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Development Document for Effluent Limitations Guidelines and Standards for the Nonferrous Metals Manufacturing Point Source Category

FINAL

Volume VII
Primary Beryllium
Primary Nickel and Cobalt
Secondary Nickel
Secondary Tin

Printed on Recycled Paper

ORGANIZATION OF THIS DOCUMENT

This development document for the nonferrous metals manufacturing category consists of a general development document which considers the general and overall aspects of the regulation and 31 subcategory specific supplements. These parts are organized into 10 volumes as listed below.

The information in the general document and in the supplements is organized by sections with the same type of information reported in the same section of each part. Hence to find information on any specific aspect of the category one would need only look in the same section of the general document and the specific supplements of interest.

The ten volumes contain contain the following subjects:

Volume I	General Development Document
Volume II	Bauxite Refining Primary Aluminum Smelting Secondary Aluminum Smelting
Volume III	Primary Copper Smelting Primary Electrolytic Copper Refining Secondary Copper Refining Metallurgical Acid Plants
Volume IV	Primary Zinc Primary Lead Secondary Lead Primary Antimony
Volume V	Primary Precious Metals and Mercury Secondary Precious Metals Secondary Silver Secondary Mercury
Volume VI	Primary Tungsten Secondary Tungsten and Cobalt Primary Molybdenum and Rhenium Secondary Molybdenum and Vanadium
Volume VII	Primary Beryllium Primary Nickel and Cobalt Secondary Nickel Secondary Tin
Volume VIII	Primary Columbium and Tantalum Secondary Tantalum Secondary Uranium
Volume IX	Primary and Secondary Titanium Primary Zirconium and Hafnium
Volume X	Primary and Secondary Germanium and Gallium Primary Rare Earth Metals Secondary Indium

DEVELOPMENT DOCUMENT

for

EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS

for the

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

VOLUME VII

Primary Beryllium
Primary Nickel and Cobalt
Secondary Nickel
Secondary Tin

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NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Primary Beryllium Subcategory

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PRIMARY BERYLLIUM SUBCATEGORY

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SECTION I

SUMMARY

This document provides the technical basis for promulgating effluent limitations based on best practicable technology (BPT) and best available technology economically achievable (BAT) for existing direct dischargers, pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS).

The primary beryllium subcategory consists of three plants. One discharges directly to a river or stream, and two achieve zero discharge of process wastewater.

EPA first studied the primary beryllium subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, and 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 the sources and volumes of water used, the processes used, the sources of pollutants and wastewaters in the plant, and the constituents of wastewaters including priority pollutants. As a result, 16 subdivisions or building blocks have been identified for this subcategory that warrant separate effluent limitations. These include:

a Solvent extraction raffinate from bertrandite ore,
b Solvent extraction raffinate from beryl ore,
c Beryllium carbonate filtrate,
d Beryllium hydroxide filtrate,
f Beryllium oxide calcining furnace wet air pollution control,
g Beryllium hydroxide supernatant,
h Process water,
i Fluoride furnace scrubber,
j Chip treatment wastewater,
k Beryllium pebble plant area vent wet air pollution control,
l Beryl ore gangue dewatering,
m Bertrandite ore gangue dewatering,
n Beryl ore processing,
o AIS area wastewater,
p Bertrandite ore leaching scrubber, and
q Bertrandite ore counter current decantation scrubber.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the primary beryllium 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 various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each plant for each of the control and treatment options considered for the subcategory. These costs were then used by the Agency to estimate the impact of implementing the various options in the subcategory. For each control and treatment option that the Agency found to be most effective and technically feasible in controlling the discharge of pollutants, the number of potential closures, number of employees affected, and impact on price were estimated. These results are reported in a separate document entitled "Economic Impact Analysis of Effluent Limitations and Standards for the Nonferrous Metals Manufacturing Industry."

After examining treatment technology being operated in the subcategory, the Agency has identified promulgated BPT as pollutant removal based on chemical precipitation and sedimentation technology, and ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams. To meet the BPT effluent limitations based on this technology, the primary beryllium subcategory is estimated to incur a capital cost of $226,500 and an annual cost of $251,200.

For BAT, the Agency has built upon the BPT technology basis by adding filtration as an effluent polishing step to the end-of-pipe treatment scheme. To meet the BAT effluent limitations based on this technology, the primary beryllium subcategory is estimated to incur a capital cost of $256,200 and an annual cost of $265,600.

NSPS and PSNS are equivalent to BAT. In selecting NSPS and PSNS, 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 or PSNS criteria. Therefore, the technology basis of BAT has been determined as the best demonstrated technology.

The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. BCT is not being promulgated because the methodology for BCT has not yet been finalized.

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

SECTION II

CONCLUSIONS

EPA has divided the primary beryllium subcategory into 16 subdivisions for the purpose of effluent limitations and standards. These subdivisions are:

(a) Solvent extraction raffinate from bertrandite ore,
(b) Solvent extraction raffinate from beryl ore,
(c) Beryllium carbonate filtrate,
(d) Beryllium hydroxide filtrate,
(e) Beryllium oxide calcining furnace wet air pollution control,
(f) Beryllium hydroxide supernatant,
(g) Process water,
(h) Fluoride furnace scrubber,
(i) Chip treatment wastewater,
(j) Beryllium pebble plant area vent wet air pollution control.
(k) Beryl ore gangue dewatering,
(l) Bertrandite ore gangue dewatering,
(m) Beryl ore processing,
(n) AIS area wastewater,
(o) Bertrandite ore leaching scrubber, and
(p) Bertrandite ore counter current decantation scrubber.

BPT is promulgated based on the performance achievable by the application of ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation and sedimentation (lime and settle) technology. The following BPT effluent limitations are promulgated:

(a) Solvent Extraction Raffinate from Bertrandite Ore

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore as beryllium		
Beryllium	2,763.000	1,235.000
Chromium (Total)	988.200	404.300
Copper	4,267.000	2,246.000
Cyanide (Total)	651.300	269.500
Ammonia (as N)	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000
TSS	92,090.000	43,800.000
pH	Within the range of 7.5 to 10.0 at all times	

(b) <u>Solvent Extraction Raffinate from Beryl Ore</u>

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore as beryllium		
Beryllium	270.600	121.000
Chromium (Total)	96.800	39.600
Copper	418.000	220.000
Cyanide (Total)	63.800	26.400
Ammonia (as N)	29,330.000	12,890.000
Fluoride	7,700.000	4,378.000
TSS	9,020.000	4,290.000
pH	Within the range of 7.5 to 10.0 at all times	

(c) <u>Beryllium Carbonate Filtrate</u>

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced as beryllium		
Beryllium	263.800	118.000
Chromium (Total)	94.380	38.610
Copper	407.600	214.500
Cyanide (Total)	62.210	25.740
Ammonia (as N)	28,590.000	12,570.000
Fluoride	7,508.000	4,269.000
TSS	8,795.000	4,183.000
pH	Within the range of 7.5 to 10.0 at all times	

(d) <u>Beryllium Hydroxide Filtrate</u> BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced as beryllium		
Beryllium	167.280	74.800
Chromium (Total)	59.840	24.480
Copper	258.400	136.000
Cyanide (Total)	39.440	16.320
Ammonia (as N)	18,128.800	7,969.600
Fluoride	4,760.000	2,652.000
TSS	5,576.000	2,652.000
pH	Within the range of 7.5 to 10.0 at all times	

(e) <u>Beryllium Oxide Calcining Furnace Wet Air Pollution Control</u> BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	324.400	145.000
Chromium (Total)	116.000	47.470
Copper	501.000	263.700
Cyanide (Total)	76.470	31.640
Ammonia (as N)	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000
TSS	10,810.000	5,142.000
pH	Within the range of 7.5 to 10.0 at all times	

(f) Beryllium Hydroxide Supernatant BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced from scrap and residues as beryllium		
Beryllium	282.900	126.500
Chromium (Total)	101.200	41.400
Copper	437.000	230.000
Cyanide (Total)	66.700	27.600
Ammonia (as N)	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000
TSS	9,430.000	4,485.000
pH	Within the range of 7.5 to 10.0 at all times	

(g) Process Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	215.000	96.140
Chromium (Total)	76.910	31.460
Copper	332.100	174.800
Cyanide (Total)	50.690	20.980
Ammonia (as N)	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000
TSS	7,167.000	3,409.000
pH	Within the range of 7.5 to 10.0 at all times	

(h) Fluoride Furnace Scrubber BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(i) Chip Treatment Wastewater BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	9.533	4.263
Chromium (Total)	3.410	1.395
Copper	14.730	7.750
Cyanide (Total)	2.248	0.930
Ammonia (as N)	1,033.000	454.200
Fluoride	271.300	154.200
TSS	317.800	151.100
pH	Within the range of 7.5 to 10.0 at all times	

(j) Beryllium Pebble Plant Area Vent Wet Air Pollution Control BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(k) Beryl Ore Gangue Dewatering BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	1.283	0.574
Chromium (Total)	0.459	0.188
Copper	1.982	1.043
Cyanide (Total)	0.302	0.125
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756
TSS	42.763	20.339
pH	Within the range of 7.5 to 10.0 at all times	

(l) Bertrandite Ore Gangue Dewatering BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of bertrandite processed		
Beryllium	3.279	1.466
Chromium (Total)	1.173	0.480
Copper	5.064	2.665
Cyanide (Total)	0.773	0.320
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034
TSS	109.265	51.968
pH	Within the range of 7.5 to 10.0 at all times	

(m) Beryl Ore Processing BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	8.983	4.017
Chromium (Total)	3.213	1.315
Copper	13.876	7.303
Cyanide (Total)	2.118	0.876
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330
TSS	299.423	142.409
pH	Within the range of 7.5 to 10.0 at all times	

(n) Aluminum Iron Sludge (AIS) Area Wastewater BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of total beryllium carbonate produced as beryllium		
Beryllium	575.640	247.400
Chromium (Total)	205.920	84.240
Copper	889.200	468.000
Cyanide (Total)	135.720	56.160
Ammonia (as N)	62,384.400	27,424.800
Fluoride	16,380.000	9,313.200
TSS	19,188.000	9,126.000
pH	Within the range of 7.5 to 10.0 at all times	

(o) Bertrandite Ore Leaching Scrubber BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore		
Beryllium	1.859	0.831
Chromium (Total)	0.665	0.272
Copper	2.871	1.511
Cyanide (Total)	0.438	0.181
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069
TSS	61.951	29.465
pH	Within the range of 7.5 to 10.0 at all times	

(p) Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore processed		
Beryllium	0.124	0.056
Chromium (Total)	0.044	0.018
Copper	0.192	0.101
Cyanide (Total)	0.029	0.012
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010
TSS	4.141	1.970
pH	Within the range of 7.5 to 10.0 at all times	

BAT is promulgated based on the performance achievable by the application of ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology. The following BAT effluent limitations are promulgated:

(a) Solvent Extraction Raffinate from Bertrandite Ore BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore as beryllium		
Beryllium	1,842.000	831.000
Chromium (Total)	831.000	336.900
Copper	2,875.000	1,370.000
Cyanide (Total)	449.200	179.700
Ammonia (as N)	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000

(b) Solvent Extraction Raffinate from Beryl Ore BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore as beryllium		
Beryllium	180.400	81.400
Chromium (Total)	81.400	33.000
Copper	281.600	134.200
Cyanide (Total)	44.000	17.600
Ammonia (as N)	29,330.000	12,890.000
Fluoride	7,700.000	4,378.000

(c) Beryllium Carbonate Filtrate BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced as beryllium		
Beryllium	175.900	79.370
Chromium (Total)	79.370	32.180
Copper	274.600	130.800
Cyanide (Total)	42.900	17.160
Ammonia (as N)	28,590.000	12,570.000
Fluoride	7,508.000	4.269.000

(d) Beryllium Hydroxide Filtrate BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced as beryllium		
Beryllium	111.520	50.320
Chromium (Total)	50.320	20.400
Copper	174.080	82.960
Cyanide (Total)	27.200	10.880
Ammonia (as N)	18,128.800	7,969.600
Fluoride	4,760.000	2,706.400

(e) Beryllium Oxide Calcining Furnace Wet Air Pollution Control BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	216 200	97.570
Chromium (Total)	97.570	39.560
Copper	337.500	160.900
Cyanide (Total)	52.740	21.100
Ammonia (as N)	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000

(f) Beryllium Hydroxide Supernatant BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced from scrap and residues as beryllium		
Beryllium	188.600	85.100
Chromium (Total)	85.100	34.500
Copper	294.400	140.300
Cyanide (Total)	46.000	18.400
Ammonia (as N)	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000

(g) Process Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	143.300	64.680
Chromium (Total)	64.680	26.220
Copper	223.700	106.600
Cyanide (Total)	34.960	13.980
Ammonia (as N)	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000

(h) Fluoride Furnace Scrubber BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride	0.000	0.000

(i) Chip Treatment Wastewater BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	6.355	2.868
Chromium (Total)	2.868	1.163
Copper	9.920	4.728
Cyanide (Total)	1.550	0.620
Ammonia (as N)	1,033.000	454.200
Fluoride	271.300	154.200

(j) Beryllium Pebble Plant Area Vent Wet Air Pollution Control BAT

Pollutant for Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride	0.000	0.000

(k) Beryl Ore Gangue Dewatering BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	0.855	0.386
Chromium (Total)	0.386	0.156
Copper	1.335	0.636
Cyanide (Total)	0.209	0.083
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756

