

## ENVIRONMENTAL PROTECTION AGENCY

### 40 CFR Part 419

[OW-FRL-2815-5]

#### Petroleum Refining Point Source Category; Effluent Limitations Guidelines

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Final rule.

**SUMMARY:** EPA is amending the regulation which limits effluent discharges to waters of the United States from facilities engaged in the refining and processing of petroleum. EPA proposed these modifications on August 28, 1984, (49 FR 34152) in accordance with a settlement agreement which resolved a lawsuit brought against EPA by the Natural Resources Defense Council, Inc. The lawsuit challenged the final petroleum refining regulation promulgated on October 18, 1982 (47 FR 46434).

Today's final rule incorporates the proposed amendments which are: (1) Modifications to the "best available technology economically achievable" (BAT) effluent limitations for process wastewater for the pollutants phenolic compounds, total chromium, and hexavalent chromium; (2) "best conventional pollutant control technology" (BCT) effluent limitations for process wastewater; and (3) "best practicable control technology currently available" (BPT), BCT, and BAT effluent limitations for contaminated storm water runoff. Amendments are also made in this final rule, which will correct errors identified in the October 28, 1984 rule, the August 28, 1984 Proposed Rule, as well as errors contained in 40 CFR Part 419, revised as of July 1, 1984.

**DATES:** In accordance with 40 CFR 100.01, the regulations developed in this rulemaking shall be considered issued for purposes of judicial review at 1:00 p.m. Eastern time on July 29, 1985. These regulations shall become effective August 28, 1985.

Under Section 509(b)(1) of the Clean Water Act, judicial review of these regulations is available only by filing a petition for review in the United States Court of Appeals within ninety days after these regulations are considered issued for purpose of judicial review. Under section 509(b)(2) of the Clean Water Act, these requirements of the regulations may not be challenged later in civil or criminal proceedings brought by EPA to enforce these requirements.

Those portions of the existing petroleum refining effluent limitations guidelines and standards that are not substantively amended by this notice are not subject to judicial review nor is their effectiveness altered by this notice.

**ADDRESSES:** The record for this rulemaking will be available for inspection and copying at the EPA Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, SW., Washington, D.C. The EPA information regulation provides that a reasonable fee may be charged for copying.

**FOR FURTHER INFORMATION CONTACT:** Mr. Dennis Ruddy, Industrial Technology Division, at (202) 382-7131.

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#### I. Legal Authority

The amendments to the regulation described in this notice are promulgated under the authority of sections 301, 304, 307, and 501 of the Clean Water Act (the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1251, et seq., as amended by the Clean Water Act of 1977, Pub. L. 92-517). These changes are also promulgated in response to the Settlement Agreement in *Natural Resources Defense Council, Inc. v. Environmental Protection Agency*, No. 83-1122 (D.C. Cir.).

#### II. Background

##### A. Prior Regulation

On October 18, 1982, EPA published final effluent limitations guidelines and standards for the petroleum refining point source category. That regulation provided final effluent limitations for "best available technology economically achievable" (BAT) and established final pretreatment standards for existing sources (PSES) and for new sources (PSNS). The Agency retained its previously promulgated "new source performance standards" (NSPS) and

also did not modify its effluent limitations guidelines for "best practicable control technology currently available" (BPT). The Agency reserved coverage of "best conventional pollutant control technology" (BCT) effluent limitations guidelines. The preamble of the 1982 final regulations describes the history of the rulemaking. (47 FR 46343)

##### B. Challenges to the Prior Regulation

On January 27, 1983, the Natural Resources Defense Council, Inc. ("NRDC") filed a petition to review the final petroleum refining regulation. *Natural Resources Defense Council, Inc. v. Environmental Protection Agency*, No. 83-1122 (D.C. Cir.). The American Petroleum Institute ("API") and seven individual oil companies intervened in the litigation.

##### C. Settlement Agreement

On April 17, 1984, EPA, NRDC, API and all other interveners to the litigation entered into a comprehensive Settlement Agreement. In the Settlement Agreement, EPA agreed to publish a notice of proposed rulemaking and to solicit comments regarding certain modifications to the 1982 final petroleum refining BAT effluent limitations guidelines. In addition, EPA agreed to propose BCT effluent limitations guidelines for four conventional pollutants and BPT, BAT and BCT effluent limitations guidelines for contaminated storm water runoff. Petitioner NRDC agreed that if EPA took final action pursuant to and consistent with the Settlement Agreement that it will dismiss its lawsuit challenging the 1982 final petroleum refining regulation.

As part of the Settlement Agreement, the parties agreed to seek a judicial stay of the regulatory provisions to be modified. On July 24, 1984, the Court entered a stay of the effluent limitations for phenolic compounds, total chromium and hexavalent chromium for the following portions of the regulation pending the rulemaking: 40 CFR 419.13(a), 419.23(a), 419.33(a), 419.43(a), and 419.53(a). On August 28, 1984, EPA published the proposed amendments to the 1982 effluent limitations guidelines in accordance with the Settlement Agreement (49 FR 34152). Public comments were received and considered in issuing this final rule.

##### III. Changes From Proposal

Today's final rule amends the effluent limitations guidelines for the petroleum refining point source category; it is the same as the August 28, 1984 proposed amendments. However, certain cost determinations used to develop the BCT

effluent limitations guidelines have been revised since the proposal but do not affect the Agency's original conclusion that BCT should be set equal to BPT for this industry.

EPA published a proposed BCT methodology (47 FR 49176) which set forth a procedure for evaluating the cost reasonableness of BCT effluent limitations guidelines. The proposed BCT limitations for the petroleum refining industry were based upon that published methodology, which includes the "POTW test" and the "industry cost test." The Agency selected and evaluated two levels of technology for the control of conventional pollutants from petroleum refineries (i.e., recycle/reuse and recycle/reuse plus granular media filtration following BPT). Incremental (beyond BPT) conventional pollutant removals and costs associated with the candidate BCT technologies were calculated for model plants representative of each of the five petroleum refining subcategories. The resulting "cost per pound removed" ratios failed the BCT cost test. The Agency therefore proposed that BCT be set equal to BPT for all five petroleum refining subcategories.

Subsequently, EPA published a notice of data availability concerning the BCT methodology on September 20, 1984 (49 FR 37046). The Agency has revised its BCT cost evaluation for petroleum refining to incorporate the updated information referenced in the notice of data availability. The revised cost ratios for the recycle/reuse technology options with 20 to 40 percent reductions in discharge flow range from \$50.48 to \$1.36 (1977 dollars). The revised cost ratios for the recycle/reuse plus filtrations options range from \$27.05 to \$1.11 (1977 dollars). The benchmark in 1977 dollars for the POTW cost test based on the Agency's repropoed BCT methodology is approximately \$.76 per pound of pollutant removed. The Agency is presently revising the BCT methodology and expects the benchmark to change. Based on preliminary analysis, the Agency expects that the candidate technologies will fail under future BCT cost tests. Thus, the Agency has decided to establish BCT effluent limitations guidelines equal to BPT effluent limitations guidelines for the Petroleum Refining Industry in this rulemaking.

Several typographical and transcription errors appeared in 419.43(c)(2), 419.14(a), 419.34(b)(1) and in Appendix A, in the proposed rule published on August 28, 1984, 49 FR 34152. Those errors have been corrected in the amendments set forth below.

In addition, today's notice amends the BPT effluent limitations guidelines for

sulfide in Subparts A and C and for hexavalent chromium in Subpart A, which appeared in the *Federal Register* notice of October 18, 1982 (47 FR 46434) and were reprinted in 40 CFR Part 419 dated July 1, 1984 to correct typographical errors. Because these limitations appeared in both metric and English units, the typographical errors have been obvious. Also, amendments are made to correct typographical errors in a paragraph reference that appeared in Subparts D and E for NSPS, and in a refinery capacity range in a size factor table that appeared in Subpart E for BPT. These amendments appear in the amended regulation that follows this preamble.

