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EPA Development Document for Effluent Limitations Guidelines and Standards for the

Nonferrous Metals

Point Source Category
Phase II

Proposed

Supplemental Development Document For:

Bauxite Refining

DEVELOPMENT DOCUMENT

for

EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS

for the

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

PHASE II

Bauxite Refining Supplement

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SECTION I

SUMMARY AND CONCLUSIONS

Pursuant to Sections 301, 304, 306, 307, and 501 of the Clean Water Act and the provisions of the Settlement Agreement in Natural Resources Defense Council v. Train, 8 ERC 2120 (D.D.C. 1976) modified, 12 ERC 1833 (D.D.C. 1979), EPA has collected and analyzed data for plants in the bauxite refining subcategory. On April 8, 1974, EPA promulgated effluent limitations based on best practicable technology currently available (BPT) and best available technology economically achievable (BAT), standards of performance for new sources (NSPS) and pretreatment standards for new sources (PSNS). See 39 FR 12822-12830, April 8, 1974 and 40 CFR Part 421 Subpart A. In each case, the limitations and standards required no discharge of process wastewater pollutants with an allowance for discharge of monthly net precipitation (i.e., the difference in water volume between precipitation and evaporation in a one month period) that accumulates in the impoundments used by bauxite refineries to store the undigested solids produced in the refining process. This document and the administrative record provide the technical basis for review of the promulgated effluent limitations and standards.

The bauxite refining subcategory comprises 8 plants. Of the 8 plants, three discharge directly to rivers, lakes, or streams and five achieve zero discharge of process wastewater.

EPA first studied the bauxite refining subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, or water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including (1) the sources and volume of water used, the processes used, and the sources of pollutants and wastewaters in the plant; and (2) the constituents of wastewaters, including toxic pollutants. As a result, four subdivisions have been identified for this subcategory that warrant separate effluent limitations. These include:

- Digester Condensate
- Barometric Condenser Effluent
- Carbonation Plant Effluent
- Mud Impoundment Effluent

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the bauxite refining subcategory. The Agency analyzed both

historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts and air quality, solid waste generation, and energy requirements. EPA also studied flow reduction reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each discharging plant (and one zero discharger) for the control and treatment option considered for the subcategory. These costs were then used by the Agency to estimate the impact of implementing the option in the subcategory. For this control and treatment option, the number of potential closures, number of employees affected, and impact on price were estimated. These results are reported in a separate document entitled "The Economic Impact Analysis of Proposed Effluent Limitations Guidelines and Standards for the Nonferrous Smelting and Refining Industry."

After examining the various treatment technologies being operated in the subcategory, the Agency has identified BPT to be equivalent to the existing promulgated BPT effluent limitations published on April 8, 1974 (40 CFR Part 421 Subpart A). This requires no discharge of process wastewater pollutants to navigable waters, while permitting the discharge of net precipitation from red mud lake impoundments. Minor amendments to the regulatory language are being proposed to clarify references to fundamentally different factors (FDF) considerations under 40 CFR Part 125 and references to pretreatment standards under 40 CFR Part 128. As a result, the bauxite refining subcategory will not incur any incremental capital or annual costs to comply with the BPT limitations.

For BAT, the Agency is considering revising the promulgated BAT to include treatment of mud impoundment effluent by pH adjustment and activated carbon adsorption technology for removal of organic pollutants. This potential revision is based on new data collected by the Agency since the previous promulgation that indicated the presence of phenolic compounds at treatable concentrations in the mud impoundment effluent.

To meet the BAT effluent limitations based on this technology, the bauxite refining subcategory is estimated to incur a capital cost of $7.6 million and an annual cost of $2.98 million.

The technical basis of NSPS is equivalent to the existing promulgated BAT. In selecting NSPS, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technology. However, no such processes or treatment technology were considered to meet the NSPS criteria. Therefore, the technology basis of BAT has been determined as the best demonstrated technology, the technology basis of NSPS. However, the Agency is also considering the application of pH adjustment and activated

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carbon adsorption technology to the mud impoundment effluent for new sources.

The limitations and standards for BPT, BAT, NSPS, and PSNS are presented in Section II.

BAUXITE REFINING SUBCATEGORY

SECTION II

RECOMMENDATIONS

1.   No change to the existing promulgated BPT is proposed for the bauxite refining subcategory. The regulation establishes no discharge of process wastewater pollutants with an allowance for discharge of net precipitation from the mud impoundment. The technology basis for BPT is impoundment and recycle for all process wastewater.

2.   EPA is not substantially modifying the existing promulgated BAT limitations. However, the Agency is considering the establishment of limitations providing additional control of toxic organic pollutants in net precipitation discharges from the mud impoundment based on pH adjustment and activated carbon adsorption. The following BAT effluent limitations are being considered:

Pollutant or Pollutant Property	Maximum for Any One Day (mg/l)
Phenol	0.010
2-chlorophenol	0.010
Total phenols (4-AAP)	0.010

3.   Similar to BAT, EPA is not substantially modifying the existing promulgated NSPS, but is considering the establishment of performance standards based on control of organic pollutants in the discharges from the mud impoundment based on pH adjustment and activated carbon adsorption. The standards under consideration are:

Mud Impoundment Effluent

Pollutant or Pollutant Property	Maximum for Any One Day (mg/l)
Phenol	0.010
2-chlorophenol	0.010
Total Phenols (4-AAP)	0.010

4.   EPA is not proposing PSES limitations for the bauxite refining subcategory because there are no existing indirect dischargers.

5.   EPA is modifying the existing promulgated PSNS since it is unlikely that any new bauxite sources could be constructed as indirect dischargers.

6.	EPA is not proposing best conventional pollutant control technology (BCT) limitations at this time.

BAUXITE REFINING SURCATEGORY

SECTION III

INDUSTRY PROFILE

This section of the bauxite refining supplement describes the raw materials and processes used in refining bauxite to produce alumina and presents a profile of the alumina plants identified in this study. For a discussion of the purpose, authority, and methodology for this study and a general description of the non-ferrous metals manufacturing category, refer to Section III of the General Development Document.

EPA promulgated effluent limitations for BPT and BAT, new source performance standards, and pretreatment standards for new sources for the bauxite refining subcategory on April 8, 1974 as Subpart A of 40 CFR Part 421. The pollutants considered in the development of those regulations included alkalinity, pH, total dissolved solids, total suspended solids, and sulfate.

The Clean Water Act of 1977 mandates the achievement of effluent limitations requiring the application of BAT for toxic pollutants. In keeping with this emphasis on toxic pollutants, EPA is re-examining the discharge of toxic pollutants from process wastewater impoundments in the bauxite refining subcategory.

Most of the alumina produced by bauxite refiners is sold to the primary aluminum industry. Aluminum metal is widely used for building and construction materials, transportation equipment, and containers and packaging products. The remainder of the alumina is sold to the chemical, abrasive, ceramic, and refractory industries for the manufacture of products such as chemical alums, activated alumina, polishes, electrical insulators, and heat exchange media.

DESCRIPTION OF BAUXITE REFINING PROCESSES

Bauxite is the only ore of aluminum used commercially in the United States. Aluminum production is unique among metal manufacturing techniques in that nearly all purification is accomplished in the bauxite refining process. No significant removal of impurities occurs during the subsequent reduction to metal.

In the United States, bauxite is refined using the Bayer process. The classic Bayer process may be broadly divided into four major operations:

1. Bauxite grinding and digestion,
2. Red mud removal and liquor purification,

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3. Precipitation and classification, and
4. Calcination.

A variation of the process, known as the combination process, allows additional alumina recovery from solid residues when high-silica bauxites are used as the raw material.

Bauxite refining is characteristically conducted in very large scale installations. The process is conducted in an essentially closed circuit with extensive reuse and recycle of process water. Economic considerations make the maximum recovery of heat and reagents a necessity. Production processes for the bauxite refining subcategory are presented schematically in Figure III-1 and described in detail below.

RAW MATERIALS

Bauxite consists of hydrated aluminum oxide and various impurities, including iron oxide, titanium dioxide, silicon dioxide, and compounds of phosphorus and vanadium. A basic distinction is made between monohydrate bauxite, which contains alumina in the form of boehmite or diaspore (Al_2O_3) • H_2O), and trihydrate bauxite, in the form of gibbsite ($Al_2O_3•3H_2O$ or $Al(OH)_3$), because they require different digestion conditions. Further distinctions of ore type include high or low silica content, high or low iron content, and fast- or slow-settling red mud after digestion.

BAUXITE GRINDING AND DIGESTION

Bauxite ore is crushed and wet-ground with a caustic-rich solution in preparation for the digestion process. The bauxite must be ground finely enough to ensure effective digestion but not so finely that the red mud residue presents problems during settling and filtration. One plant reports the use of scrubbers for dust control in the bauxite handling operations. Because the water from these scrubbers is returned to the process to recover the bauxite value, it is considered to be a process stream rather than a wastewater stream.

The ground bauxite slurry is fed to digesters where the hydrated alumina in the bauxite is converted to a soluble salt, sodium aluminate. The reaction is accomplished using either sodium hydroxide or a combination of lime and sodium carbonate. Wastewater from wet air pollution control on lime kilns at two plants is sent to the digesters. Because the scrubber effluent is returned to the process and not discharged, it is considered to be a process stream rather than a wastewater stream.

Digestion conditions (temperature, pressure, and caustic concentration) depend on the type of bauxite processed. Monohydrate bauxites require temperatures between 200 and 250°C at up to 500 psi pressure. Trihydrate bauxites can be digested

under the more moderate conditions of 120 to 170°C and 50 to 70 psi pressure.

The product of the digestion process is a slurry containing sodium aluminate in aqueous solution and undissolved solids. This slurry enters a system of expansion vessels or "flash tanks" for cooling, pressure reduction, and heat recovery. The stream recovered from the expansion process is returned to the digesters to provide some of the heat needed to maintain proper digestion temperatures. Condensate from the vapor is frequently used for boiler water. At one plant condensate is used for hydrate washing. Excess condensate or condensate which is unsuitable for use in boilers may be disposed of.

RED MUD REMOVAL AND LIQUOR PURIFICATION

The digested bauxite suspension contains solid, insoluble bauxite particles of various sizes and compositions in a sodium aluminate solution. Particles above a certain size, e.g., 100 microns, are called "sand" and may include undigested bauxite, quartz particules, or common sand. Sand is usually removed from the suspension before red mud thickening.

The insoluble residue remaining in suspension after desanding is commonly known as red mud. Red mud contains iron oxides, titanium dioxide, aluminum present with silica, and other secondary impurities. A flocculating agent is added to the process suspension to enhance settling of the fine red mud particles.

The overflow from the mud settling and thickening steps is further clarified by filtration. This step removes red mud particles from the supersaturated aluminate liquor.

The red mud settled from the process liquor is thickened, washed, and sometimes filtered to recover caustic and alumina values. The mud is then moved as a waterborne slurry to a waste area known as a red mud lake or impoundment for disposal.

When high-silica bauxites such as those from Arkansas are used as the raw material for alumina production, the "combination process" can be applied to recover alumina and sodium values which would otherwise be lost in the red mud. As much as one-third of the total alumina value produced by a plant using Arkansas bauxite may be trapped in insoluble sodium aluminosilicates which are removed from the process with the red mud.

In the combination process, the red mud is treated first by filtration to reduce the evaporative load and then by sintering and leaching to recover alumina. After filtering and washing, the remaining solid residue or "brown mud" is sent to a mud lake for disposal. The very pure filtrate, known as white liquor, is

either combined with the process stream or precipitated and calcined separately to produce chemical-grade alumina.

Red muds from various bauxites have different characteristics which produce differing disposal considerations. For example, the yield of red mud residue from Surinam bauxite is low (approximately 1/3 ton per ton of alumina product), and the mud is amenable to filtration and effective washing on a filter. Thus, the final residue is relatively easy to handle and disposal area requirements are moderate. On the other hand, red muds from Arkansas and Jamaican bauxites are produced in much greater yield, (approximately 2 tons and 1 ton per ton of alumina, respectively), because of their larger content of contaminants. The physical characteristics of Jamaican bauxite red mud are such that filtration is difficult and countercurrent decantation may be required. It also settles poorly, reaching a solids concentration of only about 30 percent after normal settling as compared to more than 50 percent solids for the muds from other ores. As a result, area requirements for these red mud lakes are large.

One company which refines Jamaican bauxite has developed a sand bed filtration technique. In this technique, red mud is pumped to a drying bed where the solids concentration of the mud is increased from 15 or 20 percent to more than 50 percent. The surface of the mud drying bed is kept dry by drawing water off the top and, at one of the two plants using sand bed filtration, pumping it to a "clear lake." Underflow is also drawn out through the sandy bottom of the bed and sent to the clear lake. Clear lake water is then recycled to the bauxite refining operations for use as process water, forming a nearly-closed water system. The second plant that practices sand bed filtration of red mud wastes does not have a clear lake, practices no recycle of mud lake water to the process, and discharges neutralized effluent directly to surface waters.

Of the alumina plants which do not practice sand bed filtration of red mud, all report the use of red mud lakes. In addition, a refinery may have a process water lake for recycle of higher quality water than is found in the mud lake and a storm water lake to collect large volumes of rainwater runoff from the plant site. Minor remaining storage capacity in abandoned red mud lakes may be utilized to dispose of small quantities of aqueous wastes which are intolerable in the recycle circuit. Examples of such wastes are spent acids from equipment cleaning and the effluent from salting-out evaporators.

PRECIPITATION AND CLASSIFICATION

The purified sodium aluminate solution obtained by removing solid impurities from the digested liquor passes through heat exchangers and is cooled before being discharged into large

precipitation vessels. Vapor produced in the flash cooling area is condensed and reused in other parts of the plant.

During precipitation, aluminum hydroxide crystallizes from the super-saturated sodium aluminate in the presence of seed crystals. The precipitation conditions are carefully controlled so that the solids formed will be amenable to easy separation and washing. The precipitated hydrate crystals are classified by size; small crystals are washed and fed to calcining furnaces. Aluminum trihydrate scale can also be recovered from the precipitators and processed to make an activated alumina by-product.