(l) Bertrandite Ore Gangue Dewatering BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of bertrandite ore processed		
Beryllium	2.185	0.986
Chromium (Total)	0.986	0.400
Copper	3.411	1.626
Cyanide (Total)	0.533	0.213
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034

(m) Beryl Ore Processing BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	5.988	2.702
Chromium (Total)	2.702	1.095
Copper	9.348	4.455
Cyanide (Total)	1.461	0.584
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330

(n) Aluminum Iron Sludge (AIS) Area Wastewater BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of total beryllium carbonate produced as beryllium		
Beryllium	383.760	173.160
Chromium (Total)	173.160	70.200
Copper	599.040	285.480
Cyanide (Total)	93.600	37.440
Ammonia (as N)	62,384.400	27,424.800
Fluoride	16,380.000	9,313.200

(o) Bertrandite Ore Leaching Scrubber BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore processed		
Beryllium	1.239	0.559
Chromium (Total)	0.559	0.227
Copper	1.934	0.922
Cyanide (Total)	0.302	0.121
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069

(p) <u>Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber</u> BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore processed		
Beryllium	0.083	0.037
Chromium (Total)	0.037	0.015
Copper	0.129	0.062
Cyanide (Total)	0.020	0.008
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010

NSPS is promulgated based on the performance achievable by the application of ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology. The following effluent standards are promulgated for new sources:

(a) Solvent Extraction Raffinate from Bertrandite Ore NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore as beryllium		
Beryllium	1,842.000	831.000
Chromium (Total)	831.000	336.900
Copper	2,875.000	1,370.000
Cyanide (Total)	449.200	179.700
Ammonia (as N)	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000
TSS	33,690.000	26,950.000
pH	Within the range of 7.5 to 10.0 at all times	

(b) Solvent Extraction Raffinate from Beryl Ore NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore as beryllium		
Beryllium	180.400	81.400
Chromium (Total)	81.400	33.000
Copper	281.600	134.200
Cyanide (Total)	44.000	17.600
Ammonia (as N)	29,330.000	12,890.000
Fluoride	7,700.000	4,378.000
TSS	3,300.000	2,640.000
pH	Within the range of 7.5 to 10.0 at all times	

(c) Beryllium Carbonate Filtrate NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced as beryllium		
Beryllium	175.900	79.370
Chromium (Total)	79.370	32.180
Copper	274.600	130.800
Cyanide (Total)	42.900	17.160
Ammonia (as N)	28,590.000	12,570.000
Fluoride	7,508.000	4,269.000
TSS	3,218.000	2,574.000
pH	Within the range of 7.5 to 10.0 at all times	

(d) Beryllium Hydroxide Filtrate NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced as beryllium		
Beryllium	111.520	50.320
Chromium (Total)	50.320	20.400
Copper	174.080	82.960
Cyanide (Total)	27.200	10.880
Ammonia (as N)	18,128.800	7,969.600
Fluoride	4,760.000	2,706.400
TSS	2,040.000	1,632.000
pH	Within the range of 7.5 to 10.0 at all times	

(e) Beryllium Oxide Calcining Furnace Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	216.200	97.570
Chromium (Total)	97.570	39.560
Copper	337.500	160.900
Cyanide (Total)	52.740	21.100
Ammonia (as N)	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000
TSS	3,956.000	3,164.000
pH	Within the range of 7.5 to 10.0 at all times	

(f) Beryllium Hydroxide Supernatant NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced from scrap and residues as beryllium		
Beryllium	188.600	85.100
Chromium (Total)	85.10Q	34.500
Copper	294.400	140.300
Cyanide (Total)	46.000	18.400
Ammonia (as N)	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000
TSS	3,450.000	2,760.000
pH	Within the range of 7.5 to 10.0 at all times	

(g) Process Water NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	143.300	64.680
Chromium (Total)	64.68Q	26.220
Copper	223.700	106.600
Cyanide (Total)	34.960	13.980
Ammonia (as N)	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000
TSS	2,622.000	2,098.000
pH	Within the range of 7.5 to 10.0 at all times	

(h) Fluoride Furnace Scrubber NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(i) hip Treatment Wastewater NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	6.355	2.868
Chromium (Total)	2.868	1.163
Copper	9.920	4.728
Cyanide (Total)	1.550	0.620
Ammonia (as N)	1,033.000	454.200
Fluoride	271.300	154.200
TSS	116.300	93.000
pH	Within the range of 7.5 to 10.0 at all times	

(j) Beryllium Pebble Plant Area Vent Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(k) Beryl Ore Gangue Dewatering NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average

mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	0.855	0.386
Chromium (Total)	0.386	0.156
Copper	1.335	0.636
Cyanide (Total)	0.209	0.083
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756
TSS	15.645	12.516
pH	Within the range of 7.5 to 10.0 at all times	

(l) Bertrandite Ore Gangue Dewatering NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of bertrandite ore processed		
Beryllium	2.185	0.986
Chromium (Total)	0.986	0.400
Copper	3.411	1.626
Cyanide (Total)	0.533	0.213
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034
TSS	39.975	31.980
pH	Within the range of 7.5 to 10.0 at all times	

(m) Beryl Ore Processing NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	5.988	2.702
Chromium (Total)	2.702	1.095
Copper	9.348	4.455
Cyanide (Total)	1.461	0.584
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330
TSS	109.545	87.636
pH	Within the range of 7.5 to 10.0 at all times	

(n) Aluminum Iron Sludge (AIS) Area Wastewater NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of total beryllium carbonate produced as beryllium		
Beryllium	383.760	173.160
Chromium (Total)	173.160	70.200
Copper	599.040	285.480
Cyanide (Total)	93.600	37.440
Ammonia (as N)	62384.400	27424.800
Fluoride	16380.000	9313.200
TSS	7020.000	5616.000
pH	Within the range of 7.5 to 10.0 at all times	

(o) Bertrandite Ore Leaching Scrubber NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore processed		
Beryllium	1.239	0.559
Chromium (Total)	0.559	0.227
Copper	1.934	0.922
Cyanide (Total)	0.302	0.121
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069
TSS	22.665	18.132
pH	Within the range of 7.5 to 10.0 at all times	

(p) Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore processed		
Beryllium	0.083	0.037
Chromium (Total)	0.037	0.015
Copper	0.129	0.062
Cyanide (Total)	0.020	0.008
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010
TSS	1.515	1.212
pH	Within the range of 7.5 to 10.0 at all times	

EPA is not promulgating pretreatment standards for existing sources (PSES) for the primary beryllium subcategory.

PSNS are promulgated based on the performance achievable by the application of ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology. The following pretreatment standards are promulgated for new sources:

(a) <u>Solvent Extraction Raffinate from Bertrandite Ore</u> PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore as beryllium		
Beryllium	1,842.000	831.000
Chromium (Total)	831.0Q0	336.900
Copper	2,875.000	1,370.000
Cyanide (Total)	449.200	179.700
Ammonia (as N)	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000

(b) <u>Solvent Extraction Raffinate from Beryl Ore</u> PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore as beryllium		
Beryllium	180.000	81.000
Chromium (Total)	81.400	33.000
Copper	281.600	134.200
Cyanide (Total)	44.000	17.600
Ammonia (as N)	29,330.000	12,890.000
Fluoride	7,700.000	4,378.000

(c) Beryllium Carbonate Filtrate PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium carbonate produced as beryllium		
Beryllium	175.900	79.370
Chromium (Total)	79.370	32.180
Copper	274.600	130.800
Cyanide (Total)	42.900	17.160
Ammonia (as N)	28,590.000	12,570.000
Fluoride	7,508.000	4,269.000

(d) Beryllium Hydroxide Filtrate PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced as beryllium		
Beryllium	111.520	50.320
Chromium (Total)	50.320	20.400
Copper	174.080	82.960
Cyanide (Total)	27.200	10.880
Ammonia (as N)	18,128.800	7,969.600
Fluoride	4,760.000	2,706.400

(e) Beryllium Oxide Calcining Furnace Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	216.200	97.570
Chromium (Total)	97.570	39.560
Copper	337.500	160.900
Cyanide (Total)	52.740	21.100
Ammonia (as N)	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000

(f) Beryllium Hydroxide Supernatant PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium hydroxide produced from scrap and residues as beryllium		
Beryllium	188.600	85.100
Chromium (Total)	85.100	34.500
Copper	294.400	140.300
Cyanide (Total)	46.000	18.400
Ammonia (as N)	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000

(g) Process Water PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	143.300	64.680
Chromium (Total)	64.680	26.220
Copper	223.700	106.600
Cyanide (Total)	34.960	13.980
Ammonia (as N)	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000

(h) Fluoride Furnace Scrubber PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride		

(i) Chip Treatment Wastewater PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	6.355	2.868
Chromium (Total)	2.868	1.163
Copper	9.920	4.728
Cyanide (Total)	1.550	0.620
Ammonia (as N)	1,033.000	454.200
Fluoride	271.300	154.200

(J) Beryllium Pebble Plant Area Vent Wet Air Pollution Control PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium (Total)	0.000	0.000
Copper	0.000	0.000
Cyanide (Total)	0.000	0.000
Ammonia (as N)	0.000	0.000
Fluoride	0.000	0.000

(k) Beryl Ore Gangue Dewatering PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	0.855	0.386
Chromium (Total)	0.386	0.156
Copper	1.335	0.636
Cyanide (Total)	0.209	0.083
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756

(l) Bertrandite Ore Gangue Dewatering PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of bertrandite ore processed		
Beryllium	2.185	0.986
Chromium (Total)	0.986	0.400
Copper	3.411	1.626
Cyanide (Total)	0.533	0.213
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034

(m) Beryl Ore Processing PSNS

Pollutant or Pollutant Property	Maximum for Any 1 Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	5.988	2.702
Chromium (Total)	2.702	1.095
Copper	9.348	4.455
Cyanide (Total)	1.461	0.584
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330

(n) Aluminum Iron Sludge (AIS) Area Wastewater PSNS

Pollutant or Pollutant Property	Maximum for Any 1 Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of total beryllium carbonate produced as beryllium		
Beryllium	383.760	173.160
Chromium (Total)	173.160	70.200
Copper	599.040	285.480
Cyanide (Total)	93.600	37.440
Ammonia (as N)	62384.400	27424.800
Fluoride	16380.000	9313.200

(o) Bertrandite Ore Leaching Scrubber PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore processed		
Beryllium	1.239	0.559
Chromium (Total)	0.559	0.227
Copper	1.934	0.922
Cyanide (Total)	0.302	0.121
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069

(p) Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg of bertrandite ore processed		
Beryllium	0.083	0.037
Chromium (Total)	0.037	0.015
Copper	0.129	0.062
Cyanide (Total)	0.020	0.008
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010

EPA is not promulgating best conventional pollutant control technology (BCT) limitations for the primary beryllium subcategory at this time.

SECTION III

SUBCATEGORY PROFILE

This section of the primary beryllium supplement describes the raw materials and processes used in producing primary beryllium and presents a profile of the primary beryllium plants identified in this study.

Beryllium, the seventh lightest known metal, is manufactured and used in three principal product forms: beryllium copper alloy, beryllium oxide and beryllium metal. It is estimated that about 80 percent of beryllium consumption is in the form of beryllium copper or other master alloy, and the remaining 20 percent represents approximately equal quantities of beryllium as the oxide and as the pure metal. Beryllium copper alloy, containing 0.5 to 2.75 percent beryllium is used in various electrical and mechanical applications including current carrying springs, welding components, tooling dies, safety tools, bearing sleeves, and overseas cable housings. Beryllium oxide, in pure or ceramic form, is used in a number of electronic applications as a heat sink in resistor cores, integrated circuit chip carriers, traveling wave tubes, and laser tubes. Pure beryllium metal is used primarily in aerospace applications including missile components, aircraft brakes, nozzles, optics, and nuclear components.

DESCRIPTION OF PRIMARY BERYLLIUM PRODUCTION

The production of beryllium products can be divided into three distinct operations - production of beryllium hydroxide from beryllium ores, production of beryllium oxide from beryllium hydroxide, and production of beryllium metal from beryllium hydroxide. The primary beryllium production processes are shown schematically in Figures III-1 through III-3 (pages 3646-3649) and described below. Beryllium-copper master alloy is produced from beryllium hydroxide in a two-step process: calcination of beryllium hydroxide to beryllium oxide, and production of beryllium-copper master alloy using a carbon reduction process. No process wastewater is generated by beryllium-copper master alloy production.

RAW MATERIALS

Most domestic beryllium is extracted from bertrandite ore ($4BeO_2SiO_2H_2O$). Imported and domestically produced beryl ore ($3BeOAl_2O_36SiO_2$) is another raw material for the primary beryllium industry. The only company processing ore maintains the capability for processing beryl ore, and, in 1985, processed approximately 2,200 tons of beryl ore, compared with the 95,000 tons of bertrandite ore processed that year.

PRODUCTION OF BERYLLIUM HYDROXIDE

The production of beryllium hydroxide from beryl and bertrandite ores is presented schematically in Figure III-1 (page 3646). Bertrandite ore is first wet ground and screened to form a slurry which is leached with a 10 percent sulfuric acid solution. The mixture is washed and tailings removed in countercurrent thickeners. The sludge from the thickeners is pumped to the tailings pond as a slurry. The thickener supernatant, containing 0.5 to 0.6 grams per liter of beryllium, next enters a solvent extraction process where beryllium is extracted from solution with di-2-ethylhexyl phosphoric acid in kerosene. The barren raffinate solution is discarded as a wastewater stream.

