ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 435

[FRL–6581–4]

Effluent Limitations Guidelines for the Oil and Gas Extraction Point Source Category

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed Rule; Supplemental information and notice of meeting.

SUMMARY: On February 3, 1999 (64 FR 5488), EPA proposed technology-based effluent limitations guidelines and standards under the Clean Water Act (CWA) for the discharge of pollutants from oil and gas drilling operations associated with the use of synthetic-based drilling fluids (SBFs) and other non-aqueous drilling fluids into waters of the United States. This proposed rule would apply to certain existing and new facilities in the offshore subcategory beyond three miles from shore and offshore of Alaska, and the Cook Inlet, Alaska, portion of the coastal subcategory of the oil and gas extraction point source category.

This document presents a summary of all data received and collected by EPA since publication of the proposal; an assessment of the usefulness of the data in EPA's analyses; summary descriptions of revised engineering and economic models; and updated modeling results incorporating the new data. This notice also discusses ''best management practices'' (BMPs) as potential alternative requirements to reduce the discharges of toxic and hazardous pollutants.

DATES: Submit your comments by June 20, 2000. A public meeting will be held on Tuesday, April 25, 2000, from 1:00 p.m. to 5:30 p.m. Central Standard Time.

ADDRESSES: Submit comments by mail to Mr. Carey A. Johnston at the following address: U.S. Environmental Protection Agency; Engineering and Analysis Division (4303); 1200 Pennsylvania Avenue, NW; Washington, DC 20460. Please submit any references cited in your comments. EPA would appreciate an original and two copies of your comments and enclosures (including references). Hand delivered comments may be submitted at the EPA Headquarters Water Docket (address below). Comments may also be filed electronically to ''johnston.carey@epa.gov.'' Electronic comments sent to the above e-mail address will be treated like all other submitted comments.

The data and analyses being announced today are available for review in the EPA Water Docket at EPA Headquarters at Waterside Mall, Room EB–57, 401 M. St. SW, Washington, DC 20460. For access to the docket materials, call (202) 260–3027 between 9:00 a.m. and 4:00 p.m. for an appointment. A reasonable fee may be charged for copying.

The public meeting will be held at the Minerals Management Service (MMS), Gulf of Mexico OCS Region Office, Room 111, 1201 Elmwood Park Boulevard, New Orleans, LA, 70123–2394.

FOR FURTHER INFORMATION CONTACT: For additional technical information, contact Mr. Carey A. Johnston at (202) 260–7186 or at the following e-mail address: johnston.carey@epa.gov. For additional economic information contact Mr. James Covington at (202) 260–5132 or at the following e-mail address: covington.james@epa.gov.

SUPPLEMENTARY INFORMATION: Visitors attending the New Orleans public meeting (*see* **ADDRESSES**) will need to sign in at the MMS guard booth and obtain a visitors badge. If you wish to present formal comments at the public meeting you should have a written copy for submittal. No meeting materials will be distributed in advance of the public meeting; all materials will be distributed at the meeting. Limited teleconferencing capability will be available for the meeting. Persons wishing to participate via telephone or who have special audio-visual needs should contact Mr. Carey A. Johnston, (202) 260–7186.

The Agency invites all parties to coordinate their data collection activities with EPA to facilitate mutually beneficial and cost-effective data submissions. Please refer to the **FOR FURTHER INFORMATION CONTACT** for technical contacts at EPA.

To ensure that EPA can properly respond to comments, the Agency prefers that commenters cite, where possible, the paragraph(s) or sections in the notice or supporting documents to which each comment refers. Please submit an original and two copies of your comments and enclosures (including references).

Commenters who want EPA to acknowledge receipt of their comments should enclose a self-addressed, stamped envelope. No facsimiles (faxes) will be accepted. Comments and data will also be accepted on disks in Wordperfect, ASCII, or Adobe Acrobat (*.pdf) format.

All comments will be organized by EPA's Engineering and Analysis Division (EAD) and submitted by EAD to the record supporting this rulemaking (Docket No. W–98–26) in the EPA Water Docket. Electronic comments must be submitted as a Wordperfect, ASCII, or Adobe Acrobat (*.pdf) format file avoiding the use of any form of encryption. Electronic comments must be identified by the docket number W–98–26 and may be filed online at many Federal Depository Libraries. No confidential business information (CBI) should be sent via e-mail. EPA's information technology services (e.g., e-mail, website) were temporarily shut down, beginning Thursday, February 17, in order to review and improve security measures. EPA's e-mail services are now operational. However, EPA recommends that persons submitting comments electronically call Mr. Carey A. Johnston, (202) 260–7186, to confirm EPA receipt.

Contents of This Document

I. Purpose of This Notice

On February 3, 1999 (64 FR 5488), EPA proposed technology-based effluent limitations guidelines and standards under the Clean Water Act (CWA) for the discharge of pollutants from oil and gas drilling operations associated with the use of synthetic-based drilling fluids (SBFs) and other non-aqueous drilling fluids into waters of the United States. This proposed rule would apply to certain existing and new facilities in the offshore subcategory (i.e., facilities seaward of the inner territorial boundary) and the Cook Inlet, Alaska, portion of the coastal subcategory of the oil and gas extraction point source category.

In this notice, EPA is making new data submissions available for comment. Additionally, EPA is providing descriptions of revised economic and engineering models incorporating the new data. Summary descriptions of updated modeling results are also given in this notice. This notice also discusses ''best management practices'' (BMPs) as potential alternative requirements to reduce the discharges of toxic and hazardous pollutants. Finally, this notice announces that EPA has submitted an Information Collection Request (ICR) to the Office of Management and Budget (OMB) for these BMP alternatives to numeric effluent limitations and standards. EPA solicits public comment on any of the issues or information presented in this notice of data availability and in the administrative record supporting this notice.

II. Overview of Proposal and Data Acquired Since the Proposal

Since about 1990, the oil and gas extraction industry developed SBFs with synthetic and non-synthetic oleaginous (oil-like) materials as the base fluid to provide the drilling performance characteristics of traditional oil-based fluids (OBFs) based on diesel and mineral oil, but with lower environmental impact and greater worker safety through lower toxicity, elimination of polynuclear aromatic hydrocarbons (PAHs), faster biodegradability, lower bioaccumulation potential, and, in some drilling situations, less drilling waste volume.

EPA's information to date, including limited seabed surveys in the Gulf of Mexico, indicate that the effect zone of the discharge of certain SBFs is within a few hundred meters of the discharge point. These surveys also indicate that the sea floor may significantly recover in one to two years. EPA believes that impacts are primarily due to smothering by the drill cuttings, changes in sediment grain size and composition (physical alteration of habitat), and anoxia (absence of oxygen) caused by the decomposition of the base fluid. The benthic smothering and changes in grain size and composition from the cuttings are effects that are also associated with the discharge of water-based drilling fluids (WBFs) and associated cuttings. Based on the record to date, EPA finds that these impacts, which are believed to be of limited duration, are less harmful to the environment than the non-water quality environmental impacts associated with the option of prohibiting the discharge of all SBF-wastes. Moreover, EPA prefers SBFs over OBFs as there are operational accidents that lead to spills and loss of drilling fluid to the environment.

The proposed rule, published on February 3, 1999 (64 FR 5488), identified possible methods to control SBF discharges associated with cuttings (SBF-cuttings) in a way that reflects the appropriate level of technology. EPA proposed using stock limitations and standards on the base fluids from which the drilling fluids are formulated. This would ensure that substitution of synthetic and other oleaginous base fluids for traditional mineral oil and diesel oil reflects the appropriate level of technology. In other words, EPA wants to ensure that only the SBFs formulated from the ''best'' base fluids are allowed for discharge. Parameters that distinguish the various base fluids are the PAH content, sediment toxicity, rate of biodegradation, and potential for bioaccumulation.

EPA also proposed that SBF-cuttings should be controlled with discharge limitations and standards, such as a limitation on the toxicity of the SBF at the point of discharge, and a limitation on the mass (as volume) or concentration of SBFs discharged. The latter type of limitation would take advantage of the solids separation efficiencies achievable with SBFs, and consequently minimize the discharge of organic and toxic components. Additionally, EPA proposed that SBF discharges not associated with cuttings (e.g., incidental spills, accumulated solids, deck drainage) should meet zero discharge requirements, as this is the current industry practice due to the value of these drilling fluids.

Since proposal, EPA has obtained additional data and information from the industry and the Agency's continued data collection activities. The Agency has included these data, information, and the preliminary results of EPA's evaluation in sections III.A through III.H of the supporting record of this notice, available for review in the Water Docket (see **ADDRESSES** section at the beginning of this notice).

The industry data submittals are related to stock limitations and standards on base fluid (e.g., PAH content, sediment toxicity, biodegradation, bioaccumulation), discharge limitations and standards (e.g., free oil, formation oil contamination, retention of SBF on cuttings), technical performance of ester-based drilling fluids, subsea pumping systems, cuttings microencapsulation systems, best management practices (BMPs), and health and safety considerations. The specific data, information, and comments provided to EPA are discussed below in detail.

The Agency's collected data are related to stock limitations and standards (e.g., sediment toxicity and biodegradation); non-water quality environmental impacts (NWQI) including on-shore disposal capacity of exploration and production wastes and monetization of air emissions; economic costs related to deepwater projects; discharge limitations and standards; and projected environmental outcomes such as sediment pore water quality.

EPA will evaluate all analytical data in the rulemaking record to set limitations and standards that represent the appropriate level of technology using a combination of methods referenced below. Specifically, for sediment toxicity and biodegradation limitations and standards, EPA will evaluate each of the various sediment toxicity and biodegradation method test data for the various synthetic base fluids against known standards such as diesel. Moreover, EPA will use all sediment toxicity and biodegradation data to assess the ability of each sediment toxicity and biodegradation method identified below to discriminate between different types of synthetic base fluids and produce consistent results.

In addition, a list of SBF rulemaking stakeholder meetings and the respective minutes can be found in section III.A.(c) of the rulemaking record.

A. Industry Data Submissions Since Proposal Publication

1. Sediment Toxicity Test Results and Revised Methods

In the February 1999 proposal, EPA set the Best Available Technology Economically Achievable (BAT) and New Source Performance Standards (NSPS) stock limitation for sediment toxicity as: ''10-day LC_{50} of stock base fluid minus 10-day LC_{50} of C_{16}–C_{18} internal olefin shall not be less than zero.'' [The term ''LC_{50}'' is used to identify how much of a substance is needed to kill half of a group of experimental organisms in a given time; a higher LC_{50} value means the material is less toxic]. EPA also proposed a compliance method, American Society for Testing and Material (ASTM) method E1367–92, and sediment preparation procedures for this stock limitation (Appendix 3 to Subpart A of Part 435).

In addition to sediment toxicity tests using ASTM method E1367–92, industry has recently conducted several studies using alternative sediment toxicity test methods including a method based on determining toxicity to the mysid shrimp, *Mysidopsis bahia,* in a sediment-water interface system. As a result of this effort, industry has supplied information on the use of formulated sediments and the shortening of the exposure period of synthetic base fluids to marine amphipods. EPA proposes to use one of these methods (i.e., ASTM method E1367–92 or alternative industry mysid shrimp sediment toxicity test method) for: (1) the establishment of an appropriate sediment toxicity rate stock limitation in the final rule; and (2) use as a compliance tool.

Several papers published by M–I Drilling Fuids, L.L.C. (MIDF) provided data on the toxicity of the synthetic base fluid C_{16}–C_{18} internal olefin (IO) and diesel in formulated sediments as well as data on the results of tests conducted with a 96-hour exposure period as compared to the standard 10-day exposure as specified in ASTM E1367–92 (Rabke and Candler, 1998; Rabke and Candler, 1999; Still, et al., 1999).

This work conducted by MIDF was done in an effort to increase the discriminatory power of the test between the toxicity of synthetic base fluids and diesel, as well as between the different synthetic base fluids. MIDF believes that the longer exposure time reduces discriminatory power because the test sediment toxicity becomes a greater factor relative to the test base fluid toxicity over time. Therefore, the test sediment's toxicity would tend to normalize and obscure the differences in toxicities of the test base fluids as test duration increases. Table II.A.1.1 summarizes the LC_{50} industry sediment toxicity data with various drilling fluids [i.e., diesel, internal olefin (IO), linear alpha olefin (LAO), poly alpha olefin (PAO), and ester]. A more complete review of these procedures and data can be found in section III.B.(b) of the rulemaking record.

TABLE II.A.1.1: INDUSTRY LC_{50} SEDIMENT TOXICITY DATA FOR VARIOUS DRILLING BASE FLUIDS AT TWO DIFFERENT TIME PERIODS

	Drilling base fluid	LC_{50} (mg/Kg)	95% Confidence interval
Baker Hughes INTEQ-Generated Data			
96-Hour Test	C14/16/18 IO	4020	2926–8219
	C14/16/18/20 IO	>5111	NA
	C16/18 IO	3515	2726–5215
	C14/15/16/17/18 LAO/IO	1497	1299–1725
10-Day Test	Diesel	343	297–391
	C14/16/18 IO	646	625–1250
	C14/16/18/20 IO	1218	1070–1453
	C16/18 IO	1464	1172–1681
	C14 LAO	205	187–223
	C16 LAO	407	353–473
	C14/15/16/17/18 LAO/IO	854	696–1018
	C30+PAO	2359	1478–5156
	Enhanced Mineral Oil	79	37–117
	Linear Paraffin	1047	846–1257
	Paraffin	111	101–122
Baroid-Generated Data			
96-Hour Test	Diesel	453	416–493
	IO	876	442–1663
	LAO	490	291–924
	Ester	>20000	NA
	Ester (Low viscosity)	>20000	NA
10-Day Test	Diesel	230	209–251
	IO	564	447–639
	LAO	338	294–378
	Ester	>10000	NA
	Ester (Low viscosity)	2447	2197–2701
MIDF Drilling-Generated Data			
96-Hour Test	Diesel	566	510–629
	IO	3686	2890–4893

Method Reference: EPA February 1999 Proposal (64 FR 5488).

Finally, one commenter on the February 1999 proposal, Baroid Drilling Fluids, provided preliminary sediment toxicity data for two of its ester-based drilling fluids. The data provided in the comments indicate that both esters may have lower toxicities than other base fluids (e.g., C_{16}–C_{18} IO, paraffin, mineral oil, diesel oil). However, EPA data presented in Table II.B.1.1 indicate that the sediment toxicity of IO and ester are significantly better than other alternative base fluids.

2. Biodegradation Test Results and Revised Methods

In the February 1999 proposal, EPA set the BAT and NSPS stock limitation for biodegradation rate as: ''percent stock base fluid degraded at 120 days minus percent C_{16}–C_{18} internal olefin degraded at 120 days shall not be less than zero.'' EPA also proposed a compliance method for this stock limitation (Appendix 4 to Subpart A of Part 435).

Industry stakeholders conducted a series of biodegradation tests for determining biodegradation of SBFs and OBFs using the method proposed by EPA (Appendix 4). Industry stakeholders also identified alternative analytical biodegradation methods and used these alternative methods to generate data. EPA solicits comment in this notice on use of these alternative methods and corresponding data to set biodegradation limitations and standards and compliance methods. EPA proposes to use one of these methods for: (1) The establishment of an appropriate biodegradation rate stock limitation in the final rule; and (2) use as a compliance tool. The first analytical test method is the solid-phase degradation test as EPA proposed in February 1999 (Appendix 4). This method consists of spiking ''clean'' marine or estuarine sediment with a base fluid and placing these test samples in exposure tanks filled with seawater. The concentration of base fluid is measured at regular intervals during the test to monitor the degradation of the base fluid.

Industry-supplied data using the solid phase test are summarized in Table II.A.2.1.

TABLE II.A.2.1: INDUSTRY SOLID PHASE BIODEGRADATION TEST RESULTS

Elapsed time of test	Percent loss relative to day 0				
	Olive oil (percent)	Finagreen ester (percent)	Diesel (percent)	C16–C18 Internal olefin	Neodene 1518 (percent)
Day 10	84	56	*	*	*
Day 20	88	59	*	*	*
Day 45	96	90	−2	39	2
Day 110	99	95	22	73	58
Day 186	99	99	55	93	83

Method Reference: EPA February 1999 Proposal (64 FR 5488).
*Not tested.

The second biodegradation method evaluated by industry is the marine anaerobic closed bottle test. This test procedure places a mixture of SBFs or OBFs, marine sediment, and sea water into a tightly capped clean serum bottle. The conditions within the closed bottle result in the anaerobic degradation of SBFs or OBFs. The anaerobic processes degrading the base fluids produce gas. This gas production is monitored as a measure of the degradation process. Industry-supplied data using the closed bottle test are summarized in Table II.A.2.2.