The spent liquor separated from the hydrate crystals during classification is returned to the grinding and digestion processes to recover the caustic value of the stream. The spent caustic is first heated in heat exchangers by the steam recovered from the flash cooling of the process liquor before precipitation. The liquor then passes through evaporators which remove excess water. The caustic is thus reconcentrated before being mixed with the bauxite ore in the digesters.

The vapor generated in the spent caustic evaporators is condensed in barometric condensers using once-through cooling water. Although occasional upsets may cause entrainment of caustic, the barometric condensate, also referred to as hotwell discharge, from properly operated evaporators is generally a high quality water which is either impounded with the red mud or discharged directly to surface waters.

Some provision must be made to bleed off a part of the recycled caustic to prevent the accumulation of soluble salts in the system. In some plants, one of the evaporators is a "salting-out" evaporator which concentrates a portion of the recycled caustic stream. The concentrated stream is then disposed of in an old mud lake or a landfull.

An alternate method of removing salts is to mix some of the spent liquor with the slurry from the digesters. The soluble contaminants are removed by the red mud which is then filtered out and discarded. This technique of salt removal has been demonstrated in only one plant and may not be possible with red mud from all bauxite ore types.

One plant removes soluble salts from the process by carbonating a small amount of pregnant liquor from the precipitation process and some of the hydrate seed. An alumina precipitate is settled from the carbonated mixture and calcined. The recovered sodium aluminate is then returned to the process at the mixing and digestion operation. The solution from which the alumina was precipitated contains neutralized soluble impurities and is directly discharged without further treatment.

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CALCINATION

The moist filter cake of aluminum oxide from the precipitation and classification operations is conveyed to calciners where it is converted to anhydrous alumina, the form most suitable for later use in electrolytic reduction to aluminum metal. Dust control for the calciners is provided by electrostatic precipitators or baghouse filters.

One plant dries part of the hydrate filter cake rather than exposing it to the more severe conditions of calcination. The product of this operation is sold as a dried hydrate. Condensate from the dryers is collected and reused in the precipitation process.

PROCESS WASTEWATER SOURCES

A variety of processes are involved in bauxite refining. The significant wastewater sources that are associated with this subcategory can be subdivided as follows:

1. Digester condensate,
2. Barometric condenser effluent,
3. Carbonation plant effluent, and
4. Mud impoundment effluent.

OTHER WASTEWATER SOURCES

There are other waste streams associated with the bauxite refining subcategory. These waste streams include, but are not limited to:

1. Stormwater other than that which falls within the process water impoundment area, and
2. Maintenance and cleanup water.

These waste streams are not considered as a part of this rulemaking. EPA believes that the flows and pollutant loadings associated with these waste streams are insignificant relative to the waste streams selected, or are best handled by the appropriate permit authority on a case-by-case basis under authority of Section 403 of the Clean Water Act.

AGE, PRODUCTION, AND PROCESS PROFILE

Figure III-2 shows the location of the eight alumina plants operating in the United States. This figure shows that the plants are located in the southern states and in the U.S. Virgin Islands.

Table III-1 summarizes the relative age and discharge status of the eight alumina plants. Most of the plants are between 20 and

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40 years old. None of the alumina plants are more than 50 years old.

Table III-2 lists the 1982 production ranges for the alumina plants. Four of the eight plants produce 200,000 to 300,000 kkg/yr as aluminum contained. Two plants produce less than 200,000 kkg/yr, and the remaining two produce more than 400,000 kkg/yr as aluminum contained.

Table III-3 lists the major production processes associated with the refining of bauxite. Also shown is the number of plants generating wastewater from these processes.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS
IN THE BAUXITE REFINING SUBCATEGORY BY DISCHARGE TYPE

Type of Plant Discharge	Initial Operating Year (Range) (Plant Age in Years)					Total
	1982-1963 (0-20)	1962-1953 (20-30)	1952-1943 (30-40)	1942-1933 (40-50)	Before 1932 (50+)	
Direct	0	2	1	0	0	3
Indirect	0	0	0	0	0	0
Zero	1	1	2	1	0	5
TOTAL	1	3	3	1	0	8

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Table III-2

PRODUCTION RANGES FOR THE BAUXITE REFINING SUBCATEGORY

Type of Plant Discharge	Alumina Production Ranges for 1982 (Thousand kkg/yr as Aluminum Contained)				Total Number of Plants
	0-200	200-300	300-400	400-600	
Direct	0	3	0	0	3
Indirect	0	0	0	0	0
Zero	2	1	0	2	5
					8

Table III-3

SUMMARY OF BAUXITE REFINING SUBCATEGORY PROCESSES AND
ASSOCIATED WASTE STREAMS

Process	Number of Plants With Process	Number of Plants Reporting Generation of Wastewater*
Bauxite Grinding and Digestion	8	
- Digester Condensate	4	4
Red Mud Removal and Liquor Purification	8	
- Mud Impoundment Effluent	3	3
Precipitation and Classification	8	
- Barometric Condenser Effluent	5	5
- Carbonation Plant Effluent	1	1
Calcination	8	

*Through reuse or evaporation practices, a plant may "generate" a wastewater from a particular process but not discharge it.

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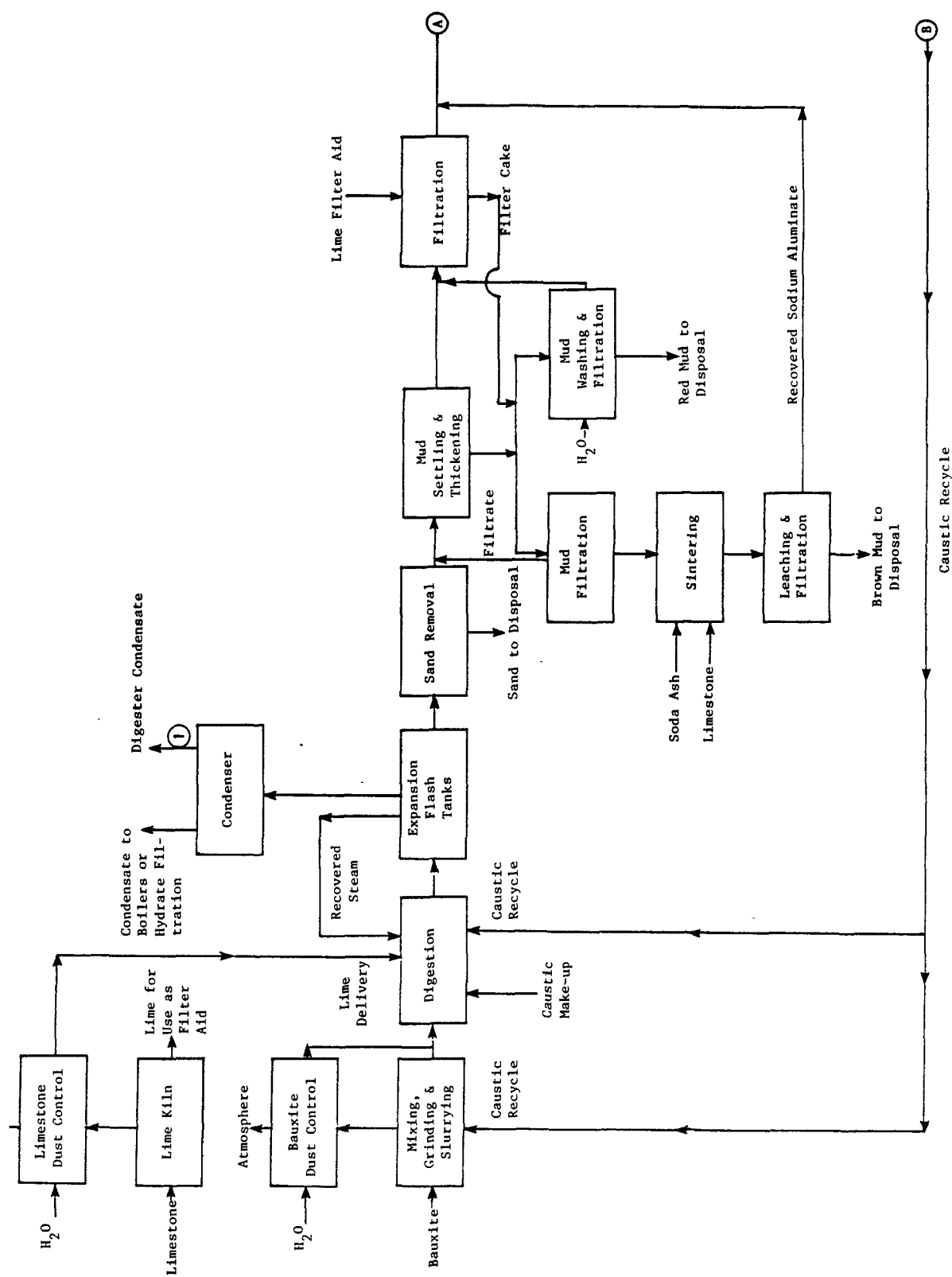
Figure III-1

BAUXITE REFINING PROCESS

Figure III-1 (Continued)

BAUXITE REFINING PROCESS
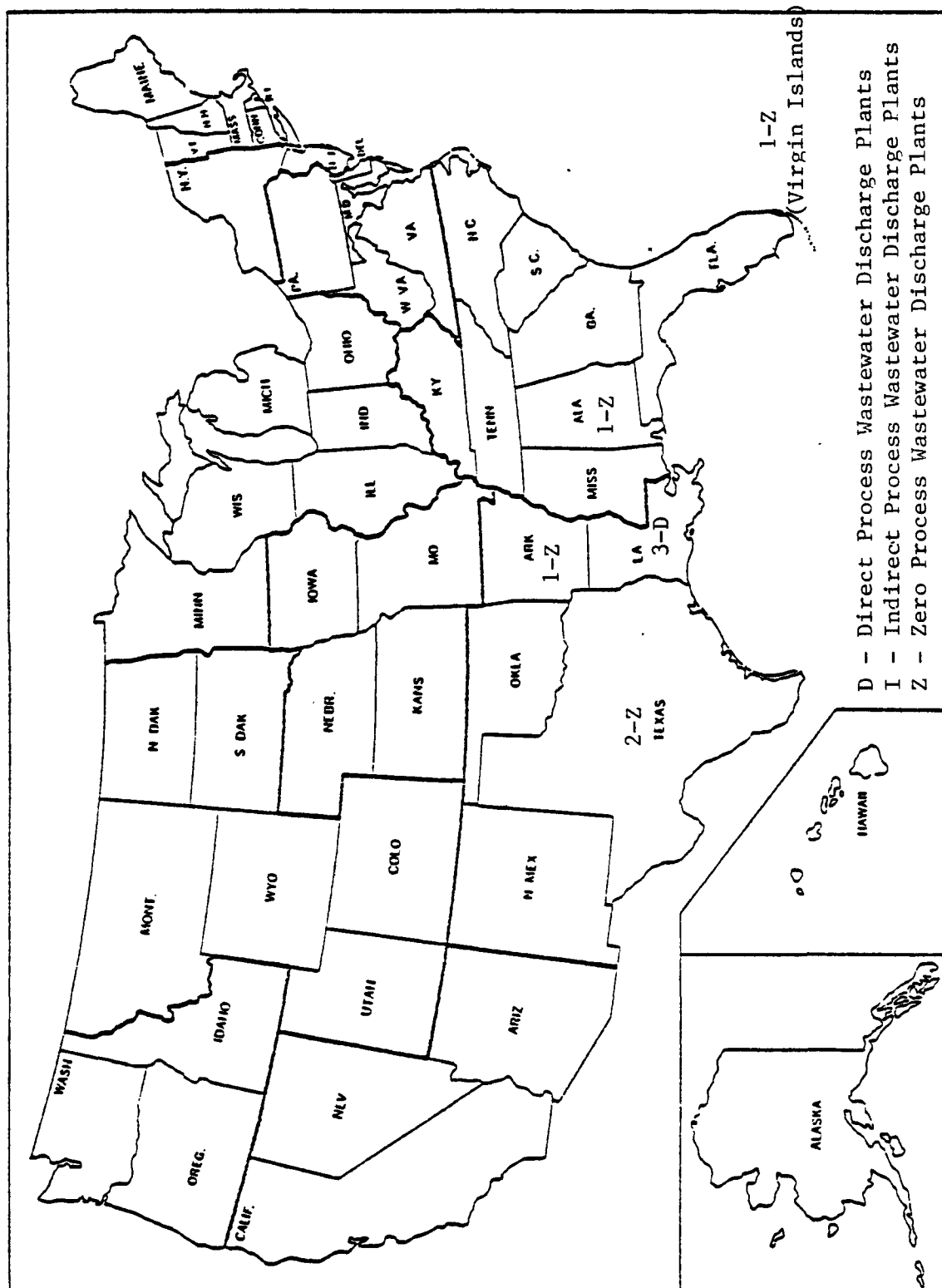
Figure III-2

GEOGRAPHIC LOCATIONS OF THE BAUXITE REFINING SUBCATEGORY PLANTS

D — Direct Process Wastewater Discharge Plants
I — Indirect Process Wastewater Discharge Plants
Z — Zero Process Wastewater Discharge Plants

BAUXITE REFINING SUBCATEGORY

SECTION IV

SUBCATEGORIZATION

As discussed in Section IV of the General Development Document, the nonferrous metals manufacturing category has been subcategorized to take into account pertinent industry characteristics, manufacturing process variations, and a number of other factors which affect the ability of the facilities to achieve effluent limitations. This section summarizes the factors considered during the designation of the bauxite refining subcategory and its related subdivisions.

FACTORS CONSIDERED IN SUBCATEGORIZATION

The following factors were evaluated for use in determing appropriate subcategories for the nonferrous metals category:

1. Metal products, co-products, and by-products;
2. Raw materials;
3. Manufacturing processes;
4. Product form;
5. Plant location;
6. Plant age;
7. Plant size;
8. Air pollution control methods;
9. Meteorological conditions;
10. Treatment costs;
11. Nonwater quality aspects;
12. Number of employees;
13. Total energy requirements; and
14. Unique plant characteristics.