Wastewater streams are generated from both the bertrandite ore gangue and beryl ore gangue dewatering processes. Further, wastewater streams are generated in the bertrandite ore leaching scrubber and bertrandite counter current decantation scrubber processes.

The beryllium is stripped from the organic phase into an aqueous solution containing 4 to 5 grams per liter of beryllium. Aluminum and iron are precipitated from solution and the aluminum iron sludge is discarded. Beryllium is then precipitated from solution as beryllium carbonate which is separated from the liquid phase by filtration. The barren filtrate is discarded as a wastewater stream or further processed for uranium recovery by solvent extraction prior to discharge. The beryllium carbonate may be sold as a product or further processed to beryllium hydroxide.

The beryllium carbonate filter cake is reslurried in deionized water and hydrolyzed in an autoclave to convert the suspended solids to beryllium hydroxide. Beryllium hydroxide is then separated from the liquid phase by filtration and the filtrate discarded as a waste stream. Beryllium hydroxide may be further processed to make beryllium copper alloy, beryllium oxide, or pure beryllium metal.

When beryl ore is processed, the ore is crushed and melted at about 1625^{o}C. The molten material is quenched with cold water to produce a glassy material called frit. The frit is dried, ground and leached with strong sulfuric acid, forming a mixture of beryllium sulfate, aluminum sulfate, and silica. Water is added to the mixture and the silica is separated in a series of countercurrent decantation steps. The resultant silica sludge is discarded. The beryllium solution, containing approximately 10 to 11 grams per liter of beryllium is further processed by solvent extraction, purification and precipitation in an identical manner as beryllium solution from bertrandite ore. Beryl ore processing generates wastewater streams from the quench pit, scrubber and washdown operations.

BERYLLIUM OXIDE PRODUCTION

Pure beryllium oxide is produced for use in ceramics production or sold directly to customers. The process is shown schematically in Figure III-2 (page 3647). The oxide is produced by dissolving beryllium hydroxide in water and sulfuric acid. The resulting beryllium sulfate solution is then filtered to remove impurities. The solution flows to an evaporator followed by two crystallizers in parallel where beryllium sulfate crystals are formed. The crystals are separated from the mother liquor in a centrifuge and the mother liquor is recycled to the beryllium hydroxide dissolver. The beryllium sulfate is calcined in gas-fired furnaces at about 1100°C to beryllium oxide.

Sulfur dioxide in the exhaust gases from the calcining furnaces is removed in caustic scrubbers which discharge scrubber water to treatment.

BERYLLIUM METAL PRODUCTION

The beryllium manufacturing process is shown schematically in Figure III-3 (page 3649). Beryllium hydroxide, $Be(OH)_2$, is added to a batch makeup tank along with an ammonium bifluoride solution, calcium carbonate, and recycled beryllium fluoride (BeF_2). The resultant ammonium beryllium fluoride solution is filtered to remove insoluble impurities. The filter cake is filtered a second time and rinsed with ammonium bifluoride solution to recover any beryllium present in the filter cake. The rinse water is sent to an evaporator where it is concentrated prior to being recycled to the batch makeup tank. The washed filter cake is a fluoride sludge which is sent to treatment. The condensate from the evaporator flows to the process water pit for reuse.

The filtered ammonium beryllium fluoride solution is treated with ammonium sulfide to precipitate dissolved impurities, particularly iron. The precipitated solids are removed in a filter and the resultant sulfide sludge is sent to treatment.

The ammonium beryllium fluoride solution flows to a crystallizer where ammonium beryllium fluoride crystals are formed. Solids are separated from the liquid phase in a centrifuge, the supernatant from the centrifuge is recycled back to the crystallizer and the solids are sent to a drier. The condensate from the crystallizer is sent to the process water pit for reuse.

The dried ammonium beryllium fluoride, $(NH_4)_2BeF_4$, is heated in a graphite induction furnace to drive off ammonium fluoride (NH_4F) and produce beryllium fluoride (BeF_2). The off-gases from the fluoride furnace pass through a recirculating wet scrubber where ammonium fluoride is absorbed from the gas into an aqueous solution. The resultant ammonium fluoride solution generated in the scrubber is used, along with hydrofluoric acid, to make ammonium bifluoride solution. This solution is used in various steps in the beryllium metal production process, particularly in the dissolution of beryllium hydroxide to produce ammonium beryllium fluoride solution.

Beryllium fluoride is reduced to beryllium metal in a furnace. Magnesium is added to the furnace and the resulting product is a matrix of beryllium metal and magnesium fluoride (MgF_2). This matrix is crushed in a hammer mill and ball mill. The beryllium, referred to as beryllium pebbles, is separated from magnesium fluoride by washing our during milling. Gravity separation in a bath of bromochloromethane is used to separate heavy metals from beryllium pebbles after milling. The magnesium fluoride residue is washed with ammonium bifluoride solution to recover any beryllium which may be present as beryllium fluoride. The beryllium fluoride solution is recycled to the batch makeup tank where beryllium hydroxide is dissolved to produce ammonium beryllium fluoride solution. The magnesium fluoride residue is then slurried to a disposal pond.

Two other additional beryllium recovery operations are present in the primary beryllium subcategory. These are recovery of beryllium as a hydroxide from low-grade sources and treatment of high-grade beryllium chips. The hydroxide operation recovers beryllium from various internal and external sources, although the amount of total plant beryllium production resulting from secondary material (i.e.. beryllium scrap recycled from customers) is very small. Beryllium is recovered by precipitating it as $Be(OH)_2$ with sodium hydroxide, separating the precipitate in a clarifier, and dewatering the hydroxide in a centrifuge. The overflow (or supernatant) from the clarifier is discarded.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in primary beryllium production, the process wastewater sources can be subdivided into the 18 building blocks listed below.

(a) Solvent extraction raffinate from bertrandite ore,
(b) Solvent extraction raffinate from beryl ore,
(c) Beryllium carbonate filtrate,
(d) Beryllium hydroxide filtrate,
(e) Beryllium oxide calcining furnace wet air pollution control,
(f) Beryllium hydroxide supernatant,
(g) Process water,
(h) Fluoride furnace scrubber
(i) Chip leaching wastewater,
(j) Beryllium pebble plant area vent wet air pollution control,
(k) Beryl ore gangue dewatering,
(l) Bertrandite ore gangue dewatering,
(m) Beryl ore processing,
(n) AIS area wastewater,
(o) Bertrandite ore leaching scrubber, and
(p) Bertrandite ore counter current decantation scrubber.

OTHER WASTEWATER SOURCES

There may be other wastewater streams associated with the primary beryllium subcategory. These streams include stormwater runoff, and 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 and 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 Ill-4 (page 3649) shows the location of the three primary beryllium plants operating in the United States. The facility which produces beryllium hydroxide from ore is a zero discharge facility and is located in a net evaporation area. The facility which produces beryllium oxide, beryllium-copper master alloy, and beryllium metal from beryllium hydroxide is a direct discharger. The other facility which produces beryllium-copper master alloy has a dry process. The plant which produces beryllium hydroxide from ores began producing hydroxide in 1969. The facility which produces beryllium oxide and beryllium metal has been operating since 1957.