TABLE II.A.2.2: INDUSTRY MARINE ANAEROBIC CLOSED BOTTLE BIODEGRADATION TEST RESULTS

Elapsed time of test	Cumulative gas production over time (ml)					
	Olive oil	C_{16}–C_{18} internal olefin	C_{14}–C_{16} linear alpha olefin	Synthetic paraffin	C_{30}	Blank control
Day 0	0.00	0.00	0.00	0.00	0.00	0.00
Day 5	9.29	2.77	3.67	3.32	3.32	3.88
Day 25	50.00	8.59	10.00	7.05	6.62	5.99
Day 33	103.50	12.50	15.00	10.00	8.00	8.30
Day 67	150.41	18.38	22.15	13.67	10.45	11.12
Day 77	152.50	22.21	26.46	15.83	12.42	12.28
Day 95	160.61	24.60	32.74	18.16	12.18	12.98
Day 113	162.88	29.71	42.91	21.14	12.80	13.30
Day 132	164.78	39.74	55.50	23.17	13.38	14.01
Day 155	169.18	59.00	88.16	27.19	15.42	16.07
Day 194	167.74	92.36	114.50	25.82	13.97	14.57
Day 231	171.57	104.50	138.22	29.49	17.47	17.63
Day 271	175.58	119.88	151.20	33.33	21.63	22.11

Method Reference: ISO 11734: ''Water quality—Evaluation of the 'ultimate' anaerobic biodegradability of organic compounds in digested sludge—Method by measurement of the biogas production'' (1995 edition).

The third biodegradation test method is the respirometry test. This analytical method determines biodegradation by measuring the carbon dioxide production and/or oxygen consumption due to microbial oxidation of the test fluid in sediment. Industry-supplied data using the respirometry test are summarized in Table II.A.2.3.

TABLE II.A.2.3: INDUSTRY RESPIROMETRY BIODEGRADATION TEST RESULTS

Elapsed time of test	Cumulative oxygen consumption over time (mg)		
	Blank control	Rapeseed oil control	Amodrill 1000 SBF
Day 1	3.38	4.57	4.46
Day 2	6.26	8.26	6.62
Day 3	6.52	9.03	10.49
Day 4	12.68	22.29	14.13
Day 5	16.42	34.29	18.43
Day 6	18.50	41.33	21.02
Day 7	21.40	50.02	24.67
Day 8	24.02	58.42	27.96
Day 9	26.66	66.12	31.19
Day 10	29.10	72.88	34.36
Day 11	31.48	78.86	37.25
Day 12	33.88	84.26	39.96
Day 13	36.27	89.00	42.67
Day 14	38.80	93.33	45.48
Day 15	41.28	97.26	48.24
Day 16	43.31	100.76	50.96
Day 17	45.19	103.86	53.47

TABLE II.A.2.3: INDUSTRY RESPIROMETRY BIODEGRADATION TEST RESULTS—Continued

Elapsed time of test	Cumulative oxygen consumption over time (mg)		
	Blank control	Rapeseed oil control	Amodrill 1000 SBF
Day 19	49.29	110.34	58.86
Day 20	50.80	112.69	60.76
Day 21	52.53	115.34	62.78
Day 22	54.23	117.98	64.83
Day 23	55.73	120.38	66.57
Day 26	60.94	127.73	72.97
Day 27	62.32	129.64	74.76
Day 28	64.00	131.77	76.66
Day 29	65.60	133.81	78.81
Day 30	67.14	135.75	81.04
Day 31	68.59	137.53	82.97
Day 32	70.10	139.32	84.96
Day 33	71.66	141.13	86.98
Day 34	73.09	143.45	88.84
Day 35	74.82	144.51	91.08
Day 36	76.29	146.15	93.17
Day 37	77.47	147.59	94.68
Day 38	79.11	149.22	96.82
Day 39	80.64	150.80	98.87
Day 40	82.31	152.51	101.26
Day 41	83.44	153.83	102.68

Note: data were not collected on Days 18, 24, and 25.
Method Reference: Modification of OPPTS 835.3110: ''Fate, Transport and Transformation Test Guidelines: Ready Biodegradability,'' EPA 712–C–98–076, January 1998.

A more complete review of these procedures and data can be found in section III.B.(b) of the rulemaking record.

Finally, one commenter on the February 1999 proposal, American Petroleum Institute/National Ocean Industries Association (API/NOIA), stated, without any supporting data, that esters biodegrade more quickly than the alternative non-aqueous fluid systems. EPA agrees with this statement based on recent EPA biodegradation test results (*see* section II.B.2).

3. Formation Oil Contamination (Offshore and On-shore Tests)

In the February 1999 proposal, EPA proposed the BAT limitation and NSPS for formation oil as zero discharge. EPA also proposed a screening method [Reverse Phase Extraction (RPE) method given in Appendix 6 to Subpart A of Part 435] and an assurance method [Gas Chromatograph/Mass Spectrometer (GC/MS) method given in Appendix 5 to Subpart A of Part 435] for determining compliance. These methods continue to be EPA's preferred option for the final rule.

Industry has sponsored research regarding both of these analytical methods for determining formation oil contamination. The RPE procedure is to be used offshore. It measures ultraviolet (UV) fluorescence to detect the presence of aromatic compounds. Since proposal, refinements have been made in the test to minimize interference from emulsifiers. A more complete review of this procedure can be found in section III.B.(b) of the rulemaking record.

The GC/MS method is expected to be performed in a land-based laboratory. This procedure, which measures the area under GC peaks and target aromatics, is a dependable laboratory technique proposed by EPA to supplement the RPE test for verification purposes. A more complete review of this procedure can be found in section III.B.(b) of the rulemaking record.

4. SBF on Cuttings Retention Data

In this section, EPA summarizes the relationship of the industry supplied data to EPA's proposal, the relationship of these data to reductions in discharges to the environment, and the SBF on cuttings data submitted by industry.

a. SBF on Cuttings Data in Relation to EPA's Proposal. In February 1999, EPA proposed a BAT limitation and NSPS for base fluid retained on cuttings as a maximum value of 10.2 percent, not to be exceeded by the weighted average for retention over the course of drilling a well. EPA also proposed a method for demonstrating compliance with this discharge limitation (Appendix 7 to Subpart A of Part 435). In today's notice EPA, with input from industry, presents the proposed option along with several alternatives utilizing Best Management Practices (BMPs). EPA is considering three options for the final rule for the BAT limitation and NSPS controlling SBF retained on discharged cuttings: (1) a single numeric discharge limitation with an accompanying compliance test method; (2) allowing operators to choose either a single numeric discharge limitation with an accompanying compliance test method, or as an alternative, a set of BMPs that employs limited cuttings monitoring; or (3) allowing operators to choose either a single numeric discharge limitation with an accompanying compliance test method or an alternative set of BMPs that employ no cuttings monitoring.

Further EPA corrected technical errors in the proposed rule based on the statistical analysis of the SBF on cuttings data obtained from the Gulf of Mexico (GOM). The average percent SBF on cuttings was corrected from 11.5 to 11.4 for current practice and from 7.11 to 7.09 for the BAT/NSPS technology. The proposed well averaged maximum limitation and standard were corrected from 10.2 to 9.42. Cost and loading calculations presented in the February 1999 SBF technical support documents were not affected by these changes because these calculations were based on the rounded values of 11 for current practice and 7 for the BAT/NSPS technology. The technical errors requiring these changes were related to EPA's calculation of drilling intervals.

EPA calculates drilling intervals as the depth drilled since the last measurement for retention on cuttings.

EPA uses this measurement in conjunction with pipe diameter to estimate the volume of cuttings associated with a particular retention on cuttings measurement. EPA then uses this volume in the weighted summary statistics for the retention on cuttings data. Some data used at proposal were submitted with drilling intervals already calculated and other data were submitted with depth measurements calculated from the ocean floor. In the proposed rule as published in the **Federal Register**, EPA used both sets of measurements as if they all represented drilling intervals. However, in the record for the proposed rule, EPA calculated and used drilling intervals for those data submitted with depth measurements calculated from the ocean floor. More information on these errors and the corrections is given in section I.C(d)(59) of the rulemaking record.

Several comments received on the February 1999 proposal related to the use of cuttings retention data from the North Sea to set the GOM numeric guidelines and standards for percent retention. As discussed below, EPA has subsequently obtained sufficient data from the GOM to set limitations and standards without use of the North Sea data.

b. Relationship of SBF on Cuttings Retention Data to Protection of the Environment. Cuttings retention data measure the amount of residual drilling fluid retained on cuttings. A higher cuttings retention value indicates that more drilling fluid is adhering to the cuttings. EPA is interested in the cuttings retention measurement not only as an indicator of the amount drilling fluid discharged into the ocean but also as an indicator of the ability of cuttings to biodegrade and disperse and not form deleterious cuttings piles and mats. Moreover, understanding the fate and transport of discharged cuttings is an important step in modeling and monitoring potential environmental and human health impacts.

SBFs are a subcategory of non-aqueous drilling fluids (NAFs) which do not easily disperse in the water column. The effects of NAF-cuttings on benthic fauna may be categorized as being caused by: (1) physical smothering; (2) the presence of potential toxic and hazardous pollutants and biodegradation by-products (*e.g.,* heavy metals, aromatics, hydrocarbons, sulfides); and (3) the organic enrichment of sediment which may produce anoxic conditions (Limia and Peresich, 1992). Field studies indicate that the responses shown by benthic communities to cuttings discharges are the result of a combination of these effects. Numerous field studies show that the most harmful benthic effects are generally within 500 meters of development drilling operations and within 250 meters of single well sites (Davies et al., 1989).

Reducing the amount of initial base fluid on cuttings is beneficial in promoting biodegradation of SBFs in the benthic environment. Literature data make clear that the biodegradation of SBFs in the environment is not simply an exponential decay (Getliff et al., 1997). The half-life of the base fluid decreases as the initial concentration of base fluid on cuttings decreases. Therefore, it is vital to minimize the initial concentration of base fluid on cuttings discharged to maximize the rates of biodegradation and seabed recovery.

Reducing the amount of initial base fluid on cuttings is also beneficial in preventing the build-up of deleterious cuttings piles and mats. A decrease in benthic individuals within the zone of maximum cuttings deposition (*i.e.,* cuttings piles and mats) is a result of physical smothering and organic enrichment which produces anoxic conditions and toxic sulfide biodegradation by-products (Daan et al., 1996; Limia, 1996). A reduction of benthic individuals beyond the immediate area of physical impact may be indicative of a toxic effect (Davies and Kingston, 1992). The build-up of these harmful cuttings piles and mats is controlled by several factors including the conditions of the receiving waters (*e.g.,* currents, distance from discharge to seabed) and the retention of SBF on cuttings. A study of cuttings piles in the North Sea found that piles of cuttings are found predominantly at particular sites in the central and northern North Sea, where water depths are greater, and currents less than, the southern North Sea (Bell et al., 1998).

Results from laboratory experiments modeling typical ocean conditions show that high NAF content on cuttings (i.e., high cuttings retention values) lead to ''lumps'' of material, rather than separate particles, which rapidly settle out (i.e., have high fall velocities) to the benthic environment (Delvigne, 1996). Moreover, field results show that cuttings are dispersed during transit to the seabed and no cuttings piles are formed when SBF concentrations on cuttings are held below 5% (Getliff et al., 1997; Hanni et al., 1998). Additionally, cuttings discharged from cuttings dryers (with SBF retention values under 5%) in combination with a sea water flush, hydrate very quickly and disperse like water-based cuttings (Hanni et al., 1998).

Overall, lowering the percentage of residual drilling fluid retained on cuttings increases the recovery rate of the seabed receiving the cuttings (Getliff et al., 1997; Vik et al., 1996). Therefore, limiting the amount of NAF content in discharged cuttings controls: (1) The amount of NAF discharged to the ocean; (2) the biodegradation rate of discharged NAF; and (3) the potential for NAF-cuttings to develop cuttings piles and mats which are detrimental to the benthic environment.

c. SBF on Cuttings Data Submitted by Industry. Subsequent to proposal, SBF on cuttings data from various formations within the GOM have been submitted by an industry workgroup, individual operators, and by equipment vendors. These data characterize performance for a variety of cuttings treatment technologies, including existing shaker technologies and add-on equipment. Several comments on the February 1999 proposal also provided cursory information and data related to the performance of new and existing solids control equipment and drilling fluids. For example, one comment by Derrick Equipment Company described SBF cuttings retention values in the range of 8 to 9% by weight for a GOM well using a new shale shaker design. A comment by Baroid Drilling Fluids stated that the lower viscosity of its new ester-based drilling fluid will lead to greater recovery of its ester-based fluid from cuttings.

Based on these data and other GOM data presented at proposal, EPA has modeled and analyzed the cuttings retention performance of several technologies. A summary of the revised models is presented in section III.D. A summary of the analyses developed by EPA, including the development of numeric guidelines and standards, is presented in section IV.D. Detailed descriptions of the statistical methods, summary statistics, overall averages, and percentiles associated with each technology can be found in section III.C.(a) of the rulemaking record.

5. Industry Seabed Survey

Permits authorizing the discharge of SBF-cuttings are required to meet (a) technology-based requirements, and (b) CWA section 403(c) Ocean Discharge Criteria, or, in State waters of Cook Inlet, Alaska, State water quality criteria. The February 1999 proposal described the CWA 403(c) requirements and the seabed surveys EPA thinks would be occurring, based on information available at that time to satisfy these permit requirements. Today's notice updates the description of the seabed survey efforts that industry is currently planning.

EPA understands that the industry is planning a cooperative effort to address the CWA section 403(c) requirements in the GOM. Industry representatives have told EPA that their cooperative seafloor study would include a review of historical data on SBF usage on the shelf and slope, and these data would be analyzed to select a representative series of platforms.

The overall objective of the study is to assess the fate and effects (physical, chemical, and biological) of discharged SBF-cuttings at continental shelf (40 m to 300 m water depth) and deepwater (>300 m water depth) GOM sites. Specific sub-objectives include determining the thickness and areal extent of cuttings accumulations, determining the temporal behavior of SBF concentrations in sediments, documenting the physical-chemical sediment conditions, and determining whether a zone of biological effect exists.

The study will include four cruises: a scouting cruise, a screening cruise, and two sampling cruises. The purpose of the scouting cruise, which is intended to take place in late spring of 2000, is to conduct a preliminary physical survey of ten continental shelf sites to: (1) assess the extent of cuttings accumulations; (2) assess the suitability of each site for further sampling; and (3) guide further sampling operations. The results of this cruise will be used to select five continental shelf sites where the subsequent screening cruise will be conducted.

During the screening cruise, five continental shelf sites and three deepwater sites will be surveyed. The purpose of this cruise is to: (1) Assess SBF concentrations and other sediment physical-chemical conditions (*e.g.,* oxidation-reduction profile, grain size, mineralogy, metals, total organic carbon) at all eight sites; (2) test and refine the proposed field and laboratory methods; and (3) make preliminary benthic infaunal and sediment toxicity assessments at the five continental shelf sites. Based on data acquired during this cruise, sampling strata will be designated and platform sites will be designated as primary or secondary. The three deepwater sites and three of the five continental shelf sites will be primary sites, and the remaining two continental shelf platforms will be secondary sites.

The sampling cruise will be similar to the screening cruise in terms of physical-chemical analyses, but will include an increased number of samples. Infaunal and sediment toxicity analyses will be included at the three primary continental shelf sites. Sampling at the two secondary continental shelf sites will be similar to that at the primary sites, but the suite of analyses will not be as extensive (e.g., it will not include metals, infaunal, or sediment toxicity analyses).

EPA plans on using the data from the first survey to identify any negative environmental effects from SBF discharges. If this data becomes available in time, EPA might use that information in its assessment of a controlled discharge option as compared to the NWQIs of a zero discharge option. The current work plan for the seabed survey can be found in section III.F.(a) of the rulemaking record.

6. Bioaccumulation

Several comments related to bioaccumulation were submitted to EPA in response to the February 1999 proposal. In particular, one industry commenter stated, without supporting data, that there is currently sufficient data available amongst the various companies to show that synthetic base fluids are not believed to bioaccumulate; further, that most members of the industry groups maintain operations in the European sector where bioaccumulation testing of base fluids has already been conducted in compliance with the Harmonized Offshore Chemical Notification Format (HOCNF) requirements. However, another commenter stated, also without supporting data, that marine organisms higher in the food chain are at significant risk due to bioaccumulation of SBF. EPA is again requesting any data related to the potential of SBF to bioaccumulate and the related chronic or toxic effects on higher level organisms.

7. Technical Performance of Ester-based Drilling Fluids

In the proposed rule, EPA proposed its sediment toxicity and biodegradation BAT limitations and NSPS based on product substitution with C_{16}–C_{18} Internal Olefins. Several commenters on the February 1999 proposal and other industry stakeholders offered data related to the technical and environmental performance of SBFs (e.g., Limia and Peresich, 1992). Specifically, three commenters provided data on the dynamic or kinematic viscosity of several SBFs (e.g., isomerized olefins, esters). Baroid Drilling Fluids provided data on its ''new ester'' with a dynamic viscosity comparable to a C_{16}–C_{18} IO. This drilling fluid manufacturer claims that the new ester allows formulation of fluids which have cold water performance comparable to, if not better than, some IOs (*e.g.,* C_{16}–C_{18} IO). Moreover, Baroid Drilling Fluids noted that the price of esters-based drilling fluids in the GOM have been reduced in half since their introduction and use in the GOM. EPA has also received information that indicates that esters still remain 40–90% more expensive than IOs (Johnston, 2000a). EPA has also received information that original and new ester technology continues to exhibit higher viscosity that could result in higher downhole losses of whole drilling fluids and higher cutting retention values (Friedheim and Conn, 1996; Johnston, 2000a). Finally, EPA has received information on the technical limitations (e.g., stability, elastomer swelling, sediment toxicity, lack of field experience) of original and new esters (Daan et al., 1996; Johnston, 2000a; Patel, 1998; Schaanning et al., 1996).