Evaluation of all factors that could warrant subcategorization resulted in the designation of the bauxite refining subcategory. Three factors were particularly important in establishing these classifications: the type of metal produced, the nature of the raw materials used, and the manufacturing processes involved.

In Section IV of the General Development Document, each of these factors is described, and the rationale for selecting metal products, manufacturing processes and raw materials as the principal factors used for subcategorization is discussed. On the basis of these factors, the nonferrous metals manufacturing category (phase II) was divided in 21 subcategories, one of them being bauxite refining.

Bauxite refining was considered as a single subcategory during the previous (1974) rulemaking (40 CFR Part 421, Subpart A). The 1974 rulemaking established BPT and BAT effluent limitations and

standards for new sources and sources discharging to POTW's for the bauxite refining subcategory. The purpose of this present rulemaking is to propose minor technical modifications to the effluent limitations and standards and solicit comment on additional requirements for the net precipitation discharges allowed by the existing regulation.

FACTORS CONSIDERED IN SUBDIVIDING THE BAUXITE REFINING SUBCATEGORY

The rationale for considering further subdivision of the bauxite refining subcategory is based primarily on the production process used. Within this subcategory, a number of different operations are performed, which may or may not have a water use or discharge, and which may require the establishment of separate effluent limitations and standards. While bauxite refining is still considered a single subcategory, a more thorough examination of the production processes has illustrated the need for limitations and standards based on a specific set of waste streams. Limitations and standards will be based on specific flow allowances for the following subdivisions:

1. Digester condensate,
2. Barometric condenser effluent,
3. Carbonation plant effluent, and
4. Mud impoundment effluent.

OTHER FACTORS

Factors other than manufacturing processes which were considered in this evaluation either support the establishment of the four subdivisions or were determined to be inappropriate bases for subdivision. Air pollution control methods, treatment costs, and total energy requirements are functions of the selected subcategorization factors, namely metal product, raw materials, and production processes. For reasons discussed in Section IV of the General Development Document, factors such as plant age, plant size, and number of employees were also evaluated and determined to be inappropriate bases for subdivision of this nonferrous metals subcategory.

TYPE OF PLANT

There is fundamentally only one process for refining bauxite: the Bayer process. The combination process, a variation of the Bayer process, further treats the red mud waste from the Bayer process to recover additional aluminum and alkali values. The differences in the manufacturing processes and wastes produced at Bayer-process plants and combination process plants are not significant enough to warrant further subdivision based on plant type.

RAW MATERIALS

The major process waste associated with the refining of bauxite is the red mud residue. While the monohydrate content of different ores requires different digestion conditions at different plants, the quality of the red mud waste is not significantly affected. Similarly, the differences in quality between the red mud from the Bayer process and the brown mud waste generated when residues from high-silica bauxites are treated by the combination process do not warrant further subdivision.

There are differences in the amount of mud generated per ton of alumina produced which depend on the source of the bauxite. Only one-third ton of mud is produced per ton of alumina when Surinam bauxite is processed; two or more tons of mud are produced per ton of bauxite when Arkansas bauxite is refined. Nevertheless, these differences affect the size, not the nature of the disposal problem. Therefore, the specific type of bauxite raw material refined is not chosen as a basis for further subdivision.

PLANT LOCATION

The relationship between annual rainfall and annual evaporation is significant at bauxite refining plants because the process facilities and red mud lakes typically cover large land areas. In regions where precipitation exceeds evaporation, collected rainfall runoff can accumulate and present disposal problems. However, if provisions are made to segregate process wastewaters and runoff from plant sites, the runoff can be discharged to its normal water course. By allowing the discharge of net rainfall from the impoundment areas, accumulation of water and disruption of the plant's water balance can be avoided. Therefore, further subdivision based on plant location is not necessary.

BAUXITE REFINING SUBCATEGORY

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of wastewater associated with the bauxite refining subcategory. Data used to quantify wastewater flow and pollutant concentrations are presented, summarized, and discussed. The contribution of specific production processes to the overall wastewater discharge from bauxite refining plants is identified whenever possible.

Section V of the General Development Document contains a detailed description of the data sources and methods of analysis used to characterize wastewater from the nonferrous metals category. To summarize this information briefly, two principal data sources were used: data collection portfolios (dcp) and field sampling results. Data collection portfolios, completed for each of the bauxite refining plants, contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from bauxite refining plants, a field sampling program was conducted. Wastewater samples were analyzed for 124 of the 126 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. Also, samples were never analyzed for asbestos. There is no reason to expect that TCDD or asbestos would be present in bauxite refining wastewater.) Two plants were selected for sampling in the bauxite refining subcategory. A complete list of the pollutants considered and a summary of the techniques used in sampling and laboratory analyses are included in Section V of the General Development Document. In general, the samples were analyzed for three classes of pollutant: toxic organic pollutants, toxic metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

As described in Section IV of this supplement, the bauxite refining subcategory has been further divided into four subdivisions. Differences in the characteristics of the wastewater streams corresponding to each subdivision are to be expected and are addressed separately in the discussions that follow. These wastewater sources are:

1. Digester condensate,
2. Barometric condenser effluent,
3. Carbonation plant effluent, and
4. Mud impoundment effluent.

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WASTEWATER CHARACTERISTICS DATA

Data used to characterize the various wastewaters associated with bauxite refining come from two sources: data collection portfolios (dcp) and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolios, plants were asked to indicate which of the toxic pollutants were known or were believed to be present in their effluent. Two plants indicated that toxic organics were known to be present. Three plants stated that toxic metals were known or believed to be present in their effluent. The responses from the three plants which provided information are summarized below.

Pollutant	Known Present	Believed Present
23. chloroform	1	0
44. methylene chloride	1	0
48. dichlorobromomethane	1	0
65. phenol	2	2
68. di-n-butyl phthalate	1	0
70. diethyl phthalate	1	0
86. toluene	1	0
114. antimony	2	2
115. arsenic	2	3
117. beryllium	1	1
118. cadmium	1	2
119. chromium (Total)	2	3
120. copper	2	3
121. cyanide (Total)	1	0
122. lead	2	3
123. mercury	2	3
124. nickel	1	2
125. selenium	2	3
126. silver	2	3
127. thallium	1	2
128. zinc	2	3

FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from bauxite refining plants, wastewater samples were collected at two of the eight plants. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 and V-2 at the end of this section.

The sampling data for the bauxite refining subcategory are presented in tables at the end of this section. The stream codes listed may be used to identify the location of each of the samples on the process flow diagrams in Figures V-1 and V-2.

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Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected.

Several points regarding these tables should be noted. First, the data tables include some samples measured at concentrations considered not quantifiable. The base-neutral extractable, acid extractable, and volatile organics are generally considered not quantifiable at concentrations equal to or less than 0.010 mg/l. Below this concentration, organic analytical results are not quantitatively accurate; however, the analyses are useful to indicate the presence of a particular pollutant. The pesticide fraction is considered not quantifiable at concentrations equal to or less than 0.005 mg/l. Nonquantifiable results are designated in the tables with an asterisk (double asterisk for pesticides).

Second, the detection limits shown on the data tables are not the same in all cases as the published detection limits for these pollutants by the same analytical methods. The detection limits used were reported with the analytical data and hence are the appropriate limits to apply to the data. Detection limit variation can occur as a result of a number of laboratory-specific, equipment-specific, and daily operator-specific factors. These factors can include day-to-day differences in machine calibration, variation in stock solutions, and variation in operators.

Third, the statistical analysis of data includes some samples measured at concentrations considered not quantifiable. Toxic organics data reported as an asterisk or with a "less than" sign are considered as detected but below quantifiable concentrations, and a value of zero is used for averaging. A value of zero is also used for averaging if a pollutant is reported as not detected. Finally, toxic metal values reported as less than a certain value were considered as below quantification and a value of zero is used in the calculation of the average.

Finally, appropriate source water concentrations are presented with the sampling data. The method by which each sample was collected is indicated by number as follows:

1. One-time grab
2. Manual composite during intermittent process operation
3. 8-hour manual composite
4. 8-hour automatic composite
5. 24-hour manual composite
6. 24-hour automatic composite

WASTEWATER CHARACTERISTICS AND FLOWS BY SUBDIVISION

Bauxite refining involves four principal sources of wastewater, each of which has potentially different characteristics. The

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wastewater characteristics corresponding to each subdivision will be described separately in the discussions that follow.

EPA promulgated limitations for the bauxite refining subcategory on April 8, 1974 as Subpart A of 40 CFR Part 421. The established limitations allow no discharge of process wastewater pollutants to navigable waters. A discharge is allowed from the overflow of a process wastewater impoundment in a volume equal to the difference between the precipitation that falls within the impoundment and the evaporation from that impoundment (this is termed net precipitation). EPA is not proposing any modifications to the no discharge limitation for process wastewater pollutants. For this reason, water use and discharge flow will be addressed only with regard to the mud impoundment effluent in the discussions that follow.

DIGESTER CONDENSATE

Bauxite ore is digested with caustic to produce a slurry of sodium aluminate in aqueous solution with undissolved solids. This slurry enters a system of expansion vessels or "flash tanks" for cooling, pressure reduction, and heat recovery. Vapor released in the flash tanks is condensed as a high quality water suitable for reuse as boiler water or product wash water. The digester condensate is characterized by treatable concentrations of phenols, low concentrations of suspended solids, and high pH. Sampling data for the digester condensate are presented in Table V-2.

BAROMETRIC CONDENSER EFFLUENT

The spent liquor separated from the hydrate crystals during classification is returned to the grinding and digestion processes to recover the caustic value of the stream. The liquor passes through evaporators which remove excess water and re-concentrate the caustic stream for reuse.

The vapor generated in the spent caustic evaporators is condensed in barometric condensers. Although occasional upsets may cause entrainment of caustic, the condensate, also referred to as hotwell discharge, is a good quality, somewhat alkaline water. This stream is characterized by treatable concentrations of phenols and suspended solids. Sampling data for barometric condenser effuent are presented in Table V-3.

CARBONATION PLANT EFFLUENT

Some provision must be made to remove soluble salts from the recycled caustic to prevent the accumulation of impurities in the process. One plant removes and carbonates a small portion of the process liquor and the hydrate seed. The resulting alumina precipitate is returned to the digesters. The overflow from the carbonation process contains the soluble impurities in a

neutralized solution which is characterized by treatable concentrations of phenols and suspended solids. Sampling data for carbonation plant effluent are presented in Table V-4.

MUD IMPOUNDMENT EFFLUENT

Red mud is the major waste stream from the bauxite refinery. It contains all of the impurities from the bauxite, such as iron oxide, silicon dioxide, and titanium dioxide, as well as by-products formed during the process, such as sodium aluminum silicates and calcium silicates. Red mud is discharged to ponds, along with other process streams, where insoluble solids, including the oxides of metallic elements, settle out of suspension. The clarified liquid, characterized by treatable concentrations of phenols and high pH, can be recycled and discharged directly from the mud lake or decanted to a "clear lake" before recycle or discharge.

The water use and discharge rates of this wastewater are listed in Table V-1 in liters per year of mud impoundment effluent. Sampling data for the effluent from mud impoundments at two plants are presented in Table V-5. At plant A, the impoundment effluent is discharged directly from the mud lake without recycle to the process. At plant B, overflow and underflow from the red mud drying beds are sent to a clear lake from which water is recycled or discharged.

Table V-1

WATER USE AND DISCHARGE RATES FOR
MUD IMPOUNDMENT EFFLUENT
(liters/yr)

Plant Code	Discharge Flow
1171	1.45×10^9
1141	5.95×10^9
1076	2.983×10^8
1136	0
1073	0
1135	0
1032	0
1015	0

NR = Present, but data not reported in dcp.

Table V-2

BAUXITE REFINING SUBCATEGORY
DIGESTER CONDENSATE
SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Source	Concentrations (mg/1) Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	101	5		0.018	0.026	0.021
	201	5			0.093	0.016
4. benzene	201	1		*	0.140	0.215
6. carbon tetrachloride	101	1			0.140	
11. 1,1,1-trichloroethane	201	1				*
21. 2,4 6-trichlorophenol	201	5	ND	0.032		
22. p-chloro-m-cresol	201	5	ND	ND		
23. chloroform	101	1	*	*	*	*
	201	1	*	0.054	0.093	0.052
24. 2-chlorophenol	201	5	ND	ND		
31. 2,4-dichlorophenol	201	5	ND	0.011		
34. 2,4-dimethylphenol	101	5			0.930	0.576
	201	5	*	ND	0.420	
39. fluoranthene	101	5	*	0.015	*	0.015
	201	5		*	*	*

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Table V-2 (Continued)

BAUXITE REFINING SUBCATEGORY
DIGESTER CONDENSATE
SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/1)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
44. methylene chloride	101	1	*	*	0.018	0.068
	201	1		0.073	0.020	0.018
55. naphthalene	101	5		0.039	0.018	0.010
	201	5			0.130	*
57. 2-nitrophenol	101	5	ND	ND		*
	201	5			*	0.130
58. 4-nitrophenol	201	5	ND	ND		
59. 2,4-dinitrophenol	201	5	ND	ND		
60. 4,6-dinitro-o-cresol	101	5	*	0.016		
	201	5				0.011
64. pentachlorophenol	101	5	ND	ND		
	201	5				*
65. phenol	101	5	*	1.800	2.300	1.500
	201	5	ND	2.100	1.30	0.110
66. bis(2-ethylhexyl) phthalate	101	5	0.790	0.066	0.055	0.110
	201	5	0.020	0.053		0.013

Table V-2 (Continued)