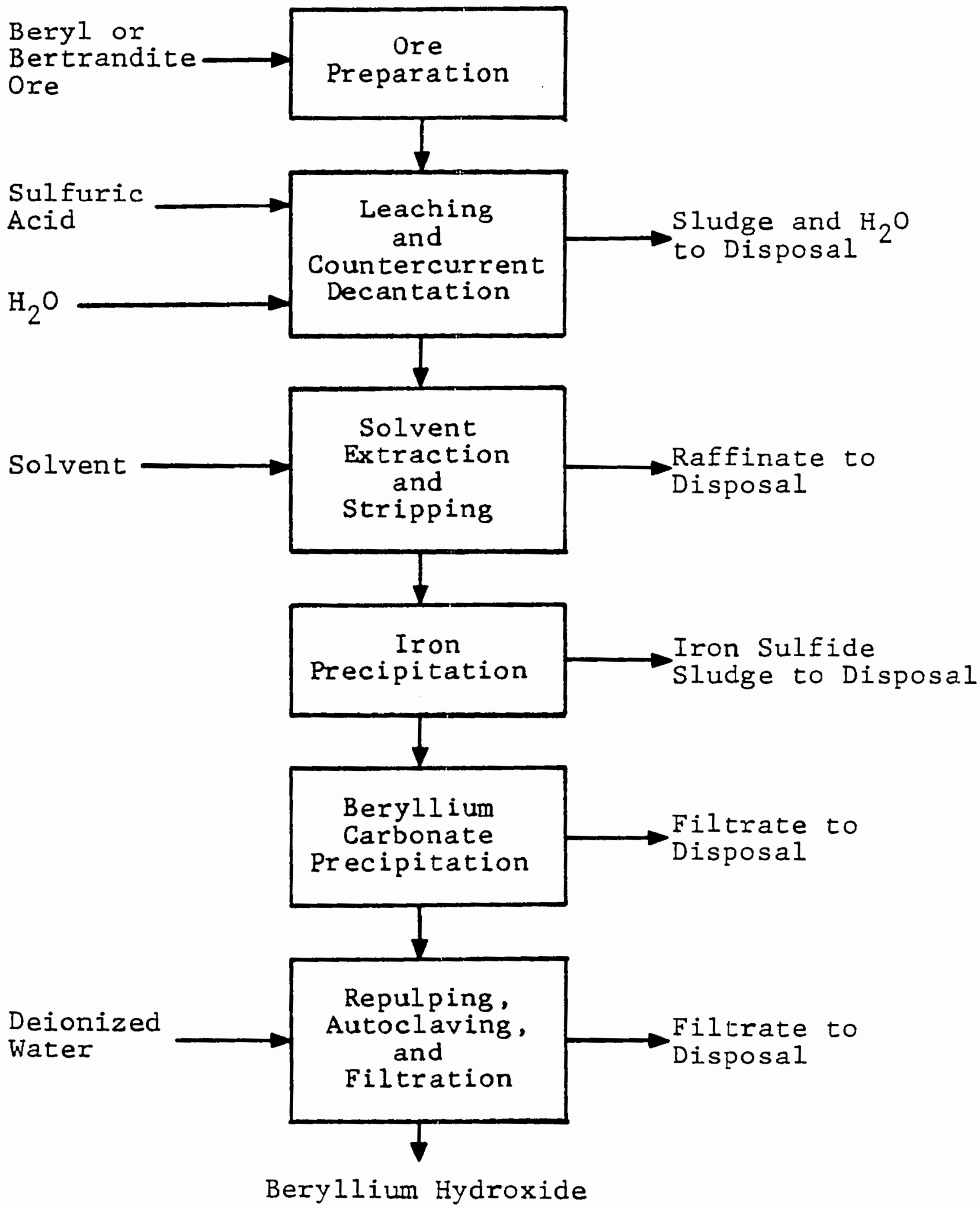

Figure III-1

BERYLLIUM HYDROXIDE PRODUCTION PROCESS

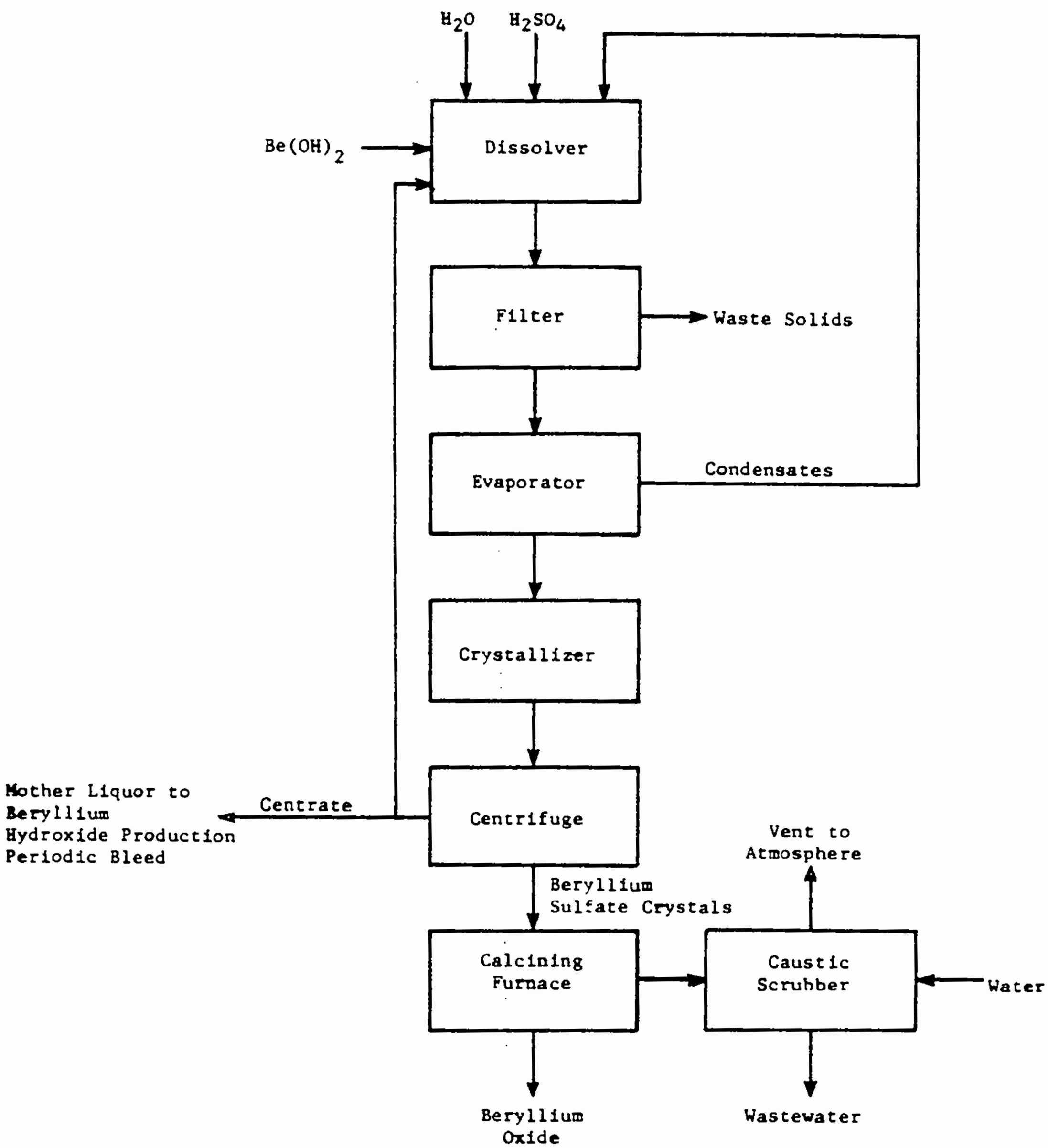

Figure III-2

BERYLLIUM OXIDE PRODUCTION PROCESS

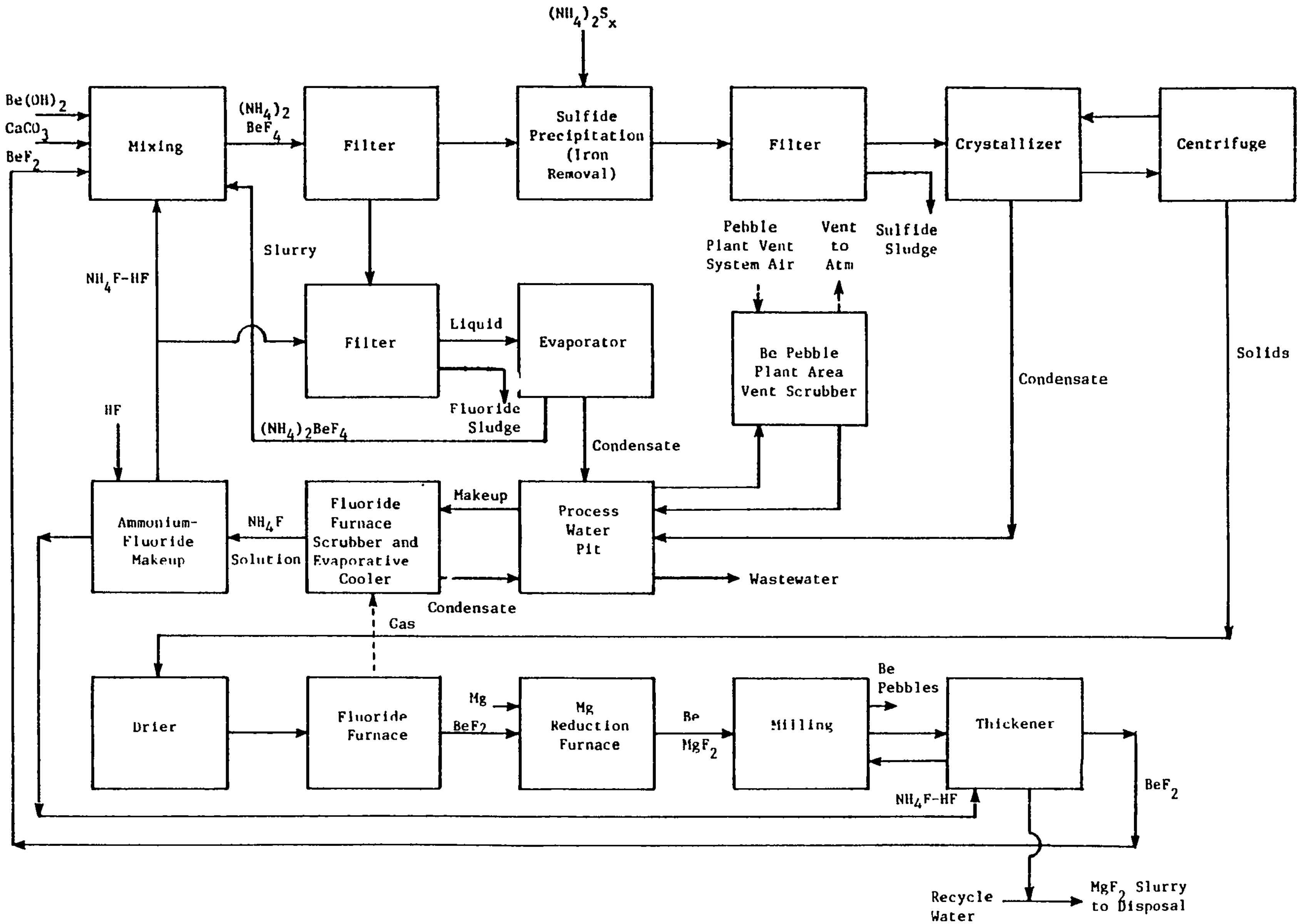

Figure III-3

BERYLLIUM METAL PRODUCTION PROCESS

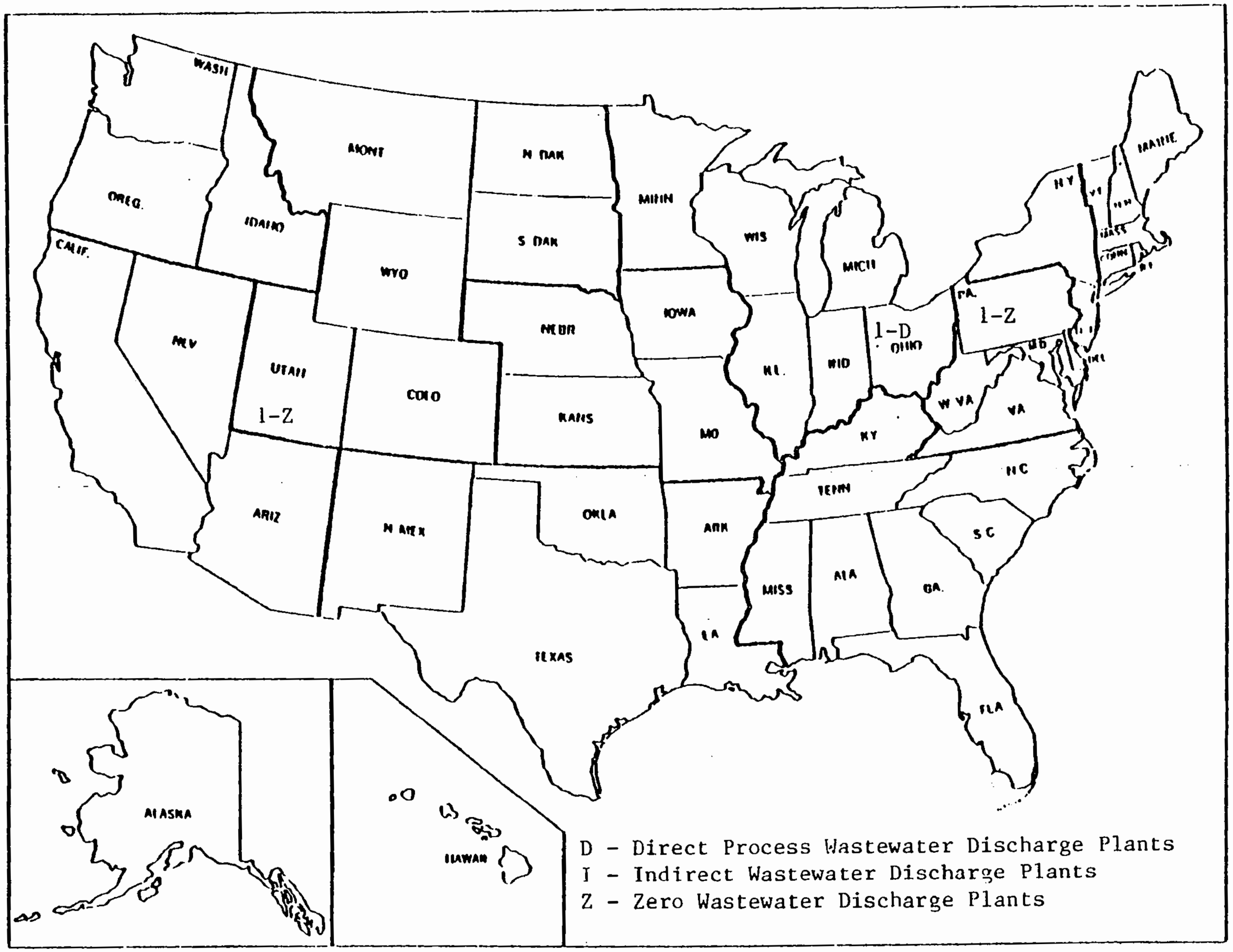

Figure III-4

GEOGRAPHIC LOCATIONS OF THE PRIMARY BERYLLIUM SUBCATEGORY PLANTS

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SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the primary beryllium subcategory and its related subdivisions. Production normalizing parameters for each subdivision will also be discussed.

FACTORS CONSIDERED IN SUBDIVIDING THE PRIMARY BERYLLIUM SUBCATEGORY

The factors listed previously were each evaluated when considering subdivision of the primary beryllium subcategory. In the discussion that follows, the factors will be described as they pertain to this particular subcategory.

The rationale for considering further subdivision of the primary beryllium subcategory is based primarily on differences in the production processes and raw materials 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. While primary beryllium is still considered a single subcategory, an examination of the production processes has illustrated the need for limitations and standards based on a specific set of wastewater streams. Limitations will be based on specific flow allowances for the following subdivisions:

(a) Solvent extraction raffinate from bertrandite ore,
(b) Solvent extraction raffinate from beryl ore,
(c) Beryllium carbonate filtrate,
(d) Beryllium hydroxide filtrate,
(e) Beryllium oxide calcining furnace wet air pollution control,
(f) Beryllium hydroxide supernatant,
(g) Process water,
(h) Fluoride furnace scrubber,
(i) Chip treatment wastewater,
(j) Beryllium pebble plant area vent wet air pollution control,
(k) Beryl ore gangue dewatering,
(l) Bertrandite ore gangue dewatering,
(m) Beryl ore processing,
(n) AIS area wastewater,
(o) Bertrandite ore leaching scrubber, and
(p) Bertrandite ore counter current decantation scrubber.

These building blocks follow directly from differences within the three distinct beryllium production operations: beryllium hydroxide production from ore, beryllium oxide production from beryllium hydroxide, and beryllium metal production from beryllium hydroxide.

The production of beryllium hydroxide from ore gives rise to the subdivisions (a) through (d) and (k) through (p). Solvent extraction raffinates are a major source of wastewater directly attributable to leaching bertrandite or beryl ore with sulfuric acid and extracting beryllium from the leach solution. Precipitation of beryllium carbonate and beryllium hydroxide each result in filtrate wastewater streams.

Wastewater is generated from the dewatering of beryl ore and bertrandite ore gangue. Beryl ore processing generates wastewater from quenching, scrubber operation and washdown. Aluminum-iron sludge removal generates wastewater. Wastewater is also generated by scrubbing operations associated with bertrandite ore leaching and bertrandite ore counter current decantation operations.

Wastewater from scrubbers which control emissions from calcining furnaces are a major source of wastewater associated with the production of beryllium oxide from beryllium hydroxide.

The operations associated with the production of beryllium metal from beryllium hydroxide give rise to subdivisions (x) through (y). In one by-product recovery operation, beryllium is recovered from internally generated scrap and residues and small amounts of recycled material from customers, by leaching in sulfuric acid and precipitating beryllium hydroxide. A supernatant wastewater stream results. Process condensates result from ammonium beryllium fluoride crystallization and evaporation of ammonium bifluoride filtrate. Wet scrubbers are used to control emissions from fluoride furnaces which convert ammonium beryllium fluoride to beryllium fluoride, and to recover ammonium fluoride for reuse. In addition, wet scrubbers are used to control particulate levels in the air vented from the beryllium pebble plant. Pure beryllium metal scrap is treated with nitric and hydrofluoric acid prior to being vacuum cast along with beryllium pebbles prior to billet manufacturing. The spent acid is discharged as a wastewater stream.

OTHER FACTORS

The other factors considered in this evaluation were shown to be inappropriate bases for subdivision. Air pollution control methods, treatment costs, and total energy requirements are functions of the selected subcategorization factors -- metal product, raw materials, and production processes. Therefore, they are not independent factors and do not affect the subcategorization which has been applied. Certain other factors, such as plant age, plant size, and the number of employees, were also evaluated and determined to be inappropriate for use as bases for further subdivision of the primary beryllium subcategory.

PRODUCTION NORMALIZING PARAMETERS

As discussed previously, the effluent limitations and standards developed in this document establish mass limitations on the discharge of specific pollutant parameters. To allow these regulations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP).

In general, for each production process which has a wastewater associated with it, the actual mass of beryllium product or intermediate produced will be used as the PNP. Thus, the PNPs for the 16 subdivisions or building blocks are listed below.