Due to the potential for better environmental performance of ester-based drilling fluids, EPA is considering basing the sediment toxicity and biodegradation stock limitations and standards on original esters instead of the proposed C_{16}–C_{18} IO. EPA is also considering sub-categorizing the regulation, based on the use of esters. The different sub-categorization options under consideration by EPA include: (1) limiting SBF discharges by setting numeric limitations and standards based on ester-based drilling fluids when water temperatures are above the practical limitations of esters; and (2) limiting SBF discharges by setting numeric limitations and standards based on C_{16}–C_{18} IOs, thus allowing the discharge of SBFs other than ester-based drilling fluids, when water temperatures are below the practical limitations of esters.

EPA solicits comment on this subcategory approach, and again is requesting any information and data related to the cost, technical performance, potential environmental impacts (e.g., sediment and aquatic toxicity, biodegradation), and frequency of industry use of ester-based drilling fluids.

8. Subsea Pumping Systems

In the February 1999 proposal (64 FR 5495), EPA outlined an innovative technology, generally referred to as ''subsea pumping,'' that may potentially outperform conventional drilling techniques in very deepwater conditions (generally greater than 3,000 feet of water). Subsea pumping is claimed by the developer to contribute to a number of environmental, technical, and economic benefits.

The technology involves pumping the drilling fluid up a separate riser by means of pumps at or near the seafloor. Rotary drilling methods in a system using subsea pumping are generally similar to conventional drilling methods, with the exception that the drilling fluid and small cuttings (i.e., < one-quarter inch) are boosted by one or more pumps near the seafloor. By boosting the drilling fluid, the adverse effects on the wellbore caused by the drilling fluid pressure from the seafloor to the surface are eliminated, thereby allowing wells to be drilled with as much as 50 percent reduction in the number of casing strings generally required to line the well wall. Wells are drilled in less time, including less trouble time.

The developer of this technology claims that subsea pumping can significantly improve drilling efficiencies and thereby reduce the volume of drilling fluid discharged, as well as reduce the non-water quality effects of fuel use and air emissions. Because fewer casing strings are needed, the hole diameter in the upper sections of the well can be smaller, which reduces the amount of cuttings produced. Also, the well bore will require fewer casing strings of smaller diameter, resulting in a reduction in steel consumption. An additional benefit of subsea pumping systems is the potential to extend the use of ester-based fluids in the cooler, deeper waters of the GOM. Finally, subsea system drilling may double or triple the reach of horizontal or directional deepwater delineation sidetrack wells. Accordingly, this may reduce the number of delineation wells needed to characterize a oil and gas formation.

To enable the pumping of drilling fluids and cuttings to the surface, about half of the drill cuttings, comprising the cuttings larger than approximately one-quarter inch, are separated from the drilling fluid and discharged at the seafloor since these cuttings cannot reliably be pumped to the surface. With a currently reported design, the drill cuttings that are separated at the seafloor are discharged through an eductor hose at the seafloor within a 150-foot radius of the well site. The drilling fluid, which is boosted at the seafloor and transports the remainder of the drill cuttings back to the surface, is conventionally processed.

Since the February 1999 proposal, the subsea pumping system developer has reviewed the technology with staff from Minerals Management Service (MMS) GOM Office, EPA Region 6, and EPA Headquarters. In a letter dated May 24, 1999, MMS provided conditional approval to the developer for using its subsea system for exploratory and development wells in Outer Continental Shelf (OCS) waters. In a letter dated July 30, 1999, EPA Region 6 concluded that discharges from the developers subsea system are generally authorized by the general permit for the western GOM (Permit No. GMG290000) provided that the subsea discharges are monitored.

EPA Headquarters staff met with the developers of the subsea pumping system on January 18, 2000, to discuss the technical and environmental performance of the new technology. As part of the meeting, the technology developers submitted a technical basis for supporting their improved environmental, technical, and economic performance. The developers also discussed with EPA Headquarters staff their current plans to field test their subsea pump system solids removal equipment offshore under atmospheric, not subsea, conditions. The tests are scheduled to begin in May 2000 with data becoming available in July 2000. The developers are planning to collect SBF retention data as well as other data to determine the fractions and concentrations of SBF discharged subsea. Notes from the January 18, 2000, meeting (including the technology developer technical report), anticipated subsea pumping field test plans, and the two previously mentioned letters are given in section III.B.(b) of the rulemaking record.

The subsea system developer commented on the February 1999 proposal and suggested that a definition for ''subsea pumping'' and a clarification of subsea pumping discharge sampling and monitoring requirements be added to this notice. In the supporting documentation for the proposed rule, Development Document for Proposed Effluent Limitations Guidelines and Standards for Synthetic-Based Drilling Fluids and other Non-Aqueous Drilling Fluids in the Oil and Gas Extraction Point Source Category (EPA–821–B–98–021), EPA stated that for purposes of monitoring, samples of the subsea discharge can be transported to the surface for analysis.

Based on the potential for reducing discharges to the environment and as previously stated in the SBF Development Document, EPA is considering different technology options for this subsea discharge. These options include limiting the type of drilling fluids available for use in subsea pumping systems; different monitoring and sampling requirements for subsea discharges; subsea cuttings discharge dispersal techniques; and cuttings retention requirements that are different from surface discharges. EPA is requesting comments on the most appropriate limitations and combination of limitations for these subsea discharges. EPA is also requesting more information about the anticipated percentage of future deepwater drilling operations that will employ subsea pumping systems.

9. Cuttings Micro-encapsulation Systems

EPA Headquarters staff met with the developers of a new cuttings management system, silica micro-encapsulation, on September 23, 1999, to discuss the technical and environmental performance of the new technology. Silica micro-encapsulation is a process by which the NAF attached to the cuttings is physically encapsulated in an insoluble matrix of amorphous silicate. More information on this technology is given in section III.B.(b) of the rulemaking record.

The technology developer claims that the encapsulated oils do not leach and do not biodegrade. The stated benefit of the micro-encapsulation process is the ability to convert non-aqueous fluid cuttings into water wet particles. Consequently, the non-aqueous fluid cuttings behave in the water column similarly to water-based fluid cuttings. The developer claims that this allows for maximum dispersion of non-aqueous fluid cuttings. Finally, the developer claims that the dispersion of the cuttings into a much greater area substantially reduces the potential for benthic smothering and other toxic and chronic environmental effects.

One issue related to this technology is the incompatibility of the micro-encapsulation technology with the February 1999 proposal method for determining the amount of drilling fluid that adheres to drill cuttings. This method, Appendix 7 to Subpart A of Part 435–API Recommended Practice 13B–2 (64 FR 5547), is designed to measure the relative weights of liquid and solid components in a sample of wet drill cuttings. The method uses a known weight of wet cuttings that is heated in a retort chamber to vaporize the liquids contained in the sample. The high heat of the retort analysis (approximately 930 °F) can break down the micro-encapsulation coating and release the previously sequestered oil droplet. Therefore EPA's proposed requirements for minimizing oil on cuttings and use of the retort method may eliminate the incentive to use the micro-encapsulation technology.

EPA may consider different technology options for these micro-encapsulated cuttings discharges. These options include product substitution of only certain types of drilling fluids available for use in micro-encapsulating systems; different monitoring and sampling requirements for micro-encapsulated discharges; different toxicity tests; and different cuttings retention requirements. Specifically, EPA is proposing that this technology may be more beneficial in combination with other technologies (e.g., product substitution, add-on solids removal equipment) to assist operators in meeting site specific CWA section 403 NPDES permit requirements. As stated previously, switching to less toxic and more biodegradable drilling fluids, reducing the oil on cuttings, and increasing the dispersion of the cuttings is instrumental in preventing build-up of cuttings piles and reducing impacts to the benthic environment. Use of this micro-encapsulation technology to promote cuttings dispersion and further sequester the oil on cuttings, after use of new solids control equipment, may provide addition environmental protection. EPA is requesting comments and information related to the environmental, technical, and economic performance of this and similar micro-encapsulation technologies and the incentive/disincentive issue with respect to the proposed retention limitation and standard using the retort method as the compliance test method.

B. EPA Data Collection Since Proposal Publication

1. Sediment Toxicity Test Results

Because of the limited data available for the proposal on the sediment toxicity of both the base fluids and whole drilling fluid systems, EPA has begun a study using sediment toxicity test methods to: (1) determine the toxicity of various base fluids and whole synthetic fluid drilling systems on amphipods for purposes of selecting fluids that represent the appropriate level of technology; and (2) evaluate possible sediment toxicity compliance method options. The initial tests conducted in December 1999 at the EPA Gulf Breeze Laboratory evaluated the sediment toxicity of three synthetic base fluids compared to diesel and have consisted of 96-hour and 10-day exposure tests with an IO, a LAO, and an ester as the base fluids as compared to No. 2 diesel oil. At the same time, EPA's contract laboratory, Battelle, also conducted initial sediment toxicity tests on mineral oil and paraffin in addition to the same three synthetic base fluids evaluated by the EPA Gulf Breeze Laboratory.

EPA is currently conducting tests to determine influences of whole fluid compositions and crude oil contamination on the sediment toxicity of an internal olefin (IO), linear alpha olefin (LAO), and ester. Current and previous sediment toxicity tests conducted by EPA have used the ASTM E1367–92 sediment toxicity method supplemented with a sediment preparation procedure (*see* 64 FR 5536: Appendix 3 to Subpart A of Part 435). Table II.B.1.1 summarizes the sediment toxicity data that EPA has collected since proposal.

TABLE II.B.1.1: EPA-COLLECTED LC_{50} SEDIMENT TOXICITY DATA WITH VARIOUS DRILLING BASE FLUIDS FOR TWO DIFFERENT TIME PERIODS

	Drilling base fluid	LC50 (mg/Kg)	95% Confidence interval
EPA Gulf Breeze Laboratory—Generated Data			
96-Hour Test	Internal Olefin	ND	NA
	Linear Alpha Olefin	750	677–930
	Ester	10812	9138–12793
	Diesel	463	426–505
10-Day Test	Internal Olefin	660	423–1029
	Linear Alpha Olefin	419	350–502
	Ester	ND	NA
	Diesel	199	171–232
EPA Contract Laboratory (Battelle)—Generated Data			
96-Hour Test	Internal Olefin	>8000	NA
	Linear Alpha Olefin	2921	2260—3775
	Ester	7686	7158—8253
	Mineral Oil	436	485—391
	Paraffin	2263	1936—2644
10-Day Test	Internal Olefin	2530	2225—2876
	Linear Alpha Olefin	1208	1089—1339
	Ester	4275	3921—4662
	Mineral Oil	176	163—190
	Paraffin	1151	1038—1276

Method Reference: EPA February 1999 Proposal (64 FR 5488).
ND—Not determined; NA—Not applicable.

In addition, EPA is assessing the toxicity potential for degradation by-products. EPA has some information related to SBF by-products (Candler et al., 1995; Getliff et al., 1997; Johnston, 2000a). These data show that aerobic and anaerobic degradation mechanisms for many SBFs (especially linear hydrocarbons) produce by-products that include biodegradable alcohols and fatty acids. Some SBFs, such as linear paraffins, are still the subject of some debate as to their exact mode of biodegradation and associated by-products under anaerobic conditions. In addition, ester-based drilling fluids by-products (e.g., alcohols) may exhibit toxic effects in the water column (Johnston, 2000a). EPA solicits comments and data on whether there are any known persistent or toxic by-products created by the biodegradation of synthetic base fluids. This information will allow EPA to assess the overall environmental impact of using synthetic base fluids.

Finally, as originally stated in the February 1999 proposal (64 FR 5491), EPA may require additional or alternative controls as part of the BAT/NSPS discharge options based on method development and data gathering subsequent to today's notice: (1) Maximum sediment toxicity of drilling fluid at point of discharge (minimum LC_{50}, mL drilling fluid/kg dry sediment by 10-day sediment toxicity test or amended test); (2) maximum aqueous phase toxicity of drilling fluid at point of discharge (minimum LC_{50} by Suspended Particulate Phase (SPP) test (*see* Appendix 2 of Subpart A of Part 435) or amended SPP test); and (3) maximum potential for bioaccumulation of stock base fluid (maximum concentration in sediment-eating organisms). In particular, EPA is interested in controlling the toxicity of SBFs in the sediment and the water column and may require both a sediment toxicity test and an aqueous phase toxicity test to assess overall toxicity.

A more complete review of the sediment toxicity procedures and data can be found in section III.B.(a) of the rulemaking record.

2. Biodegradation Test Results

Because of the limited data available for the proposal on the biodegradation of SBFs, EPA has begun a study using the solid phase biodegradation test, proposed in February 1999, to: (1) determine the biodegradation of various synthetic base fluids for purposes of selecting fluids that represent the appropriate level of technology; and (2) evaluate possible biodegradation compliance options. This project began in January 2000 and results are anticipated to be finalized in March 2000. Table II.B.2.1 summarizes the data collected to date. A more complete review of these procedures and data can be found in section III.B.(a) of the rulemaking record.

TABLE II.B.2.1: EPA SOLID PHASE BIODEGRADATION TEST

	Percent loss relative to day 0					
	Ester (percent)	Paraffin (percent)	Poly (alpha) olefin (percent)	Mineral oil (percent)	Internal olefin (percent)	Linear alpha olefin (percent)
Day 0	0	0	0	0	0	0
Day 14	53	21	22	20	9	8
Day 28	60	19	25	21	18	16

Method Reference: EPA February 1999 Proposal (64 FR 5488).

3. EPA Engineering Data Collection Activities

During the week of October 25, 1999, EPA staff traveled to Texas and Louisiana to observe onshore and offshore equipment used for treating and disposing of SBF and SBF-cuttings. Highlights of the onshore portion of the field trip include visits to an operating cuttings dryer unit, a fracture slurry injection facility, and a barge facility on the GOM intercoastal waterway.

Offshore highlights included visits to two oil and gas drilling operations to observe waste management and pollution prevention practices. EPA staff also observed working solids control equipment including cuttings dryers. These cuttings dryers are designed to recover more SBF from cuttings generated by primary and secondary shale shakers. This field trip also included an all day meeting with cuttings dryer equipment vendor representatives and members of industry. Field notes from the site visit and minutes of the all day meeting can be found in section III.B.(a) of the rulemaking record.

EPA also obtained information from the industry primarily related to the per-well aspects of drilling with SBF in three subject areas: (1) Drilling operations; (2) solids control equipment and systems; and (3) costs, in order to better understand current and emerging SBF and SBF-waste management practices.

Finally, EPA collected information from MMS regarding accidental spills of OBFs and SBFs. Spills can release small and large quantities of drilling fluid. In particular, undetected leaking lines can release several hundred barrels of drilling fluid while accidental riser disconnects can release several thousand barrels of whole drilling fluid into the environment. Specifically, EPA is interested in: (1) the occurrences of accidents and events that can cause the release of OBF and SBF whole drilling fluid (e.g., riser disconnects, blow-outs, shallow water flow problems); (2) the number of these accidents and events over the past five years for each MMS region (Alaska, California, GOM); (3) the location of these events (i.e., shallow or deepwater); and (4) the volumes associated with these accidents and events. Preliminary information is that there have been several spills of OBFs over the past five years, but most were small volumes. In addition, MMS data identifies three events, including two riser disconnects, that resulted in significant releases of SBFs into the environment for the months of January and February 2000. Under the zero discharge option EPA assumes that all operators requiring NAF will switch to OBFs. As the toxicity of OBFs is greater than SBFs, EPA will use this spill data as a factor in supporting the selection of a controlled discharge option in the final rule.

A more complete review of the EPA collected engineering data can be found in section III.B.(a) of the rulemaking record.

4. Non-Water Quality Environmental Impacts (NWQI)

The additional cuttings retention data submitted to EPA (*see* section II.A.4) were used in the revision of the engineering models that form the basis for all per-well numeric compliance analyses. Based on changes in the engineering models described below in section III.A, EPA revised the numeric NWQIs of fuel usage, air emissions, and solid waste generation.

The U.S. Department of Energy (DOE) collected information about currently operating onshore commercial disposal facilities that are permitted to receive offshore drilling wastes. The Argonne National Laboratory (DOE) contacted State officials in Louisiana, Texas, California, and Alaska to obtain this information. EPA also identified a list of Louisiana commercial non-hazardous oilfield wastes (NOW) facilities from the Louisiana Department of Natural Resources.

EPA also contacted Alaska, Texas, and Louisiana regulatory agencies to obtain current information concerning management of offshore and coastal exploration and production wastes. The Texas Natural Resource Conservation Commission (TNRCC) provided permit information and waste disposal limitations for the Texas fracture slurry injection facility visited by EPA staff (*see* section II.B.3). The Alaska Oil and Gas Conservation Commission (AOGCC) provided information related to Cook Inlet formation disposal of drilling fluids and cuttings.