#### IV. Amendments to the Petroleum Refining Point Source Category Regulation

The following are the changes to the petroleum industry regulation that EPA proposed on August 28, 1984:

##### A. Best Available Technology Effluent Limitations Guidelines

On October 18, 1982 EPA published final effluent limitations guidelines for best available technology economically achievable (BAT) and final pretreatment standards for existing sources (PSES) and for new sources (PSNS) for the petroleum refining industry, 47 FR 46434. The Natural Resources Defense Council ("NRDC") filed a petition to review the October 18, 1982 regulation in the United States Court of Appeals for the District of Columbia Circuit. The American Petroleum Institute (API) and seven companies which own and operate petroleum refineries intervened in that proceeding. A number of issues were raised in settlement discussions among the parties in the lawsuit pertaining to the BAT effluent limitations guidelines. After extensive discussions, the petitioner, interveners and EPA entered a Settlement Agreement, which provides for specified revisions to the BAT effluent limitations guidelines. Those revisions are set forth in today's amended regulation.

In October 1982 EPA promulgated BAT effluent limitations for the following pollutants: (1) Nonconventional pollutants: chemical oxygen demand (COD), phenolic compounds (4AAP), ammonia (as N) and sulfide; and (2) toxic pollutants: total chromium and hexavalent chromium. The model technology for these regulations was flow equalization, initial oil and solids removal, advanced oil and solids removal, biological treatment and filtration or other final "polishing steps."

The Agency is now amending the BAT effluent limitations guidelines for total

chromium, hexavalent chromium and phenolic compounds (4AAP). EPA is adding flow reduction to the model treatment technology for the BAT effluent limitations guidelines and is basing the effluent limitations for each of these three pollutants on a more recent data base, rather than the one it relied upon in the October 18, 1982 BAT promulgation. That rulemaking utilized the same data based used by the Agency when it established best practicable control technology currently available (BPT) effluent limitations guidelines for the petroleum refining point source category. The BPT level of control for this industry was promulgated on May 9, 1974 (39 FR 16560) and subsequently amended on May 20, 1975 (40 FR 21939). The BAT effluent limitations guidelines for other pollutants remain unchanged.

The BAT effluent limitations guidelines for total chromium being promulgated today are based upon the revised 1979 flow model developed by the Agency to predict refinery flows, rather than the BPT 1974 flow model used in the October 1982 BAT promulgation. The effluent limitations for total chromium being promulgated today were derived by applying this updated flow model to concentrations for total chromium observed from plant sampling in 1976-1977.

BAT effluent limitations guidelines for hexavalent chromium and phenolic compounds being promulgated today were derived using the 1982 Development Document concentrations and the revised 1979 flow model to more accurately represent effluent reductions for these pollutants which the industry was generally achieving in 1979 or could technologically achieve by the final BAT compliance date. BAT for hexavalent chromium being promulgated today is based upon option 7 (discharge flow reduction of 37.5 percent from the revised 1979 model flow). BAT for phenolic compounds (4AAP) being promulgated today is based upon option 8 (a reduction of 20 percent from the revised 1979 model flow).

Under today's rulemaking, the BAT effluent limitations guidelines for each of these three pollutants are substantially more stringent than the BAT effluent limitations guidelines promulgated in 1982. The total allowable discharge of total chromium to the nation's navigable waters is reduced by approximately 288,000 pounds per year, a 66 percent annual reduction beyond discharge levels allowable under the existing BAT effluent limitations guidelines; the total allowable discharge of hexavalent chromium is reduced by

approximately 19,300 pounds per year, a 56 percent annual reduction beyond discharge levels allowable under existing BAT; the total allowable discharge of phenolic compounds (4AAP), is reduced by approximately 75,000 pounds per year, a 43 percent annual reduction beyond discharge levels allowable under existing BAT. These reductions are based on data in the Agency's refined BAT flow model. The refined flow model is included in the record for this rulemaking in a report entitled "Petroleum Refining Industry, Refinements to 1979 Proposed Flow Model."

EPA believes that approximately one half of the refineries which directly discharge pollutants to navigable waters already are complying with the effluent limitations being promulgated today. Further, EPA believes that the effluent limitations are economically achievable for the industry.

In the preamble to the October 18, 1982 promulgated regulations for this industry, EPA estimated that capital costs of \$112 million and \$37 million (1979 dollars) in annualized costs would be required in order for petroleum refiners to comply with option 7, one of the BAT control treatment options considered by the Agency (47 FR 46438). Likewise, EPA estimated that capital costs of \$77 million and annualized costs of \$25 million (1979 dollars) would be required in order for petroleum refiners to comply with option 8, another of the BAT control treatment options considered by the Agency (47 FR 46438).

The revised limitations being promulgated today for phenolic compounds, hexavalent chromium and total chromium are not based on either option 7 or option 8 alone. The effluent limitations for phenolic compounds are based upon option 8. The effluent limitations for hexavalent chromium are based upon option 8. The effluent limitations for hexavalent chromium are based upon option 7. The effluent limitations for total chromium, while somewhat more stringent than the BAT effluent limitations for total chromium, are less stringent than those based upon option 8.

The Agency has reevaluated the costs of compliance for today's changes to the BAT effluent limitations and estimates that the total industry costs of compliance would not exceed those previously calculated for option 8. EPA estimates that no more than 61 petroleum refineries will have to incur aggregate capital costs no greater than \$77 million and annualized costs no greater than \$25 million (1979 dollars). These costs translate to an average increase of no greater than one half cent

per gallon of refinery product. No refinery closures are anticipated by the Agency. Refinery capacity and consumption would remain unaffected. Given these factors, the Agency believes that its earlier heavy reliance on costs as the basis for rejecting more stringent effluent controls in this industry was inappropriate, and that the effluent limitations guidelines for total chromium, hexavalent chromium and phenolic compounds (4AAP) being promulgated today, rather than the effluent limitations guidelines promulgated in 1982, are appropriate for this industry as the BAT level of control. The revised Bat numerical limitations and contained in the final regulation.

#### *B. Best Conventional Pollutant Control Technology Effluent Limitations Guidelines*

As part of the Settlement Agreement EPA agreed to propose best conventional pollutant control technology ("BCT") effluent limitations guidelines for the petroleum refining industry. The 1977 Amendments to the Clean Water Act ("CWA") added section 301(b)(2)(E) of the Act establishing BCT for discharge of conventional pollutants from existing industrial point sources. Conventional pollutants are those defined in section 304(a)(4) [biochemical oxygen demanding pollutants (BOD<sub>5</sub>), total suspended solids (TSS), fecal coliform and pH], and any additional pollutants defined by the Administrator as "conventional". The Administrator designated oil and grease as a conventional pollutant on July 30, 1979, 44 FR 44501.

BCT is not an additional limitation but replaces BAT for the control of conventional pollutants. In addition to other specified in Section 304(b)(4)(B) the Act requires the BCT limitations be assessed in light of a two-part "cost reasonableness" test. *American Paper Institute v. EPA*, 660 F2d 954 (4th Cir. 1981). The first test compares the cost for private industry to reduce its conventional pollutants with the costs to publicly owned treatment works for similar levels of reduction in their discharge of these pollutants. The second test examines the cost-effectiveness of additional industrial treatment beyond best practicable control technology currently available (BPT). EPA must find that limitations are "reasonable" under both tests before establishing them as BCT. In no case may BCT be less stringent than BPT.

EPA published a proposed BCT methodology on October 29, 1982. (47 FR 49176). This proposed BCT methodology explains the details of the two part cost-

reasonableness test, i.e., the "POTW test" and the "industry cost test." In addition, the Agency published a "notice of data availability" concerning the proposed BCT methodology on September 20, 1984 (49 FR 37046).

Today's promulgated BCT effluent limitations guidelines for the petroleum refining industry are based on the proposed BCT methodology. Today's final regulations establish BCT equal to BPT for the petroleum refining industry.

EPA considered two levels of technology for incremental control beyond BPT of total suspended solids (TSS) and oil and grease. These technology levels are recycle/reuse and recycle/reuse followed by granular media filtration. These technologies are already in use at certain sites in the petroleum refining industry. These technologies were selected as candidate BCT technologies because the Agency believes they represent the first levels of control beyond BPT which could effect reduction in conventional pollutant loadings in this industry. Filtration alone was not selected as a candidate BCT technology because it is one of the existing BPT treatment technologies. However, the Agency decided to consider the combination of recycle/reuse plus filtration as a candidate BCT technology. This is because the decreased hydraulic loading resulting from recycle/reuse results in the need for smaller and less costly filtration equipment than that included in the BPT treatment model. The BCT cost test was then performed on the combination of recycle/reuse and filtration as a double-check on the effects of the less costly filtration step.