	Building Block	PNP
1.	Solvent extraction raffinate from bertrandite ore	kkg of beryllium carbonate produced from bertrandite ore as beryllium
2.	Solvent extraction raffinate from beryl ore	kkg of beryllium carbonate produced from beryl ore as beryllium
3.	Beryllium carbonate filtrate	kkg of beryllium carbonate produced as beryllium
4.	Beryllium hydroxide filtrate	kkg of beryllium hydroxide produced as beryllium
5.	Beryllium oxide calcining furnace wet air pollution control	kkg of beryllium oxide produced
6.	Beryllium hydroxide supernatant	kkg of beryllium hydroxide produced from scrap and residues as beryllium
7.	Process water	kkg of beryllium pebbles produced
8.	Fluoride furnace scrubber	kkg of beryllium pebbles produced
9.	Chip treatment wastewater	kkg of beryllium scrap chips treated
10.	Beryllium pebble plant area vent wet air pollution control	kkg of beryllium pebbles produced
11.	Beryl ore gangue dewatering	kkg of beryl ore processed
12.	Bertrandite ore gangue dewatering	kkg of bertrandite ore processed
13.	Beryl ore processing	kkg of beryl ore processed

	Building Block	PNP
14.	AIS area wastewater	kkg of total beryllium carbonate produced as beryllium
15.	Bertrandite ore leaching scrubber	kkg of bertrandite ore processed
16.	Bertrandite ore counter current decantation scrubber	kkg of bertrandite ore processed

Other PNPs were considered. The use of production capacity instead of actual production was eliminated from consideration because the mass of the pollutant produced is more a function of true production than of installed capacity.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the primary beryllium subcategory. Water use and discharge rates are explained and then summarized in tables at the end of this section. Data used to characterize the wastewaters are presented. Finally, the specific source, water use and discharge flows, and wastewater characteristics for each separate wastewater source are discussed.

Two principal data sources were used in the development of effluent limitations and standards for this subcategory; data collection portfolios (dcp) and field sampling results. Data collection portfolios contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from primary beryllium plants, a field sampling program was conducted. Samples were analyzed for 124 of the 126 priority 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. Samples were also never analyzed for asbestos. There is no reason to expect that TCDD or asbestos would be present in nonferrous metals manufacturing.) One plant was selected for sampling in the primary beryllium subcategory. In general, the samples were analyzed for three classes of pollutants: priority organic pollutants, priority metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

As described in Section IV of this supplement, the primary beryllium subcategory has been divided into 16 subdivisions or wastewater sources, so that the promulgated regulation contains mass discharge limitations and standards for 16 building blocks which may discharge process wastewater. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow. These wastewater sources are:

(a) Solvent extraction raffinate from bertrandite ore,
(b) Solvent extraction raffinate from beryl ore,
(c) Beryllium carbonate filtrate,
(d) Beryllium hydroxide filtrate,
(e) Beryllium oxide calcining furnace wet air pollution control,
(f) Beryllium hydroxide supernatant,
(g) Process water,
(h) Fluoride furnace scrubber,
(i) Chip treatment wastewater,
(j) Beryllium pebble plant area vent wet air pollution control,
(k) Beryl ore gangue dewatering,

(l) Bertrandite ore gangue dewatering,
(m) Beryl ore processing,
(n) AIS area wastewater,
(o) Bertrandite ore leaching scrubber, and
(p) Bertrandite ore counter current decantation scrubber.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios, water use and wastewater discharge flow, were calculated for each stream. The two ratios are differentiated by the flow value used in calculation. Water use is defined as the volume of water or other fluid required for a given process per mass of beryllium product and is therefore based on the sum of recycle and makeup flows to a given process. Wastewater flow discharged after pretreatment or recycle (if these are present) is used in calculating the production normalized flow -- the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of beryllium produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carry-over on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. As an example, beryllium oxide calcining furnace wet air pollution control water flow is related to the production of the beryllium oxide. As such, the discharge rate is expressed in liters of scrubber water per metric ton of beryllium oxide produced (gallons of scrubber water per ton of beryllium oxide as produced).

The production normalized discharge flows were compiled and statistically analyzed by stream type. These production normalized water use and discharge flows are presented by subdivision in Tables V-1 through V-10 (pages 3663 - 36666) Where appropriate, an attempt was made to identify factors that could account for variations in water use and discharge rates. These variations are discussed later in this section by subdivision. A similar analysis of factors affecting the wastewater flows is presented in Sections IX, X, XI, and XII where representative BPT, BAT, NSPS, and pretreatment flows are selected for use in calculating the effluent limitations.

The water use and discharge rates shown do not include nonprocess wastewater, such as rainfall runoff and noncontact cooling water.

WASTEWATER CHARACTERIZATION DATA

Data used to characterize the various wastewaters associated with primary beryllium production come from two sources--data collection portfolios and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolios, the beryllium plants that discharge wastewater were asked to specify the presence or absence of toxic pollutants in their wastewater. In all cases, the plants indicated that the priority organic pollutants were believed to be absent. The responses for the priority metals and cyanide are summarized below:

Pollutant	Known Present	Believed Present
Antimony	0	0
Arsenic	0	0
Beryllium	1	1
Cadmium	0	0
Chromium	0	0
Copper	1	1
Cyanide	1	0
Lead	1	1
Mercury	0	0
Nickel	1	0
Selenium	0	0
Silver	0	0
Thallium	0	0
Zinc	0	0

FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from primary beryllium plants. wastewater samples were collected at one of the two primary beryllium plants in the United States. A diagram indicating the sampling sites and contributing production processes is shown in Figures V-1 and V-2 (page 3727 - 3728).

Raw wastewater data are summarized in Tables V-11 through V-15 (pages 3667 - 3696) Analytical results at various points in the treatment scheme of plant A are summarized in Tables V-16 through V-20 (pages 3700 - 3723). Note that the stream numbers listed in the tables correspond to those given in individual plant sampling site diagrams, Figures V-1 and V-2. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected.

The data tables include some samples measured at concentrations considered not quantifiable. The base-neutral extractable, acid extractable, and volatile organics generally are 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.

The detection limits shown on the data tables for priority metals and conventional and nonconventional pollutants 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.

The statistical analysis of data includes some samples measured at concentrations considered not quantifiable. For data considered as detected but below quantifiable concentrations. a value of zero is used for averaging. Priority organic nonconventional, and conventional pollutant data reported with a "less than" sign are considered as detected, but not further quantifiable. A value of zero is also used for averaging. If a pollutant is reported as not detected, it is assigned a value of zero in calculating the average. Finally, priority metal values reported as less than a certain value were considered as not quantifiable, and consequently were assigned a value of zero in the calculation of the average.

Finally, appropriate source water concentrations are presented with the summaries of 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

Since primary beryllium production involves 16 principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

SOLVENT EXTRACTION RAFFINATE FROM BERTRANDITE ORE

Beryllium is extracted from bertrandite ore by leaching with sulfuric acid and extracting beryllium from the acid solution with an organic solvent, di-2-ethylhexyl phosphoric acid in kerosene. The barren acid solution, or raffinate stream, is discarded as a waste stream. Water use and discharge rates for this stream are presented in Table V-1 (page 3663) in liters per metric ton of beryllium carbonate produced (as beryllium). These flows were calculated based on process information from the one facility currently processing bertrandite ore.

Although no sampling data are available for this waste stream, it is expected to have an acidic pH, treatable concentrations of beryllium and other toxic metals which may be leached from the ore along with beryllium, and treatable concentrations of suspended solids. It is also possible that low levels of priority organic pollutants are present in this stream as residuals from the solvent extraction process.

SOLVENT EXTRACTION RAFFINATE FROM BERYL ORE

Beryllium is extracted from beryl ore in a manner similar to that used with bertrandite ore. After preliminary processing steps, the ore is leached with sulfuric acid and beryllium is extracted from the acid solution with an organic solvent. The barren raffinate is discharged. Water use and discharge rates for this wastewater stream are presented in Table V-2 (page 3663) in liters per metric ton of beryllium carbonate produced (as beryllium).

No sampling data are available for this waste stream; however, it is expected to have an acidic pH and treatable concentrations of beryllium and other priority metals which may be present in the beryl ore raw material. Treatable concentrations of suspended solids are also expected to be present. It is also possible that toxic organic pollutants may be present in this wastewater stream if they are present in the organic solvent as impurities.

BERYLLIUM CARBONATE FILTRATE

Beryllium is stripped from the organic phase into an aqueous solution. Beryllium carbonate is precipitated and separated from the liquid phase by filtration. The filtrate stream is then discharged. Water use and discharge rates for this waste stream are presented in Table V-3 (page 3663) in liters per metric ton of beryllium carbonate produced (as beryllium).

Although there are no sampling data available for this waste stream it is expected to have an alkaline pH and treatable concentrations of beryllium and possibly other toxic metals. Since the separation of $BeCO_4$ from the organic phase is virtually complete, no priority organic pollutants are expected to be present in this stream.

BERYLLIUM HYDROXIDE FILTRATE

Beryllium carbonate is reslurried in deionized water, and hydrolyzed in an autoclave to convert the suspended solids to beryllium hydroxide. The beryllium hydroxide is separated from the liquid phase by filtration. The filtrate stream is then discharged. Water use and discharge rates are shown in Table V-4 (page 3664) in liters per metric ton of beryllium hydroxide produced (as beryllium).

The flow rate shown in Table V-4 was revised based on new information supplied to Agency after the completion of the original rulemaking.

No sampling data are available for this wastewater stream; however, it is expected to have an alkaline pH and may contain treatable concentrations of beryllium.

BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL

When beryllium oxide is produced from beryllium hydroxide, the hydroxide is converted to beryllium sulfate and the sulfate is calcined in a furnace to produce beryllium oxide. Sulfur oxide emissions from the furnaces are controlled with caustic scrubbers. The scrubber liquor is discharged as a wastewater stream. The production normalized water use and discharge rates for beryllium oxide calcining furnace wet air pollution control are shown in Table V-5 (page 3664) in liters per metric ton of beryllium oxide produced and the water use data includes extensive recycle (i.e., greater than 90 percent recycle).

Table V-11 (page 3667) summarizes the field sampling data for beryllium oxide calcining wet air pollution control. This waste stream has a neutral pH and very high concentrations of dissolved solids (primarily sodium sulfate). Treatable concentrations of beryllium, fluoride, and suspended solids are present.

BERYLLIUM HYDROXIDE SUPERNATANT

When beryllium is recovered from recycled customer material, internally generated residues, scrap, and recycled mother liquor from the beryllium oxide crystallization operations, the raw material is dissolved in sulfuric acid and beryllium is then precipitated with caustic as beryllium hydroxide After gravity separation, the supernatant is discharged as a wastewater stream. Production normalized water use and discharge data for beryllium hydroxide supernatant are shown in Table V-6 (page 3664) in liters per metric ton of beryllium hydroxide produced (as beryllium).

Table V-12 (page 3672) summarizes the field sampling data for beryllium hydroxide supernatant. It can be seen that this waste stream has an alkaline pH and treatable concentrations of beryllium, copper, fluoride, and suspended solids.

PROCESS WATER

Process condensates are generated from the ammonium beryllium fluoride crystallizer and the ammonium fluoride sludge filtrate evaporator. The condensed water is used as makeup for the fluoride furnace scrubbing system, for the beryllium pebble plant scrubbing system, for sludge washing, and general plant water usage such as floor washings. Periodic discharge from the process water pit is necessary to prevent dissolved solids build-up. Production normalized water use and discharge rates for process water are presented in Table V-7 in liters per metric ton of beryllium metal produced.

Field sampling data for process water are summarized in Table V-13 (page 3676). These data are from samples collected from the process water pit. The data show that process water is characterized by a neutral pH, and treatable concentrations of beryllium and fluoride. Ammonia and cyanide are also reported as present above treatable concentrations.

FLUORIDE FURNACE SCRUBBER

Beryllium fluoride (BeF_2) intermediate is produced by heating ammonium beryllium fluoride in a graphite induction furnace and driving off ammonium fluoride (NH_4F). Ammonium fluoride is recovered in a wet scrubbing system. Although the scrubber liquor is recycled extensively (>99.9 percent), a blowdown stream is periodically recycled to the ammonium bifluoride makeup tank to be used in beryllium fluoride intermediate production Production normalized water use and discharge rates for fluoride furnace scrubbing liquor are presented in Table V-8 (page 3665) in liters per metric ton of beryllium pebbles produced.

Although at proposal this stream was believed to have been sampled, comments from the plant indicated that the scrubber sampled was the area vent scrubber in the beryllium pebble plant. Fluoride furnace scrubber wastewater is expected to be contaminated with ammonia and fluoride based on the process occurring in the furnace.

CHIP TREATMENT WASTEWATER

Pure beryllium metal scrap in the form of chips is treated with nitric acid and rinsed prior to being vacuum cast along with beryllium pebbles into a beryllium metal billet. The spent acid and rinse water are discharged. This operation combines refining beryllium from secondary as well as primary sources. The quantity of beryllium scrap treated and subsequently cast with the beryllium pebbles, however, is small enough to have negligible impact on the production normalized water use and discharge rates for this operation. Water use and discharge rates are presented in Table V-9 (page 3665) in liters per metric ton of beryllium scrap chips treated.

Table V-15 (page 3696) summarizes the field sampling data for chip treatment wastewater. This wastewater is characterized by an acid pH and very high concentrations of beryllium. Other priority metals are present at treatable concentrations including chromium and zinc. Treatable concentrations of fluoride and suspended solids are also present.