BAUXITE REFINING SUBCATEGORY
DIGESTER CONDENSATE
SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Source	Concentrations (mg/l) Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
67. butyl benzyl phthalate	101	5	*	*	*	*
68. di-n-butyl phthalate	101	5	*	0.034	*	*
	201	5			0.047	0.032
70. diethyl phthalate	101	5		0.015	0.016	*
	201	5		0.080	0.280	0.010
71. dimethyl phthalate	101	5		0.022	0.038	
73. benzo(a)pyrene	101	5				*
	201	5				*
76. chrysene	101	5				*
	201	5			*	*
77. acenaphthylene	101	5		0.030		
	201	5			0.053	
80. fluorene	101	5		*	0.033	0.043
84. pyrene	101	5		*	*	*
	201	5		*	*	*
85. tetrachloroethylene	101	1		0.012	*	*
	201	1			*	

Table V-2 (Continued)

BAUXITE REFINING SUBCATEGORY
DIGESTER CONDENSATE
SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
86. toluene	101	1			0.029	0.017
	201	1		0.053	0.345	0.460
87. trichloroethylene	101	1		*	*	
	201	1			*	*
89. aldrin	201	5	**	**		**
92. 4,4'-DDT	101	5	**	**	**	**
	201	5	**	**	**	**
93. 4,4'-DDE	101	5	**	**		
	201	5	**	**	**	**
94. 4,4'-DDD	101	5			**	**
97. endosulfan sulfate	101	5			**	**
	201	5		**	**	
98. endrin	201	5		**	**	**
99. endrin aldehyde	101	5		**	**	
	201	5	**	**	**	**
101. heptachlor epoxide	101	5	**	**		**
	201	5	**	**	**	**

Table V-2 (Continued)

BAUXITE REFINING SUBCATEGORY
DIGESTER CONDENSATE
SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/1) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
102. alpha-BHC	101	5				**
104. gamma-BHC	101	5	**	**		**
	201	5	**	**	**	**
105. delta-BHC	201	5	**	**		
106. PCB-1242 (a)	101	5	**	**		**
	201	5	**	**	**	**
107. PCB-1254 (a)	101	5	**	**		**
	201	5	**	**	**	**
108. PCB-1221 (a)	101	5	**	**		**
	201	5	**	**	**	**
109. PCB-1232 (b)	101	5	**	**		**
	201	5	**	**	**	**
110. PCB-1248 (b)	101	5	**	**		**
	201	5	**	**	**	**
111. PCB-1260 (b)	101	5	**	**		**
	201	5	**	**	**	**

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Table V-2 (Continued)

BAUXITE REFINING SUBCATEGORY
DIGESTER CONDENSATE
SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
112. PCB-1016 (a)	101	5	**	**	**	**
	201	5	**	**	**	**
114. antimony	101	5	<0.1	<0.1	<0.1	<0.1
	201	5	<0.1	<0.1	<0.1	
115. arsenic	101	5	<0.01	<0.01	<0.01	<0.01
	201	5	<0.01	<0.01	0.03	
121. cyanide	101	1		0.002	<0.001	0.001
	201	1		0.002	<0.001	0.002
125. selenium	101	5	<0.01	<0.01	<0.01	<0.01
	201	5	<0.01	<0.01	<0.01	
126. silver	101	5	<0.02	<0.02	<0.02	<0.02
	201	5	<0.02	<0.02	<0.02	
127. thallium	101	5	<0.1	<0.1	<0.1	<0.1
	201	5	<0.1	<0.1	<0.1	
Nonconventional Pollutants						
chemical oxygen demand (COD)	101	5	39	131	158	139
	201	5	24	229	214	167

Table V-2 (Continued)

BAUXITE REFINING SUBCATEGORY
DIGESTER CONDENSATE
SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
chloride	101	5				8.6
fluoride	101	5				0.15
phenolics	101	1			7.19	7.82
	201	1			6.05	6.44
Conventional Pollutants						
oil and grease	101	1		31	11	7
	201	1		7	5	5
total suspended solids (TSS)	101	5	768	6	5	6
	201	5	277	11	2	14
pH (standard units)	101	5		9.10	9.71	9.48
	201	5		9.85	9.55	

†Sample Type Code: 1 - One-time grab
                    5 - 24-hour manual composite

*Less than 0.01 mg/l.

**Less than 0.005 mg/l.

(a),(b) Reported together.

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Table V-3

BAUXITE REFINING SUBCATEGORY
BAROMETRIC CONDENSER (HOT WELL) DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/1)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	102	5			*	*
	202	6			*	*
4. benzene	102	1	*	*		*
10. 1,2-dichloroethane	102	1	*	*		*
20. 2-chloronaphthalene	202	6			*	
21. 2,4,6-trichlorophenol	202	6	ND	0.032		
22. p-chloro-m-cresol	102	5	ND	0.013		
	202	6	ND	ND		
23. chloroform	102	1	*	*		0.013
	202	1	*	*	*	*
24. 2-chlorophenol	202	6	ND	*		
31. 2,4-dichlorophenol	202	6	*	0.010		
34. 2,4-dimethylphenol	102	5			0.038	
	202	6		*		
39. fluoranthene	102	5	*		*	*
	202	6			*	

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Table V-3 (Continued)

BAUXITE REFINING SUBCATEGORY
BAROMETRIC CONDENSER (HOT WELL) DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
44. methylene chloride	102	1	*	0.063		
	202	1			0.110	0.028
55. naphthalene	202	6			*	*
57. 2-nitrophenol	102	5				*
	202	6		0.110	*	*
58. 4-nitrophenol	202	6	ND	ND		*
59. 2,4-dinitrophenol	202	6	ND	ND		
60. 4,6-dinitro-o-cresol	202	6	*	0.019		
64. pentachlorophenol	202	6	ND	ND		
65. phenol	102	5	*		0.075	*
	202	6	ND	2.0	*	
66. bis(2-ethylhexyl) phthalate	102	5	0.790	0.170	0.016	0.017
	202	6	0.020	*	1.3	0.022
67. butyl benzyl phthalate	102	5	*		*	*
	202	6				*
68. di-n-butyl phthalate	102	5	*		*	*
	202	6		*	0.016	*

Table V-3 (Continued)

BAUXITE REFINING SUBCATEGORY
BAROMETRIC CONDENSER (HOT WELL) DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
70. diethyl phthalate	102	5			*	*
	202	6		*		*
71. dimethyl phthalate	102	5	0.011		*	*
	202	6				
73. benzo(a)pyrene	102	5				*
76. chrysene	202	6				*
77. acenaphthylene	102	5			*	*
	202	6			*	*
80. fluorene	102	5		*	*	*
	202	6				*
84. pyrene	102	5	*		*	*
	202	6				
85. tetrachloroethylene	102	1		*		*
	202	1				
86. toluene	102	1		*	*	*
	202	1				
89. aldrin	202	6	**	**	**	**

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Table V-3 (Continued)

BAUXITE REFINING SUBCATEGORY
BAROMETRIC CONDENSER (HOT WELL) DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
90. dieldrin	102	5	**		**	**
	202	6			**	**
91. chlordane	102	5	**		**	**
	202	6	**	**	**	**
92. 4,4'-DDT	102	5	**		**	**
	202	6	**	**	**	**
93. 4,4'-DDE	102	5	**		**	**
	202	6	**	**	**	**
94. 4,4'-DDD	102	5		**		**
	202	6				
95. alpha-endosulfan	202	6		**	**	
96. beta-endosulfan	102	5		**	**	
	202	6				
97. endosulfan sulfate	102	5		**	**	**
	202	6			**	
98. endrin	102	5	**	**	**	**
	202	6				**

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Table V-3 (Continued)

BAUXITE REFINING SUBCATEGORY
BAROMETRIC CONDENSER (HOT WELL) DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
99. endrin aldehyde	202	6	**	**		
100. heptachlor	102	5			**	**
	202	6		**	**	**
101. heptachlor epoxide	102	5	**		**	**
	202	6	**	**	**	**
102. alpha-BHC	102	5				**
	202	6	**	**		**
103. beta-BHC	102	5	**		**	**
	202	6	**	**	**	**
104. gamma-BHC	102	5	**		**	**
	202	6	**	**	**	**
105. delta-BHC	202	6	**	**	**	**
106. PCB-1242 (a)	102	5	**		**	**
	202	6	**	**	**	**
107. PCB-1254 (a)	102	5	**		**	**
	202	6	**	**	**	**

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Table V-3 (Continued)

BAUXITE REFINING SUBCATEGORY
BAROMETRIC CONDENSER (HOT WELL) DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
108. PCB-1221 (a)	102	5	**		**	**
	202	6	**	**	**	**
109. PCB-1232 (b)	102	5	**		**	**
	202	6	**	**	**	**
110. PCB-1248 (b)	102	5	**		**	**
	202	6	**	**	**	**
111. PCB-1260 (b)	102	5	**		**	**
	202	6	**	**	**	**
112. PCB-1016 (b)	102	5	**		**	**
	202	6	**	**	**	**
121. cyanide (Total)	102	1	ND	0.002	0.002	<0.001
	202	1	ND	<0.001	0.001	0.002
Nonconventional Pollutants						
chemical oxygen demand (COD)	102	5	39	36	36	50
	202	6	24	31	28	30
chloride	102	5				20
fluoride	102	5				0.33

Table V-3 (Continued)

BAUXITE REFINING SUBCATEGORY
BAROMETRIC CONDENSER (HOT WELL) DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
phenolics	102	1	ND	0.374	0.190	0.169
	202	1	ND	0.020	0.023	
Conventional Pollutants						
oil and grease	102	5	ND	10	9	2
	202	6	ND	5	4	4
total suspended solids (TSS)	102	5	768	373	275	270
	202	6	277	296	462	291
pH (standard units)	102	5		8.70	9.12	9.25
	202	6		8.0	8.2	

†Sample Type Code: 1 - One-time grab
                    5 - 24-hour manual composite
                    6 - 24-hour automatic composite

*Less than 0.01 mg/l.

**Less than 0.005 mg/l.

(a),(b) Reported together.

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Table V-4

BAUXITE REFINING SUBCATEGORY
CARBONATION PLANT EFFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
21. 2,4,6-trichlorophenol	203	5	ND	ND		
22. p-chloro-m-cresol	203	5	ND	ND		
23. chloroform	203	1	*	*	0.054	
24. 2-chlorophenol	203	5	ND	1.600		
31. 2,4-dichlorophenol	203	5	ND	ND		
34. 2,4-dimethylphenol	203	5	*	ND	0.140	
39. fluoranthene	203	5			*	
44. methylene chloride	203	1			*	
57. 2-nitrophenol	203	5	ND	ND		
58. 4-nitrophenol	203	5	ND	ND		
59. 2,4-dinitrophenol	203	5	ND	ND		
60. 4,6-dinitro-o-cresol	203	5	*	ND		
64. pentachlorophenol	203	5	ND	ND		

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Table V-4 (Continued)

BAUXITE REFINING SUBCATEGORY
CARBONATION PLANT EFFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
65. phenol	203	5	ND	2.100	1.300	
66. bis(2-ethylhexyl) phthalate	203	5	0.020		0.016	
67. butyl benzyl phthalate	203	5			*	
68. di-n-butyl phthalate	203	5			*	
70. diethyl phthalate	203	5			0.017	
71. dimethyl phthalate	203	5	0.011		0.130	
77. acenaphthylene	203	5			*	
84. pyrene	203	5			*	
85. tetrachloroethylene	203	1			0.021	
87. trichloroethylene	203	1			*	
89. aldrin	203	5	**		**	
90. dieldrin	203	5			**	
91. chlordane	203	5	**		**	

Table V-4 (Continued)

BAUXITE REFINING SUBCATEGORY
CARBONATION PLANT EFFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/1) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
93.	4,4'-DDE	203	5	**		**	
96.	beta-endosulfan	203	5			**	
97.	endosulfan sulfate	203	5			**	
100.	heptachlor	203	5	**		**	
101.	heptachlor epoxide	203	5	**		**	
103.	beta-BHC	203	5	**		**	
104.	gamma-BHC	203	5	**		**	
105.	delta-BHC	203	5	**		**	
106.	PCB-1242 (a)	203	5	**		**	
107.	PCB-1254 (a)	203	5	**		**	
108.	PCB-1221 (a)	203	5	**		**	
109.	PCB-1232 (b)	203	5	**		**	
110.	PCB-1248 (b)	203	5	**		**	
111.	PCB-1260 (b)	203	5	**		**	
112.	PCB-1016 (b)	203	5	**		**	

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Table V-4 (Continued)

BAUXITE REFINING SUBCATEGORY
CARBONATION PLANT EFFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
112. PCB-1016 (b)	203	5	**		**	
114. antimony	203	5	<0.1	<0.1		
115. arsenic	203	5	<0.01	0.44		
121. cyanide (Total)	203	1		<0.001	<0.001	
125. selenium	203	5	<0.01	<0.01		
126. silver	203	5	<0.02	0.02		
127. thallium	203	5	<0.1	0.3		
Nonconventional Pollutants						
chemical oxygen demand (COD)	203	5	24	8,270	3,985	
phenolics	203	1		24.6	11.2	
Conventional Pollutants						
oil and grease	203	1		43	9	

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Table V-4 (Continued)

BAUXITE REFINING SUBCATEGORY
CARBONATION PLANT EFFLUENT
RAW WASTEWATER SAMPLING DATA

			Concentrations (mg/l)			
Pollutant	Stream Code	Sample Type†	Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
total suspended solids (TSS)	203	5	277	325	887	
pH (standard units)	203	5		7.9	8.4	

†Sample Type Code: 1 - One-time grab
                    5 - 24-hour manual composite

*Less than 0.01 mg/l.

**Less than 0.005 mg/l.

(a),(b) Reported together.