In order to determine whether these candidate technologies are "cost-reasonable", EPA developed one model plant representative of a typical plant in each of the five BPT subcategories. The five BPT subcategories are:

- A—Topping
- B—Cracking
- C—Petrochemical
- D—Lube
- E—Integrated

Then EPA calculated the incremental (beyond BPT) conventional pollutant removals and the incremental costs associated with these technologies for each model plant. Based on this information, cost-per-pound ratios were calculated for each of the five BPT subcategories.

EPA evaluated reductions in total suspended solids (TSS), biochemical oxygen demand (BOD<sub>5</sub>), and oil and grease for each of these technology levels. However, oil and grease was not considered for the BCT calculations for

recycle/reuse for this industry. Additionally, BOD<sub>5</sub> was not considered for the BCT calculations for filtration for this industry. This is in accordance with the proposed BCT methodology in order to avoid "double counting" of the amount of pollutants removed by a candidate BCT technology.

The recycle/reuse technology option identified for BCT was evaluated in the range of from 20 to 40 percent reduction in discharge flow. The cost per pound ranges from \$41.00 to \$0.77 (1977 dollars) [\$50.48 to \$1.36 (1977 dollars) based upon the September 20, 1984 notice of data availability] in the first part of the proposed BCT cost reasonableness test (the "POTW test"). Accordingly, the Agency found that the addition of recycle/reuse technology fails the first part of the proposed BCT cost reasonableness test in all five subcategories (\$0.30 per pound in 1977 dollars) [approximately \$0.76 per pound in 1977 dollars based upon the September 20, 1984 notice of data availability].

The Agency also found that the addition of recycle/reuse plus filtration fails the first part of the proposed BCT cost reasonableness test in all five subcategories. The recycle/reuse portion of this option was evaluated in the range of from 20 to 40 percent reduction in discharge flow. The cost per pound (1977 dollars) ranges from \$21.00 to \$0.58, compared to the benchmark of \$0.30 per pound (1977 dollars) [\$27.05 to \$1.11, compared to the benchmark of approximately \$0.76 per pound (1977 dollars) based upon the September 20, 1984 notice of data availability].

Therefore, the Agency is promulgating BCT equal to BPT for the five subcategories in this industry.

A more complete discussion of the selection of the candidate BCT technologies, the details of the first part of the proposed BCT cost reasonableness test ("POTW test"), and the basis for decision are contained in the administrative record of this rulemaking.

### *C. Effluent Limitations Guidelines for Contaminated Storm Water Runoff*

In the October 18, 1982 rulemaking the Agency withdrew storm water effluent limitations guidelines for BPT, BAT and NSPS, because they were remanded by the U.S. Court of Appeals in *American Petroleum Institute v. EPA*, 540 F.2d 1023 (10th Cir. 1976).

Since that remand there has been some confusion on the part of permit writers and others as to whether storm water runoff ("runoff") effluent limitations should be contained in permits. There are two kinds of such

runoff, i.e., contaminated and uncontaminated.

The purpose of this rulemaking is to establish BPT, BCT and BAT effluent limitations guidelines for contaminated storm water runoff. Today's promulgated contaminated runoff effluent limitations are to be included in petroleum refinery permits in addition to process wastewater effluent limitations. NSPS for contaminated runoff is being reserved for future rulemaking.

In today's final regulations EPA is defining contaminated runoff, for purposes of these regulations only, to be runoff which comes into contact with any raw material, intermediate product, finished product, by-product or waste product located on petroleum refinery property. Any other storm water runoff at a refinery is considered uncontaminated. Today's final regulations also amend the definition of the term "runoff" currently found in 40 CFR 419.11(b) to clarify that it means the flow of storm water resulting from precipitation coming into contact with petroleum refinery property. Contaminated runoff constitutes an additional source of pollution which must be managed during periods of precipitation along with process wastewater from refinery operations. Today's final regulations do not establish numerical effluent limitations for uncontaminated runoff. Effluent limitations, including but not limited to allocations for uncontaminated runoff may be established by the permit writer based on his/her best professional judgment.

The Agency believes that the best practicable control technology currently available, the best conventional pollutant control technology and the best available technology economically achievable for treatment of contaminated runoff are the same as the technologies identified for treatment of process wastewater. The Agency has not identified any feasible technologies capable of achieving pollutant reductions for contaminated runoff from refineries to any greater degree than those which are achievable by the process wastewater treatment facility.

The Agency believes that the conventional pollutant oil and grease and the nonconventional pollutant parameter total organic carbon (TOC) are appropriate measures to determine whether pollutant loadings in contaminated runoff would be measurably reduced by the model treatment technologies used to develop these final regulations. Under today's final regulations for BPT, wastewater consisting solely of contaminated runoff may be discharged directly without

treatment if it does not exceed 15 mg/l oil and grease and 110 mg/l TOC, based upon an analysis of any single grab or composite sample. Under today's final regulations for BCT, wastewater consisting solely of contaminated runoff may be discharged directly without treatment, if it does not exceed 15 mg/l oil and grease and under the final regulations for BAT, wastewater consisting solely of contaminated runoff may be discharged directly without treatment if it does not exceed 110 mg/l TOC. If contaminated runoff (whether or not it exceeds 15 mg/l oil and grease or 110 mg/l TOC) is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 15 mg/l oil and grease or 110 mg/l TOC is not commingled or treated with any other type of wastewater, then such runoff would be subject to the alternative BPT/BCT/BAT effluent limitations guidelines for contaminated runoff being promulgated today, as appropriate. These oil and grease and TOC numerical effluent limitations are based on the concentrations expected from the properly designed and operated model treatment facilities.

The effluent limitations guidelines in today's BPT regulation for contaminated runoff are based on the same concentrations and variability factors used to develop the Agency's existing BPT process wastewater effluent limitations guidelines.

Today's BAT regulation for contaminated runoff is based upon the same concentrations and variability factors used to develop the Agency's existing BAT process wastewater effluent limitations guidelines, except those for total chromium, which are based upon the same concentrations and variability factors used for today's promulgated BAT effluent limitations guidelines for process wastewater.

Today's promulgated BAT effluent guidelines for phenolic compounds (4AAP) for contaminated runoff are based on the same concentrations used for the existing BAT effluent limitations guidelines for process wastewater and the same variability factors used for the Agency's existing BAT effluent limitations guidelines. EPA has determined that this approach is appropriate because of the specifics of each data base available to the Agency. If EPA used the variability factors from today's promulgated BAT effluent limitations guidelines, less stringent BAT contaminated runoff numerical effluent limitations for phenolic compounds (4AAP) would be derived than under today's promulgated BPT

contaminated runoff numerical effluent limitations for phenolic compounds (4AAP). The more stringent effluent limitations clearly are achievable and as a matter of law BAT cannot be less stringent than BPT.

Today's BCT regulation for contaminated runoff is based on the same concentrations and variability factors used for today's promulgated BCT process wastewater effluent limitations guidelines.

The Agency believes that the costs attributable to today's regulations will be minimal, while providing for reductions in refinery pollutant discharges. This is because the Agency believes the industry as a whole already is (a) treating contaminated runoff with process wastewater or (b) is discharging contaminated runoff below today's promulgated threshold for treatment. Today's final regulations do not cover contaminated runoff which is commingled with nonprocess wastewater streams. EPA believes that such instances are infrequent, and accordingly, they are left to the permit writer's discretion.

Unlike the effluent limitations guidelines for process wastewater for this industry which are mass-based, today's promulgated effluent limitations guidelines for contaminated runoff are concentration-based. This is because storm water volumes are not related to any measurement of refinery production. However, under today's regulations permit effluent limitations for contaminated runoff are to be established on a mass basis. The mass-based effluent limitations for each regulated pollutant for contaminated runoff in a petroleum refining permit are the product of (1) the respective effluent guideline concentration for that pollutant; and (2) the measured or calculated contaminated runoff volume.

Under today's regulations permit writers are given flexibility in determining refinery storm water volumes on a case-by-case basis. The following factors are among those appropriate for permit writers to consider in determining what contaminated runoff volume to use in calculating mass-based effluent limitations for refinery permits: (a) Measured difference between dry weather and wet weather discharge flow from the treatment facility where contaminated runoff is the only runoff present in the treatment facility; and (b) volume of contaminated runoff water calculated from the product of (1) measurement of land area where precipitation would become contaminated, and (2) an historical

measure of precipitation for the particular refinery location.