BERYLLIUM PEBBLE PLANT AREA VENT WET AIR POLLUTION CONTROL

The beryllium pebble plant contains a ventilation system for air circulation A wet scrubber is employed to clean the used air prior to venting to the atmosphere. Although the scrubber liquor is recycled extensively, a blowdown stream is periodically discharged to the process water pit. Makeup water for the scrubber is obtained from the process water pit.

Field sampling data for beryllium pebble plant area vent scrubber are summarized in Table V-14 (page 3691). The data show that this stream is characterized by a slightly acidic pH, and treatable concentrations of beryllium and fluoride.

ADDITIONAL BUILDING BLOCKS

In the settlement agreement of April 1987, EPA agreed to propose to add new building blocks for the following six processes in the primary beryllium subcategory: beryl ore gangue dewatering, bertrandite ore gangue dewatering, beryl ore processing (comprises quench pit, scrubber and washdown), AIS area wastewater, bertrandite ore leaching scrubber, and bertrandite ore counter current decantation scrubber. These building blocks were not included in the promulgated rule because the Agency lacked adequate information about these processes to promulgate effluent limits at that time. The Agency anticipated that effluent limits for these wastestreams would be established on a best professional judgment ("BPJ") basis by the permit writers during the permit issuance process. The petitioner has requested that EPA establish national regulations for these processes and during the settlement negotiations, the Agency obtained the necessary additional information about these processes to do so.

The wastewater discharge rates for these six processes are given below: beryl ore gangue dewatering 1,043 l/kkg of beryl ore processed, bertrandite ore gangue dewatering 2,665 l/kkg of bertrandite ore processed, beryl ore processing 7,303 l/kkg of beryl ore processed, aluminum iron sludge (AIS) area wastewater 468,000 l/kkg of total beryllium carbonate produced as beryllium, bertrandite ore leaching scrubber 1,511 l/kkg of bertrandite ore processed, bertrandite ore countercurrent decantation (CCD) scrubber 101 l/kkg of bertrandite ore processed.

TABLE V-1

WATER USE AND DISCHARGE RATES FOR
SOLVENT EXTRACTION RAFFINATE FROM BERTRANDITE ORE

(10^3 l/kkg of beryllium carbonate produced from bertrandite ore as beryllium)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1177	0	2246	2246

TABLE V-2

WATER USE AND DISCHARGE RATES FOR
SOLVENT EXTRACTION RAFFINATE FROM BERYL ORE

(10^3 l/kkg of beryllium carbonate produced from beryl ore as beryllium)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1177	0	220	220

TABLE V-3

WATER USE AND DISCHARGE RATES FOR
BERYLLIUM CARBONATE FILTRATE

(10^3 l/kkg of beryllium carbonate produced as beryllium)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1177	0	214.5	214.5

TABLE V-4

WATER USE AND DISCHARGE RATES FOR
BERYLLIUM HYDROXIDE FILTRATE

(10^3 l/kkg of beryllium carbonate produced as beryllium)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1177	0	136.0	136.0

TABLE V-5

WATER USE AND DISCHARGE RATES FOR
BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL

(10^3 l/kkg of beryllium oxide produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1111	>90	NR	263.7

TABLE V-6

WATER USE AND DISCHARGE RATES FOR
BERYLLIUM HYDROXIDE SUPERNATANT

(10^3 l/kkg of beryllium hydroxide produced from scrap and residues as beryllium)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1111	0	230.0	230.0

TABLE V-7

WATER USE AND DISCHARGE RATES FOR
PROCESS WATER

(10^3 l/kkg of beryllium pebbles produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1111	NR	NR	174.8

TABLE V-8

WATER USE AND DISCHARGE RATES FOR
SOLVENT EXTRACTION RAFFINATE FROM BERTRANDITE ORE

(10^3 l/kkg of beryllium carbonate produced
from bertrandite ore as beryllium)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1111	100	NR	0

TABLE V-9

WATER USE AND DISCHARGE RATES FOR
CHIP TREATMENT WASTEWATER

(10^3 l/kkg of beryllium scrap chips treated)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1111	0	7.75	7.75

TABLE V-10

WATER USE AND DISCHARGE RATES FOR
BERYLLIUM PEBBLE PLANT AREA VENT WET AIR POLLUTION CONTROL

(10^3 l/kkg of beryllium pebbles produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1111	NR	NR	0

Table V-11

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	481	6	<0.003	<0.003	<0.003	<0.003
	484	6		0.015	0.013	<0.003
115. arsenic	481	6	<0.003	<0.003	<0.003	<0.003
	484	6		<0.003	<0.003	<0.003
117. beryllium	481	6	<0.001	0.49	0.89	0.88
	484	6		2.0	1.20	0.98
118. cadmium	481	6	<0.004	0.005	<0.004	<0.004
	484	6		<0.004	0.012	0.015
119. chromium (total)	481	6	0.017	0.055	0.042	0.042
	484	6		0.050	0.086	0.13
120. copper	481	6	0.47	0.13	0.17	0.12
	484	6		1.5	0.38	0.16
122. lead	481	6	<0.16	<0.168	<0.168	<0.168
	484	6		<0.168	<0.168	<0.16
123. mercury	481	6	<0.0002	<0.0002	<0.0002	<0.0002
	484	6		<0.0002	<0.0002	<0.0002

Table V-11 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
124. nickel	481	6	<0.006	0.043	0.019	0.022
	484	6		0.022	0.036	0.036
125. selenium	481	6	<0.003	<0.003	<0.003	<0.003
	484	6		<0.003	<0.003	<0.003
126. silver	481	6	<0.0005	0.10	0.024	0.033
	484	6		0.066	0.070	0.10
127. thallium	481	6	<0.002	<0.002	<0.002	<0.002
	484	6		<0.002	<0.002	<0.002
128. zinc	481	6	0.018	0.052	0.039	0.087
	484	6		0.054	0.051	0.049
Nonconventional Pollutants						
acidity	481	6	<1	<1	<1	<1
	484	6		<1	<1	<1
alkalinity	481	6	311	1,350	710	750
	484	6		240	280	126
aluminum	481	6	<0.100	0.49	0.47	0.59
	484	6		0.51	0.47	1.0

Table V-11 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
ammonia nitrogen	481	6	6.6	<0.02	<0.02	120
	484	6		35	50	77
barium	481	6	0.20	0.027	0.23	0.19
	484	6		0.15	0.076	0.15
boron	481	6	<0.018	0.50	0.92	0.39
	484	6		0.89	0.57	0.79
calcium	481	6	57	4.9	9.3	11
	484	6		10	11	13
chemical oxygen demand (COD)	481	6	<1	230	<1	130
	484	6		39	490	31
chloride	481	6	95	330	120	125
	484	6		260	340	190
cobalt	481	6	<0.012	0.30	<0.012	<0.012
	484	6		0.023	0.033	0.037
fluoride	481	6	0.81	5.6	2,250	13
	484	6		4.8	7,900	35
iron	481	6	1.4	0.55	0.32	0.67
	484	6		0.62	1.4	0.95

Table V-11 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
magnesium	481	6	36	15	21	15
	484	6		19	15	18
manganese	481	6	0.013	0.039	0.058	0.064
	484	6		0.067	0.072	0.076
molybdenum	481	6	0.005	0.046	0.059	0.030
	484	6		0.043	0.052	0.063
phosphate	481	6	<0.732	1.1	8.0	1.6
	484	6		<0.732	2.9	1.0
sodium	481	6	17	8,800	1,800	3,300
	484	6		4,200	9,800	6,000
sulfate	481	6	1,400	39,000	6,500	7,300
	484	6		24,000	29,000	18,000
tin	481	6	<0.12	<0.12	<0.12	<0.12
	484	6		<0.12	<0.12	<0.12
titanium	481	6	0.73	0.035	<0.010	<0.010
	484	6		<0.010	0.40	0.16
total dissolved solids (TDS)	481	6	550	39,000	8,200	33,000
	484	6		22,000	42,000	23,000

Table V-11 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
total organic carbon (TOC)	481	6	<1	10	11	11
	484	6		8	8	2
total solids (TS)	481	6	550	39,000	8,280	34,000
	484	6		22,000	42,000	25,000
vanadium	481	6	<0.006	0.032	<0.006	<0.006
	484	6		0.019	0.058	0.10
yttrium	481	6	<0.001	<0.001	<0.001	<0.001
	484	6		<0.001	<0.001	<0.001
Conventional Pollutants						
oil and grease	481	1	<1	<1	26	<1
	484	1		<1	<1	<1
total suspended solids (TSS)	481	6	4	100	33	55
	484	6		45	60	
pH (standard units)	481	6	6.84	8.10	8.24	7.52
	484	6		7.58	6.86	6.90

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

Table V-12

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM HYDROXIDE SUPERNATANT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	491	1	<0.003	<0.003		
115. arsenic	491	1	<0.003	<0.003		
117. beryllium	491	1	<0.001	12		
118. cadmium	491	1	<0.004	<0.004		
119. chromium (total)	491	1	0.017	0.11		
120. copper	491	1	0.47	1.4		
122. lead	491	1	<0.16	<0.168		
123. mercury	491	1	<0.0002	<0.0002		
124. nickel	491	1	<0.006	0.12		
125. selenium	491	1	<0.003	<0.003		
126. silver	491	1	<0.0005	0.32		
127. thallium	491	1	<0.002	<0.002		
128. zinc	491	1	0.018	0.19		

Table V-12 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM HYDROXIDE SUPERNATANT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	491	1	<1	<1		
alkalinity	491	1	311	2,450		
aluminum	491	1	<0.100	13		
ammonia nitrogen	491	1	6.6	13.4		
barium	491	1	0.20	0.57		
boron	491	1	<0.018	<0.018		
calcium	491	1	57	3.5		
chemical oxygen demand (COD)	491	1	<1	300		
chloride	491	1	95	520		
cobalt	491	1	<0.012	0.019		
fluoride	491	1	0.81	1,600		
iron	491	1	1.4	3.2		
magnesium	491	1	36	2.7		

Table V-12 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM HYDROXIDE SUPERNATANT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
manganese	491	1	0.013	0.092		
molybdenum	491	1	0.005	0.41		
phosphate	491	1	<0.732	19		
sodium	491	1	17	23,000		
sulfate	491	1	1,400	130,000		
tin	491	1	<0.12	<0.12		
titanium	491	1	0.73	1.3		
total dissolved solids (TDS)	491	1	550	99,000		
total organic carbon (TOC)	491	1	<1	<1		
total solids (TS)	491	1	550	100,000		
vanadium	491	1	<0.006	0.10		
yttrium	491	1	<0.001	<0.001		

Table V-12 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
BERYLLIUM HYDROXIDE SUPERNATANT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	491	1	<1	<1		
total suspended solids (TSS)	491	1	4	100		
pH (standard units)	491	1	6.84	11.5		