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Table V-5

BAUXITE REFINING SUBCATEGORY
MUD LAKE DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/1)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	104	5				*
6. carbon tetrachloride	104	1		*		
10. 1,2-dichloroethane	104	1	*			
21. 2,4,6-trichlorophenol	104	5			0.048	0.072
	204	6	ND	*	0.054	
22. p-chloro-m-cresol	204	6	ND	ND		
23. chloroform	104	1	*	0.026	*	ND
	204	1	*	ND	0.015	0.063
24. 2-chlorophenol	204	6	ND	0.065		0.720
31. 2,4-dichlorophenol	104	5		0.050	0.047	0.054
	204	6		*	0.060	
34. 2,4-dimethylphenol	104	5		*		*
	204	6	*	*	*	
39. fluoranthene	104	5	*	*		*
	204	6		*	*	*

Table V-5 (Continued)

BAUXITE REFINING SUBCATEGORY
MUD LAKE DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
44. methylene chloride	104	1	*	0.051	*	
	204	1			0.020	0.170
48. dichlorobromomethane	104	1			*	
55. naphthalene	204	6			*	0.020
57. 2-nitrophenol	104	5	ND	ND	0.067	
	204	6				*
58. 4-nitrophenol	104	5	ND	ND	0.040	0.017
	204	6			0.310	
59. 2,4-dinitrophenol	204	6	ND	ND		
60. 4,6-dinitro-o-cresol	204	6	*	0.011		
64. pentachlorophenol	104	5	ND	ND		
	204	6				*
65. phenol	104	5	*	0.034	0.035	0.038
	204	6	ND	0.320	0.230	0.750
66. bis(2-ethylhexyl) phthalate	104	5	0.790	0.015	0.330	0.820
	204	6	0.020	0.720	0.650	*

Table V-5 (Continued)

BAUXITE REFINING SUBCATEGORY
MUD LAKE DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
67. butyl benzyl phthalate	104	5	*	*	*	*
	204	6			*	*
68. di-n-butyl phthalate	104	5	*	*	*	*
	204	6			*	0.018
70. diethyl phthalate	204	6	0.011		0.010	0.015
71. dimethyl phthalate	104	5				*
	204	6				1.50
77. acenaphthylene	104	5		*		0.018
	204	6				0.086
80. fluorene	104	5				*
84. pyrene	104	5	*			*
	204	6		*	*	*
85. tetrachloroethylene	104	1		0.012		
86. toluene	204	1			*	
91. chlordane	104	5	**	**	**	**
	204	6	**		**	**

Table V-5 (Continued)

BAUXITE REFINING SUBCATEGORY
MUD LAKE DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
92. 4,4'-DDT	104	5	**	**	**	**
	204	6	**	**	**	**
93. 4,4'-DDE	204	6	**	**	**	**
95. alpha-endosulfan	104	5	**	**		**
96. beta-endosulfan	104	5			**	**
97. endosulfan sulfate	104	5		**	**	**
	204	6		**	**	**
98. endrin	104	5	**	**	**	
	204	6		**	**	**
99. endrin aldehyde	204	6	**	**	**	**
100. heptachlor	104	5	**	**	**	**
	204	6	**	**	**	**
101. heptachlor epoxide	104	5	**	**	**	**
	204	6	**	**	**	**
102. alpha-BHC	104	5	**	**	**	
	204	6	**	**		

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Table V-5 (Continued)

BAUXITE REFINING SUBCATEGORY
MUD LAKE DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l)				
				Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)								
103.	beta-BHC	104	5	**	**	**	**
		204	6	**	**	**	**
104.	gamma-BHC	104	5	**	**		
		204	6	**	**	**	**
106.	PCB-1242 (a)	104	5	**	**	**	**
		204	6	**	**	**	**
107.	PCB-1254 (a)	104	5	**	**	**	**
		204	6	**	**	**	**
108.	PCB-1221 (a)	104	5	**	**	**	**
		204	6	**	**	**	**
109.	PCB-1232 (b)	104	5	**	**	**	**
		204	6	**	**	**	**
110.	PCB-1248 (b)	104	5	**	**	**	**
		204	6	**	**	**	**
111.	PCB-1260 (b)	104	5	**	**	**	**
		204	6	**	**	**	**
112.	PCB-1016 (b)	104	5	**	**	**	**
		204	6	**	**	**	**

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Table V-5 (Continued)

BAUXITE REFINING SUBCATEGORY
MUD LAKE DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
114. antimony	104	5	<0.1	<0.1	<0.1	<0.1
	204	6	<0.1	<0.1	<0.1	
115. arsenic	104	5	<0.01	0.2	0.14	0.16
	204	6	<0.01	0.32	0.08	
121. cyanide (Total)	104	1		0.01	0.003	0.003
	204	1		<0.001	<0.001	<0.001
125. selenium	104	5	<0.01	<0.01	<0.01	<0.01
	204	6	<0.01	<0.01	<0.01	
126. silver	104	5	<0.02	<0.02	<0.02	<0.02
	204	6	<0.02	<0.02	<0.02	
127. thallium	104	5	<0.1	<0.1	<0.1	<0.1
	204	6	<0.1	0.1	<0.1	
Nonconventional Pollutants						
chemical oxygen demand (COD)	104	5	39	364	374	451
	204	6	24	977	943	495
chloride	104	5				33
fluoride	104	5				4
	204	6		2		

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Table V-5 (Continued)

BAUXITE REFINING SUBCATEGORY
MUD LAKE DISCHARGE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Source	Concentrations (mg/l) Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
phenolics	104	1		0.197	0.116	0.151
	204	1		0.981	1.15	1.23
Conventional Pollutants						
oil and grease	104	1		15	23	5
	204	1			6	22
total suspended solids (TSS)	104	5	768	18	16	9
	204	6	277	11	2	4
pH (standard units)	104	5		11.70	11.76	11.72
	204	6		11.55	11.5	

†Sample Type Code: 1 - One-time grab
                     5 - 24-hour manual composite
                     6 - 24-hour automatic composite

*Less than 0.01 mg/l.

**Less than 0.005 mg/l.
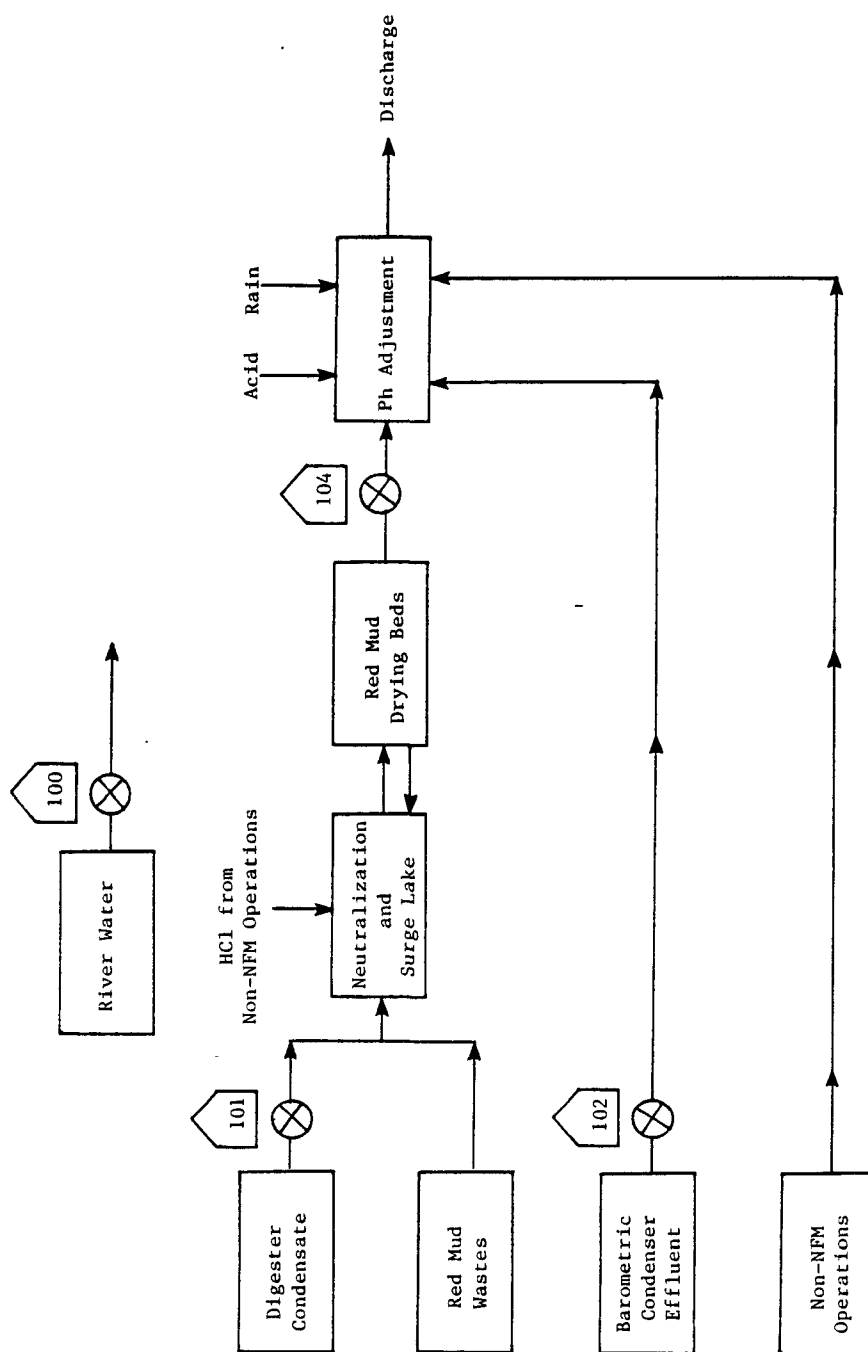
(a),(b) Reported together.

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Figure V-1

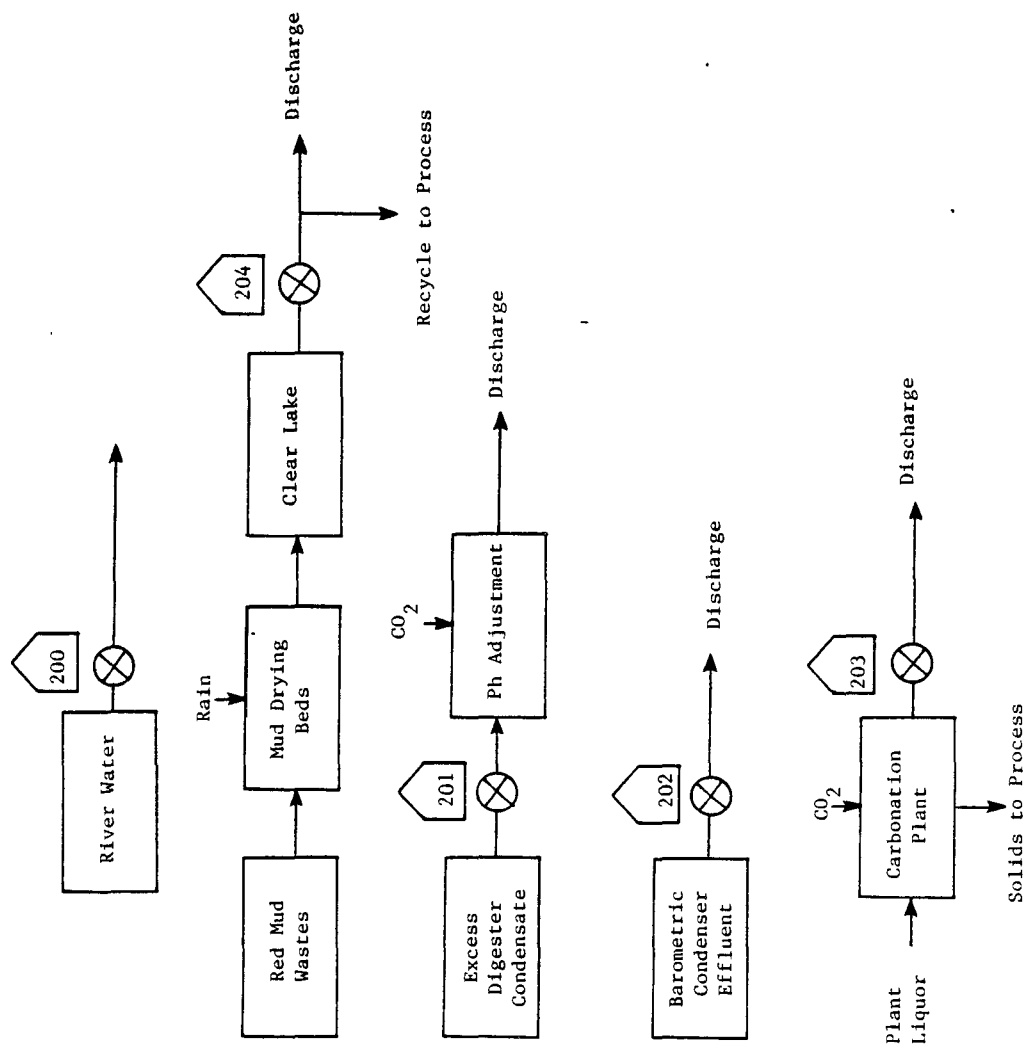SAMPLING SITES AT BAUXITE REFINING PLANT A

Figure V-2

SAMPLING SITES AT BAUXITE REFINING PLANT B

BAUXITE REFINING SUBCATEGORY

SECTION VI

SELECTION OF POLLUTANT PARAMETERS

Section V of this supplement presented data from bauxite refining plant sampling visits and subsequent chemical analyses. This section examines that data and discusses the selection or exclusion of pollutants for potential limitation. The legal basis for the exclusion of toxic pollutants under Paragraph 8(a) of the Settlement Agreement is presented in Section VI of the General Development Document.

Each pollutant selected for potential limitation is discussed in Section VI of the General Development Document. That discussion provides information concerning the origin of the pollutant (i.e., whether it is a naturally occurring substance, processed metal, or a manufactured compound); general physical properties and the form of the pollutant; toxic effects of the pollutant in humans and other animals; and behavior of the pollutant in POTW at the concentrations expected in industrial discharges.

This section discusses the selection of conventional and nonconventional pollutants for consideration for regulation. The discussion that follows also describes the analysis that was performed to select or exclude toxic pollutants for further consideration for limitations and standards. Pollutants will be selected for further consideration if they are present in concentrations treatable by the technologies considered in this analysis. The treatable concentrations used for the toxic metals were the long-term performance values achievable by lime precipitation, sedimentation, and filtration. The treatable concentrations for the toxic organics were the long-term performance values achievable by activated carbon adsorption (see Section VII of the General Development Document - Combined Metals Data Base).