Once the mass based effluent limitation is derived, it may be incorporated into a refinery permit in one of three ways. The proper choice depends on site-specific factors, such as local rainfall patterns and the design of runoff holding facilities.

The first method is a continuous allocation. This presents the problem of providing an allocation when no runoff is present and is appropriate only where precipitation patterns are relatively constant through the year or when holding facilities are used to bleed runoff into the treatment facility over most or all of the year. The second method is a variable allocation based on measurement or calculation of actual contaminated runoff volume. While this is the most ideal method, it may present compliance measurement and enforcement complexities. The third method is dual wet weather/dry weather limitations triggered by either time of year, precipitation events, or actual contaminated runoff volume. The method of determining contaminated runoff volume used to calculate the effluent limitations will vary depending on the method used and the design of any runoff holding facilities. Therefore, it is left to the permit writer to select an appropriate method under today's rulemaking.

These regulations do not address uncontaminated runoff which is discharged through the process wastewater treatment facility. This is because the Agency believes that introducing uncontaminated runoff to the process wastewater treatment system may result in the discharge of an increased mass of pollutants to the environment compared to the mass of pollutants discharged if no uncontaminated runoff were present in the process wastewater treatment system. Therefore, the Agency does not want to encourage this practice on a national basis.

In the case of BPT, the effluent limitations guidelines promulgated today are for the following pollutants (1) conventional pollutants: total suspended solids (TSS), oil and grease, five-day biochemical oxygen demand (BOD<sub>5</sub>) and pH; (2) nonconventional pollutants: phenolic compounds (4AAP), chemical oxygen demand (COD) and total organic carbon (TOC); and (3) toxic pollutants: total chromium and hexavalent chromium. In the case of BAT, the effluent limitations guidelines being promulgated today are for (1) nonconventional pollutants: Phenolic compounds (4AAP), chemical oxygen

demand (COD) and total organic carbon (TOC); and (2) toxic pollutants: total chromium and hexavalent chromium. In the case of BCT, the effluent limitations guidelines being promulgated today are for the conventional pollutants TSS, oil and grease, BOD<sub>5</sub> and pH. In the case of COD, there may be instances where extremely high chloride levels (greater than 1,000 mg/l) will interfere with the COD analytical method. In this event, the Agency believes that TOC is an acceptable substitute parameter for COD. A TOC limitation shall be based upon effluent data from the particular refinery which correlated TOC to BOD<sub>5</sub>. Where adequate correlation data are not available, the permitting authority may establish a TOC limitation on a ratio of 2.2 to 1 to the applicable BPT/BCT effluent limitations for BOD<sub>5</sub>. This ratio is based upon effluent data analyzed by the Agency.

No effluent limitations guidelines for contaminated runoff are being promulgated for the nonconventional pollutants ammonia (as N) and sulfide regulated under existing BPT and BAT levels of control.

#### V. Environmental Impact of the Amendments

EPA's estimates of the reduction in industry-wide direct discharges of phenolic compounds, hexavalent chromium, and total chromium for process wastewater from those allowed under the 1982 final petroleum industry regulation to those allowed by today's amendments are presented below.

REDUCTIONS IN ALLOWABLE DISCHARGE  
[Pounds per year]

Pollutant	Reduction
Total chromium .....	286,000
Hexavalent chromium .....	19,300
Phenolic compounds .....	75,000

#### VI. Responses to Major Comments

The Agency encourages public participation in the rulemaking process and solicited comments on the proposed amendments. Public comments were received and considered in issuing this final rule. A summary of all the comments received and the Agency's responses to those comments are included in a report titled, "Responses to Public Comments on the Proposed Amendments to the Effluent Limitations Guidelines for the Petroleum Refining Point Source Category", which is included in the public record for this regulation.

Most of the commenters expressed full support for the promulgation of the

amended regulations as proposed. Although none of the commenters disagreed with the Agency's action, some believed it necessary to comment on the background and development of the proposal and to seek clarification on the Agency's intended procedures for applying the effluent limitations guidelines. The major comments are addressed below.

#### *A. Best Available Technology Effluent Limitations Guidelines (BAT)*

Some of the commenters argued that wastewater flow reduction is not an appropriate basis upon which to base effluent limitations guidelines for this industry. It was claimed that other pollutant specific control techniques will be used, if necessary, to achieve the proposed discharge limits for process wastewater.

The Agency has documentation that flow reduction is an achievable technology for this industry. Industry and Agency studies that confirm this fact are included in the rulemaking record for this regulation. These investigations conclusively demonstrated that refineries have numerous methods available to reduce process wastewater generation or discharge volumes. These studies also demonstrated that the costs and specific methods available are heavily dependent on site-specific factors at each individual refinery. The Agency has also noted that there is a substantial downward trend in historical water usage/discharge rates industry-wide regardless of environmental regulatory requirements.

There may be some refineries which have already achieved a low flow condition or cannot implement flow reduction due to site-specific factors. In these cases, improvements to the existing treatment system design or operation, or in refinery operating practices, may be necessary to meet today's amended BAT effluent limitations. It should be further clarified that the regulation does not preclude the implementation of other control options such as pollutant specific control techniques or other techniques which a refinery considers the most cost-effective method to achieve its permit conditions.

Clarification was sought by commenters on the method that should be followed to determine the appropriate refinery production rates for calculating mass effluent limits. Questions were also raised about the possibility of BAT pollutant limits being less stringent than BPT levels due to differences in the procedures for calculating BAT and BPT permit limits.

The effluent limitations guidelines developed for the petroleum refining industry are production based. Although previous permits may have been issued on the basis of process capacities, permit limits based on the revised BAT regulations should be calculated on the basis of actual production rates. For this reason, the permit writer should undertake a thorough review of a refinery's historical process utilization rates and process groupings to determine a reasonable measure of actual production projected for the period the permit would be in effect. This method of determining appropriate process feedstock rates for use in calculating mass effluent limits is in accordance with 40 CFR 122.45(b). The individual process feedstock rates established should be based on data from the same time period, i.e., all production data for the same time period. Generally, this time period (e.g., calendar year) could be that for which the sum of the crude process feedstock rates is the greatest, but is still representative of anticipated feedstock rates for the duration of the NPDES permit.

The next step in this method is to calculate a daily average feedstock rate for each refinery process included in the determination of effluent limitations. These values may be calculated by dividing an historical annual feedstock rate for each process by the number of days the process was in operation. These same average daily process feedstock rates should be used in the calculation of both daily maximum and 30-day average BAT effluent limitations. This method is consistent with the procedure the Agency used to develop the effluent limitation factors for the amended regulations and with 40 CFR 122.45. Additionally, the daily maximum and 30-day average variability factors, which are components of the effluent limitation factors used to derive permit effluent limitations, reflect short-term (i.e., monthly and daily) deviations from long-term (annual average) performance.

The amended BAT limits for phenolic compounds, total chromium and hexavalent chromium are based on a flow model and daily maximum variability factors which are different than those used to establish the BPT regulations. Some BAT permit limitations could be less stringent than the BPT limitations for a given refinery, even though the BAT and BPT limitations are calculated using the same process feedstock rates determined in accordance with the provisions of 40 CFR 122.45. These occurrences can be caused by the inclusion of additional processes and a

new process grouping in the BAT flow model. In such instances, the resultant permit limitations would be the more stringent of either the calculated BPT limitations or calculated BAT limitations. This is because BAT permit limitations may not be less stringent than BPT. In order to make a proper comparison, the BPT limitations should be recalculated using: (1) Production data from the same time period that are used to calculate the BAT limitations; and (2) the BPT process groupings and subcategorization.

In an effort to provide guidance on the application of the proposed amendments to the BAT effluent limitations guidelines, the Agency held workshops in San Francisco and Dallas for permit writers during November and December 1984.

#### *B. Best Conventional Pollutant Control Technology Effluent Limitations Guidelines (BCT)*

Commenters agreed with the approach that was followed by the Agency in its BCT cost evaluation and that the two candidate technologies selected are the most cost effective beyond BPT. Even though the Agency found that none of the four regulatory options that were considered passed the BCT cost test for any of the five subcategories, commenters argued that the actual cost per pound of pollutant removed would be greater than those estimated by EPA. It was argued that the removal cost ratios presented in the Agency's original BCT cost evaluation report were underestimated because filtration costs were understated and removal efficiencies were overstated. It was also pointed out that the BCT evaluation should incorporate available updated information.