EPA also reviewed two papers that detail operations of a large Louisiana onshore fracture slurry injection facility operated by Chevron for Naturally Occurring Radioactive Materials/Non-Hazardous Oilfield Wastes (NORM/NOW) (Baker et al., 1999a; Baker et al., 1999b). Currently, this Chevron facility is limited by its permit to only handle exploration and production wastes from Chevron GOM operations.

EPA also contacted Cook Inlet, Alaska, operators to identify the current and projected use of SBF and the most current waste management options for drill cuttings and fluids. Operators noted that few wells were being drilled with SBF due to NPDES general permit prohibition of SBF discharges. Furthermore, Cook Inlet operators noted that the only drill cuttings and fluid management options available to them are land disposal of cuttings or grinding and injection of the cuttings back into the formation. Land disposal of OBF- and SBF-cuttings was identified as cost prohibitive.

In considering all options for management of non-aqueous fluids (NAF) and NAF-cuttings, EPA is also identifying possible scenarios for cross-media contamination. In particular, EPA is trying to identify former NOW treatment, storage, or disposal facilities that are now CERCLA (or ''Superfund''), RCRA Corrective Action, or State lead cleanup sites. An initial search by EPA identified several such sites including several sites around Abbeville, Louisiana. Accordingly, EPA is requesting additional information related to other sites (Superfund, RCRA Corrective Action, or State lead) that have been contaminated with NOW from offshore operations.

The findings of current onshore waste management options and former NOW facilities that are now cleanup sites outlined in this section are presented in section III.B.(a) of the rulemaking record.

Also subsequent to the proposal, EPA has monetized the human health benefits associated with volatile organic compound (VOC), particulate matter (PM), and sulfur dioxide (SO_2) emission reductions for the two controlled discharge options. The valuation methodology is presented in section III. The results of these revisions are presented in section IV below.

5. Economic Data (including Deep Water Model Wells)

EPA collected information from industry regarding model deepwater project costs for the Gulf of Mexico, produced water treatment costs, wellhead oil and gas prices, and drilling activity forecasts. A summary of the data is provided in section III.G of the rulemaking record.

EPA is developing a methodology to examine the economic and financial impacts of the SBF guidelines on both existing and new deepwater oil and gas projects in response to comments from industry that these projects are vastly different from the projects analyzed as part of the Offshore Oil and Gas Effluent Guidelines economic analysis. At proposal, EPA relied on the results of that latter analysis showing Gulf of Mexico projects to be only minimally affected by even the most stringent drilling waste option (the zero discharge option). Because of the unique nature of deepwater projects and because of their greater distance from shore, industry believes deepwater projects need to be evaluated for economic impacts resulting from options considered for the rule.

EPA is thus developing a computer model similar to the one used for the Offshore rule, and also nearly identical to the one developed for the Main Pass operations in the Gulf of Mexico investigated during the Coastal Oil and Gas Effluent Guidelines rule. The general structure of the model is based on the Main Pass Model with a few minor variations [for example, severance tax is not an issue, so this line item is not used (*see* Economic Impact Analysis of Final Effluent Limitations Guidelines and Standards for the Coastal Subcategory of the Oil and Gas Extraction Point Source Category, Appendices A and B, EPA–821–R–96–022)].

The major differences of this model compared to the Main Pass model are the inputs. EPA investigated a number of deepwater projects for use as model projects. These projects included all currently operating projects, as well as a number that should come on line shortly. Over 30 projects fit this description. From these initial projects, EPA selected as many as possible to use in modeling deepwater projects. Data availability was the primary criterion used in selecting the model projects. EPA selected all deepwater projects for analysis that operated in 1998 and that had original proved reserves data available in public documents. The most recent publicly available documents on proved reserves are those provided by MMS on its website and these documents are current through December 31, 1996. Proved reserves are used to distinguish the relative size of projects, since the indication of the ultimate size of a project is reserves, not necessarily the current production (new projects that have not completed the maximum number of wells that would be productive at any one time would end up classified as smaller than they will eventually become). Size of project is important, since results will be reported over a group of projects (i.e, results for small, medium, and large projects) rather than project-by-project. Size of reserves also allows EPA to determine how many wells might be drilled at a project over time.

Using the data availability criterion, EPA reduced the number of projects that can be modeled to twenty. One project did not operate in 1998, and the others either have not yet started producing, or are so new that original proved reserves had not been calculated for them in December 1996. The twenty projects include four small projects (original proved reserves of 10 million barrels of oil equivalent (BOE) or less, eight medium-size projects (original proved reserves approximately between 10 million and 100 million BOE), and eight large projects (original proved reserves over 100 million BOE). BOE for each project is the sum of the oil (42 gal. oil = 1 BOE) and natural gas (1,000 scf = 0.178 BOE). To model new projects, however, five of the twenty projects were dropped from the analysis as being too old or as using construction technologies unlikely to be used in the future. The remaining 15 projects generally had been producing less than 5 years in 1998.

Other information was obtained either from industry contacts or was based on data developed by EPA and used either in analyzing the economic impacts of the Offshore or Coastal Subcategory Oil and Gas Effluent Guidelines. Section III.G of the rulemaking record provides data on projects used to model deepwater projects as well as assumptions and sources of data for the oil and gas financial model.

6. Environmental Assessment Data

a. Water and Sediment Quality Criteria. Subsequent to conducting water quality analyses for the Environmental Assessment (EA) for the proposed rule, EPA published its revised recommended water quality criteria for arsenic (deletion of human health criterion); copper (increased from 2.4 µg/l to 4.8 µg/l and 3.1 µg/l for acute and chronic aquatic community criteria, respectively); mercury (increased from 0.025 µg/l to 0.94 µg/l for chronic aquatic community criterion), and phenol (deletion of human health criterion) in the **Federal Register** (December 10, 1998; 63 FR 68354). In addition Alaska promulgated new State water quality standards for toxic pollutants on May 27, 1999 (*see* Alaska Administrative Code, Title 18, Chapter 70 or section III.F.(a).2 of the rulemaking record). These deletions and corrections are incorporated in revisions to the analyses of water column, pore water, and sediment guidelines quality outlined in the February 1999 Environmental Assessment Document (EPA–821–B–98–019).

b. *Dilution Data.* The same model used in the February 1999 proposal, Brandsma (1996), was used in this notice to estimate the concentration of synthetic fluids within the water column for assessment of attainment with recommended water quality criteria. These revised dilution calculations are used for the water column water quality analyses and for the calculations of exposure concentrations for the health benefits analyses.

c. *Review of the Seabed Surveys.* In response to comments and new data received, EPA revised the Seabed Survey portion of the Environmental Assessment. All of the studies presented in the original EA were re-analyzed to correct omissions and errors identified by commenters. One additional study was submitted by a commenter, BP Amoco, entitled Deepwater Sampling at a Synthetic Drilling Mud Discharge Site on the Outer Continental Shelf, Northern Gulf of Mexico (Fechhelm et al., 1999). EPA reviewed this study which investigated the deepwater benthic effects of a SBF (90% linear-alpha olefins and 10% esters) discharge and added relevant data to the EPA EA analyses.

EPA EA models use a mean of SBF sediment concentrations from various seabed surveys found in the literature. EPA updated the mean SBF sediment concentration (at 100m from the modeled discharge) from 13,892 mg/kg to 14,741 mg/kg to incorporate new data identified in the BP Amoco benthic study.

d. *Receipt of the United Kingdom Offshore Operators Association (UKOOA) Research Reports.* In June 1998, UKOOA, supported by the Oil Industry International Exploration and Production Forum (E & P Forum) and in co-operation with the Norwegian oil association (OLF), launched an initiative to tackle the historical legacy of accumulated drill cuttings beneath offshore installations in the North Sea. Many of these North Sea cuttings piles were generated from the practice of discharging cuttings from multiple wells into a single deposition point. These drilling operations also used OBFs which contain a high PAH content. The ultimate goal of the UKOOA research is to identify the best environmental practice and the best techniques available for managing these accumulations.

Immediately prior to publication of this notice, EPA acquired several reports related to the UKOOA industry research activities in the North Sea. These UKOOA reports are based on literature review and field studies. Specifically, EPA received UKOOA reports related to cuttings pile toxicity, faunal colonization of cuttings piles, contaminant leaching from drill cuttings piles, and natural degradation and estimated recovery time-scale.

EPA plans to incorporate the relevant major findings and conclusions into the final EPA SBF Environmental Assessment document and analyses. Specifically, EPA plans on using relevant North Sea data in assessing its method alternatives for determining sediment toxicity, biodegradation, and bioaccumulation. Moreover, EPA plans to incorporate relevant data from North Sea field studies into assessing the various discharge and zero discharge options for SBF-wastes. Section III.B.(a) of the rulemaking record gives summary of the data collected to support the EPA SBF Environmental Assessment.

III. Revised Models

A. Revised Engineering Models

1. Large Volume Discharges

Through discussions with stakeholders and the October 1999 site visits to offshore drilling operations, EPA has obtained more information about current and emerging solids control practices. Regarding current practices, EPA has re-evaluated its model of the ''standard'' or ''baseline'' solids control system. The baseline model presented in the February 1999 proposal consisted of a primary shale shaker that discharges cuttings and a secondary shale shaker that discharges fine-particle cuttings (referred to as ''fines'').

Since proposal, EPA learned that cuttings are discharged from both primary and secondary shale shakers, and that fines are generated from additional equipment such as high-speed shale shakers (called ''mud cleaners'') and centrifuges whose purpose is to treat the drilling fluid by removing undesirable fine solids. These fines were reported by one industry commenter on the February 1999 proposal to have SBF cuttings retention values as high as 20 percent by weight.

Therefore, the revised baseline model consists of primary and secondary shale shakers, plus a ''fines removal unit'' that may be either a mud cleaner or a centrifuge. Discharges from the baseline model system consist of cuttings from the primary shale shaker, cuttings from the secondary shale shaker, and fines from the fines removal unit. Based on data provided in the spreadsheets submitted by industry representatives, the baseline model volume fractions of the three discharges, expressed as percentages of the total volume of all cuttings discharged from the baseline model well, are 78.5% for the primary shakers, 18.5% for the secondary shakers, and 3% for the fines removal unit.

EPA received sufficient additional cuttings retention data from GOM sources to re-evaluate the discharges of these three units and to calculate a revised baseline long-term average retention value of 11.4% by weight of SBF on cuttings. Despite the revision of the retention data and the model baseline system, the revised long-term average retention value is only slightly higher than the 11% originally calculated for the proposal, providing further confidence in the accuracy of the baseline model and associated data.

Since the February 1999 proposal, the GOM offshore drilling industry has increased its use of ''add-on'' cuttings drying equipment, ''cuttings dryers,'' to reduce the amount of SBF adhering to the cuttings prior to discharge. Specifically, over twenty GOM SBF well projects utilized these cuttings dryers in the recent past to reduce the amount of SBF discharged (Johnston, 2000a). Current data available to EPA indicates that these cuttings dryers can operate consistently and efficiently when properly installed and maintained. Specifically, vendor supplied data associated with these cuttings dryer deployments suggest that the overall cuttings dryer downtime (i.e., time when cuttings dryer equipment is not operable) is approximately one percent of the overall operating time (Johnston, 2000a).

At the time of the February 1999 proposal, EPA had obtained retention data from only one such add-on technology, namely the Mud-10 vibrating centrifugal dryer. Since then, EPA has observed the operation of another drying technology, generally referred to as a vertical centrifuge dryer. The vertical centrifuge dryer unit serves the same purpose and occupies the same location in the treatment train as the Mud-10 unit. EPA generically refers to the Mud-10 unit and the vertical centrifuge dryer as the ''cuttings dryer.''

Immediately prior to publication of this notice, EPA also received limited cuttings retention data from a third type of add-on equipment referred to as a ''squeeze press'' mud recovery unit. When installed, the squeeze press mud recovery unit occupies the same location as the above-mentioned cuttings dryers and serves to reduce the amount of SBF adhering to the cuttings prior to discharge. The specific data for the squeeze press were received too late to include in the statistical determination of retention values for today's notice. However, these data are included in the public record for the rule and EPA solicits comments on them (Johnston, 2000b). These data, along with additional retention data received from other industry sources, will be evaluated and included in the appropriate engineering and statistical analyses used to support the cuttings retention limitation in the final rule.

Most cuttings dryer applications include a centrifuge or mud cleaner in the treatment train, to serve the same purpose as the fines removal unit in the baseline system (i.e., to remove undesirable fine solids from the drilling fluid recovered by the cuttings dryer). Therefore, EPA's revised model of BAT/NSPS-level solids control includes primary and secondary shale shakers that send all their cuttings to a cuttings dryer, followed by a fines removal unit. There are two discharges from the BAT/NSPS-level model solids control system: one from the cuttings dryer and one from the fines removal unit. The BAT/NSPS-model volume fractions of the two discharges, expressed as percentages of the total volume of all cuttings discharged from the BAT/NSPS-model well, are 97% for the cuttings dryer and 3% from the fines removal unit. EPA, however, solicits more volume fraction data to further refine its baseline and BAT/NSPS discharge models.

For today's notice, EPA evaluated two different scenarios based on the above BAT/NSPS-model solids control system. The first scenario assumes that both the cuttings from the cuttings dryer and the fines from the fines removal unit are discharged. This first BAT/NSPS-model scenario is essentially unchanged from the BAT/NSPS-model presented at the February 1999 proposal. The long-term average SBF cuttings retention value for this first BAT/NSPS-model scenario is 2.68% by weight. This new long-term average cuttings retention value is lower than the February 1999 proposal BAT/NSPS-model long-term average cuttings retention value of 7% by weight. The difference is attributable to the replacement of the North Sea data with data from recent GOM drilling projects. The second BAT/NSPS-model scenario assumes that only the cuttings are discharged, and the fines, which represent a comparably smaller volume of waste, are retained for zero discharge via hauling to shore for land-based disposal. Therefore, the long-term average cuttings retention value for this second BAT/NSPS-model scenario is equal to the retention value for the cuttings dryer, 2.45% by weight.

At this time, EPA thinks that data from the GOM are adequate to represent field conditions throughout the United States. These data include variations in geological formations, drilling conditions, and rates of penetration. However, EPA is still requesting cuttings retention data from offshore and coastal drilling operations that use SBFs. In particular, EPA is requesting SBF cuttings retention data from United States offshore or coastal oil and gas exploration and production facilities operating outside of the GOM. If EPA does not receive additional non-GOM data, EPA is comfortable with applying the GOM data to other offshore and coastal regions in the United States.

The analyses for compliance costs, pollutant loadings, and numeric non-water quality environmental impacts are based on the volumes of waste solids and adhering drilling fluid estimated to be discharged from each of four model wells. The model wells are defined in terms of four categories: deep water (i.e., ≥1000 ft) development, deep water exploratory, shallow water (i.e., <1000 ft) development and shallow water exploratory. While the model well sizes are unchanged, the volumes of adhering drilling fluid were revised based on the revised retention values. Based on further communication since the February 1999 proposal with industry about current and future drilling plans in the GOM, California, Alaska, and North Carolina, the numbers of each type of model well drilled annually are also unchanged. EPA is, however, requesting more data detailing the annual number of shallow water and deep water SBF-wells. EPA is also requesting data on the conditions and frequency when SBFs are chosen over water-based drilling fluids, when both drilling fluids are technically acceptable for drilling (i.e., some shallow water wells).

EPA also re-evaluated the zero-discharge option using the updated baseline retention data. The only notable change in the approach to the zero-discharge analysis is the distribution of wells using land-based disposal versus wells using onsite injection. The original analysis assumed that 80% of the affected wells would use land-based disposal and 20% would use onsite injection. While this assumption remains applicable to shallow water wells, EPA learned from industry sources that onsite injection is currently less applicable to deep water wells, due to limitations of mechanical equipment, geology, and well placement. Therefore, the zero discharge analysis now assumes that all deep water wells will haul cuttings to shore for land-based disposal. As zero discharge remains a proposed management option, EPA is requesting additional data and information related to what drilling fluids and waste management practices operators will likely use and the overall impact on the annual number of drilling projects if EPA selects the zero discharge management option for SBFs.

The current engineering cost analysis also assigns the installation and downtime costs to every well. However, EPA recognizes that it is likely that multiple wells would be drilled from a single installation, thereby reducing the effect of the installation cost on each well's total compliance cost. It is also likely that some drilling rigs will purchase and permanently install cuttings dryers and fines removal units, further reducing the effect of installation costs on any one well. The data EPA has gathered to date are limited in this regard. Therefore, EPA requests additional information pertaining to the average number of wells drilled annually with SBF per platform, and the number of platforms capable of permanently installing cuttings dryers and fines removal units.

Details of the revised engineering models are provided in a technical support document in section III.C.(b) of the rulemaking record.

2. Small Volume Discharges

In its study of current solids control practices, EPA learned that SBF is controlled with zero discharge practices at the drill floor, in the form of vacuums and sumps to retrieve spilled fluid. EPA also learned that approximately 75 barrels of solids coated with SBF can accumulate in the dead spaces of the mud pit, sand trap, and other equipment in the drilling fluid circulation system. Current practice is to either wash these solids out with water for overboard discharge, or to retain the waste solids for disposal.