†Sample Type Code: 1 - One-time grab

Table V-13

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	426	1	ND	*	* *	
2. acrolein	426	1	ND	ND	ND ND	
3. acrylonitrile	426	1	*	1.682	4.593 4.559	
4. benzene	426	1	*	0.188	0.207 0.617	
5. benzidine	426	1	ND	ND	ND ND	
6. carbon tetrachloride	426	1	*	0.069	0.161 0.162	
7. chlorobenzene	426	1	*	*	* *	
8. 1,2,4-trichlorobenzene	426	1	ND	ND	ND ND	
9. hexachlorobenzene	426	1	ND	ND	ND ND	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
10. 1,2-dichloroethane	426	1	*	*	0.211 0.142	
11. 1,1,1-trichloroethane	426	1	*	*	* *	
12. hexachloroethane	426	1	ND	ND	* *	
13. 1,1-dichloroethane	426	1	*	0.019	0.043 0.043	
14. 1,1,2-trichloroethane	426	1	*	*	* *	
15. 1,1,2,2-tetrachloroethane	426	1	*	*	0.078 *	
16. chloroethane	426	1	ND	*	ND ND	
17. bis(chloromethyl)ether	426	1	ND	ND	ND ND	
18. bis(2-chloroethyl)ether	426	1	ND	ND	ND ND	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
19. 2-chloroethyl vinyl ether	426	1	*	0.101	0.015 0.030	
20. 2-chloronaphthalene	426	1	ND	ND	ND ND	
21. 2,4,6-trichlorophenol	426	1	ND	ND	ND ND	
22. p-chloro-m-cresol	426	1	ND	*	ND 0.072	
23. chloroform	426	1	*	0.044	0.106 0.109	
24. 2-chlorophenol	426	1	ND	ND	ND ND	
25. 1,2-dichlorobenzene	426	1	ND	ND	ND ND	
26. 1,3-dichlorobenzene	426	1	ND	ND	ND ND	
27. 1,4-dichlorobenzene	426	1	ND	ND	ND ND	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
28. 3,3'-dichlorobenzidine	426	1	ND	ND	ND ND	
29. 1,1-dichloroethylene	426	1	*	0.047	0.111 0.115	
30. 1,2-trans-dichloroethylene	426	1	*	0.053	0.134 0.133	
31. 2,4-dichlorophenol	426	1	ND	ND	ND ND	
32. 1,2-dichloropropane	426	1	*	0.043	0.113 0.104	
33. 1,3-dichloropropene	426	1	*	*	0.036 0.023	
34. 2,4-dimethylphenol	426	1	ND	ND	ND ND	
35. 2,4-dinitrotoluene	426	1	ND	ND	ND *	
36. 2,6-dinitrotoluene	426	1	*	*	* *	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
37. 1,2-diphenylhydrazine	426	1	*	*	* *	
38. ethylbenzene	426	1	*	*	* *	
39. fluoranthene	426	1	*	ND	ND *	
40. 4-chlorophenyl phenyl ether	426	1	ND	ND	ND ND	
41. 4-bromophenyl phenyl ether	426	1	ND	ND	ND ND	
42. bis(2-chloroisopropyl)ether	426	1	ND	ND	ND ND	
43. bis(2-chloroethoxy)methane	426	1	*	ND	ND *	
44. methylene chloride	426	1	*	0.114	0.211 0.208	
45. methyl chloride (chloromethane)	426	1	*	*	* *	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
46. methyl bromide (bromomethane)	426	1	ND	*	* *	
47. bromoform (tribromomethane)	426	1	*	*	0.130 0.077	
48. dichlorobromomethane	426	1	*	0.021	0.051 0.051	
49. trichlorofluoromethane	426	1	ND	ND	ND ND	
50. dichlorodifluoromethane	426	1	ND	ND	ND ND	
51. chlorodibromomethane	426	1	*	0.080	0.288 0.139	
52. hexachlorobutadiene	426	1	ND	ND	ND ND	
53. hexachlorocyclopentadiene	426	1	ND	ND	ND ND	
54. isophorone	426	1	ND	ND	ND ND	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
55. naphthalene	426	1	*	*	* *	
56. nitrobenzene	426	1	ND	ND	ND *	
57. 2-nitrophenol	426	1	ND	ND	ND ND	
58. 4-nitrophenol	426	1	ND	ND	ND ND	
59. 2,4-dinitrophenol	426	1	ND	ND	ND ND	
60. 4,6-dinitro-o-cresol	426	1	ND	ND	ND ND	
61. N-nitrosodimethylamine	426	1	ND	ND	ND *	
62. N-nitrosodiphenylamine	426	1	ND	*	ND *	
63. N-nitrosodi-n-propylamine	426	1	ND	ND	ND ND	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
64. pentachlorophenol	426	1	ND	ND	ND ND	
65. phenol	426	1	ND	ND	ND ND	
66. bis(2-ethylhexyl) phthalate	426	1	0.024	*	* *	
67. butyl benzyl phthalate	426	1	*	*	* *	
68. di-n-butyl phthalate	426	1	0.157	0.034	0.134 ND	
69. di-n-octyl phthalate	426	1	*	ND	ND ND	
70. diethyl phthalate	426	1	0.076	*	0.270 *	
71. dimethyl phthalate	426	1	ND	*	ND *	
72. benzo(a)anthracene	426	1	*	ND	ND ND	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
73. benzo(a)pyrene	426	1	*	ND	ND ND	
74. benzo(b)fluoranthene	426	1	0.016	ND	ND *	
75. benzo(k)fluoranthane	426	1	0.011	ND	ND *	
76. chrysene	426	1	0.017	ND	ND ND	
77. acenaphthylene	426	1	ND	ND	* *	
78. anthracene (a)	426	1	ND	*	* *	
79. benzo(ghi)perylene	426	1	ND	ND	ND *	
80. fluorene	426	1	ND	*	* *	
81. phenanthrene (a)	426	1	ND	*	* *	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
82. dibenzo(a,h)anthracene	426	1	ND	ND	ND ND	
83. indeno (1,2,3-c,d)pyrene	426	1	ND	ND	ND ND	
84. pyrene	426	1	*	ND	ND *	
85. tetrachloroethylene	426	1	*	0.184	0.474 0.481	
86. toluene	426	1	0.085	0.029	0.085 0.065	
87. trichloroethylene	426	1	*	0.017	0.015 0.086	
88. vinyl chloride (chloroethylene)	426	1	ND	*	* *	
114. antimony	426	1 QC	<0.003	<0.003	<0.003 <0.003	<0.003
115. arsenic	426	1 QC	<0.003	0.19	<0.003 <0.003	0.12

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
117. beryllium	426	1	<0.001	230	86	36
		QC			84	
118. cadmium	426	1	<0.004	0.047	0.007	0.023
		QC			0.005	
119. chromium (total)	426	1	0.017	0.11	0.058	0.090
		QC			0.059	
120. copper	426	1	0.47	1.6	1.2	1.5
		QC			1.1	
121. cyanide (total)	426	1			32.6**	
122. lead	426	1	<0.16	<0.16	<0.168	<0.16
		QC			<0.168	
123. mercury	426	1	<0.0002	0.0006	0.0009	0.0006
		QC			0.0008	
124. nickel	426	1	<0.006	0.067	0.027	0.032
		QC			0.019	
125. selenium	426	1	<0.003	<0.003	<0.003	<0.003
		QC			<0.003	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
126. silver	426	1	<0.0005	<0.0005	0.006	<0.0005
		QC			0.007	
127. thallium	426	1	<0.002	<0.002	<0.002	<0.002
		QC			<0.002	
128. zinc	426	1	0.018	0.10	0.047	0.091
		QC			0.041	
Nonconventional Pollutants						
acidity	426	1	<1	<1	<1	<1
		QC			<1	
alkalinity	426	1	311	1,300	1,400	1,560
		QC			1,270	
aluminum	426	1	<0.100	26	18	16
		QC			19	
ammonia nitrogen	426	1			4,300**	
barium	426	1	0.20	3.3	2.0	2.3
		QC			3.6	
boron	426	1	<0.018	53	44	37
		QC			39	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
calcium	426	1	57	<0.090	0.44	4.0
		QC			0.97	
chemical oxygen demand (COD)	426	1	<1	55	1,600	1,990
		QC			1,600	
chloride	426	1	95	66	<1	<1
		QC			<1	
cobalt	426	1	<0.012	0.062	0.013	0.044
		QC			0.014	
fluoride	426	1	0.81	5,600	43	3,500
		QC			47	
iron	426	1	1.4	3.6	4.2	3.9
		QC			3.6	
magnesium	426	1	36	1.1	0.19	2.5
		QC			0.29	
manganese	426	1	0.013	0.065	0.036	0.083
		QC			0.030	
molybdenum	426	1	0.005	0.092	0.013	0.068
		QC			0.024	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
phosphate	426	1	<0.732	17	6.6	9.2
		QC			6.0	
sodium	426	1	17	56	41	39
		QC			40	
sulfate	426	1	1,400	130	100	83
		QC			100	
tin	426	1	<0.12	<0.12	<0.12	<0.12
		QC			<0.12	
titanium	426	1	0.73	1.9	1.4	1.7
		QC			1.4	
total dissolved solids (TDS)	426	1	550	3,800	98	530
		QC			100	
total organic carbon (TOC)	426	1	<1	510	1,350	440
		QC			980	
total solids (TS)	426	1	550	4,200	98	570
		QC			129	
vanadium	426	1	<0.006	0.22	<0.006	0.10
		QC			<0.006	

Table V-13 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PROCESS WATER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
yttrium	426	1	<0.001	<0.001	<0.001	<0.001
		QC			<0.001	
Conventional Pollutants						
oil and grease	426	1	<1	<1	5.2	15
		QC			7.9	
total suspended solids (TSS)	426	1	4	34	<1	4
		QC			<1	
pH (standard units)	426	1	6.84	7.94	8.09	7.83
		QC			7.99	

†Sample Type Code: 1 - One-time grab

*Less than or equal to 0.010 mg/l.

**Data from split samples analyzed by the plant and used because EPA analyses were inconclusive.

Table V-14

PRIMARY BERYLLIUM SAMPLING DATA
PEBBLE PLANT AREA VENT SCRUBBER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	473	1	<0.003		<0.003	
		QC			<0.003	
115. arsenic	473	1	<0.003		0.042	
		QC			0.060	
117. beryllium	473	1	<0.001		210	
		QC			210	
118. cadmium	473	1	<0.004		0.033	
		QC			0.034	
119. chromium (total)	473	1	0.017		0.14	
		QC			0.093	
120. copper	473	1	0.47		0.58	
		QC			0.50	
122. lead	473	1	<0.16		<0.168	
		QC			<0.168	
123. mercury	473	1	<0.0002		0.0004	
		QC			0.0003	

Table V-14 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PEBBLE PLANT AREA VENT SCRUBBER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
124. nickel	473	1	<0.006		0.064	
		QC			0.064	
125. selenium	473	1	<0.003		<0.003	
		QC			<0.003	
126. silver	473	1	<0.0005		0.008	
		QC			<0.0005	
127. thallium	473	1	<0.002		<0.002	
		QC			<0.002	
128. zinc	473	1	0.018		0.096	
		QC			0.13	
Nonconventional Pollutants						
acidity	473	1	<1		<1	
		QC			<1	
alkalinity	473	1	311		630	
		QC			640	
aluminum	473	1	<0.100		46	
		QC			41	

Table V-14 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PEBBLE PLANT AREA VENT SCRUBBER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
ammonia nitrogen	473	1	6.6		<0.02	
		QC			<0.02	
barium	473	1	0.20		21	
		QC			24	
boron	473	1	<0.018		57	
		QC			62	
calcium	473	1	57		4.5	
		QC			4.9	
chemical oxygen demand (COD)	473	1	<1		1,930	
		QC			1,900	
chloride	473	1	95		61	
		QC			36	
cobalt	473	1	<0.012		0.074	
		QC			0.035	
fluoride	473	1	0.81		6,650	
		QC			6,350	

Table V-14 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PEBBLE PLANT AREA VENT SCRUBBER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
iron	473	1	1.4		3.7	
		QC			4.6	
magnesium	473	1	36		1.6	
		QC			0.72	
manganese	473	1	0.013		0.041	
		QC			0.066	
molybdenum	473	1	0.005		0.083	
		QC			0.082	
phosphate	473	1	<0.732		2.9	
		QC			4.0	
sodium	473	1	17		74	
		QC			76	
sulfate	473	1	1,400		140	
		QC			150	
tin	473	1	<0.12		<0.12	
		QC			<0.12	
titanium	473	1	0.73		1.6	
		QC			1.4	

Table V-14 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
PEBBLE PLANT AREA VENT SCRUBBER
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
total dissolved solids (TDS)	473	1	550		3,910	
		QC			3,500	
total organic carbon (TOC)	473	1	<1		470	
		QC			440	
total solids (TS)	473	1	550		3,900	
		QC			3,700	
vanadium	473	1	<0.006		0.12	
		QC			0.011	
yttrium	473	1	<0.001		<0.001	
		QC			<0.001	
Conventional Pollutants						
oil and grease	473	1	<1		<1	
		QC			8	
total suspended solids (TSS)	473	1	4		5	
		QC			23	
pH (standard units)	473	1	6.84		5.41	
		QC			5.43	

†Sample Type Code: 1 - One-time grab

Table V-15

PRIMARY BERYLLIUM SAMPLING DATA
CHIP TREATMENT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	495	1	<0.003			<0.003
115. arsenic	495	1	<0.003			<0.003
117. beryllium	495	1	<0.001			3,300
118. cadmium	495	1	<0.004			0.063
119. chromium (total)	495	1	0.017			7.4
120. copper	495	1	0.47			1.4
122. lead	495	1	<0.16			0.20
123. mercury	495	1	<0.0002			<0.0002
124. nickel	495	1	<0.006			0.78
125. selenium	495	1	<0.003			<0.003
126. silver	495	1	<0.0005			0.040
127. thallium	495	1	<0.002			<0.002
128. zinc	495	1	0.018			7.2

Table V-15 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
CHIP TREATMENT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	495	1	<1			6,300
alkalinity	495	1	311			<1
aluminum	495	1	<0.100			110
ammonia nitrogen	495	1	6.6			<0.02
barium	495	1	0.20			0.068
boron	495	1	<0.18			2.3
calcium	495	1	57			8.8
chemical oxygen demand (COD)	495	1	<1			300
chloride	495	1	95			170
cobalt	495	1	<0.012			0.10
fluoride	495	1	0.81			2,500
iron	495	1	1.4			87
magnesium	495	1	36			37

Table V-15 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
CHIP TREATMENT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
manganese	495	1	0.013			9.9
molybdenum	495	1	0.005			0.44
phosphate	495	1	<0.732			18
sodium	495	1	17			51
sulfate	495	1	1,400			73
tin	495	1	<0.12			<0.12
titanium	495	1	0.73			3.9
total dissolved solids (TDS)	495	1	550			34,000
total organic carbon (TOC)	495	1	<1			170
total solids (TS)	495	1	550			35,000
vanadium	495	1	<0.006			0.35
yttrium	495	1	<0.001			<0.001

Table V-15 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
CHIP TREATMENT
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	495	1	<1			35
total suspended solids (TSS)	495	1	4			370
pH (standard units)	495	1	6.84			0.97

†Sample Type Code: 1 - One-time grab

Table V-16

PRIMARY BERYLLIUM SAMPLING DATA
TRIANGULAR LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	477	2	<0.003	<0.003	<0.003	<0.003
		QC			<0.003	
115. arsenic	477	2	<0.003	<0.003	<0.003	<0.003
		QC			<0.003	
117. beryllium	477	2	<0.001	1.3	0.46	1.4
		QC			0.46	
118. cadmium	477	2	<0.004	0.027	<0.004	0.009
		QC			<0.004	
119. chromium (total)	477	2	0.017	0.084	0.043	0.11
		QC			0.039	
120. copper	477	2	0.47	39	2.1	60
		QC			2.7	
121. cyanide (total)	477	1	0.12		0.09	
		QC			0.10	
122. lead	477	2	<0.16	<0.16	<0.168	<0.168
		QC			<0.168	
123. mercury	477	2	<0.0002	<0.0002	<0.0002	<0.0002
		QC			<0.0002	