As discussed in Section III of this preamble, the Agency has revised its BCT cost evaluation to incorporate the updated information referenced in the notice of data availability published on September 20, 1984 (49 FR 37046). The Agency also believes that the filtration costs and removal efficiencies used in its original evaluation are realistic. Nonetheless, if costs were understated and pollutant removals were overstated as argued, then removal cost ratios would fail the BCT cost test by an even wider margin, which would not change the Agency's original conclusion that BCT should be set equal to BPT for this industry.

#### *C. Effluent Limitations Guidelines for Contaminated Storm Water Runoff*

Commenters supported the reinstatement of allocations for the

discharge of contaminated storm water runoff commingled with process wastewater and treated in a refiner's effluent treatment system. Commenters recognized that storm water runoff can have a significant impact on a wastewater treatment system and argued that allocations are appropriate for both contaminated and uncontaminated runoff. In addition, clarifications were requested on the Agency's definition of contaminated runoff and its intentions to include only water which comes into direct contact with raw materials or petroleum products (i.e., exposed or spilled oil) or to extend its coverage to runoff from storage areas or tank farms where, ideally, no direct contact occurs.

The Agency's intent in promulgating storm water runoff limitations is to provide a mechanism for the control of storm water when this waste stream is, or is very likely to be, contaminated by direct contact with raw, intermediate or final products. The collection and treatment of storm water runoff that is uncontaminated can be costly and burden the refinery's wastewater treatment system. For this reason, the Agency wishes to encourage refineries which segregate uncontaminated storm water runoff from contaminated wastewater streams to continue this practice. The regulation, however, does not require such segregation.

One commenter argued that the total organic carbon (TOC) and oil and grease discharge criteria for the control of contaminated runoff effectively sets storm water runoff limitations.

The 110 mg/l TOC and 15 mg/l oil and grease applicability criteria for BAT/BCT effluent limitations apply only to contaminated runoff as defined at § 419.11(g). These values are intended to serve as threshold criteria for including contaminated runoff effluent limitations (e.g., phenolic compounds, total chromium, total suspended solids) in NPDES permits. These criteria or other limitations may be applied to such discharges on a case-by-case basis at the permitting authority's discretion. For example, a particular stormwater runoff discharge that normally meets the threshold criteria may be of a nature where it could become very contaminated by an accidental spill. In such situations it may be appropriate to impose the TOC, oil and grease and/or other values as effluent limitations or to at least require periodic sampling and analysis for such pollutants to monitor the nature of such discharges.

#### VII. Executive Order 12291

Under Executive Order 12291, EPA

must judge whether a regulation is "major" and therefore subject to the requirement of a Regulatory Impact Analysis. This regulation is not major because it does not fall within the criteria for major regulations established in Executive Order 12291.

#### VIII. Regulatory Flexibility Analysis

Under the Regulatory Flexibility Act, 5 U.S.C. 601 et seq., EPA must prepare a Regulatory Flexibility Analysis for all regulations that have a significant impact on a substantial number of small entities. The Agency does not believe that today's rulemaking will have a significant impact on any segment of the petroleum refining industry, large or small. The Agency has not, therefore, prepared a formal analysis for this regulation.

#### IX. OMB Review

This regulation was submitted to the Office of Management and Budget for review as required by Executive Order 12291. Any comments from OMB to EPA and any EPA responses to those comments are available for public inspection at Room M2404, U.S. EPA, 401 M Street, SW., Washington, D.C. from 9:00 a.m. to 4:00 p.m. Monday through Friday, excluding Federal holidays.

#### X. List of Subjects in 40 CFR Part 419

Petroleum, water pollution control, Wastewater treatment and disposal.

Dated: July 1, 1985.

A. James Barnes,  
*Acting Administrator.*

For the reasons set out in the preamble, EPA is amending 40 CFR Part 419 as follows:

#### PART 419—PETROLEUM REFINING POINT SOURCE CATEGORY

1. The authority citation for Part 419 continues to read as follows:

Authority: Secs. 301, 304 (b), (c), (e), and (g), 306 (b) and (c), 307 (b) and (c), and 501, Federal Water Pollution Control Act as amended (the Act); 33 U.S.C. 1311, 1314 (b), (c), (e), and (g), 1316 (b) and (c), 1317 (b) and (c), and 1361; 86 Stat. 816, Pub. L. 92-500; 91 Stat. 1567, Pub. L. 95-217.

2. Section 419.11 is amended by revising paragraph (b) and adding paragraph (g) to read as follows:

#### § 419.11 Specialized definitions.

\* \* \* \* \*

(b) The term "runoff" shall mean the flow of storm water resulting from precipitation coming into contact with petroleum refinery property.

\* \* \* \* \*

(g) The term "contaminated runoff" shall mean runoff which comes into contact with any raw material, intermediate product, finished product, by-product or waste product located on petroleum refinery property.

#### § 419.12 [Amended]

3. In § 419.12(a), the table is amended as follows:

A. Under the heading "English units (pounds per 1,000 bbl of feedstock)", in the first column opposite "sulfide", "0.53" is revised to read "0.053".

B. Under the heading "English units (pounds per 1,000 bbl of feedstock)", opposite "sulfide" in the second column, "0.24" is revised to read "0.024".

C. Under the heading "English units (pounds per 1,000 bbl of feedstock)", opposite "hexavalent chromium", in the first column "0.10" is revised to read "0.01".

#### § 419.32 [Amended]

4-6. In § 419.32(a), in the second column of the table, under "Metric units (Kilograms per 1,000m<sup>3</sup> of feedstock)", opposite "sulfide", "0.52" is revised to read "0.22".

#### § 419.52 [Amended]

7. The table in § 419.52(b)(1), under the column "1,000 barrels of feedstock per stream day," the figures "125.0 to 124.9" and "200 to 244.9" are revised to read "125.0 to 149.9" and "200.0 to 224.9," respectively.

#### §§ 419.12, 419.22, 419.32, 419.42, and 419.52 [Amended]

8. Sections 419.12(e), 419.22(e), 419.32(e), 419.42(e), and 419.52(e) are amended by removing the paragraph heading and the word "reserved" and by adding the following text:

§ 419 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available (BPT).

\* \* \* \* \*

(e) *Effluent Limitations for Contaminated Runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff, which may be discharged after the application of the best practicable control technology currently available by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process

wastewater, it may be discharged if it does not exceed 15 mg/l oil and grease and 110 mg/l total organic carbon (TOC) based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 15 mg/l oil and grease or 110 mg/l TOC is not commingled or treated with any other type of wastewater, the quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of contaminated runoff as determined by the permit writer times the concentrations listed in the following table:

Pollutant or pollutant property	BPT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of flow)	
BOD <sub>5</sub> .....	48.	26.
TSS.....	33.	21.
COD <sup>1</sup> .....	360.	180.
Oil and grease.....	15.	8.
Phenolic compounds (4AAP).....	0.35	0.17
Total chromium.....	0.73	0.43
Hexavalent chromium.....	0.062	0.028
pH.....	( <sup>2</sup> )	( <sup>2</sup> )
	English units (pounds per 1,000 gallons of flow)	
BOD <sub>5</sub> .....	0.40	0.22
TSS.....	0.28	0.18
COD <sup>1</sup> .....	3.0	1.5
Oil and grease.....	0.13	0.067
Phenolic compounds (4AAP).....	0.0029	0.0014
Total chromium.....	0.0060	0.0035
Hexavalent chromium.....	0.00052	0.00023
pH.....	( <sup>2</sup> )	( <sup>2</sup> )

<sup>1</sup> In any case in which the applicant can demonstrate that the chloride ion concentration in the effluent exceeds 1,000 mg/l (1,000 ppm), the permitting authority may substitute TOC as a parameter in lieu of COD. A TOC effluent limitation shall be based on effluent data from the particular refinery which correlates TOC to BOD<sub>5</sub>. If in the judgment of the permitting authority, adequate correlation data are not available, the effluent limitations for TOC shall be established at a ratio of 2.2 to 1 to the applicable effluent limitations for BOD<sub>5</sub>.

<sup>2</sup> Within the range of 6.0 to 9.0.

**§§ 419.13, 419.23, 419.33, 419.43, and 419.53 [Amended]**

9. Sections 419.13, 419.23, 419.33, 419.43, and 419.53 are amended by removing the entries and effluent limitations for phenolic compounds, total chromium, and hexavalent chromium from the tables in paragraph (a).