Since zero discharge practices at the drill floor during drilling are the current practice, no additional costs were considered for controlling spills of SBF at this location. However, EPA did investigate options for controlling the discharges of accumulated solids generated by equipment cleaning procedures at the end of a drilling project. Assuming that every drilling project generates approximately 75 barrels of these small-volume waste accumulated solids, the costs vary only by: (1) geographic region; and (2) the numbers of wells in each regulatory scenario. EPA used the line-item costs developed for the zero discharge compliance cost analysis to calculate per-well and total costs for existing and new sources to dispose of accumulated solids via hauling to land based disposal facilities. The industry-wide costs resulting from this analysis are given below in section IV, Table IV.A.2.1.

B. Revised Economic Models

EPA plans to use the same methodologies in analyzing firm-level impacts used at proposal, but will update information to include at a minimum 1998 financial data as well as 1997 financial data. The year 1998 was not a good year for the oil and gas industry, whereas 1997 was a good year, so these two years should provide some sense of the volatility of the industry. EPA still expects that the impact on firms will be minimal, even given the difficult year the industry had in 1998. Additionally, EPA will use the same methodology for the small business analysis that was used at proposal. EPA does not expect the analysis to change significantly from proposal because: (1) Costs have not changed substantially; (2) only a few small operators are believed to be using SBFs; and (3) very few wells are drilled by small operators in a year.

Instead of relying on the Offshore Oil and Gas Effluent Guidelines EIA to provide a sense of financial impact at the facility level, however, EPA is changing the approach to allow deepwater projects to be modeled financially, as discussed in section II.

At the time of this notice, EPA believes that economic impacts from even the most stringent option (*i.e.,* zero discharge of SBFs) will have only minimal influence on most deepwater projects. However, as zero discharge remains a proposed management option, EPA is requesting additional data and information related to whether or not the selection of the zero discharge management option for SBFs will affect the overall annual number of drilling projects in deep and shallow waters in the United States. Further technical details are presented in supporting documentation in section III.G of the rulemaking record, which discusses potential impacts on typical, or average, deepwater projects.

However, because averages can obscure the effects at the most vulnerable projects, EPA will be looking closely at the potential for option costs to cause any measurable impacts at projects that do not conform to the parameters of the average project using the financial model. Although model outputs will be reported in the aggregate by project size, each individual project will be represented in the model inputs to allow EPA to identify impacts more precisely.

The projects likeliest to show some potential for impact are the smallest projects (both existing and new, if the existing projects continue to drill), the oldest existing projects (such as Lena and Cognac, which have produced over 80 percent of their original proved reserves as of 1996), or very marginal projects. Because any project could be marginal when all the factors are accounted for, even the relatively small cost of the SBF rule could have an impact on one or more projects, although, at this time, EPA believes this possibility is small.

C. Revised Environmental Assessment (EA) Models

Revisions to the regulatory options such as the revised retention on cuttings values and the addition of another controlled discharge option has resulted in changes in the SBF environmental assessment. The retention on cuttings affects both the pollutant loadings and the volume of waste discharged, thereby affecting the water quality, sediment quality and human health impacts. EPA has therefore re-iterated the various EA analyses and the results are presented in section IV below. There are, however, no changes in the EA models as outlined in the February 1999 proposal and the Environmental Assessment Document (EPA–821–B–98–019).

The models developed to calculate the NWQIs of air emissions, fuel usage, and solid waste generation have been revised parallel to the revisions in the engineering models described in section III.A. The revised waste volumes that resulted from new retention data required adjustments of such NWQI model elements as numbers of boat trips, cuttings boxes, and crane lifts. An additional NWQI model was developed for the BAT/NSPS discharge scenario based on 2.45% retention on cuttings. For both of the discharge scenarios, the energy requirements for the cuttings dryer and fines removal units were revised to reflect the newer technologies now accounted for in the engineering models. Finally, the zero discharge model was changed according to the new finding that deep water wells cannot readily utilize onsite injection and, rather, haul cuttings to shore-based disposal facilities.

Also subsequent to the February 1999 proposal, EPA monetized the human health benefits for the two controlled discharge options associated with reducing volatile organic compound (VOC), particulate matter (PM), and sulfur dioxide (SO_2) emissions. The valuation methodology used to conduct the monetized benefits analysis is presented in Environmental Assessment of the Final Effluent Limitations Guidelines and Standards for the Pharmaceutical Manufacturing Industry (EPA–821–B–98–008). The results of these revisions are presented in section IV below.

D. Revised Models for the Performance of Cuttings Treatment Technologies

As stated in the February 1999 proposal, EPA is considering setting limitations and standards for the percent retention of synthetic-based drilling fluids on cuttings that may be discharged from the cuttings dryer and fines removal technologies. EPA received cuttings retention data after the February 1999 proposal (*see* section II.A.4). This section of the notice outlines the revisions made to the statistical models for the performance of cuttings treatment technologies. A summary of the output of these revised models with new data is given in section IV.D.

EPA analyzed cuttings treatment data presented at proposal using well averages where each cuttings retention value is weighted by an associated hole volume. Since publication of the proposed statistical support document in February 1999, EPA incorporated four changes into the statistical methods used to estimate summary statistics which support the development of numeric limitations and standards for the retention of synthetic-based drilling fluids on cuttings. These changes are: (1) Imputation of volume-weighted factors for zero and negative drilling intervals; (2) correction to the estimator for volume-weighted variances; (3) the addition of uniformly-weighted summary statistics; and (4) consideration of the 99th percentile rather than the 95th percentile for the development of numeric limitations and standards for the maximum well averaged percent retention of SBF on cuttings.

EPA generally estimated the volume of cuttings using the drilling interval and the pipe diameter immediately preceding a retention measurement. However, at times, the drilling intervals are reported as zero or negative. A negative drilling interval indicates that the drill pipe has been pulled up to facilitate drilling in a new direction. EPA excluded negative interval data from the proposal. In this report, negative drilling intervals are treated in the same fashion as zero drilling intervals.

At proposal, EPA estimated weighted variances as if the weights could only take on a small number of possible values. However, those weights are based on the volume of cuttings associated with a particular drilling interval and that volume may take on infinitely many values. In this report, EPA estimated weighted variances as if the weights could only take on infinitely many values.

Under the assumption that the retention on cuttings increased with the depth drilled, EPA proposed numeric guidelines and standards using retention values weighted by the volume drilled. However, the graphics showing percent retention versus depth drilled do not indicate that this is true (EPA, 2000). Therefore, EPA has added the use of uniformly-weighted summary statistics as part of EPA's statistical models. With no apparent relationship between depth drilled and percent retention, the uniformly-weighted summary statistics are more appropriate. Basing numeric guidelines and standards on a single type of measurement, as opposed to a combination of multiple types of measurements, will reduce the measurement variability associated with the guidelines and standards. Additional benefits of setting numeric guidelines and standards based on uniformly-weighted summary statistics include eliminating the need to: (1) Calculate the length of interval drilled; (2) impute volumes where zero or negative intervals exist; and (3) use unusual variance estimation procedures. EPA prefers to set numeric guidelines and standards for percent retention based on uniformly-weighted summary statistics as opposed to volume weighted summary statistics.

EPA proposed numeric limitations and standards under the assumption that, on a long-term average basis, good engineering practice would allow appropriately designed and well operated solids control equipment systems to perform at least as well as approximately 95% of the systems whose data were used to develop the limitations and standards. Operationally, cuttings retention values are averaged over the course of drilling an individual well and EPA's candidate BAT limitation or NSPS is the estimated 95th percentile for the available well averages.

The CWA confers considerable discretion in determining what constitutes best available technology and best available demonstrated technology. In exercising this discretion, the Agency has proposed and promulgated limitations and standards that provide for the variability observed in application of these technologies. This allowance provides for variation in the performance of the recommended treatment technologies and establishes a standard that EPA expects well operated treatment systems to be capable of achieving at all times.

Given that there is less experience to date with the application of the cuttings dryer technology than many other candidate BAT and NSPS technologies generally, the Agency is also considering setting numeric limitations and standards based on the 99th percentile. This would provide a larger allowance for treatment variability than is provided by the proposed limitations and standards based on the 95th percentile.

Detailed descriptions of the statistical methods, summary statistics, overall averages, and percentiles associated with each technology can be found in section III.C.(a) of the rulemaking record.

IV. Revised Analyses

A. Revised Compliance Costs Results

1. Large Volume Discharges

Based on the revised engineering models described in section III.A above, EPA revised its calculations of baseline, compliance option, and incremental compliance costs. The industry profile and the methodology for estimating costs that were presented with the proposed rule have not changed for today's notice. The results of the revised compliance cost analyses are presented in Table IV.A.1.1 for existing sources and in Table IV.A.1.2 for new sources.

TABLE IV.A.1.1: SUMMARY ANNUAL COST/SAVINGS, EXISTING SOURCES (1998$/YEAR)

Technology basis	Costs (savings) in 1998$/year [wells/year]			
	Gulf of Mexico [wells/yr]	Offshore California [wells/yr]	Cook Inlet, Alaska [wells/yr]	Total [wells/yr]
Baseline/Current Practice Technology Costs:				
Discharge with 11.4% retention of SBF on cuttings	20,032,850 [94 wells/yr]	NA[a]	NA[a]	20,032,850 [94 wells/yr]
Zero Discharge via land disposal or onsite injection (current OBF-drilled wells only).	3,494,062 [23 wells/yr]	2,287,281 [12 wells/yr]	214,237 [1 well/yr]	5,995,580 [36 wells/yr]
Total Baseline Costs per Area	23,526,912 [117 wells/yr]	2,287,281 [12 wells/yr]	214,237 [1 well/yr]	26,028,430 [130 wells/yr]
Technology Option Costs:				
Discharge with 2.68% retention of SBF on cuttings	20,257,350 [117 wells/yr]	2,463,440 [12 wells/yr]	211,350 [1 well/yr]	22,932,140 [130 wells/yr]
Discharge with 2.45% retention of SBF on cuttings	20,365,837 [117 wells/yr]	2,472,517 [12 wells/yr]	214,672 [1 well/yr]	23,053,026 [130 wells/yr]
Zero Discharge of SBF-wastes via land disposal or onsite injection.	31,666,153[b] [94 wells/yr]	NA[a]	NA[a]	31,666,153 [94 wells/yr]
Incremental Tech. Option Costs (Savings):				
Discharge with 2.68% retention of SBF on cuttings	(3,269,562) [117 wells/yr]	176,159 [12 wells/yr]	(2,887) [1 well/yr]	(3,096,290) [130 wells/yr]
Discharge with 2.45% retention of SBF on cuttings	(3,161,075) [117 wells/yr]	185,236 [12 wells/yr]	435 [1 well/yr]	(2,975,404) [130 wells/yr]

TABLE IV.A.1.1: SUMMARY ANNUAL COST/SAVINGS, EXISTING SOURCES (1998$/YEAR)—Continued

Technology basis	Costs (savings) in 1998$/year [wells/year]			
	Gulf of Mexico [wells/yr]	Offshore California [wells/yr]	Cook Inlet, Alaska [wells/yr]	Total [wells/yr]
Zero Discharge of SBF-wastes via land disposal or on-site injection.	11,633,303[c] [94 wells/yr]	NA[a]	NA[a]	11,633,303 [94 wells/yr]

[a] NA: Not applicable since currently there are no discharges of SBF-cuttings in these waters.
[b] This technology option cost estimates zero discharge costs associated with the 94 GOM wells that are currently allowed to discharge SBF.
[c] This incremental technology option cost only covers the 94 GOM wells that are currently allowed to discharge SBF and does not include baseline compliance costs of zero discharge for the 23 GOM OBF wells (i.e., $3,494,062).

TABLE IV.A.1.2: SUMMARY ANNUAL COST/SAVINGS, NEW SOURCES (1998$/YEAR)

Technology basis	Gulf of Mexico
Baseline/Current Practice Technology Costs:	
Discharge with 11.4% retention of SBF on cuttings	2,306,325
Technology Option Costs:	
Discharge with 2.68% retention of SBF on cuttings	1,388,250
Discharge with 2.45% retention of SBF on cuttings	1,395,913
Zero Discharge of SBF-wastes via land disposal or onsite injection	4,581,838
Incremental Technology Option Costs (Savings):	
Discharge with 2.68% retention of SBF on cuttings	(918,075)
Discharge with 2.45% retention of SBF on cuttings	(910,412)
Zero Discharge of SBF-wastes via land disposal or onsite injection	2,275,513

Note: All cost estimates in this table are based on an assumption of 19 new source wells per year.

Details of the revised compliance cost data and analyses are available in a technical support document in section III.C.(b) of the rulemaking record.

2. Small Volume Discharges

As stated in section III.A.2 of this notice, EPA learned that SBF is controlled with zero discharge practices at the drill floor, in the form of vacuums and sumps to retrieve spilled fluid. Industry estimated that essentially all of the SBF that spills on the rig floor is recovered using the controls described above. The amount of SBF spilled on the rig floor that is not captured by current practices is estimated at less than 1 gallon SBF per 100 feet drilled.

Industry representatives have stated that industry is split on the practice of discharging accumulated solids with some discharging accumulated solids provided permit limitations and standards are met and others opting to haul this material to shore for disposal (*see* section II.B.3). Approximately 75 barrels per well of fine solids and barite, of which up to 25% is SBF, accumulate in the rig mud pits, sand traps, and other equipment. Several hundred barrels (approximately 200 to 400 barrels) of water are used to wash out the mud pits. Industry representatives also indicated to EPA that those oil and gas extraction operations that discharge wash water and accumulated solids first recover free SBF.

EPA used the line-item costs developed for the zero discharge compliance cost analysis to calculate per-well and total costs for existing and new sources to dispose of accumulated solids via hauling to land based disposal facilities. Section III.A.2 outlines the assumptions used to calculate the annual zero discharge costs for small volume wastes given below in Table IV.A.2.1. Overall, the estimated per-well costs (1998$) were $1,221 for GOM wells, $2,186 for Offshore California wells, and $10,638 for Cook Inlet wells.

TABLE IV.A.2.1: ANNUAL ZERO DISCHARGE COSTS FOR SMALL-VOLUME SBF WASTES (1998$/YEAR)

Technology Basis	Gulf of Mexico	California	Cook Inlet, AK	Total
Existing Sources:				
Baseline and BAT/NSPS Discharge Scenarios[a]	$142,857	$26,235	$10,638	$179,730
Zero Discharge[b]	114,774	[d] NA	[d] NA	114,774
New Sources:				
All Scenarios (Baseline, BAT/NSPS Discharge, and Zero Discharge)[c]	23,199	[d] NA	[d] NA	23,199

[a] Costs are the same for baseline and two discharge scenarios because each analysis is based on 117 wells.
[b] Zero discharge costs for existing sources are based on 94 wells.
[c] Costs are the same for all new-source scenarios because each analysis is based on 19 wells.
[d] NA: Not Applicable.

B. Revised Pollutant Loadings Results

EPA reviewed additional information regarding drilling fluid additives provided by the industry representatives in response and subsequent to the February 1999 proposal, and found no information prompting changes to the concentrations or list of pollutants presented at the time of proposal. EPA revised the pollutant loadings analysis according to the changes in the engineering and statistical models described in section III.A and III.D of this notice.

The loadings analysis depends on the estimated volumes of cuttings and SBF discharged per model well for each discharge scenario. Other than adjusting the loadings to the revised waste volumes and revised discharge scenarios, the analysis remains unchanged from the February 1999 analyses. Tables IV.B.1 and IV.B.2 present the revised loadings for existing and new sources, respectively. EPA assumes that operators will switch from OBFs in the current baseline model to SBFs under both SBF controlled discharge options. These tables present the loadings associated with discharges of SBF and entrained fines [e.g., <5 microns (10^{-6} meters)]. EPA also calculated the loadings associated with SBF solids that can be removed by solids control equipment (e.g., >5 microns).