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS

This study considered samples from the bauxite refining subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and two nonconventional pollutant parameters (chemical oxygen demand and total phenolics). Because existing BPT regulations (40 CFR Part 421, Subpart A) specify zero discharge of process wastewater pollutants, only sampling data from allowable mud impoundment effluents were considered in the selection of conventional and nonconventional pollutant parameters for regulation.

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

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The conventional and nonconventional pollutants or pollutant parameters selected for consideration for limitation in this subcategory are:

pH
phenolics

The pH values observed in five samples ranged from 11.5 to 11.76. Effective and consistent removal of toxic organics by activated carbon or chemical oxidation requires careful control of pH. Therefore, pH is selected for consideration for limitation in this subcategory.

Phenolics concentrations in six samples ranged from 0.116 to 1.23 mg/l. The observed concentrations are above those considered treatable by identified treatment technology. Sampling data from process wastewater streams, presented in Section V, indicate the presence of phenolic compounds throughout the bauxite refining process. Therefore, phenolics are considered for limitation in this subcategory.

The major source of oil and grease in the bauxite refining subcategory is from the lubrication of process machinery. Because oil and grease in process wastewater is not present in significant concentrations, oil and grease is not selected for limitation.

Total suspended solids (TSS) concentrations in six samples range from 2 to 18 mg/l. Although treatable, these concentrations are not considered to be significant and are not expected to interfere with end-of-pipe treatment technologies such as activated carbon adsorption or chemical oxidation. Therefore, total suspended solids are not selected for limitation in the bauxite refining subcategory.

TOXIC POLLUTANTS

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-1. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater data from mud impoundment effluents at plant A and plant B (see Section V). All other wastewaters have existing zero discharge regulations and were therefore not considered here. Treatment plant and source water samples were not considered in this frequency count.

TOXIC POLLUTANTS NEVER DETECTED

The toxic pollutants listed below were either not analyzed or not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing regulations:

2. acrolein*
3. acrylonitrile*
4. benzene*
5. benzidene*
7. chlorobenzene*
8. 1,2,4-trichlorobenzene*
9. hexachlorobenzene*
10. 1,2-dichloroethane*
11. 1,1,1-trichloroethane*
12. hexachloroethane*
13. 1,1-dichloroethane*
14. 1,1,2-trichloroethane*
15. 1,1,2,2-tetrachloroethane*
16. chloroethane*
17. bis (chloromethyl) ether (deleted)*
18. bis (2-chloroethyl) ether*
19. 2-chloroethyl vinyl ether (mixed)*
20. 2-chloronaphthalene*
22. parachlorometa cresol
25. 1,2-dichlorobenzene*
26. 1,3-dichlorobenzene*
27. 1,4-dichlorobenzene*
28. 3,3'-dichlorobenzidine*
29. 1,1-dichloroethylene*
30. 1,2-trans-dichloroethylene*
32. 1,2-dichloropropane*
33. 1,2-dichloropropylene (1,3-dichloropropene)*
35. 2,4-dinitrotoluene*
36. 2,6-dinitrotoluene*
37. 1,2-diphenylhydrazine*
38. ethylbenzene*
40. 4-chlorophenyl phenyl ether*
41. 4-bromophenyl phenyl ether*
42. bis(2-chloroisopropyl) ether*
43. bis(2-choroethoxy) methane*
45. methyl chloride (chloromethane)*
46. methyl bromide (bromomethane)*
47. bromoform (tribromomethane)*
49. trichlorofluoromethane (deleted)*
50. dichlorodifluoromethane (deleted)*
51. chlorodibromomethane*
52. hexachlorobutadiene*
53. hexachlorocyclopentadiene*
54. isophorone*
56. nitrobenzene*
59. 2,4-dinitrophenol
61. N-nitrosodimethylamine*
62. N-nitrosodiphenylamine*
63. N-nitrosodi-n-propylamine*
69. di-n-octyl phthalate*
72. benzo (a)anthracene (1,2-benzanthracene)*
73. benzo (a)pyrene (3,4-benzopyrene)*
74. 3,4-benzofluoranthene*

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75.    benzo(k)fluoranthane (11,12-benzofluoranthene)*
76.    chrysene*
78.    anthracene*
79.    benzo(ghi)perylene (1,11-benzoperylene)*
81.    phenanthrene*
82.    dibenzo (a,h)anthracene (1,2,5,6-dibenzanthracene)*
83.    indeno (1,2,3-cd)pyrene (w,e,-o-phenylenepyrene)*
87.    trichloroethylene*
88.    vinyl chloride (chloroethylene)*
89.    aldrin*
90.    dieldrin*
94.    4,4'-DDD(p,p'TDE)*
105.   g-BHC-Delta*
113.   toxaphene*
116.   asbestos
117.   beryllium*
118.   cadmium*
119.   chromium (Total)*
120.   copper*
122.   lead*
123.   mercury*
124.   nickel*
128.   zinc*

129.   2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)
```

*We did not analyze for these pollutants in samples of raw wastewater from this subcategory. These pollutants are not believed to be present based on the Agency's best engineering judgement which includes consideration of raw materials and process operations.

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LEVEL

The toxic pollutants listed below were never found above their analytical quantification concentration in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing regulations.

```
1.    acenaphthene
6.    carbon tetrachloride (tetrachloromethane)
34.  2,4-dimethylphenol
39.   fluoranthene
48.   dichlorobromomethane
64.   pentachlorophenol
67.   butyl benzyl phthalate
80.   fluorene
84.   pyrene
86.   toluene
91.   chlordane (technical mixture and metabolites)
```

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92.    4,4'-DDT
93.    4,4'-DDE(p,p'DDX)
95.    a-endosulfan-Alpha
96.    b-endosulfan-Beta
97.    endosulfan sulfate
98.    endrin
99.    endrin aldehyde
100.   heptachlor
101.   heptachlor epoxide
102.   alpha-BHC
103.   beta-BHC
104.   r-BHC (lindane)-Gamma
106.   PCB-1242 (Arochlor 1242)
107.   PCB-1254 (Arochlor 1254)
108.   PCB-1221 (Arochlor 1221)
109.   PCB-1232 (Arochlor 1232)
110.   PCB-1248 (Arochlor 1248)
111.   PCB-1260 (Arochlor 1260)
112.   PCB-1016 (Arochlor 1016)
114.   antimony
121.   cyanide (Total)
125.   selenium
126.   silver
```

TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies.

```
115. arsenic
127. thallium
```

Arsenic was detected above its analytical quantification limit in five of five samples from two plants. These samples were below the 0.34 mg/l concentration considered achievable by treatment. Therefore, arsenic is not selected for limitation.

Thallium was detected above its analytical quantification limit in one of five samples from two plants. This sample was below the 0.34 mg/l concentration considered achievable by identified treatment technology. Therefore, thallium is not selected for limitation.

TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

The following pollutants were not selected for limitation because they were detected in only a small number of sources:

```
23.  chloroform
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44.  methylene chloride
55.  naphthalene
60.  4,6-dinitro-o-cresol
66.  bis(2-ethylhexyl) phthalate
68.  di-n-butyl phthalate
70.  diethyl phthalate
71.  dimethyl phthalate
77.  acenaphthylene
85.  tetrachloroethylene
```

Although these pollutants were not selected for consideration in establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations.

Chloroform was detected above its treatable limit in three of six samples from two plants at concentrations of 0.015, 0.026, and 0.063 mg/l. This pollutant is not attributable to any source within the refinery. It also appears in the source water and it is commonly used in the analytical laboratories as a solvent. For these reasons chloroform is not considered for limitation.

Methylene chloride was found above its treatable concentration in three of four samples from two plants at concentrations of 0.020, 0.051, and 0.170 mg/l. This pollutant is not attributable to specific materials or processes associated with bauxite refining. It is, however, a common solvent used in analytical laboratories. Since the possibility of sample contamination is likely, methylene chloride is not selected for limitation.

Naphthalene was detected above its treatable concentration in one of two samples from one plant, at a concentration of 0.02 mg/l. This pollutant is not attributable to bauxite refining operations or raw materials; it is also present only slightly above the treatability concentration. For these reasons, naphthalene is not considered for limitation.

4,6-Dinitro-o-cresol was found above its treatability concentration in one sample from one plant, at a concentration of 0.011 mg/l. Because this pollutant is not attributable to any specific materials or processes in the bauxite refining operation, and it is present only slightly above the treatability concentration of 0.01 mg/l, this pollutant is not selected for limitation.

Bis(2-ethylhexyl) phthalate was found above its treatable concentration of 0.01 mg/l in five of six samples from two plants. This compound is a plasticizer commonly used in laboratory and field sampling equipment and is not used as a raw material or formed as a by-product in this subcategory. Therefore, bis(2-ethylhexyl) phthalate is not selected for limitation.

Di-n-butyl phthalate was found above its treatable concentration of 0.01 mg/l in one of six samples from two plants. This compound is a plasticizer commonly used in laboratory and field sampling equipment and is not used as a raw material or formed as a by-product in this subcategory. Therefore, di-n-butyl phthalate is not selected for limitation.

Diethyl phthalate was found above its treatable concentration of 0.01 mg/l in one of two samples from one plant. This compound is a plasticizer commonly used in laboratory and field sampling equipment and is not used as a raw material or formed as a by-product in this subcategory. Therefore, diethyl phthalate is not selected for limitation.

Dimethyl phthalate was found above its treatable concentration in one of two samples from two plants at a concentration of 1.5 mg/l. This pollutant is not attributable to specific materials or processes associated with bauxite refining. The high concentration is probably due to contamination from laboratory equipment. Therefore, dimethyl phthalate is not selected for limitation.

Acenaphthylene was found above its analytical quantification limit in two of three samples from two plants at concentrations of 0.018 and 0.086 mg/l. This pollutant has been shown to be present in the wastewater from briquette quenching operations in the primary aluminum subcategory. The two sampled plants are integrated facilities which manufacture a number of aluminum-based products. Therefore, because it is likely to be generated by processes outside the bauxite refining subcategory and because it is not specifically attributable to the bauxite refining process, acenaphthylene is not selected for limitation.

Tetrachloroethylene was found above its treatability limit in one sample from one plant, at a concentration of 0.012 mg/l. This pollutant is not attributable to any process or material in the refining process; it is present only slightly above its treatability concentration of 0.01 mg/l and it is frequently used in the laboratory, where contamination could occur. For these reasons, tetrachloroethylene is not selected for limitation.

TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION FOR LIMITATION

The toxic pollutants listed below are selected for further consideration in establishing limitations for this subcategory. The selected pollutants are discussed individually following the list.

    21.   2,4,6-trichlorophenol
    24.   2-chlorophenol
    31.   2,4-dichlorophenol
    57.   2-nitrophenol

58. 4-nitrophenol
65. phenol

2,4,6-Trichlorophenol was found above its analytical quantification limit in three of four samples from two plants with concentrations ranging from 0.048 to 0.072 mg/l. All three of those samples were above the 0.01 mg/l concentration considered achievable by identified treatment technology. Therefore, 2,4,6-trichlorophenol is selected for further consideration for limitation.

2-Chlorophenol was found above its analytical quantification limit in two of two samples from one plant with concentrations of 0.065 and 0.720 mg/l. Both of those samples were above the 0.01 mg/l treatability concentration. Threfore, 2-chlorophenol is selected for further consideration for limitation.

2,4-Dichlorophenol was found above its analytical quantification limit in four of five samples from two plants with concentrations ranging from 0.047 to 0.060 mg/l. All four of those samples were above the 0.01 mg/l treatability concentration. Therefore, 2,4-dichlorophenol is selected for further consideration for limitation.

2-Nitrophenol was found above its analytical quantification limit in one of three samples from two plants at a concentration of 0.067 mg/l. That sample was above the 0.01 mg/l treatability concentration. Therefore, 2-nitrophenol is selected for further consideration for limitation.

4-Nitrophenol was found above its analytical quantification limit in three of four samples from two plants with concentrations ranging from 0.017 to 0.310 mg/l. Those three samples were above the 0.01 mg/l treatability concentration. Therefore, 4-nitrophenol is selected for further consideration for limitation.