10. Sections 419.13, 419.23, 419.33, 419.43, and 419.53 are further amended by redesignating paragraph (e) as (f), redesignating paragraph (d) as (e), redesignating paragraph (c) as (d), and revising the redesignated paragraph (f) to read as follows:

**§ 419.—Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT).**

(f) *Effluent Limitations for Contaminated Runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff, which may be discharged after the application of the best available technology economically achievable by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process wastewater, it may be discharged if it does not exceed 110 mg/l total organic carbon (TOC) based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 110 mg/l TOC is not commingled or treated with any other type of wastewater, the quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of contaminated runoff as determined by the permit writer times the concentrations listed in the following table:

Pollutant or pollutant property	BAT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of flow)	
Phenolic compounds (4AAP).....	0.35	0.17
Total chromium.....	0.60	0.21
Hexavalent chromium.....	0.062	0.028
COD <sup>1</sup> .....	360.	180.
	English units (pounds per 1,000 gallons of flow)	
Phenolic compounds (4AAP).....	0.0029	0.0014
Total chromium.....	0.0050	0.0018
Hexavalent chromium.....	0.00052	0.00023
COD <sup>1</sup> .....	3.0	1.5

<sup>1</sup> In any case in which the applicant can demonstrate that the chloride ion concentration in the effluent exceeds 1,000 mg/l (1,000 ppm), the permitting authority may substitute TOC as a parameter in lieu of COD. A TOC effluent limitation shall be based on effluent data from the particular refinery which correlates TOC to BOD<sub>5</sub>. If in the judgment of the permitting authority, adequate correlation data are not available, the effluent limitations for TOC shall be established at a ratio of 2.2 to 1 to the applicable effluent limitations for BOD<sub>5</sub>.

11. Sections 419.23, 419.33, 419.43, and 419.53 are amended in newly designated paragraph (d) by changing "419.13(c)" to read "419.13(d)".

12. Sections 419.12 (a) and (c), 419.13 (a), 419.16 (a) and (c), 419.22(a),

419.23(a), 419.26(a), 419.32(a), 419.33(a), 419.36(a), 419.42(a), 419.43(a), 419.46(a), 419.52(a), 419.53(a), and 419.56(a) are amended by revising footnote (1) to the table to read "1 See footnote following table in § 419.13(b)".

**§§ 419.13, 419.23, 419.33, and 419.53 [Amended]**

13. Sections 419.13, 419.23, 419.33, and 419.53 are amended by adding a new paragraph (c) to read as follows:

**§ 419.—Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT).**

(c)(1) In addition to the provisions contained above pertaining to COD, ammonia and sulfide, any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT):

(i) For each of the regulated pollutant parameters listed below, the effluent limitation for a given refinery is the sum of the products of each effluent limitation factor times the applicable process feedstock rate, calculated as provided in 40 CFR 122.45(b). Applicable production processes are presented in Appendix A, by process type. The process identification numbers presented in this Appendix A are for the convenience of the reader. They can be cross-referenced in the *Development Document for Effluent Limitations Guidelines, New Source Performance Standards, and Pretreatment Standards for the Petroleum Refining Point Source Category* (EPA 440/1-82/014), Table III-7, pp. 49-54.

Pollutant or pollutant property and process type	BAT effluent limitation factor	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 cubic meters of feedstock)	
Phenolic compounds (4AAP):		
Crude.....	0.037	0.009
Cracking and coking.....	0.419	0.102
Asphalt.....	0.226	0.055
Lube.....	1.055	0.257
Reforming and alkylation.....	0.377	0.092
Total chromium:		
Crude.....	0.030	0.011
Cracking and coking.....	0.340	0.118
Asphalt.....	0.183	0.064
Lube.....	0.855	0.297
Reforming and alkylation.....	0.305	0.106
Hexavalent chromium:		
Crude.....	0.0019	0.0009
Cracking and coking.....	0.0218	0.0098

Pollutant or pollutant property and process type	BAT effluent limitation factor	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Asphalt.....	0.0117	0.0053
Lube.....	0.0549	0.0248
Reforming and alkylation.....	0.0196	0.0088
English units (pounds per 1,000 bbl of feedstock)		
Phenolic compounds (4AAP):		
Crude.....	0.013	0.003
Cracking and coking.....	0.147	0.038
Asphalt.....	0.079	0.019
Lube.....	0.369	0.090
Reforming and alkylation.....	0.132	0.032
Total chromium:		
Crude.....	0.011	0.004
Cracking and coking.....	0.119	0.041
Asphalt.....	0.064	0.022
Lube.....	0.299	0.104
Reforming and alkylation.....	0.107	0.037
Hexavalent chromium:		
Crude.....	0.0007	0.0003
Cracking and coking.....	0.0076	0.0034
Asphalt.....	0.0041	0.0019
Lube.....	0.0192	0.0087
Reforming and alkylation.....	0.0069	0.0031

(2) See the comprehensive example in Subpart D, § 419.43(c)(2).

14. Section 419.43 is amended by adding a new paragraph (c) to read as follows:

**§ 419.43 Effluent limitation guidelines representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT).**

\* \* \* \* \*

(c)(1) In addition to the provisions contained above pertaining to COD, ammonia and sulfide, any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT):

(i) For each of the regulated pollutant parameters listed below, the effluent limitation for a given refinery is the sum of the products of each effluent limitation factor times the applicable process feedstock rate, calculated as provided in 40 CFR 122.45(b). Applicable production processes are presented in Appendix A, by process type. The process identification numbers presented in this Appendix A are for the convenience of the reader. They can be cross-referenced in the *Development Document for Effluent Limitations Guidelines, New Source Performance Standards, and Pretreatment Standards for the Petroleum Refining Point Source Category* (EPA 440/1-82/014), Table III-7, pp. 49-54.

Pollutant or pollutant property and process type	BAT effluent limitation factor	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Metric units (kilograms per 1,000 m <sup>3</sup> of feedstock)		
Phenolic compounds (4AAP):		
Crude.....	0.037	0.009
Cracking and coking.....	0.419	0.102
Asphalt.....	0.228	0.055
Lube.....	1.055	0.257
Reforming and alkylation.....	0.377	0.092
Total chromium:		
Crude.....	0.030	0.011
Cracking and coking.....	0.340	0.118
Asphalt.....	0.183	0.064
Lube.....	0.855	0.297
Reforming and alkylation.....	0.305	0.106
Hexavalent chromium:		
Crude.....	0.0019	0.0009
Cracking and coking.....	0.0218	0.0098
Asphalt.....	0.0117	0.0053
Lube.....	0.0549	0.0248
Reforming and alkylation.....	0.0196	0.0088
English units (pounds per 1,000 bbl of feedstock)		
Phenolic compounds (4AAP):		
Crude.....	0.013	0.003
Cracking and coking.....	0.147	0.038
Asphalt.....	0.079	0.019
Lube.....	0.369	0.090
Reforming and alkylation.....	0.132	0.032
Total chromium:		
Crude.....	0.011	0.004
Cracking and coking.....	0.119	0.041
Asphalt.....	0.064	0.022
Lube.....	0.299	0.104
Reforming and alkylation.....	0.107	0.037
Hexavalent chromium:		
Crude.....	0.0007	0.0003
Cracking and coking.....	0.0076	0.0034
Asphalt.....	0.0041	0.0019
Lube.....	0.0192	0.0087
Reforming and alkylation.....	0.0069	0.0031

(2) Example Application of Effluent Limitations Guidelines as Applicable to Phenolic Compounds, Hexavalent Chromium, and Total Chromium.

The following example presents the derivation of a BAT phenolic compound (4AAP) effluent limitation (30-day average) for a petroleum refinery permit. The methodology is also applicable to hexavalent chromium and total chromium.