TABLE IV.B.1: SUMMARY ANNUAL SBF POLLUTANT LOADINGS FOR EXISTING SOURCES (LBS/YEAR) [a]

Technology basis	SBF pollutant loadings (reductions) in pounds/year [a] [wells/year]			
	Gulf of Mexico	Offshore California	Cook Inlet, Alaska	Total
Baseline/Current Practice Tech. Loadings:				
Discharge with 11.4% retention of SBF on cuttings	34,364,661 [94 wells/yr]	[b] NA	[b] NA	34,364,661 [94 wells/yr]
Zero Discharge via land disposal or onsite injection (current OBF-drilled wells only).	0 [23 wells/yr]	0 [12 wells/yr]	0 [1 well/yr]	0 [36 wells/yr]
Total Baseline Loadings per Area	34,364,661 [117 wells/yr]	0 [12 wells/yr]	0 [1 well/yr]	34,364,661 [130 wells/yr]
Technology Option Loadings:				
Discharge with 2.68% retention of base fluid on cuttings	7,328,175 [117 wells/yr]	466,072 [12 wells/yr]	26,413 [1 well/yr]	7,820,660 [130 wells/yr]
Discharge with 2.45% retention of base fluid on cuttings	6,464,827 [117 wells/yr]	411,167 [12 wells/yr]	23,302 [1 well/yr]	6,889,295 [130 wells/yr]
Zero Discharge of SBF-wastes via land disposal or onsite injection.	0 [94 wells/yr]	[b] NA	[b] NA	0 [94 wells/yr]
Increm. Tech. Opt. Loadings (Reductions):				
Discharge with 2.68% retention of base fluid on cuttings	(27,036,486) [117 wells/yr]	466,072 [12 wells/yr]	26,413 [1 well/yr]	(26,544,001) [130 wells/yr]
Discharge with 2.45% retention of base fluid on cuttings	(27,899,834) [117 wells/yr]	411,167 [12 wells/yr]	23,302 [1 well/yr]	(27,465,365) [130 wells/yr]
Zero Discharge of SBF-wastes via land disposal or onsite injection.	(34,364,661) [94 wells/yr]	[b] NA	[b] NA	(34,364,661) [94 wells/yr]

[a] SBF pollutant loadings only includes loadings associated with discharges of SBF and entrained fines (e.g., < 5 microns)
[b] NA Not Applicable

TABLE IV.B.2: SUMMARY ANNUAL POLLUTANT LOADINGS FOR NEW SOURCES (LBS/YEAR) [a]

Technology basis	Gulf of Mexico
Baseline/Current Practice Technology Loadings:	
Discharge with 11.4% retention of SBF on cuttings	3,949,786
Technology Option Loadings:	
Discharge with 2.68% retention of SBF on cuttings	745,855
Discharge with 2.45% retention of SBF on cuttings.	657,981
Zero Discharge of SBF-wastes via land disposal or onsite injection	0
Incremental Technology Option Loadings (Reductions):	
Discharge with 2.68% retention of SBF on cuttings	(3,203,931)
Discharge with 2.45% retention of SBF on cuttings.	(3,291,805)
Zero Discharge of SBF-wastes via land disposal or onsite injection	(3,949,786)

Note: All loading (reduction) estimates in this table are based on an assumption of 19 new source wells/yr.
[a] Only includes loadings associated with discharges of SBF and entrained fines (e.g., <5 microns)

The zero discharge option also reduces the amount of SBF-solids [i.e., solids that can be removed by solids control equipment (e.g., >5 microns)] from the current baseline. The estimated annual baseline discharges of SBF-solids from existing sources is 126,321,650 lbs./year. The estimated annual loadings (in lbs./year) of SBF-solids for existing sources are: 152,240,270 (2.68% retention controlled discharge option); 147,673,062 (2.45% retention controlled discharge option); and 0 (zero discharge option). The estimated annual baseline discharge of SBF-solids from new sources is 14,519,050 lbs./year. The estimated annual loadings (in lbs./year) of SBF-solids for new sources are: 14,519,050 (2.68% retention controlled discharge option); 14,083,488 (2.45% retention controlled discharge option); and 0 (zero discharge option). Complete details of the loadings analysis are available in a technical support document in the rulemaking record for this notice.

C. Revised Non-Water Quality Environmental Impacts (NWQI) Results

1. Air Emissions and Fuel Usage

EPA revised the analysis of the numeric NWQIs of air emissions and fuel usage pursuant to the changes in the engineering models described in section III.A of today's notice. Changes to the numeric NWQI analysis derive from the revised waste volumes, as well as changes in the BAT/NSPS discharge scenarios.

In both the first and second BAT/NSPS discharge scenarios, additional air emissions and fuel usage result from the addition of the fines removal unit. Both scenarios also incorporate the average energy and fuel requirements of the two types of cuttings dryer that EPA observed in October 1999 (*see* section II.B.3). In the second BAT/NSPS discharge scenario in which the fines waste stream is retained for shipping to land-based disposal, additional air emissions and fuel usage are incurred for a portion of the supply boat trip, and for trucks and other equipment involved in the land disposal zero discharge scenario.

As described in section III.A, EPA learned from industry representatives that onsite injection is not generally technologically practicable for deep water drilling projects. Therefore, NWQIs attributable to hauling and land disposing drilling wastes were assigned to all deep water wells in the zero discharge analysis. Tables IV.C.1 and IV.C.2 present the revised air emissions (tons/yr) and fuel (BOE/yr) usage for existing and new sources, respectively.

Other than the specific changes described above, the methodology for the numeric NWQI analysis is unchanged since the February 1999 proposal. Details of this analysis are available in a technical support document located in the rulemaking record for this notice.

TABLE IV.C.1: SUMMARY ANNUAL NON-WATER QUALITY ENVIRONMENTAL IMPACTS, EXISTING SOURCES

Technology basis	Non-water quality environmental impacts reductions (increases) [wells/year—wpr]							
	Gulf of Mexico		Offshore California		Cook Inlet, AK		Total	
	Air emissions (tons/yr)	Fuel usage (BOE/yr)	Air emissions (tons/yr)	Fuel usage (BOE/yr)	Air emissions (tons/yr)	Fuel usage (BOE/yr)	Air emissions (tons/yr)	Fuel usage (BOE/yr)
Baseline/Current Practice NWQIs:								
Discharge with 11.4% retention of base fluid on cuttings.	42 [94 wpy]	4,512 [94 wpy]	[a]NA	[a]NA	[a]NA	[a]NA	42 [94 wpy]	4,512 [94 wpy]
Zero Discharge (current OBF-wells only).	65 [23 wpy]	4,811 [23 wpy]	47 [12 wpy]	2,940 [12 wpy]	2.5 [1 wpy]	338 [1 wpy]	115 [36 wpy]	8,089 [36 wpy]
Total Baseline NWQIs per Area.	107 [117 wpy]	9,323 [117 wpy]	47 [12 wpy]	2,940 [12 wpy]	2.5 [1 wpy]	338 [1 wpy]	157 [130 wpy]	12,601 [36 wpy]
Technology Option NWQIs:								
Discharge with 2.68% retention of SBF on cuttings.	127 [117 wpy]	10,422 [117 wpy]	7.6 [12 wpy]	673 [12 wpy]	0.06 [1 wpy]	40 [1 wpy]	135 [130 wpy]	11,135 [130 wpy]
Discharge with 2.45% retention of SBF on cuttings.	191 [117 wpy]	15,685 [117 wpy]	52 [12 wpy]	853 [12 wpy]	0.20 [1 wpy]	67 [1 wpy]	243 [130 wpy]	16,605 [130 wpy]
Zero Discharge of SBF-wastes via land disposal or onsite injection.	561 [94 wpy]	39,702 [94 wpy]	[a]NA	[a]NA	[a]NA	[a]NA	561	39,702 [94 wpy]
Incr. Tech. Opt. NWQI Red. (Incr.):								
Discharge with 2.68% retention of SBF on cuttings.	20 [117 wpy]	(1,099) [117 wpy]	40 [12 wpy]	2,267 [12 wpy]	2.45 [1 wpy]	298 [1 wpy]	22 [130 wpy]	1,466 [130 wpy]
Discharge with 2.45% retention of SBF on cuttings.	(84) [117 wpy]	(6,362) [117 wpy]	(4.8) [12 wpy]	2,087 [12 wpy]	2.31 [1 wpy]	271 [1 wpy]	(87) [130 wpy]	(4,004) [130 wpy]
Zero Discharge of SBF-wastes via land disposal or onsite injection.	(519) [94 wpy]	(35,191) [94 wpy]	[a]NA	[a]NA	[a]NA	[a]NA	(519) [94 wpy]	(35,191) [94 wpy]

Note: 1 ton = 2000 lbs; BOE = barrels of oil equivalent
[a] NA: Not Applicable

TABLE IV.C.2: SUMMARY ANNUAL NON-WATER QUALITY ENVIRONMENTAL IMPACTS, NEW SOURCES

Technology basis	Gulf of Mexico	
	Air emissions (tons/yr)	Fuel usage (BOE/yr)
Baseline/Current Practice Technology NWQIs:		
Discharge with 11.4% retention of SBF on cuttings	4.8	515
Technology Option NWQIs:		
Discharge with 2.68% retention of SBF on cuttings	13	1,073
Discharge with 2.45% retention of SBF on cuttings.	23	1,923
Zero Discharge of SBF-wastes via land disposal or onsite injection	68	4,784
Incremental Technology Option NWQIs Reductions (Increases):		
Discharge with 2.68% retention of SBF on cuttings	(8.2)	(558)
Discharge with 2.45% retention of SBF on cuttings.	(18)	(1,408)
Zero Discharge of SBF-wastes via land disposal or onsite injection	(63)	(4,269)

Note: All NWQI reductions (increases) in this table are based on an assumption of 19 new source wells/yr
Note: 1 ton = 2000 lbs; BOE = barrels of oil equivalent

2. Solid Waste Generation and Management

EPA assumes that based on the relative cheaper cost of OBF (approximately 5 times less expensive per barrel than SBFs), operators will use OBFs rather than SBFs if EPA selects the zero discharge option for all SBF-wastes. Consequently, operators will be land disposing or injecting OBFs if EPA selects the zero discharge option for all SBF-wastes.

As stated in the February 1999 proposal, the regulatory options considered for this rule will not cause generation of additional solids. However, EPA calculated the amount of waste cuttings that would be land disposed and injected onsite in each regulatory scenario, and determined that there would be a considerable reduction in the amount of mineral-oil or diesel oil-contaminated cuttings land disposed and injected with the implementation of either of the controlled discharge options.

Applying the revised waste volumes and discharge scenarios described above, the accounting of disposed waste is revised as follows. In the baseline analysis, wells that currently drill using OBFs generate 27 million (MM) pounds of waste cuttings that are land disposed, and 6.8 MM pounds that are injected onsite, for a total of 34 MM pounds of waste cuttings disposed. This amount of disposed waste would be reduced to zero under the BAT/NSPS options allowing discharge at 2.68% retention, and would be reduced to 6.4 MM pounds under the BAT/NSPS option allowing discharge at 2.45%. The 6.4 MM pounds disposed in the second discharge scenario is the fine particle waste retained for hauling to land based disposal. Under the zero discharge option, the baseline amount of waste disposed is increased to 152 MM pounds.

3. Safety Issues

The impact of the effluent limitation guidelines (ELG) on safety is one factor considered in the non-water quality environmental impact analysis. EPA has identified two safety issues related to drilling fluids: (1) deleterious vapors generated by organic materials in drilling fluids; and (2) waste hauling activities that increase the risk of injury to workers. EPA is requesting comments and data related to these two safety issues as well as other safety issues related to drilling fluid selection and waste management.

a. *Vapors Generated by Organic Materials in Drilling Fluids.* One of the key concerns in exploration and production projects is the exposure of wellsite personnel to vapors generated by organic materials in drilling fluids (Candler et al., 1995). Areas on the drilling location with the highest exposure potentials are sites near solids control and open pits. These areas are often enclosed in rooms and ventilated to prevent unhealthy levels of vapors from accumulating. If the total volume of organic vapors can be reduced then any potential health effects will also be reduced regardless of the nature of the vapors.

Generally speaking the aromatic fraction of the vapors is the most toxic to the mammalian system. The high volatility and absorbability through the lungs combined with their high lipid solubility serve to increase their toxicity. OBFs have a high aromatic content and vapors generated from using these drilling fluids include aromatics (e.g., alkybenzenes, naphthalenes, and alkyl-naphthalenes), alkanes (e.g., C_7–C_{18} straight chained and branched), and alkenes. Some minerals oils also generate vapors that contain the same types of chemical compounds, but generally at lower concentrations, as those found in the diesel vapors (e.g, aromatics, alkanes, cyclic alkanes, and alkenes). Because SBF are manufactured from compounds with specifically defined compositions, the subsequent compound can exclude toxic aromatics. Consequently, toxic aromatics can be excluded from the vapors generated by using SBFs.

In general, SBFs (e.g., esters, LAOs, PAOs, IOs) generate much lower concentrations of vapors than do OBFs (Candler et al., 1995). Moreover, the vapors generated by these SBFs are less toxic than traditional OBFs because they do not contain aromatics.

b. *Waste Hauling Activities.* Industry has commented in previous effluent guidelines, such as the Coastal Subcategory Oil and Gas Extraction and Development ELG, that a zero discharge requirement would increase the risk of injury to workers due to increased waste hauling activities. These activities include vessel trips to and from the drilling platform to haul waste, transfer of waste from the platform onto a service vessel, and transfer in port onto a barge or dock.

EPA has identified and reviewed additional data sources to determine the likelihood that imposition of a zero discharge limitation on cuttings contaminated with SBF could increase risk of injury due to additional waste hauling demands. The sources of safety data are the U.S. Coast Guard (USCG), the Minerals Management Service (MMS), the American Petroleum Institute (API), and the Offshore Marine Service Association (OMSA). The following is a summary of the findings from this review.

The data indicate that there are reported incidents that are associated with the collection, hauling, and onshore disposal of wastes from offshore. However, the data do not distinguish whether any of these incidents can be attributed to specific waste management activities.

Most offshore incidents are due to human error or equipment failure. The rate at which these incidents occur will not be changed significantly by increased waste management activities. However, if the number of man hours and/or equipment hours are increased, there will be more reportable incidents given an unchanged incident rate. These potential increases may be offset by reduced incident rates through increased training or equipment maintenance and inspection; but these changes cannot be predicted. One indication that training and maintenance can reduce incident rates is a 1998 API report entitled ''1997 Summary of U.S. Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry,'' which established that injury incident rates have been decreasing over the last 14 years. If this decrease continues, there should be no increase in the number of safety incidents due to a requirement to haul SBF-contaminated cuttings to shore for disposal. The details of this analysis are available in a technical support document in the rulemaking record for today's notice.

4. Monetized Health Benefits

EPA estimated emissions associated with each of the regulatory options as part of the NWQI analyses. The pollutants considered in the NWQI analyses are nitrogen oxides (NO_X), volatile organic carbon (VOC), particulate matter (PM), sulfur dioxide (SO_2), and carbon monoxide (CO). Of these pollutants, EPA has monetized the human health benefits or impacts associated with VOC, PM, and SO_2 emissions using the methodology presented in the Environmental Assessment of the Final Effluent Limitations Guidelines and Standards for the Pharmaceutical Manufacturing Industry (EPA–821–B–98–008). Each of these pollutants have human health impacts and reducing these emissions can reduce these impacts.

Several VOCs exhibit carcinogenic and systemic effects and VOCs, in general, are precursors to ground-level ozone, which negatively affects human health and the environment. PM impacts include aggravation of respiratory and cardiovascular disease and altered respiratory tract defense mechanisms. SO_2 impacts include nasal irritation and breathing difficulties in humans and acid deposition in aquatic and terrestrial ecosystems.

The unit values (in 1990 dollars) are $489 to $2,212 per megagram (Mg) of VOC; $10,823 per Mg of PM; and $3,516 to $4,194 per Mg of SO_2. Using the Engineering News Record Construction Cost Index (*see* www.enr.com/cost/costcci.asp) these conversion factors are scaled up using the ratio of 5920:4732 (1998$:1990$). EPA currently does not have unit values for CO and NO_X and is soliciting information regarding their valuation. Following is a summary of the monetized benefits for each of the regulatory options for both existing and new sources.

TABLE IV.C.3: SUMMARY OF MONETIZED HUMAN HEALTH BENEFITS OR IMPACTS ASSOCIATED WITH VOC, PM, AND SO_2 EMISSIONS, EXISTING SOURCES (1998$/YR)

	Criteria air pollutant		
	VOC	PM	SO_2
Baseline/Current Practice Air Emissions, Mg/yr:			
Discharge with 11.4% retention of SBF on cuttings	2.15	1.87	1.74
Zero Discharge (current OBF wells only)	9.57	1.93	1.68
Total Baseline Air Emissions, Mg/yr	11.72	3.80	3.42
Compliance Air Emissions, Mg/yr:			
(1) Discharge with 2.68% retention of SBF on cuttings	6.90	5.98	5.57
(2) Discharge with 2.45% retention of SBF on cuttings	25.68	9.65	8.45
(3) Zero Discharge [a]	113.84	20.96	18.42
Incremental Compliance Emission Reductions (Increases), Mg/yr:			
(1) Discharge with 2.68% retention of SBF on cuttings	4.82	(2.18)	(2.15)
(2) Discharge with 2.45% retention of SBF on cuttings	(13.96)	(5.85)	(5.03)
(3) Zero Discharge [a]	(11.69)	(19.09)	(16.68)
Unit Value of Poll. Reductions, 1990$/Mg: [b]	489 to 2,212	10,823	3,516 to 4,194
Unit Value of Poll. Reductions, 1998$/Mg: [c]	612 to 2,767	13, 540	4,399 to 5,247
Incremental Compliance Benefits (Costs), 1998$/yr:			
(1) Discharge with 2.68% retention of SBF on cuttings	2,950 to 13,337.	(29,517)	(9,458) to (11,281)
(2) Discharge with 2.45% retention of SBF on cuttings	(8,544) to (38,627).	(79,209)	(22,127) to (26,392)
(3) Zero Discharge [a]	(68,354) to (309,046).	(258,479)	73,375) to (87,520)

[a] Via land disposal or on-site offshore injection
[b] Conversion factors from Environmental Assessment of the Final Effluent Limitations Guidelines and Standards for the Pharmaceutical Manufacturing Industry¢ (EPA–821–B–98–008).
[c] Scaled from 1990$ using the Engineering News Record Construction Cost Index.