Phenol was found above its analytical quantification limit in six of six samples from two plants with concentrations ranging from 0.034 to 0.750 mg/l. All six of those samples were above the 0.01 mg/l treatability concentration. Also, phenolics have been identified as constituents of bauxite ore. Therefore, phenol is selected for further consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BAUXITE REFINING
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.01	1	1		1		
2. acrolein	0.010	0.01						
3. acrylonitrile	0.010	0.01						
4. benzene	0.010	0.01						
5. benzidine	0.010	0.01						
6. carbon tetrachloride	0.010	0.01						
7. chlorobenzene	0.010	0.01	1	1		1		
8. 1,2,4-trichlorobenzene	0.010	0.01						
9. hexachlorobenzene	0.010	0.01						
10. 1,2-dichloroethane	0.010	0.01						
11. 1,1,1-trichloroethane	0.010	0.01						
12. hexachloroethane	0.010	0.01						
13. 1,1-dichloroethane	0.010	0.01						
14. 1,1,2-trichloroethane	0.010	0.01						
15. 1,1,2,2-tetrachloroethane	0.010	0.01						
16. chloroethane	0.010	0.01						
17. bis(chloromethyl) ether	0.010	0.01						
18. bis(2-chloroethyl) ether	0.010	0.01						
19. 2-chloroethyl vinyl ether	0.010	0.01						
20. 2-chloronaphthalene	0.010	0.01						
21. 2,4,6-trichlorophenol	0.010	0.01	2	4		1		3
22. parachlorometa cresol	0.010	0.01	1	1	1			
23. chloroform	0.010	0.01	2	6	2	1	0	3
24. 2-chlorophenol	0.010	0.01	1	2				2
25. 1,2-dichlorobenzene	0.010	0.01						
26. 1,3-dichlorobenzene	0.010	0.01						
27. 1,4-dichlorobenzene	0.010	0.01						
28. 3,3'-dichlorobenzidine	0.010	0.01						
29. 1,1-dichloroethylene	0.010	0.01						
30. 1,2-trans-dichloroethylene	0.010	0.01						
31. 2,4-dichlorophenol	0.010	0.01	2	5		1		4
32. 1,2-dichloropropane	0.010	0.01						
33. 1,3-dichloropropylene	0.010	0.01						
34. 2,4-dimethylphenol	0.010	0.01	2	3		3		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BAUXITE REFINING
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
35. 2,4-dinitrotoluene	0.010	0.01						
36. 2,6-dinitrotoluene	0.010	0.01						
37. 1,2-diphenylhydrazine	0.010	0.01						
38. ethylbenzene	0.010	0.01						
39. fluoranthene	0.010	0.01	2	4		4		
40. 4-chlorophenyl phenyl ether	0.010	0.01						
41. 4-bromophenyl phenyl ether	0.010	0.01						
42. bis(2-chloroisopropyl) ether	0.010	0.01						
43. bis(2-chloroethoxy) methane	0.010	0.01						
44. methylene chloride	0.010	0.01	2	4		1		3
45. methyl chloride	0.010	0.01						
46. methyl bromide	0.010	0.01						
47. bromoform	0.010	0.01						
48. dichlorobromomethane	0.010	0.01	1	1		1		
49. trichlorofluoromethane	0.010	0.01						
50. dichlorodifluoromethane	0.010	0.01						
51. chlorodibromomethane	0.010	0.01						
52. hexachlorobutadiene	0.010	0.01						
53. hexachlorocyclopentadiene	0.010	0.01						
54. isophorone	0.010	0.01						
55. naphthalene	0.010	0.01	1	2		1		1
56. nitrobenzene	0.010	0.01						
57. 2-nitrophenol	0.010	0.01	2	3	1			1
58. 4-nitrophenol	0.010	0.01	2	4	1			3
59. 2,4-dinitrophenol	0.010	0.01	1	1	1			
60. 4,6-dinitro-o-cresol	0.010	0.01	1	1		1		1
61. N-nitrosodimethylamine	0.010	0.01						
62. N-nitrosodiphenylamine	0.010	0.01						
63. N-nitrosodi-n-propylamine	0.010	0.01						
64. pentachlorophenol	0.010	0.01	2	2	1	1		
65. phenol	0.010	0.01	2	6				6
66. bis(2-ethylhexyl) phthalate	0.010	0.01	2	6		1		5

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Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BAUXITE REFINING
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
67. butyl benzyl phthalate	0.010	0.01	2	5		5		
68. di-n-butyl phthalate	0.010	0.01	2	5		4		1
69. di-n-octyl phthalate	0.010	0.01	1					
70. diethyl phthalate	0.010	0.01	2	2			1	
71. dimethyl phthalate	0.010	0.01		2		1		1
72. benzo(a)anthracene	0.010	0.01						1
73. benzo(a)pyrene	0.010	0.01						
74. 3,4-benzofluoranthene	0.010	0.01						
75. benzo(k)fluoranthene	0.010	0.01						
76. chrysene	0.010	0.01						
77. acenaphthylene	0.010	0.01	2	3		1		
78. anthracene (c)	0.010	0.01						2
79. benzo(ghi)perylene	0.010	0.01						
80. fluorene	0.010	0.01	1			1		
81. phenanthrene (c)	0.010	0.01		1				
82. dibenzo(a,h)anthracene	0.010	0.01						
83. indeno(1,2,3-cd)pyrene	0.010	0.01						
84. pyrene	0.010	0.01	2	4		4		
85. tetrachloroethylene	0.010	0.01	1	1				1
86. toluene	0.010	0.01	1	1		1		
87. trichloroethylene	0.010	0.01						
88. vinyl chloride	0.010	0.01						
89. aldrin	0.005	0.01						
90. dieldrin	0.005	0.01						
91. chlordane	0.005	0.01	2	5		5		
92. 4,4'-DDT	0.005	0.01	2	6		6		
93. 4,4'-DDE	0.005	0.01	1	1		1		
94. 4,4'-DDD	0.005	0.01						
95. alpha-endosulfan	0.005	0.01	1	2		2		
96. beta-endosulfan	0.005	0.01	1	2		2		
97. endosulfan sulfate	0.005	0.01	2	5		5		
98. endrin	0.005	0.01	2	4		4		
99. endrin aldehyde	0.005	0.01	1	1		1		
100. heptachlor	0.005	0.01	2	6		6		
101. heptachlor epoxide	0.005	0.01	2	6		6		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BAUXITE REFINING
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
102. alpha-BHC	0.005	0.01	2	3		3		
103. beta-BHC	0.005	0.01	2	6		6		
104. gamma-BHC	0.005	0.01	2	4		4		
105. delta-BHC	0.005	0.01						
106. PCB-1242 (d)	0.005	0.01	2	5		5		
107. PCB-1254 (d)	0.005	0.01	2	5		5		
108. PCB-1221 (d)	0.005	0.01	2	5		5		
109. PCB-1232 (e)	0.005	0.01	2	5		5		
110. PCB-1248 (e)	0.005	0.01	2	5		5		
111. PCB-1260 (e)	0.005	0.01	2	5		5		
112. PCB-1016 (e)	0.005	0.01	2	5		5		
113. toxaphene	0.005	0.01						
114. antimony	0.100	0.47	2	5		5		
115. arsenic	0.010	0.34	2	5		5	5	
116. asbestos								
117. beryllium	0.010	0.20						
118. cadmium	0.002	0.049						
119. chromium	0.005	0.07						
120. copper	0.009	0.39						
121. cyanide (f)	0.02	0.047	2	6		6		
122. lead	0.020	0.08						
123. mercury	0.0001	0.036						
124. nickel	0.005	0.22						
125. selenium	0.01	0.20	2	5		5		
126. silver	0.02	0.07	2	5		5		
127. thallium	0.100	0.34	2	5		4	1	
128. zinc	0.050	0.23						
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)								

(a) Analytical quantification concentration was reported with the data (see Section V).

(b) Treatable concentrations are based on performance of lime precipitation, sedimentation, and filtration.

(c), (d), (e) Reported together.

(f) Analytical quantification concentration for EPA Method 335.2, Total Cyanide Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, March 1979.

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BAUXITE REFINING SUBCATEGORY

SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters generated in the bauxite refining subcategory. This section summarizes the description of these wastewaters and indicates the level of treatment which is currently practiced for each waste stream.

CURRENT CONTROL AND TREATMENT PRACTICES

Control and treatment technologies are discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability to wastewater similar to that found in this subcategory are presented there. This section presents a summary of the control and treatment technologies that are currently applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the bauxite refining subcategory is characterized by the presence of treatable concentrations of phenolic compounds and high pH. This analysis is supported by the raw (untreated) wastewater data presented for specific sources in Section V. According to promulgated BPT limitations (40 CFR Part 421, Subpart A), the only allowable discharge of wastewater pollutants for the bauxite refining subcategory is from the mud impoundment. The other three subdivisions (digester condensate, barometric condenser effluent, and carbonation plant effluent) are all restricted to zero discharge of wastewater pollutants under the promulgated BPT regulation. Three plants in this subcategory currently discharge treated water from the mud impoundment area. One option has been selected for consideration for BPT, BAT, NSPS, and pretreatment based on this waste stream.

MUD IMPOUNDMENT EFFLUENT

Red mud is the major waste stream from bauxite refining operations. It contains the impurities from the bauxite ore as well as by-products formed during the refining process. Red mud is deposited in large ponds where insoluble solids, including the oxides of metallic elements, settle out of suspension. Rainfall from the plant site is often routed to the mud impoundment. Water from the impoundment can be recycled to the plant directly from the mud lake or it can be decanted to a separate clear lake before recycle.

Three plants currently discharge water from the mud impoundment. At one plant, water is discharged after pH adjustment without recycle to the process. At another plant, a portion of the water

which is recycled to the plant from a clear lake is discharged
without treatment. The third plant discharges excess stormwater
from closed mud lakes after pH adjustment. The remaining five
plants in this subcategory currently achieve zero discharge by
permanent lagoon impoundment and partial recycle. However, one
of these plants is considering a process technology change which
would result in a mud impoundment discharge.

CONTROL AND TREATMENT OPTIONS

The Agency examined one control and treatment alternative that is
applicable to the bauxite refining subcategory. The option
selected for evaluation represents an end-of-pipe treatment
technology.

OPTION E

Option E for the bauxite refining subcategory consists of all
control requirements of the existing BPT (no discharge of process
wastewater pollutants, and discharge of net precipitation from
process wastewater impoundments) plus pH adjustment and activated
carbon adsorption treatment of the mud impoundment effluent.
Activated carbon adsorption is used to remove organic compounds,
including phenolics, from the effluent wastewater. Adjustment of
pH is required to ensure consistent removal performance by
adsorption and to meet discharge quality standards.

The Agency also considered the use of pH adjustment and chemical
oxidation to remove phenolic compounds from the effluent
wastewater. Adjustment of pH is required to ensure consistent
removal performance by chemical oxidation and to meet discharge
quality standards. Hydrogen peroxide is suggested for the
oxidation of phenols, but other chemicals, such as chlorine
dioxide and ozone, may perform satisfactorily.

SECTION VIII

COSTS OF WASTEWATER TREATMENT AND CONTROL

This section describes the method used to develop the costs associated with the control and treatment technologies of Option E discussed in Section VII for wastewaters from bauxite refining plants. Plant-by-plant compliance costs for this option were developed. Compliance costs for chemical oxidation were also estimated. The energy requirements of the considered option as well as solid waste and air pollution aspects are also discussed. Section VIII of the General Development Document provides background on the capital and annual costs for the technology discussed herein.

TREATMENT OPTIONS COSTED FOR EXISTING SOURCES

As discussed in Section VII, one treatment option has been considered for existing bauxite refining plants. This option is summarized below and is schematically presented in Figure X-1.

OPTION E

Option E consists of the BPT requirements with additional control of the mud impoundment discharges by pH adjustment and activated carbon adsorption. The Agency also prepared capital and annual costs for pH adjustment and chemical oxidation of the mud impoundment effluent at one median plant. The calculated costs were much higher in relation to the costs for activated carbon at the same plant, therefore, no further consideration was given to this technology.

COST METHODOLOGY

A detailed discussion of the methodology used to develop the compliance costs is presented in Section VIII of the General Development Document. Plant-by-plant compliance costs have been estimated for the nonferrous metals manufacturing category and are documented in detail in the administrative record supporting this regulation. The costs for the option in this subcategory are presented in Table VIII-1.

Each of the general assumptions used to develop compliance costs is presented in Section VIII of the General Development Document. Each subcategory also contains a unique set of waste streams requiring certain subcategory-specific assumptions to develop compliance costs. The major assumptions specific to the bauxite refining subcategory are discussed briefly below.

(1) The Option E treatment system consists of pH adjustment followed by carbon adsorption.
The flows were determined from information provided in the dcp for red mud impoundment discharge flow only. The influent concentrations for phenol and 2-chlorophenol were determined from averages of field sampling data from two plants. These data are found in Table V-5.

(2) Costs for pH adjustment were based on reduction of pH from 11.5 to 9 using sulfuric acid.

(3) The carbon exhaustion rate was determined from adsorption isotherms for phenol and 2-chlorophenol, influent concentrations from the sampling data, and an effluent concentration in both cases of 0.010 mg/l. Using this procedure and an excess of 50% to account for other adsorbable organics, a carbon exhaustion rate of 2.321 lbs/1000 gallons was determined.

(4) Plants 1076 and 1141 have pH adjustment equipment in place; capital cost estimates are included for all other equipment at the three discharging plants and the one existing zero discharger who is considering a discharge.

NONWATER QUALITY ASPECTS

A general discussion of the nonwater quality aspects of the control and treatment options considered for the nonferrous metals category is contained in Section VIII of the General Development Document. Nonwater quality impacts specific to the bauxite refining subcategory, including energy requirements, solid waste and air pollution are discussed below.

ENERGY REQUIREMENTS

The methodology used for determining the energy requirements for the various options is discussed in Section VIII of the General Development Document. Energy requirements for Option E are estimated at 11,500,000 kWh/yr. This represents less than 3 percent of the total energy usage of the four plants. It is therefore concluded that the energy requirements of the treatment option considered will not have a significant impact on total plant energy consumption.

SOLID WASTE

No significant amounts of solid wastes are generated by the technologies considered for this regulation in the bauxite refining subcategory. Activated carbon is thermally regenerated either on-site or off-site, and in neither case are appreciable quantities of solid waste generated.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of activated carbon treatment and pH adjustment. Thermal regeneration of spent carbon may release trace quantities of pollutants, but these should be readily oxidized at the temperatures under which the carbon is regenerated.

Table VIII-1

COST OF COMPLIANCE FOR THE BAUXITE REFINING SUBCATEGORY
DIRECT DISCHARGERS*

(March, 1982 Dollars)

Option	Total Required Capital Cost	Total Annual Cost
E	7,600,000	2,980,000

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*Includes one plant currently practicing zero discharge of process wastewater.

BAUXITE REFINING SUBCATEGORY

SECTION IX

BEST PRACTICABLE TECHNOLOGY CURRENTLY AVAILABLE

EPA promulgated BPT limitations for the bauxite refining subcategory on April 8, 1974 as Subpart A of 40 CFR Part 421. EPA is proposing only minor technical modifications to these limitations.

The following limitations establish the quantity or quality of pollutants or pollutant properties which may be discharged by a point source after application of the best practicable control technology currently available: There shall be no dischage of process wastewater pollutants to navigable waters.

During any calendar month, there may be discharged from the overflow of a process wastewater impoundment either a volume of wastewater equal to the difference between the precipitation for that month that falls within the impoundment and the evaporation within the impoundment for that month, or, if greater, a volume of process wastewater equal to the difference between the mean precipitation for that month that falls within the impoundment and the mean evaporation for that month as established by the National Climatic Center, National Oceanic and Atmospheric Administration, for the area in which such impoundment is located (or as otherwise determined if no monthly data have been established by the National Climatic Center).