Refinery process	Process feedstock rate 1,000 bbl/day
1. Atmospheric crude distillation.....	100
2. Crude desalting.....	50
3. Vacuum crude distillation.....	75
Total crude processes (C).....	225
6. Fluid catalytic cracking.....	25
10. Hydrocracking.....	20
Total cracking and coking processes (K).....	45
18. Asphalt production.....	5
Total asphalt processes (A).....	5
21. Hydrofining.....	3
Total lube processes (L).....	3

Refinery process	Process feedstock rate 1,000 bbl/day
8. Catalytic reforming.....	10
Total reforming and alkylation processes (R).....	10

Note: 30 day average effluent limitation for phenolic compounds (4AAP), lb/day = (0.003)(225) + (0.038)(45) + (0.019)(5) + (0.090)(3) + (0.032)(10) = 2.98 lb/day

15. Section 419.14 is revised to read as follows:

**§419.14 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT):**

(a) Any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT):

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Metric units (Kilograms per 1,000 m <sup>3</sup> of feedstock)		
BOD <sub>5</sub> .....	22.7	12.0
TSS.....	15.8	10.1
Oil and Grease.....	6.9	3.7
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
English units (pounds per 1,000 bbl of feedstock)		
BOD <sub>5</sub> .....	8.0	4.25
TSS.....	5.6	3.6
Oil and Grease.....	2.5	1.3
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

(b) The limits set forth in paragraph (a) of this section are to be multiplied by the following factors to calculate the maximum for any one day and maximum average of daily values for thirty consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream day	Size factor
Less than 24.9.....	1.02
25.0 to 49.9.....	1.06
50.0 to 74.9.....	1.16
75.0 to 99.9.....	1.26
100 to 124.9.....	1.38
125.0 to 149.9.....	1.50
150.0 or greater.....	1.57

(2) Process factor.

Process configuration	Process factor
Less than 2.49.....	0.62
2.5 to 3.49.....	0.67

Process configuration	Process factor
3.5 to 4.49	0.80
4.5 to 5.49	0.95
5.5 to 5.99	1.07
6.0 to 6.49	1.17
6.5 to 6.99	1.27
7.0 to 7.49	1.39
7.5 to 7.99	1.51
8.0 to 8.49	1.64
8.5 to 8.99	1.79
9.0 to 9.49	1.95
9.5 to 9.99	2.12
10.0 to 10.49	2.31
10.5 to 10.99	2.51
11.0 to 11.49	2.73
11.5 to 11.99	2.96
12.0 to 12.49	3.24
12.5 to 12.99	3.53
13.0 to 13.49	3.84
13.5 to 13.99	4.18
14.0 or greater	4.36

(3) See the comprehensive example in Subpart D, § 419.43(b)(3).

(c) The following allocations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to ballast, which may be discharged after the application of best conventional pollutant control technology by a point source subject to this subpart, in addition to the discharge allowed by paragraph (b) of this section. The allocation allowed for ballast water flow, as kg/cu m (lb/1000 gal), shall be based on those ballast waters treated at the refinery.

Pollutant or pollutant property	BCT Effluent limitations for ballast water	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per m <sup>3</sup> of flow)	
BOD <sub>5</sub> .....	0.048	0.026
TSS.....	0.033	0.021
Oil and grease.....	0.015	0.008
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
	English units (pounds per 1,000 gallons of flow)	
BOD <sub>5</sub> .....	0.40	0.21
TSS.....	0.26	0.17
Oil and grease.....	0.126	0.067
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

(d) The quantity and quality of pollutants or pollutant properties controlled by this paragraph attributable to once-through cooling water, are excluded from the discharge allowed by paragraph (b) of this section.

(e) *Effluent Limitations for Contaminated Runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff which may be discharged after the application of the

best conventional pollutant control technology by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process wastewater, it may be discharged if it does not exceed 15 mg/l oil and grease based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 15 mg/l oil and grease is not commingled or treated with any other type of wastewater, the quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of contaminated runoff as determined by the permit writer times the concentrations listed in the following table:

Pollutant or pollutant property	BCT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of flow)	
BOD <sub>5</sub> .....	48	26
TSS.....	33	21
Oil and grease.....	15	8
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
	English units (pounds per 1,000 gallons of flow)	
BOD <sub>5</sub> .....	0.40	0.22
TSS.....	0.28	0.18
Oil and grease.....	0.13	0.067
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

16. Section 419.24 is revised to read as follows:

**§ 419.24 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT).**

(a) Any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT):

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of feedstock)	
BOD <sub>5</sub> .....	26.2	15.6
TSS.....	19.3	12.6

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Oil and grease.....	6.4	4.5
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
	English units (pounds per 1,000 bbl of feedstock)	
BOD <sub>5</sub> .....	9.9	5.5
TSS.....	6.9	4.4
Oil and grease.....	3.0	1.8
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

(b) The limits set forth in paragraph (a) of this section are to be multiplied by the following factors to calculate the maximum for any one day and maximum average of daily values for thirty consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream day	Size factor
Less than 24.9	0.91
25.0 to 49.9	0.95
50.0 to 74.9	1.04
75.0 to 99.9	1.13
100.0 to 124.9	1.23
125.0 to 149.9	1.35
150.0 or greater	1.41

(2) Process factor.

Process configuration	Process factor
Less than 2.49	0.58
2.5 to 3.49	0.63
3.5 to 4.49	0.74
4.5 to 5.49	0.88
5.5 to 5.99	1.00
6.0 to 6.49	1.09
6.5 to 6.99	1.19
7.0 to 7.49	1.29
7.5 to 7.99	1.41
8.0 to 8.49	1.53
8.5 to 8.99	1.67
9.0 to 9.49	1.82
9.5 or greater	1.89

(3) See the comprehensive example in Subpart D, § 419.42(b)(3).

(c) The provisions of § 419.14(c) apply to discharge of process wastewater pollutants attributable to ballast water by a point source subject to the provisions of this subpart.

(d) The quantity and quality of pollutants or pollutant properties controlled by this paragraph, attributable to once-through cooling water, are excluded from the discharge allowed by paragraph (b) of this section.

(e) *Effluent Limitations for Contaminated Runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff which may be discharged after the application of the

best conventional pollutant control technology by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process wastewater, it may be discharged if it does not exceed 15 mg/l oil and grease based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 15 mg/l oil and grease is not commingled or treated with any other type of wastewater, the quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of contaminated runoff as determined by the permit writer times the concentrations listed in the following table:

Pollutant or pollutant property	BCT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of flow)	
BOD <sub>5</sub> .....	48	26
TSS.....	33	21
Oil and grease.....	15	8
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
	English units (pounds per 1,000 gallons of flow)	
BOD <sub>5</sub> .....	0.40	0.22
TSS.....	0.28	0.18
Oil and grease.....	0.13	0.067
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

17. Section 419.34 is revised to read as follows:

**§ 419.34 Effluent Limitations Guidelines representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT).**

(a) Any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT):

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of feedstock)	
BOD <sub>5</sub> .....	34.6	18.4
TSS.....	23.4	14.8

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	English units (pounds per 1,000 bbl of feedstock)	
Oil and grease.....	11.1	5.9
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
	English units (pounds per 1,000 bbl of feedstock)	
BOD <sub>5</sub> .....	12.1	6.5
TSS.....	8.3	5.25
Oil and grease.....	3.9	2.1
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

(b) The limits set forth in paragraph (a) of this section are to be multiplied by the following factors to calculate the maximum for any one day and maximum average of daily values for thirty consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream day	Size factor
Less than 24.9.....	0.73
25.0 to 49.9.....	0.76
50.0 to 74.9.....	0.83
75.0 to 99.9.....	0.91
100.0 to 124.9.....	0.99
125.0 to 149.9.....	1.08
150.0 or greater.....	1.13

(2) Process factor.

Process configuration	Process factor
Less than 4.49.....	0.73
4.5 to 5.49.....	0.80
5.5 to 5.99.....	0.91
6.0 to 6.49.....	0.99
6.5 to 6.99.....	1.08
7.0 to 7.49.....	1.17
7.5 to 7.99.....	1.26
8.0 to 8.49.....	1.39
8.5 to 8.99.....	1.51
9.0 to 9.49.....	1.65
9.5 or greater.....	1.72

(3) See the comprehensive example in Subpart D, § 419.42(b)(3).

(c) The provisions of § 419.14(c) apply to discharges of process wastewater pollutants attributable to ballast water by a point source subject to the provisions of this subpart.

(d) The quantity and quality of pollutants or pollutant properties controlled by this paragraph, attributable to once-through cooling water, are excluded from the discharge allowed by paragraph (b) of this section.