TABLE IV.C.4: SUMMARY OF MONETIZED HUMAN HEALTH BENEFITS OR IMPACTS ASSOCIATED WITH VOC, PM, AND SO_2 EMISSIONS, NEW SOURCES (1998$/YR)

	Criteria air pollutant		
	VOC	PM	SO2
Baseline/Current Industry Practice Air Emissions, Mg/yr:			
Discharge with 11.4% retention of SBF on cuttings.	0.25	0.21	0.20
Compliance Air Emissions, Mg/yr:			
(1) Discharge with 2.68% retention of SBF on cuttings	0.66	0.57	0.53
(2) Discharge with 2.45% retention of SBF on cuttings	2.73	0.91	0.88
(3) Zero Discharge [a]	14.62	2.67	2.32
Incremental Compliance Emission Reductions (Increases), Mg/yr:			
(1) Discharge with 2.68% retention of SBF on cuttings	(0.41)	(0.36)	(0.33)
(2) Discharge with 2.45% retention of SBF on cuttings	(2.48)	(0.70)	(0.68)
(3) Zero Discharge [a]	(14.37)	(2.45)	(2.13)
Unit Value of Poll. Reductions, 1990$/Mg: [b]	489 to 2,212	10,823	3,516 to 4,194
Unit Value of Poll. Reductions, 1998$/Mg: [c]	612 to 2,767	13,540	4,399 to 5,247
Incremental Compliance Benefits (Costs), 1998$/yr:			
(1) Discharge with 2.68% retention of SBF on cuttings	(251) to (1,134)	(4,874)	(1,452) to (1,731)
(2) Discharge with 2.45% retention of SBF on cuttings	(1,518) to (6,862)	(9,478)	(2,991) to (3,568)
(3) Zero Discharge [a]	(8,794) to (39,762)	(33,173)	(9,370) to (11,176)

[a] Via land disposal or on-site offshore injection.

[b] Conversion factors from Environmental Assessment of the Final Effluent Limitations Guidelines and Standards for the Pharmaceutical Manufacturing Industry (EPA–821–B–98–008).
[c] Scaled from 1990$ using the Engineering News Record Construction Cost Index.

D. Revised Cuttings Retention Limitations and Standards

As stated in the February 1999 proposal, EPA is considering setting limitations and standards for the percent retention of synthetic-based drilling fluids on cuttings that may be discharged from the cuttings dryer and fines removal technologies. EPA received cuttings retention data after the February 1999 proposal (*see* section II.A.4) and revised its statistical models (*see* section III.D).

As demonstrated by oil drilling operations in various geologic formations within the Gulf of Mexico (*see* section II.A.4), the average of the individual well averages for percent SBF retention on cuttings from the cuttings dryer is 2.45, the estimated 95th percentile is 3.11, and the estimated 99th percentile is 3.38. The observed individual well averaged SBF cuttings retention values are all less than the 95th percentile. For fines removal equipment, the average of the individual well averages for percent SBF retention on cuttings is 10.0, the estimated 95th percentile is 13.1, and the estimated 99th percentile is 14.4. Only one of the observed individual well SBF cuttings retention values for fines removal equipment exceeds the 95th percentile and none exceed the 99th percentile.

Based on these summary statistics, EPA has revised the proposed limitations and standards for percent retention of drilling fluids on cuttings. Assuming that: (a) 97% of the volume of cuttings discharged come from the cuttings dryer and 3% from fines removal; and (b) the limit will be based on a 95th percentile; the new discharge limitation of base fluid retained on cuttings is 3.41% [i.e., (0.97)(3.11%) + (0.03)(13.1%) = 3.41%]. Assuming that: (a) 97% of the volume of cuttings discharged come from the cuttings dryer and 3% from fines removal; and (b) the limit will be based on a 99th percentile; the new discharge limitation of base fluid retained on cuttings is 3.71% [i.e., (0.97)(3.38%) + (0.03)(14.4%) = 3.71%].

EPA is also considering basing percent retention limitations and standards on the cuttings dryer alone, in conjunction with zero discharge for all other cuttings. In that case, the discharge limitation of base fluid retained on cuttings would be 3.11% when using the 95th percentile or 3.38% when established using the 99th percentile.

If EPA selects numeric maximum well averaged cuttings retention discharge limitations and standards as the only method for controlling SBF discharges associated with cuttings in the final rule, then all operators would be expected to either: (1) meet the numeric maximum well averaged cuttings retention limitations and standards; or (2) dispose of their waste through on-site formation injection or ship their cuttings to shore for land disposal. In addition, EPA may elect in the final rule to allow operators the flexibility of choosing either numeric limitations and standards or BMPs to control SBF discharges associated with cuttings (*see* section V). A detailed description of the statistical analyses used to develop the proposed limitations and standards for percent retention of drilling fluids on cuttings is given in section III.C.(a) of the rulemaking record.

E. Revised Environmental Assessment Results

The complete results of the revised EA analyses are given in section III.F.(b) of the rulemaking record.

1. Water Column Water Quality Analyses

In the February 1999 proposal EA analyses, there were no exceedances of water quality criteria in the water column. Based on the revised EA analyses using updated dilution values and Federal water quality criteria, there are still no water quality criteria exceedances in the water column for any of the regulatory options being considered.

2. Pore Water Quality Analyses

The revised EA analyses estimate that baseline-model (or BPT) pore water pollutant concentrations at 100 m from the discharge exceed water-quality criteria for: (1) three pollutants (Cr, Pb, Ni) for the deep water exploratory well; (2) one pollutant (Cr) for the shallow exploratory well; and one pollutant (Cr) for the deepwater development well. Barite is used as a weighting agent in the drilling fluid and is also the primary source of heavy metals (e.g., Cr, Pb, Ni) in SBF. Therefore, the baseline-model pore water exceedances are not due to the synthetic material in the SBF but rather the SBF weighting agents.

The revised EA analyses estimate that both BAT/NSPS-model controlled discharge options result in no pore water pollutant concentrations that exceed water-quality criterion.

3. Sediment Guidelines Analyses

In the February 1999 proposal, the BAT/NSPS-model controlled discharge option resulted in sediment guidelines exceedances for the deep water and shallow water exploratory wells. EPA proposed sediment guidelines can be found in section I.D.(a).13 of the rulemaking record. The revised EA sediment guidelines analyses, based on updated water quality criteria, loadings, and dilution data, result in exceedances under the baseline model (or BPT) scenario only. There are no sediment guidelines exceedances for any of the BAT/NSPS-models.

V. Best Management Practices (BMPs) Alternatives to Numeric Limitations and Standards

A. General

EPA is considering three options for the final rule for the BAT limitation and NSPS controlling SBF retained on discharged cuttings: (1) a single numeric discharge limitation with an accompanying compliance test method; (2) allowing operators to choose either a single numeric discharge limitation with an accompanying compliance test method, or as an alternative, a set of BMPs that employs limited cuttings monitoring; or (3) allowing operators to choose either a single numeric discharge limitation with an accompanying compliance test method or an alternative set of BMPs that employ no cuttings monitoring. Additionally, EPA is considering two options in the final rule for BAT limitation and NSPS for controlling SBFs not associated with SBF drill cuttings: (1) zero discharge; or (2) allowing operators to choose either zero discharge or an alternative set of BMPs with an accompanying compliance method.

EPA has initial data on the effectiveness of BMPs for controlling SBF-discharges (Farmer, 2000; Hanni et al, 1998). The initial data on BMP effectiveness was generated from over 12 deepwater projects in the North Sea and 11 deepwater projects in the GOM. Data from Farmer (2000) was received by EPA just before publication of this notice and was unable to be fully analyzed. This data set represented North Sea and GOM wells that did not employ a cuttings dryer, however, certain drilling projects in the data set did use an extra technician (''mud cop'') to assist in improving the efficiency of the existing solids control equipment through use of BMPs.

EPA is requesting additional data on the use of BMPs to reduce or prevent SBF-discharges. In particular, EPA would like to see BMP documentation associated with cuttings retention spreadsheets similar to those submitted to support the development of the numeric guidelines and standards for the retention of SBF on cuttings. EPA will be using these data sets to determine the effectiveness of BMPs and their use as alternatives to numeric limitations and standards. EPA may select any of these BMP alternative options or any combination of these BMP alternative options in the final rule.

Sections 304(e), 308(a), 402(a), and 501(a) of the Clean Water Act authorize the Administrator to prescribe BMPs as part of effluent limitations guidelines and standards or as part of a permit. EPA's BMP regulations are found at 40 CFR 122.44(k). Section 304(e) of the CWA authorizes EPA to include BMPs in effluent limitation guidelines for certain toxic or hazardous pollutants for the purpose of controlling ''plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage.'' Section 402(a)(1) and NPDES regulations [40 CFR 122.44(k)] also provide for best management practices to control or abate the discharge of pollutants when numeric limitations and standards are infeasible. In addition, section 402(a)(2), read in concert with section 501(a), authorizes EPA to prescribe as wide a range of permit conditions as the Administrator deems appropriate in order to ensure compliance with applicable effluent limitations and standards and such other requirements as the Administrator deems appropriate.

SBFs adhered to discharged cuttings may contain barite (used as a weighting agent in the drilling fluid system), and can also be contaminated with formation crude oil. Barite is a mineral principally composed of barium sulfate, however, barite ore is generally known to have trace contaminants of several heavy metals such as mercury, cadmium, arsenic, chromium, copper, lead, nickel, and zinc. Formation oil is an ''indicator'' pollutant for the many toxic and hazardous pollutant components present in the formation (crude) oil, such as aromatic and polynuclear aromatic hydrocarbons. These formation oil pollutants include benzene, toluene, ethylbenzene, naphthalene, phenanthrene, and phenol. For a complete listing of pollutants associated with SBF readers should turn to Table VII–1 in the EPA February 1999 proposal SBF Development Document (EPA–821–B–98–021). Many of these SBF pollutants are designated as hazardous pollutants under CWA section 307(a)(1), *see* 40 CFR. 410.15, and oil is a hazardous substance under section 311 of the CWA.

It should also be noted that many of these same pollutants can also be found in SBF discharges not associated with cuttings (e.g., incidental spills, accumulated solids, deck drainage). Also, the drilling fluid (SBF based) can contain barite and trace contaminants of several heavy metals. Incidental spills of SBF can release these toxic and hazardous pollutants into the environment. In addition, approximately 75 barrels per well of solids, of which up to 25% is SBF, accumulate in the rig mud pits, sand traps, and other equipment. These accumulated solids may be discharged during equipment cleaning operations.

SBF discharges such as spills and leaks and accumulated solids may also be co-mingled with deck drainage which may also contain other toxic and hazardous pollutants. Deck drainage includes all water resulting from spills, platform washings, deck washings, tank cleaning operations and run-off from curbs, gutters, and drains including drip pans and work areas. Lists of pollutants and pollutant concentrations, including toxic and hazardous pollutants, in untreated deck drainage are contained in Tables X–17, X–18, and X–19 of the Final Offshore Development Document (EPA–821–R–93–003).

Therefore, the BMP alternatives to numeric limitations and standards in this notice are directed, among other things, at preventing or otherwise controlling leaks, spills, and discharges of toxic and hazardous pollutants in SBF cuttings and non-cuttings wastes.

B. BMP Alternatives for SBF Discharges Associated with Cuttings

As previously stated, EPA is considering three options for the final rule for the BAT limitation and NSPS controlling SBF retained on discharged cuttings: (1) A single numeric discharge limitation with an accompanying compliance test method; (2) allowing operators to choose either a single numeric discharge limitation with an accompanying compliance test method, or as an alternative, a set of BMPs that employs limited cuttings monitoring; or (3) allowing operators to choose either a single numeric discharge limitation with an accompanying compliance test method or an alternative set of BMPs that employ no cuttings monitoring. The BMP alternatives were developed with input from EPA Regional permit writers and industry. Under the third alternative cuttings discharge, BMPs option (i.e., cuttings not monitored), EPA is also considering whether to require as a BMP the use of a cuttings dryer discussed above as representative of BAT/NSPS or to make the use of a cuttings dryer optional.

Some industry representatives have expressed an interest in using BMPs that are not demonstrated through limited cuttings monitoring as equivalent to a numeric cuttings retention limit to control discharges of SBF associated with cuttings. Two issues were identified by the industry representatives as a basis for their support of using BMPs as an alternative discharge limitation: (1) Low gravity solids (or ''fines'') build-up in an active mud system; and (2) engineering limitations in the installation of cuttings dryers and supporting equipment on certain rigs. If operators are correct in their assertion that setting a numeric cuttings retention limit is infeasible, EPA may use BMPs to control SBF-wastes.

As discussed in the Development Document for the February 1999 Proposal (EPA–821–B–98–021), solids control equipment generally increases the mechanical degradation of drill solids (i.e., larger particles are broken into smaller particles). An undesirable increase in drilling fluid weight and viscosity can occur when drill solids degrade into fines that cannot be removed by solids control equipment [i.e., generally classified as < 5 microns (10^{-6} meters) in length]. An unacceptable high fines content (i.e., generally > 5% of total drilling fluid weight) may consequently lead to drilling problems (e.g., undesirable rheological properties, stuck pipe). Therefore, it is possible that the increased recovery of SBF from cuttings for re-use in the active mud system, often achieved through use of the cuttings dryer in solids control systems, may lead to a build-up in fines for certain formation characteristics (e.g., high reactivity of formation cuttings, limited loss of drilling fluid into the formation).

In order to meet EPA's proposed numeric cuttings retention value where there are unfavorable formation characteristics, operators may be limited to: (1) Diluting the fines in the active mud system through the addition of ''fresh'' SBF; and/or (2) capturing a portion of the fines in a container and sending the fines to shore for disposal. One SBF manufacturer stated in a verbal conversation with EPA that over the course of the past year (1999), a Canadian operator generated 12,000 barrels of SBF which had a fines content that rendered it unusable and untreatable for future drilling applications.

Currently, however, EPA does not have documentation that the build-up of fines in SBF drilling is a widespread problem in the United States or one that cannot be handled by operators in the United States. The absence of documented fines build-up problems in the GOM may be due to a sufficient loss of SBF drilling fluid with fines down-hole. This loss of fluid into the formation would require the addition of fresh SBF drilling fluid and minimize the build-up of fines. In addition, drilling rigs are now being designed and constructed to incorporate cuttings dryer and fines removal equipment into the solids control system. EPA is requesting data and comments on the expected frequency and conditions where operators are not able to meet EPA's new proposed SBF numeric cuttings retention numbers (*see* section IV.C.5) based on fines build-up in the active mud system.

Some industry representatives have also suggested that some rigs are incapable of installing the equipment needed to meet EPA's proposed numeric cuttings retention limit (*e.g.,* cuttings dryers, fines removal equipment). EPA staff visited two offshore GOM rigs where cuttings dryer and fines removal equipment was and was not able to be installed successfully into the existing solids control equipment system. The cuttings dryer that was able to be installed into the existing solids control system was smaller than the other cuttings dryer system on the other visited rig. Moreover, the successful installation also relied on an auger transport system for moving cuttings from the existing solids control system to the new cuttings dryer and fines removal equipment. The key cuttings dryer and fines removal equipment installation limitations appear to be whether rigs can install cuttings dryers and fines removal equipment near the existing solids control units and whether an auger cuttings transport system can be used to move cuttings from the existing solids control units to the new equipment. EPA's site visit and statements by industry representatives give differing viewpoints on how many rigs cannot incorporate new equipment to meet EPA's proposed cuttings retention number. Therefore, EPA requests further information and data to identify the name and number of rigs that cannot incorporate new equipment to meet EPA's cuttings retention number.

C. BMP Alternatives for SBF Discharges Not Associated with Cuttings

As previously stated, EPA is considering two options in the final rule for BAT limitation and NSPS for controlling SBFs not associated with SBF drill cuttings: (1) zero discharge; or (2) allowing operators to choose either zero discharge or an alternative set of BMPs with an accompanying compliance method. The follow sections describe several types of SBF discharges not associated with cuttings that can be controlled through either zero discharge or a set of BMPs. At this time, EPA's preferred option for these SBF non-cuttings wastes is to give operators the choice of selecting either zero discharge or using a set of BMPs to control these discharges (Option 2 identified above). This approach would give operators the flexibility of selecting a single numeric effluent limitation or a set of BMPs designed for their respective facility.

1. Accumulated Solids

Accumulated solids is one example of a non-cuttings SBF discharge. Industry representatives have stated that industry is split on the practice of discharging accumulated solids with some discharging accumulated solids provided permit limitations and standards are met and others opting to haul this material to shore for disposal (*see* section II.B.3). Approximately 75 barrels per well of fine solids and barite, of which up to 25% is SBF, accumulate in the rig mud pits, sand traps, and other equipment. Several hundred barrels (approximately 200 to 400 barrels) of water are used to wash out the mud pits. Industry representatives also indicated that those oil and gas extraction operations that discharge wash water and accumulated solids first recover free SBF.

Industry has submitted to EPA Region 6 and EPA Headquarters a list of BMPs that can minimize these discharges. Accordingly, Industry may wish to select BMPs as the method for controlling these discharges instead of zero discharge.