EPA does not believe that the data gathered since the original promulgation warrant any adjustment in the BPT requirements. Minor amendments to the regulatory language are being proposed to clarify references to fundamentally different factors (FDF) considerations under 40 CFR Part 125 and references to pretreatment standards under 40 CFR Part 128. As a result, the bauxite refining subcategory will not incur any incremental capital or annual costs to comply with the BPT limitations.

BAUXITE REFINING SUBCATEGORY

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

The effluent limitations which must be achieved by July 1, 1984 are based on the best control and treatment technology used by a specific point source within the industrial category or subcategory, or by another industry where it is readily transferable. Emphasis is placed on additional treatment techniques applied at the end of the treatment systems currently used, as well as reduction of the amount of water used and discharged, process control, and treatment technology optimization.

The factors considered in assessing best available technology economically achievable (BAT) include the age of equipment and facilities involved, the process used, process changes, nonwater quality environmental impacts (including energy requirements), and the costs of application of such technology (Section 304(b)(2)(B) of the Clean Water Act). At a minimum, BAT represents the best available technology economically achievable at plants of various ages, sizes, processes, or other characteristics. Where the Agency has found the existing performance to be uniformly inadequate, BAT may be transferred from a different subcategory or category. BAT may include feasible process changes or internal controls, even when not in common industry practice.

The required assessment of BAT considers costs, but does not require a balancing of costs against effluent reduction benefits (see Weyerhaeuser v. Costle, 11 ERC 2149 (D.C.Cir. 1978)). However, in assessing the proposed BAT, the Agency has given substantial weight to the economic achievability of the technology.

TECHNICAL APPROACH TO BAT

In pursuing this second round of effluent limitations, the Agency reviewed a wide range of technology options and evaluated the available possibilities to ensure that the most effective and beneficial technologies were used as the basis of BAT. To accomplish this, the Agency elected to examine one technology option which could be applied to the bauxite refining subcategory as an alternative for the basis of BAT effluent limitations. The treatment technologies considered for BAT are summarized below:

Option E (Figure X-1):

- Zero discharge of process wastewater pollutants
- Discharge of net precipitation from process wastewater

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- impoundments
- pH adjustment
- Activated carbon adsorption

OPTION E

Option E consists of the existing BPT requirements (no discharge of process wastewater pollutants, discharge of net precipitation from a process wastewater impoundment), with pH adjustment and activated carbon adsorption treatment of the net precipitation discharge. Activated carbon technology is used to remove toxic organic compounds, including phenolics, from the effluent wastewater. Adjustment of pH is required to ensure consistent removal performance by adsorption and to meet discharge quality standards.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

As one means of evaluating the technology option, EPA developed estimates of the pollutant removal estimates and the associated compliance costs. The methodologies are described below.

POLLUTANT REMOVAL ESTIMATES

A complete description of the methodology used to calculate the estimated pollutant removal, or benefit, achieved by the application of the treatment option is presented in Section X of the General Development Document. In short, sampling data collected during the field sampling program were used to characterize the pollutant concentrations in the waste stream considered for regulation. This information was used with the wastewater discharge rates measured during sampling or derived from each dcp to estimate the mass of toxic pollutants generated by each plant in the bauxite refining subcategory.

The mass of pollutant discharged was estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of wastewater discharged by each plant in the subcategory. The mass of pollutant removed, referred to as the benefit, is simply the difference between the estimated mass of pollutant generated by each plant and the mass of pollutant discharged after application of the treatment option. The total subcategory removal was then estimated by summing the individual plant removal estimates for each pollutant. The pollutant removal estimates for the bauxite refining subcategory are presented in Table X-1.

COMPLIANCE COSTS

EPA calculated compliance costs for the bauxite refining subcategory by developing a wastewater treatment system design and cost estimation model that estimates capital and annual costs for the treatment option being considered. This model was

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applied to each plant's flow and pollutant characteristics, and the calculated capital and annual costs were summed to arrive at total subcategory costs. These costs, which are presented in Table X-2, were used in EPA's economic impact analysis.

BAT OPTION SELECTION

EPA promulgated BAT limitations for the bauxite refining subcategory on April 8, 1974 as Subpart A of 40 CFR Part 421. These limitations allow no discharge of process wastewater pollutants to navigable waters. A discharge is allowed from the overflow of a process wastewater impoundment in a volume equal to the net precipitation that falls within the impoundment. EPA is not proposing any modification to these limitations at this time. However, the Agency is considering the establishment of effluent limitations based on pH adjustment and activated carbon adsorption treatment of toxic organic pollutants in the mud impoundment overflow. This revision is in keeping with the emphasis of the Clean Water Act of 1977 on toxic pollutants.

Implementation of this organics control option would remove annually an estimated 4,835 kg of toxic pollutants from the raw discharge. Estimated capital cost for achieving this option would be $7.60 million, with estimated annualized costs of $2.98 million.

Activated carbon is being considered because of its ability to remove toxic organics to very low concentrations. Although no plants in the nonferrous metals manufacturing category have installed this technology for organics removal, it is demonstrated in the iron and steel manufacturing category. EPA believes that the influent characteristics are similar with respect to organics for both categories, and that, if proper design procedures are used, similar removals will be achieved. Activated carbon will remove adsorbable organics to essentially nondetectable levels if sufficient carbon and contact time are provided. These design parameters have been carefully and conservatively selected by EPA for this subcategory. Therefore, based on these considerations and the performance data from iron and steel manufacturing a level of 0.010 mg/l for phenol, 2-chlorophenol, and total phenols (4-AAP) can be achieved. The Agency solicits comments on the costs and performance of activated carbon, and the applicability of these effluent limitations to the bauxite refining subcategory.

REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C. 1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutants and pollutant parameters for limitation. This examination and

evaluation, presented in Section VI, concluded that six pollutants and pollutant parameters are present in bauxite refining wastewaters at concentrations that can be reduced by identified treatment technologies.

The high cost associated with analysis for toxic organic pollutants has prompted EPA to consider an alternative method for regulating and monitoring toxic pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent limitations and standards for each of the toxic organics found in treatable concentrations in the raw wastewater from a given subcategory, the Agency is considering effluent limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal estimate analysis. On this basis, the pollutants being considered for specific limitation are listed below:

24. 2-chlorophenol
65. phenol

By establishing limitations and standards for certain toxic organic pollutants, dischargers would attain the same degree of control over toxic organic pollutants as they would have been required to achieve had all the toxic organic pollutants been directly limited. This approach is technically justified because the design of activated carbon columns must consider the presence of other organic compounds which will be removed from the wastewater. Even though the removal of different phenolic compounds will occur at different rates, treatment of the above listed organics to the concentration values attainable by the option will be accompanied by a reduction in concentration of the unregulated organics. One nonconventional pollutant parameter, total phenolic (4-AAP), is being considered for limitation to ensure adequate removal of phenolics other than 2-chlorophenol and phenol. No toxic metal pollutants are selected for specific limitation in this subcategory.

The following toxic pollutants are not being considered for specific limitation on the basis that they would be effectively controlled by the limitations being considered for 2-chlorophenol, phenol, and total phenolics (4-AAP):

21. 2,4,6-trichlorophenol
31. 2,4-dichlorophenol
57. 2-nitrophenol
58. 4-nitrophenol

The conventional pollutant parameter pH may be limited by the best conventional technology (BCT) effluent limitations.

EFFLUENT LIMITATIONS

The concentrations achievable by application of pH adjustment and activated carbon are discussed in Section VII of the General Development Document. The effluent limitations for mud impoundment effluent under consideration for BAT are shown below.

BAT EFFLUENT LIMITATIONS UNDER CONSIDERATION FOR THE BAUXITE REFINING SUBCATEGORY

Mud Impoundment Effluent

Pollutant or Pollutant Property	Maximum for Any One Day (mg/l)
Phenol	0.010
2-Chlorophenol	0.010
Total Phenols (4-AAP)	0.010

Table X-1

POLLUTANT REMOVAL ESTIMATES
BAUXITE REFINING SUBCATEGORY

Direct Dischargers*

Pollutant	Total Raw Discharge (kg/yr)	Total Current Discharge (kg/yr)	Total Current Removed (kg/yr)	Option E Discharge (kg/yr)	Raw to Option E Removed (kg/yr)	Current To Option E Removed (kg/yr)
2-chlorophenol phenol	3,125.51 1,868.95	3,125.51 1,868.95	0 0	79.53 79.53	3,045.98 1,789.42	3,045.98 1,789.42
TOTAL TOXIC ORGANICS	4,994.45	4,994.45	0	159.06	4,835.40	4,835.40

*Includes one plant currently practicing zero discharge of process wastewater.

Table X-2

COST OF COMPLIANCE FOR THE BAUXITE REFINING SUBCATEGORY

Direct Dischargers*

Option	Capital Cost (1982 Dollars)	Annual Cost (1982 Dollars)
E	7,600,000	2,980,000

*Includes one plant currently practicing zero discharge of process wastewater.
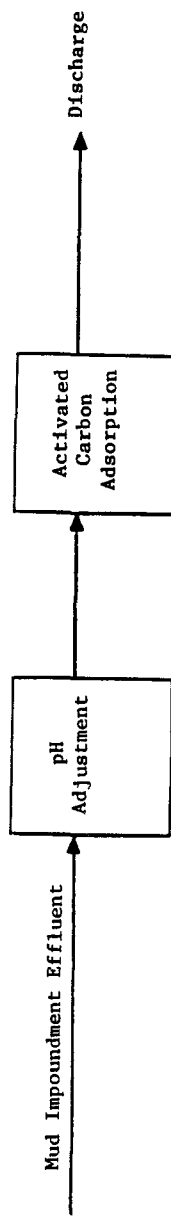
Figure X-1

OPTION E TREATMENT SCHEME FOR THE BAUXITE REFINING SUBCATEGORY

SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

The basis for new source performance standards (NSPS) under Section 306 of the Act is the best available demonstrated technology (BDT). New plants have the opportunity to design the best and most efficient production processes and wastewater treatment technologies without facing the added costs and restrictions encountered in retrofitting an existing plant. Therefore, Congress directed EPA to consider the best demonstrated process changes, in-plant controls, and end-of-pipe treatment technologies which reduce pollution to the maximum extent feasible.

This section describes the technologies for treatment of wastewater from new sources and presents the performance standards being considered for NSPS in the bauxite refining subcategory, based on the selected treatment technology.

TECHNICAL APPROACH TO NSPS

EPA promulgated new source performance standards for the bauxite refining subcategory on April 8 1974. The technology basis for this promulgation was identical to BAT. EPA is proposing only minor technical amendments to the promulgated regulation. It is also considering the limitations described in the previous section for BAT, i.e., pH adjustment and activated carbon adsorption of mud impoundment overflow. This result is a consequence of careful review by the Agency of a wide range of technology options for new source treatment systems which is discussed in Section XI of the General Development Document. This review of the bauxite refining subcategory found no new, economically feasible, demonstrated technologies which could be considered an improvement over those chosen for consideration for BAT. Additionally, there was nothing found to indicate that the wastewater flows and characteristics of new plants would not be similar to those from existing plants, since the processes used by new sources are not expected to differ from those used at existing sources.

The treatment technology considered for the NSPS option is identical to the treatment technology considered for the BAT option. This option is:

OPTION E

- Zero discharge of process wastewater pollutant
- Discharge of net precipitation from process wastewater impoundments

- pH adjustment
- Activated carbon adsorption

NSPS OPTION SELECTION

As discussed earlier, with the exception of minor technical amendments, the Agency is not modifying the existing promulgated regulation for the bauxite refining subcategory. The Agency is considering and solicits comments on performance standards based on Option E technology.

REGULATED POLLUTANT PARAMETERS

The Agency has no reason to believe that the pollutants that will be found in treatable concentrations in processes within new sources will be any different than with existing sources. Accordingly, pollutants and pollutant parameters being considered for limitation under NSPS, in accordance with the rationale of Sections VI and X, are identical to those being considered for BAT. The conventional pollutant parameter pH is also being considered for limitation. For NSPS, the Agency is considering pH limitations for mud impoundment effluent within the range of 7.5 to 10.0 at all times, and solicits comments on this limitation.

NEW SOURCE PERFORMANCE STANDARDS

The modified performance standards being considered based on pH adjustment and activated carbon adsorption technology are listed below.

NSPS UNDER CONSIDERATION FOR THE BAUXITE REFINING SUBCATEGORY

Mud Impoundment Effluent

Pollutant or Pollutant Property	Maximum for Any One Day (mg/l)
Phenol	0.010
2-Chlorophenol	0.010
Total Phenols (4-AAP)	0.010

BAUXITE REFINING SUBCATEGORY

SECTION XII

PRETREATMENT STANDARDS

EPA is not proposing pretreatment standards for existing sources at this time because there are currently no indirect discharging facilities in this subcategory.

EPA promulgated PSNS for the bauxite refining subcategory on April 8, 1974 as Subpart A of 40 CFR Part 421. The following limitations establish the quantity or quality of pollutants or pollutant properties which may be discharged by a new indirect discharger: There shall be no discharge of process wastewater pollutants to navigable waters.

During any calendar month, there may be discharged from the overflow of a process wastewater impoundment either a volume of wastewater equal to the difference between the precipitation for that month that falls within the impoundment and the evaporation within the impoundment for that month, or, if greater, a volume of process wastewater equal to the difference between the mean precipitation for that month that falls within the impoundment and the mean evaporation for that month as established by the National Climatic Center, National Oceanic and. Atmospheric Administration, for the area in which such impoundment is located (or as otherwise determined if no monthly data have been established by the National Climatic Center).

EPA is not proposing any modifications to PSNS since it is unlikely that any new bauxite sources will be constructed as indirect dischargers.

BAUXITE REFINING SUBCATEGORY

SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not proposing best conventional pollutant control technology (BCT) limitations for the bauxite refining subcategory at this time.