(e) *Effluent Limitations for Contaminated Runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff which may be discharged after the application of the best conventional pollutant control

technology by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process wastewater, it may be discharged if it does not exceed 15 mg/l oil and grease based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 15 mg/l oil and grease is not commingled or treated with any other type of wastewater, the quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of contaminated runoff as determined by the permit writer times the concentrations listed in the following table:

Pollutant or pollutant property	BCT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of flow)	
BOD <sub>5</sub> .....	48	26
TSS.....	33	21
Oil and grease.....	15	8
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
	English units (pounds per 1,000 gallons of flow)	
BOD <sub>5</sub> .....	0.40	0.22
TSS.....	0.28	0.18
Oil and grease.....	0.13	0.067
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

18. Section 419.44 is revised to read as follows:

**§ 419.44 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT).**

(a) Any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT):

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m <sup>3</sup> of feedstock)	
BOD <sub>5</sub> .....	50.6	25.8
TSS.....	35.6	22.7

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Oil and Grease.....	16.2	8.5
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
English units (pounds per 1,000 bbl of feedstock)		
BOD <sub>5</sub> .....	17.9	8.1
TSS.....	12.5	8.0
Oil and Grease.....	5.7	3.0
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

(b) The limits set forth in paragraph (a) of this section are to be multiplied by the following factors to calculate the maximum for any one day and maximum average of daily values for thirty consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream day	Size factor
Less than 49.9.....	0.71
50.0 to 74.9.....	0.74
75.0 to 99.9.....	0.81
100.0 to 124.9.....	0.88
125.0 to 149.9.....	0.97
150.0 to 174.9.....	1.05
175.0 to 199.9.....	1.14
200.0 or greater.....	1.19

(2) Process factor.

Process configuration	Process factor
Less than 6.49.....	0.81
6.5 to 7.49.....	0.88
7.5 to 7.99.....	1.00
8.0 to 8.49.....	1.09
8.5 to 8.99.....	1.19
9.0 to 9.49.....	1.29
9.5 to 9.99.....	1.41
10.0 to 10.49.....	1.53
10.5 to 10.99.....	1.67
11.0 to 11.49.....	1.82
11.5 to 11.99.....	1.98
12.0 to 12.49.....	2.15
12.5 to 12.99.....	2.34
13.0 or greater.....	2.44

(c) The provisions of § 419.14(c) apply to discharges of process wastewater pollutants attributable to ballast water by a point source subject to the provisions of this subpart.

(d) The quantity and quality of pollutants or pollutant properties controlled by this paragraph, attributable to once-through cooling water, are excluded from the discharge allowed by paragraph (b) of this section.

(e) *Effluent Limitations for Contaminated Runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff which may be discharged after the application of the best conventional pollutant control

technology by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process wastewater, it may be discharged if it does not exceed 15 mg/l oil and grease based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 15 mg/l oil and grease is not commingled or treated with any other type of wastewater, the quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of contaminated runoff as determined by the permit writer times the concentrations listed in the following table:

Pollutant or pollutant property	BCT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Metric unit (kilograms per 1,000 m <sup>3</sup> of flow)		
BOD <sub>5</sub> .....	48.	26.
TSS.....	33.	21.
Oil and grease.....	15.	8.
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
English units (pounds per 1,000 gallons of flow)		
BOD <sub>5</sub> .....	0.40	0.22
TSS.....	0.28	0.18
Oil and grease.....	0.13	0.067
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 8.0 to 9.0.

19. Section 419.54 is revised to read as follows:

**§ 419.54 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT).**

(a) Any existing point subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT):

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Metric units (kilograms per 1,000 m <sup>3</sup> of feedstock)		
BOD <sub>5</sub> .....	54.4	28.9
TSS.....	37.3	23.7

Pollutant or pollutant property	BCT effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Oil and grease.....	17.1	9.1
pH.....	( <sup>1</sup> )	( <sup>1</sup> )
English units (pounds per 1,000 bbl of feedstock)		
BOD <sub>5</sub> .....	19.2	10.2
TSS.....	13.2	8.4
Oil and grease.....	6.0	3.2
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

(b) The limits set forth in paragraph (a) of this section are to be multiplied by the following factors to calculate the maximum for any one day and maximum average of daily values for thirty consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream day	Size factor
Less than 124.9.....	0.73
125.0 to 149.9.....	0.76
150.0 to 174.9.....	0.83
175.0 to 199.9.....	0.91
200.0 to 224.9.....	0.99
225.0 or greater.....	1.04

(2) Process factor.

Process configuration	Process factor
Less than 6.49.....	0.75
6.5 to 7.49.....	0.82
7.5 to 7.99.....	0.92
8.0 to 8.49.....	1.00
8.5 to 8.99.....	1.10
9.0 to 9.49.....	1.20
9.5 to 9.99.....	1.30
10.0 to 10.49.....	1.42
10.5 to 10.99.....	1.54
11.0 to 11.49.....	1.68
11.5 to 11.99.....	1.83
12.0 to 12.49.....	1.99
12.5 to 12.99.....	2.17
13.0 or greater.....	2.26

(3) See the comprehensive example in Subpart D, § 419.42(b)(3).

(c) The provisions of § 419.14(c) apply to discharges of process wastewater pollutants attributable to ballast water by a point source subject to the provisions of this subpart.

(d) The quantity and quality of pollutants or pollutant properties controlled by this paragraph, attributable to once-through cooling water, are excluded from the discharge allowed by paragraph (b) of this section.

(e) *Effluent Limitations for Contaminated Runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff which may be

discharged after the application of the best conventional pollutant control technology by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process wastewater, it may be discharged if it does not exceed 15 mg/l oil and grease based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commingled or treated with process wastewater, or if wastewater consisting solely of contaminated runoff which exceeds 15 mg/l oil and grease is not commingled or treated with any other type of wastewater, the quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of contaminated runoff as determined by the permit writer times the concentrations listed in the following table:

Pollutant or pollutant property	BCT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
Metric units (kilograms per 1,000 m <sup>3</sup> of feedstock)		
BOD <sub>5</sub> .....	48.	26.
TSS.....	33.	21.
Oil and grease.....	15.	8.
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

Pollutant or pollutant property	BCT effluent limitations for contaminated runoff	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed
English units (pounds per 1,000 gallons of flow)		
BOD <sub>5</sub> .....	0.40	0.22
TSS.....	0.28	0.18
Oil and grease.....	0.13	0.067
pH.....	( <sup>1</sup> )	( <sup>1</sup> )

<sup>1</sup> Within the range of 6.0 to 9.0.

**§ 419.46 and 419.56 [Amended]**

20. In §§ 419.46(c) and 419.56(c), "419.15(c)", is revised to read "419.16(c)."

21. 40 CFR Part 419 is amended by adding the following Appendix A:

**Appendix A.—Processes Included in the Determination of BAT Effluent Limitations for Total Chromium, Hexavalent Chromium, and Phenolic Compounds (4AAP)**

*Crude Processes*

1. Atmospheric Crude Distillation
2. Crude Desalting
3. Vacuum Crude Distillation

*Cracking and Coking Processes*

4. Visbreaking
5. Thermal Cracking
6. Fluid Catalytic Cracking
7. Moving Bed Catalytic Cracking
10. Hydrocracking

15. Delayed Coking
16. Fluid Coking
54. Hydrotreating

*Asphalt Processes*

18. Asphalt Production
32. 200°F Softening Point Unfluxed Asphalt
43. Asphalt Oxidizing
89. Asphalt Emulsifying

*Lube Processes*

21. Hydrofining, Hydrofinishing, Lube Hydrofining
22. White Oil Manufacture
23. Propane Dewaxing, Propane Deasphalting, Propane Fractioning, Propane Deresining
24. Duo Sol, Solvent Treating, Solvent Extraction, Duotreating, Solvent Dewaxing, Solvent Deasphalting
25. Lube Vac Twr, Oil Fractionation, Batch Still (Naphtha Strip), Bright Stock Treating
26. Centrifuge and Chilling
27. MEK Dewaxing, Ketone Dewaxing, MEK-Toluene Dewaxing
28. Deoiling (wax)
29. Naphthenic Lubes Production
30. SO<sub>2</sub> Extraction
34. Wax Pressing
35. Wax Plant (with Neutral Separation)
36. Furfural Extraction
37. Clay Contacting—Percolation
38. Wax Sweating
39. Acid Treating
40. Phenol Extraction

*Reforming and Alkylation Processes*

8. H<sub>2</sub>SO<sub>4</sub> Alkylation
12. Catalytic Reforming