2. SBF Spills During Drilling Operations

Industry also noted that BMPs are already in place on most rigs to prevent spills during connections and disconnections of the drill string. Typical waste minimizing techniques include slugging the pipe (a small volume of heavy mud is pumped into the drill pipe to create a hydrostatic differential inside the drill pipe) with heavy mud. Rubber wipers may also be used on the inside and outside of the drill pipe to remove any residual mud before racking the pipe in the derrick (*i.e.,* storing the pipe on the rig). In some cases, the mud is captured with mud buckets and returned to the active mud system. Any spills on the rig floor can also be squeegeed back through the rotary into the mud system. A mud vacuum is also sometimes used. Pipe racks and the rig floor may also be designed with drip pans underneath to capture any remaining spillage. Captured fluid may go to the rig's oil/water sump for treatment and possible recovery. Industry estimated that essentially all of the SBF that spills on the rig floor is recovered using the controls described above. The amount of SBF spilled on the rig floor that is not captured by current practices is estimated by industry to be less than 1 gallon SBF per 100 feet drilled.

Industry may wish to select BMPs as the method for controlling these discharges instead of zero discharge.

D. Implementation of BMP Alternative (the BMP Plan)

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, EPA solicits comments on a BMP Plan requirement as a component of BMPs as an alternative to a numeric limitation or standard.

A BMP Plan would not be required if operators did not use BMPs to control SBF discharges. Moreover, EPA is proposing that operators be allowed to choose whether one or both of the two SBF wastestream (*i.e.,* SBF discharges associated with cuttings, SBF discharges not associated with cuttings) be managed through the BMP alternatives.

Accordingly, EPA is also proposing that operators only be required to develop and implement a BMP Plan for those SBF wastestreams it elects to manage through the BMP alternatives. Moreover, EPA is proposing that operators only be required to develop one BMP Plan if it elects to manage both SBF wastestreams (*e.g.,* discharges associated with cuttings and SBF discharges not associated with cuttings) through use of the BMP alternatives. As there are common elements in BMP Plans that cover both SBF wastestreams, EPA has grouped common elements together and identified specific elements for specific SBF wastestreams in separate sections. Table V.D.1 is a guide on what BMP Plan elements are required for the different BMP alternatives.

The SBF BMP common elements 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. EPA feels that 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.

TABLE V.D.1: BMP PLAN ELEMENTS REQUIRED FOR THE DIFFERENT BMP ALTERNATIVES TO SBF NUMERIC EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS

BMP plan alternatives [a]	SBF wastestreams operator elects to manage with BMP alternatives			BMP plan elements [e] (listed by section of this notice)
	SBF discharges not associated with cuttings [b]	SBF discharges associated with cuttings (no monitoring) [c]	SBF discharges associated with cuttings (monitoring) [d]	
1	X			Sec. V.D.1 to 5,6.
2	X	X		Sec. V.D.1 to 5,6,7.
3	X		X	Sec. V.D.1 to 5,6,8.
4		X		Sec. V.D.1 to 5,7.
5			X	Sec. V.D.1 to 5,8.

[a] Operators that elect to meet numeric limitations and standards are not required to develop BMPs or a BMP Plan.
[b] This includes incidental SBF spills, accumulated solids, and deck drainage (*see* section V.C).
[c] This includes SBF discharges associated with cuttings with no equivalency determination through monitoring (*see* section V.B).
[d] This includes SBF discharges associated with cuttings with an equivalency determination through monitoring (*see* section V.B).
[e] Operators are only required to develop one BMP Plan if the operator elects to manage both SBF wastestreams (*e.g.,* discharges associated with cuttings and SBF discharges not associated with cuttings) through use of the BMP alternatives.

1. SBF BMP Plan Purpose and Objectives

The BMP Plan must be designed to prevent or minimize the generation and the potential for the discharge of SBF from the facility to the waters of the United States through normal operations and ancillary activities. The Permittee must establish specific objectives for the control of SBF by conducting the following evaluations:

a. The Permittee should identify which SBF wastestreams (i.e., cuttings related or non-cuttings related) are to be controlled through use of the BMP alternatives and which SBF wastestreams are to be controlled through use of numeric effluent limitation guidelines and standards.

b. Each facility component or system controlled through use of BMP alternatives must be examined for its SBF-waste minimization opportunities and its potential for causing a discharge of SBF to waters of the United States due to equipment failure, improper operation, natural phenomena (e.g., rain, snowfall).

c. For each SBF wastestream controlled through BMP alternatives 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 SBF reaching surface waters, the BMP Plan should include a prediction of the direction, rate of flow and total quantity of SBF which could be discharged from the facility as a result of each condition or circumstance.

2. Requirements

The BMP Plan must be consistent with the objectives in section V.D.1. The BMP Plan may reflect requirements within spill response plans required by the Minerals Management Service (*see* 30 CFR 254) or other Federal or State requirements and incorporate any part of such plans into the BMP Plan by reference.

The Permittee must certify that its BMP Plan is complete, on-site, and available upon request to EPA or the NPDES Permit controlling authority. This certification should identify the NPDES permit number and be signed by an authorized representative of the Permittee. For new exploratory operations, the certification should be submitted no later than the written notice of intent to commence discharge. For existing dischargers, the certification should be submitted within one year of permit issuance. The BMP Plan must:

a. Be documented in narrative form, and must include any necessary plot plans, drawings or maps, and must be developed in accordance with good engineering practices. At a minimum, the BMP Plan must 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).

b. Include the following provisions concerning BMP Plan review:

(i) Be reviewed by plant engineering staff and the plant manager as warranted by changes in the operation or at the facility which are covered by the BMP.

(ii) Be reviewed and endorsed by the individuals responsible for development and implementation of the BMP Plan. Such review and endorsement may be performed by the establishment of a program of documented initial and annual refresher training of drilling equipment operators, maintenance personnel, and other technical and supervisory personnel who have responsibility for operating, maintaining, or supervising the operation and maintenance of drilling equipment.

(iii) Include a statement that the above reviews have been completed and that the BMP Plan fulfills the requirements set forth in this section of the notice. The statement must be certified by the dated signatures of the individuals responsible for development and implementation of the BMP Plan.

c. Establish specific best management practices to meet the objectives identified in section V.D.1, addressing each component or system capable of generating or causing a release of significant amounts of SBF, and identifying specific preventative or remedial measures to be implemented.

3. Documentation

The Permittee must maintain a copy of the BMP Plan and related documentation (e.g., training certifications, summary of the monitoring results, records of SBF-equipment spills, repairs, and maintenance) at the facility and must make the BMP Plan and related documentation available to EPA or the NPDES Permit controlling authority upon request. Submission of the BMP Plan and related documentation shall be at the frequency established by the NPDES permit control authority (i.e., Permit monitoring reports), but in no case less than once per five years.

4. BMP Plan Modification

For those SBF wastestreams controlled through BMP alternatives, the Permittee must 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 SBF-wastes or their release or potential release to the receiving waters. At a minimum the BMP Plan must be reviewed once every five years and amended within three months if warranted. Any such changes to the BMP Plan must be consistent with the objectives and specific requirements listed above. All changes in the BMP Plan must be reviewed by the plant engineering staff and plant manager.

5. Modification for Ineffectiveness

At any time, if the BMP Plan proves to be ineffective in achieving the general objective of preventing and minimizing the generation of SBF-wastes and their release and potential release to the receiving waters and/or the specific requirements above, the permit and/or the BMP Plan must be subject to modification to incorporate revised BMP requirements.

6. Specific Pollution Prevention Activities for SBF Discharges Not Associated With Cuttings

An approved BMP Plan may include the following examples of specific pollution prevention activities for controlling SBF discharges not associated with cuttings.

a. Establishing programs for identifying, documenting, and repairing leaking SBF equipment, tracking SBF equipment repairs, and training personnel to report and evaluate SBF spills, as detailed in section V.E.2.c and V.E.2.d below.

b. Establishing programs for identifying, documenting, and repairing malfunctioning SBF equipment, tracking SBF equipment repairs, and training personnel to report and evaluate malfunctioning SBF equipment.

c. Recovering and returning to the process or an appropriate storage container to the maximum extent practicable spilled or leaked drilling fluids to prevent their discharge.

d. Immediately recovering spills of drilling fluid on the drill floor using a vacuum, grated trough, or comparable system.

e. Providing adequate containment for SBF spills on the drill deck to minimize potential spills.

f. Establishing mud pit and equipment cleaning methods in such a way as to minimize the potential for drilling fluids discharges, including but not limited to the following:

(i) Ensuring proper operation and efficiency of mud pit agitation equipment.

(ii) Using mud gun lines during mixing to provide agitation in dead spaces to minimize solids accumulation.

(iii) Pumping drilling fluids off for use, recycle, or disposal before using wash water to dislodge solids.

(iv) Limiting the volume of wash water used to the minimum needed to dislodge and slurry solids for overboard discharge.

(v) Using water-minimizing techniques (e.g., steam or compressed air) where possible to clean the sides of the mud pit.

g. The Permittee must also include the number and dates of non-cuttings SBF-discharges managed by BMPs in their NPDES permit reports. The description of these discharges must also include estimated volume of SBF discharged and any corrective actions taken to respond to such non-cuttings SBF-discharges.

7. Specific Pollution Prevention Activities for SBF Discharges Associated With Cuttings (No-Verification Cuttings Monitoring)

The following specific pollution prevention activities are required in a BMP Plan when operators elect to control SBF discharges associated with cuttings by a set of BMPs where no equivalency determination is made through limited cuttings monitoring.

a. Establishing programs for identifying, documenting, and repairing malfunctioning SBF equipment, tracking SBF equipment repairs, and training personnel to report and evaluate malfunctioning SBF equipment.

b. Establishing operating and maintenance procedures for each component in the solids control system in a manner consistent with the manufacturer's design criteria for flow, fluid type, density, and rheological properties, which may include, but are not limited to, the following:

(i) Maintaining shale shakers such that units have adequate capacity for circulating the active drilling fluid volume, have screens of such mesh size that no more than 75% of screen area is wet, and maintain the manufacturer's design screen tension, maximum "G" force, maximum positive screen deck angle, and maximum vibrator assembly angle to screen deck;

(ii) Maintaining centrifuges such that units have sufficient capacity for active drilling fluid volume (note: for most situations where 8.5″ or larger hole sizes are drilled, multiple units may be required), have bowl revolutions per minute (RPM) adjusted as high as practical to maximize "G" force, have bowl/conveyor RPM differential minimized to subject cuttings to "G" Force for the maximum time period before leaving the unit, have feed tube adjusted to introduce cuttings to the maximum bowl diameter as they enter the unit, and have processing rates closely monitored to maximize cuttings discharge with minimum SBF retention.

c. Using gel pills or other applicable measures in order to minimize contamination of drilling fluids when changing from water-based to non-aqueous based drilling fluids and vice versa.

d. Sending interface muds through the mud recovery system prior to discharge or disposal.

8. Specific Pollution Prevention Activities for SBF Discharges Associated With Cuttings (Verification Cuttings Monitoring)

The following specific pollution prevention activities are required in a BMP Plan when operators elect to control SBF discharges associated with cuttings by a set of BMPs that are demonstrated, through limited cuttings monitoring, to meet the same level of control as the BAT/NSPS cuttings retention limit.

a. All the specific pollution prevention activities in section V.D.7

b. A daily retort analysis must be performed (in accordance with Appendix 7 to Subpart A of Part 435) during the first 0.33 X days where X is the anticipated total time (in days) to drill that particular well. The retorts analyses will be documented in the well retort log.

(i) When the arithmetic average of the cuttings retort analyses is less than the numeric cuttings retention limitation and standard, monitoring of cuttings may cease for that individual well.

(ii) When the arithmetic average of the cuttings retort analyses is greater than the numeric cuttings retention limitation and standard, monitoring will continue for the second 0.33X days where X is the anticipated total time (in days) to drill that particular well. If after the second 0.33X, the arithmetic average of the cuttings retort analyses is still greater than numeric cuttings retention limitation and standard then monitoring will continue for the remainder of the well operation. Moreover, this incident will be reported within one week to EPA or the NPDES Permit controlling authority for review and recommendations.

c. The Permittee must also include the cuttings monitoring data and dates of monitored and non-monitored SBF-cuttings discharges managed by BMPs in their NPDES permit reports.

E. Paperwork Reduction Act Requirements Related to BMPs Alternatives

The information collection requirements related to the BMP alternatives in this notice have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* An Information Collection Request (ICR) document has been prepared by EPA (ICR No. 1953.01) and a copy may be obtained from Sandy Farmer by mail at Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW, Washington, DC 20460; by e-mail at farmer.sandy@epa.gov, or by calling (202) 260–2740. A copy may be downloaded from the Internet at http://www.epa.gov/icr.

The BMP alternatives identified in this notice include information collection requirements that are intended to control the discharges of SBF in place of numeric effluent limitations and standards. These information collection requirements include, for example: (1) Training personnel; (2) analyzing spills that occur; (3) identifying equipment items that might need to be maintained, upgraded, or repaired; (4) identifying procedures for waste minimization; (4) performing monitoring (including the operation of monitoring systems) to establish equivalence with a numeric cuttings retention limitation and to detect leaks, spills, and intentional diversion; and (5) generally to periodically evaluate the effectiveness of the BMP alternatives.

The BMP alternatives also require operators to develop and, when appropriate, amend plans specifying how operators will implement the specified BMP alternatives, and to certify to the permitting authority that they have done so in accordance with good engineering practices and the requirements of the regulation. The purpose of those provisions is, respectively, to facilitate the implementation of BMP alternatives on a site-specific basis and to help the regulating authorities to ensure compliance without requiring the submission of actual BMP Plans. Finally, the recordkeeping provisions are intended to facilitate training, to signal the need for different or more vigorously implemented BMP alternatives, and to facilitate compliance assessment.

EPA has structured the BMP alternatives to provide maximum flexibility to the regulated community and to minimize administrative burdens on National Pollutant Discharge Elimination System (NPDES) permit authorities that regulate oil and gas extraction facilities. Although EPA does not anticipate that operators will be required to submit any confidential business information or trade secrets as part of this ICR, all data claimed as confidential business information will be handled by EPA pursuant to 40 CFR Part 2.

For the five SBF BMP alternatives (*see* Table V.D.1), the public reporting burdens range from an estimated 515 hours per respondent per year [i.e., (12,500 initial hours/3 years + 21,604 annual hours/year)/50 SBF well operators] to 1,363 hours per respondent per year [i.e., (17,500 initial hours/3 years + 62,334 annual hours/year)/50 SBF well operators]. EPA also estimated the annual burden for EPA Regions, the NPDES permit controlling authorities, to review BMPs and ensure compliance. EPA estimates that essentially all of the SBF discharges will occur in Federal offshore waters or in Cook Inlet, Alaska, where EPA Region X retains NPDES permit controlling authority. The EPA Regional burden for reviewing BMP Plans is estimated at 5.7 hours per year [i.e., (8 initial hours/3 years + 3 annual hours/year)/50 SBF well operators].

For new exploratory operations, the certification of BMP Plan completion should be submitted to the permit control authority no later than the written notice of intent to commence discharge. For existing dischargers, the certification should be submitted within one year of permit issuance. In addition, a copy of the completed BMP Plan may be requested by the NPDES permit control authority at any time. Submission of records to the permit control authority demonstrating periodic review of the BMP Plan are due at a minimum once every five years. Monitoring reports demonstrating compliance with the BMP Plan are due to the permit control authority at the frequency set by the permit control authority (e.g., monthly or annually) and may be requested by the permit control authority on demand. Re-fresher training certifications demonstrating compliance with the BMP Plan are due to the permit control authority at the frequency set by the permit control authority (e.g., semi-annually) and may be requested by the permit control authority on demand.

For the five SBF BMP alternatives (*see* Table V.D.1), the public reporting costs range from approximately $18,600 per respondent per year [i.e., ($921,875 initial costs/3 years + $623,625 annual costs/year)/50 SBF well operators] to $38,000 hours per respondent per year [i.e., ($1,290,625 initial costs/3 years + $1,465,100 annual costs/year)/50 SBF well operators]. The EPA Regional costs for reviewing BMP Plans is estimated at approximately $180 per year [i.e., ($12,800 initial costs/3 years + $4,800 annual costs/year) / 50 SBF well operators].

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes time needed to: review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information and disclosing and providing information; adjust the existing ways to comply with previously applicable instructions and requirements; train personnel to be able to respond to the collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR Part 9 and 48 CFR Chapter 15.

Comments are requested on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques. Send comments on the ICR to the Director, Collection Strategies Division; U.S. Environmental Protection Agency (2822); 1200 Pennsylvania Ave., NW, Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th St., NW, Washington, DC 20503, marked ''Attention: Desk Officer for EPA.'' Include the ICR number in any correspondence. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after April 21, 2000, a comment to OMB is best assured of having its full effect if OMB receives it by May 22, 2000. The final rule will respond to any OMB or public comments on the information collection requirements contained in this notice.

Dated: April 12, 2000.

J. Charles Fox,

Assistant Administrator for Water.

[FR Doc. 00–9655 Filed 4–20–00; 8:45 am]

BILLING CODE 6560–50–P