the new additive as indicated on the spreadsheet, estimated discharge toxicity is automatically recalculated. Spreadsheets are titled with mudtype and well numbers – in this case, “TG3_KCL.xls” (for custom KCl Flo-Pro mud) and “TG3_C12.xls” (for saltwater

lignosulfonate mud). **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 GOB's mud contractor's environmental office. Ask Y. Sun or P.C. Handy on shift or call MY Drilling Services at (123) 555-2727.

Try to locate bioassay data that represents the same concentration of product that you propose to use bioassay data for. If data is not available for the exact concentration, GOB requires that data on a greater concentration 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.

GOB's policy is to find bioassay data that represents mud similar to the mud that you are treating. That is, if a lubricity additive needs to be added to a KCl-based mud, ask first for any bioassays for KCl-based muds that contained the additive; if none are available, then use bioassays for the additive in an unlike mud (e.g., "lignosulfonate reference mud", or "standard bioassay reference mud").

GOB and MY 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 on the spreadsheet. This documents the worst-case nature of your estimate – in that more additives are represented than will be used.

5. It is GOB policy that no mud additive shall be applied if the estimated discharge toxicity is less than the permitted 30,000 ppm SPP *unless* adequate written documentation is attached that shows the estimation is worst-case (i.e., more additives that will be used and/or higher concentrations of additive than will be used). Final decision to apply an additive that causes estimated discharge toxicity to exceed the permitted limit will be made by the Drilling Supervisor in concurrence with GOB environmental permitting department.
6. An additive which does not cause estimated discharge toxicity to exceed the permit limit of 30,000 ppm SPP may be discharged with approval by the Drilling Supervisor or Drilling Engineer.

Attachment 11: Example Drilling Fluid Plan

**Permit No.:
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TEST/REPORT	SAMPLE	WHEN TO...	WHERE TO...
Reports			
Mud inventories (from PC in mud room)	Muds only	<ul style="list-style-type: none"> • Whenever a sample is taken for bioassay • Whenever muds are changed over • At end-of-well for all muds 	
Metals (from lab)	Muds	<ul style="list-style-type: none"> • For any mineral oil pill application • For end-of-well 	<ul style="list-style-type: none"> • Attach to mineral oil pill report • See end-of-well report below
Sheen Reports (from PC in mud room)	All muds &/or cuttings discharges	Monthly as attachment to DMR	See table for Static Sheen, attached
Barite Mercury/Cadmium (from Lab or MY)	On stock barite only	At end-of-well	Attach to DMRs
End-of-well	Compilation of <ul style="list-style-type: none"> • metals • stock barite analyses • sheen spreadsheets for whole well • last bioassay report(s) • inventories for whole well & end-of-well sample 	GOB Environmental Permitting Division will compile final report after individual pieces (bioassays, lab results, etc.) arrive from MY Drilling Services and the Drilling Supervisors & Engineers.	
Mineral Oil Pill Info	Muds “before” AND “after” pill	Whenever a pill is used – see NPDES permit requirements	Attach to bioassay report for these mud samples

STATIC SHEEN for the month of _____

Well: Thorgild #3
 NPDES #: AKG28000X

Sheen Observed >>IF sheen is observed & discharge HAS occurred in the last 24 hours:
 Notify Drilling Supervisor immediately of noncompliance (GOB must notify EPA within 24 hours)
 Sample mud AND diesel oil on-board & prepare to ship for GC/MS analysis & comparison

Reason for discharge: "Batch" or "bulk" refer to discharges as result of changing over mud, reaching end-of-well.

When in doubt, make a note at the bottom of this Table, initial it & date it!

Type of Discharge M = mud C = cuttings M/C = both	Reason for discharge B = batch S = standard	Date (mm/dd/yy)	Time (hr:min am/pm)	Observer's Initials	Sheen NSO = no sheen observed SO = sheen observed	Volume discharged (est. bbls)	Rate (est. bbl/hr)	Mud Type (Spud, Cl2, KCl)

**Attachment 11: Example Drilling Fluid Plan
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