Table V-16 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
TRIANGULAR LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
124. nickel	477	2	<0.006	0.26	0.015	0.65
		QC			0.020	
125. selenium	477	2	<0.003	<0.003	<0.003	<0.003
		QC			<0.003	
126. silver	477	2	<0.0005	0.042	0.010	0.016
		QC			0.013	
127. thallium	477	2	<0.002	<0.002	<0.002	<0.002
		QC			<0.002	
128. zinc	477	2	0.018	0.42	0.11	0.51
		QC			0.052	
Nonconventional Pollutants						
acidity	477	2	<1	<1	<1	<1
		QC			<1	
alkalinity	477	2	311	263	600	240
		QC			600	
aluminum	477	2	<0.100	5.0	0.44	4.1
		QC			0.71	

Table V-16 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
TRIANGULAR LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
ammonia nitrogen	477	2	6.6	13.4	6.9	<0.02
		QC			9.1	
barium	477	2	0.20	0.28	0.21	0.33
		QC			0.25	
boron	477	2	<0.018	1.5	0.99	0.90
		QC			1.2	
calcium	477	2	57	40	22	66
		QC			22	
chemical oxygen demand (COD)	477	2	<1	39	34	79
		QC			33	
chloride	477	2	95	100	180	230
		QC			270	
cobalt	477	2	<0.012	0.077	0.014	0.10
		QC			0.022	
fluoride	477	2	0.81	20	26	4,500
		QC			28	

Table V-16 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
TRIANGULAR LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
iron	477	2	1.4	1.7	0.83	2.5
		QC			0.87	
magnesium	477	2	36	32	4.0	38
		QC			5.2	
manganese	477	2	0.013	0.094	0.045	0.11
		QC			0.035	
molybdenum	477	2	0.005	0.095	0.024	0.031
		QC			0.029	
phosphate	477	2	<0.732	480	3.8	170
		QC			4.4	
sodium	477	2	17	2,500	2,100	2,300
		QC			2,000	
sulfate	477	2	1,400	7,000	3,900	4,300
		QC			3,900	
tin	477	2	<0.12	<0.12	<0.12	<0.12
		QC			<0.12	
titanium	477	2	0.73	0.85	<0.010	1.0
		QC			<0.010	

Table V-16 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
TRIANGULAR LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
total dissolved solids (TDS)	477	2	550	12,000	10,000	14,000
		QC			10,000	
total organic carbon (TOC)	477	2	<1	45	19	19
		QC			19	
total solids (TS)	477	2	550	12,000	11,000	15,000
		QC			11,000	
vanadium	477	2	<0.006	0.15	<0.006	<0.006
		QC			<0.006	
yttrium	477	2	<0.001	<0.006	<0.001	<0.001
		QC			<0.001	
Conventional Pollutants						
oil and grease	477	1	<1	<1	<1	
		QC			6	
total suspended solids (TSS)	477	2	4	170	24	260
		QC			21	
pH (standard units)	477	2	6.84	7.61	11.20	6.8
		QC			11.30	

†Sample Type Code: 1 - One-time grab
2 - Manual composite during intermittent process operation

Table V-17

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	427	6	ND	ND	ND	ND
2. acrolein	427	1	ND	ND	ND	ND
3. acrylonitrile	427	1	*	*	*	*
4. benzene	427	1	*	*	0.011	0.014
5. benzidine	427	6	ND	ND	ND	ND
6. carbon tetrachloride	427	1	*	*	*	*
7. chlorobenzene	427	1	*	*	*	*
8. 1,2,4-trichlorobenzene	427	6	ND	ND	ND	ND
9. hexachlorobenzene	427	6	ND	ND	ND	ND
10. 1,2-dichloroethane	427	1	*	*	*	*
11. 1,1,1-trichloroethane	427	1	*	*	*	*
12. hexachloroethane	427	6	ND	ND	*	*
13. 1,1-dichloroethane	427	1	*	*	*	*
14. 1,1,2-trichloroethane	427	1	*	*	*	*

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	427	1	*	*	*	*
16. chloroethane	427	1	ND	ND	ND	ND
17. bis(chloromethyl)ether	427	1	ND	ND	ND	ND
18. bis(2-chloroethyl)ether	427	6	ND	ND	ND	ND
19. 2-chloroethyl vinyl ether	427	1	*	*	*	*
20. 2-chloronaphthalene	427	6	ND	ND	ND	ND
21. 2,4,6-trichlorophenol	427	6	ND	ND	ND	ND
22. p-chloro-m-cresol	427	6	ND	*	ND	ND
23. chloroform	427	1	*	*	*	*
24. 2-chlorophenol	427	6	ND	ND	ND	ND
25. 1,2-dichlorobenzene	427	6	ND	ND	ND	ND
26. 1,3-dichlorobenzene	427	6	ND	ND	ND	ND
27. 1,4-dichlorobenzene	427	6	ND	ND	ND	ND
28. 3,3'-dichlorobenzidine	427	6	ND	ND	ND	ND

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	427	1	*	*	*	*
30. 1,2-trans-dichloroethylene	427	1	*	*	*	*
31. 2,4-dichlorophenol	427	6	ND	ND	ND	ND
32. 1,2-dichloropropane	427	1	*	*	*	*
33. 1,3-dichloropropene	427	1	*	*	*	*
34. 2,4-dimethylphenol	427	6	ND	ND	ND	ND
35. 2,4-dinitrotoluene	427	6	ND	ND	ND	ND
36. 2,6-dinitrotoluene	427	6	*	*	*	*
37. 1,2-diphenylhydrazine	427	6	*	ND	*	ND
38. ethylbenzene	427	1	*	*	*	*
39. fluoranthene	427	6	*	ND	ND	ND
40. 4-chlorophenyl phenyl ether	427	6	ND	ND	ND	ND
41. 4-bromophenyl phenyl ether	427	6	ND	ND	ND	ND
42. bis(2-chloroisopropyl)ether	427	6	ND	ND	*	ND

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-chloroethoxy)methane	427	6	*	*	*	*
44. methylene chloride	427	1	*	*	*	*
45. methyl chloride (chloromethane)	427	1	*	*	*	*
46. methyl bromide (bromomethane)	427	1	ND	ND	ND	ND
47. bromoform (tribromomethane)	427	1	*	*	*	*
48. dichlorobromomethane	427	1	*	*	*	*
49. trichlorofluoromethane	427	1	ND	ND	ND	ND
50. dichlorodifluoromethane	427	1	ND	ND	ND	ND
51. chlorodibromomethane	427	1	*	ND	ND	*
52. hexachlorobutadiene	427	6	ND	ND	ND	ND
53. hexachlorocyclopentadiene	427	6	ND	ND	ND	ND
54. isophorone	427	6	ND	ND	ND	ND
55. naphthalene	427	6	*	ND	*	*
56. nitrobenzene	427	6	ND	ND	*	*

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	427	6	ND	*	ND	*
58. 4-nitrophenol	427	6	ND	ND	ND	ND
59. 2,4-dinitrophenol	427	6	ND	ND	ND	ND
60. 4,6-dinitro-o-cresol	427	6	ND	0.012	ND	ND
61. N-nitrosodimethylamine	427	6	ND	ND	*	*
62. N-nitrosodiphenylamine	427	6	ND	ND	ND	ND
63. N-nitrosodi-n-propylamine	427	6	ND	ND	ND	ND
64. pentachlorophenol	427	6	ND	ND	ND	ND
65. phenol	427	6	ND	ND	ND	0.066
66. bis(2-ethylhexyl) phthalate	427	6	0.024	0.012	0.014	*
67. butyl benzyl phthalate	427	6	*	*	*	*
68. di-n-butyl phthalate	427	6	0.157	0.087	0.049	0.026
69. di-n-octyl phthalate	427	6	*	ND	*	*
70. diethyl phthalate	427	6	0.076	0.071	0.018	0.018

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	427	6	ND	ND	ND	ND
72. benzo(a)anthracene	427	6	*	ND	ND	ND
73. benzo(a)pyrene	427	6	*	ND	ND	ND
74. benzo(b)fluoranthene	427	6	0.016	ND	ND	*
75. benzo(k)fluoranthane	427	6	0.011	ND	ND	*
76. chrysene	427	6	0.017	ND	ND	ND
77. acenaphthylene	427	6	ND	ND	ND	ND
78. anthracene (a)	427	6	ND	ND	*	*
79. benzo(ghi)perylene	427	6	ND	ND	ND	ND
80. fluorene	427	6	ND	ND	ND	ND
81. phenanthrene (a)	427	6	ND	ND	*	*
82. dibenzo(a,h)anthracene	427	6	ND	ND	ND	ND
83. indeno (1,2,3-c,d)pyrene	427	6	ND	ND	ND	ND
84. pyrene	427	6	*	ND	ND	ND

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	427	1	*	*	*	*
86. toluene	427	1	0.085	*	*	*
87. trichloroethylene	427	1	*	*	*	*
88. vinyl chloride (chloroethylene)	427	1	ND	ND	ND	*
114. antimony	427	6	<0.003	<0.003	<0.003	<0.003
115. arsenic	427	6	<0.003	<0.003	<0.003	<0.003
117. beryllium	427	6	<0.001	0.029	0.27	0.024
118. cadmium	427	6	<0.004	0.005	<0.004	<0.004
119. chromium (total)	427	6	0.017	0.013	0.047	0.034
120. copper	427	6	0.47	0.75	0.59	0.38
121. cyanide (total)	427	1	0.12	0.08	0.06	<0.02
122. lead	427	6	<0.16	<0.168	<0.168	<0.168
123. mercury	427	6	<0.0002	0.0011	0.0008	0.0007
124. nickel	427	6	<0.006	0.055	0.029	0.023

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
125. selenium	427	6	<0.003	<0.003	<0.003	<0.003
126. silver	427	6	<0.0005	0.017	0.011	0.019
127. thallium	427	6	<0.002	<0.002	<0.002	<0.002
128. zinc	427	6	0.018	0.006	0.048	0.019
Nonconventional Pollutants						
acidity	427	6	<1	<1	<1	<1
alkalinity	427	6	311	92	80	82
aluminum	427	6	<0.100	0.28	<0.100	<0.100
ammonia nitrogen	427	6	6.6	8.9	<0.02	210
barium	427	6	0.20	0.15	0.27	0.23
boron	427	6	<0.018	1.2	1.7	1.7
calcium	427	6	57	140	97	120
chemical oxygen demand (COD)	427	6	<1	31	47	25
chloride	427	6	95	510	830	810

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
cobalt	427	6	<0.012	<0.012	<0.012	<0.012
fluoride	427	6	0.81	26	16.5	17
iron	427	6	1.4	1.4	1.8	0.95
magnesium	427	6	36	15	11	12
manganese	427	6	0.013	0.010	0.045	0.005
molybdenum	427	6	0.005	0.022	0.028	0.032
phosphate	427	6	<0.732	2.8	1.7	2.6
sodium	427	6	17	2,400	1,700	1,900
sulfate	427	6	1,400	3,600	3,700	3,800
tin	427	6	<0.12	<0.12	<0.12	<0.12
titanium	427	6	0.73	0.78	0.70	<0.010
total dissolved solids (TDS)	427	6	550	10,000	9,300	310
total organic carbon (TOC)	427	6	<1	12	18	13
total solids (TS)	427	6	550	11,000	9,800	300

Table V-17 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 6 LAGOON EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
vanadium	427	6	<0.006	<0.006	<0.006	<0.006
yttrium	427	6	<0.001	<0.001	<0.001	<0.001
Conventional Pollutants						
oil and grease	427	1	<1	<1	<1	5
total suspended solids (TSS)	427	6	4	23	22	34
pH (standard units)	427	6	6.84	8.63	8.25	8.29

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

*Less than or equal to 0.010 mg/l.

Table V-18

PRIMARY BERYLLIUM SAMPLING DATA
LIME TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	487	1	<0.003	<0.003	<0.003	<0.003
115. arsenic	487	1	<0.003	0.47	0.33	<0.003
117. beryllium	487	1	<0.001	240	100	550
118. cadmium	487	1	<0.004	0.13	0.032	0.23
119. chromium (total)	487	1	0.017	8.4	2.0	13
120. copper	487	1	0.47	2.5	13	7.7
121. cyanide (total)	487	1	0.12	11	21	<0.02
122. lead	487	1	<0.16	1.1	0.54	2.3
123. mercury	487	1	<0.0002	<0.0002	<0.0002	<0.0002
124. nickel	487	1	<0.006	<0.300	0.50	3.9
125. selenium	487	1	<0.003	<0.003	<0.003	<0.003
126. silver	487	1	<0.0005	0.089	0.098	0.27
127. thallium	487	1	<0.002	<0.002	<0.002	<0.002
128. zinc	487	1	0.018	2.6	0.93	4.1

Table V-18 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
LIME TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	487	1	<1	<1	<1	<1
alkalinity	487	1	311	29,000	20,000	2,800
aluminum	487	1	<0.100	<0.100	69	<0.100
ammonia nitrogen	487	1	6.6	<0.02	<0.02	<0.02
barium	487	1	0.20	2.9	3.3	2.9
boron	487	1	<0.018	9.1	29	12
calcium	487	1	57	11,000	12,000	18,000
chemical oxygen demand (COD)	487	1	<1	1,500	<1	1,630
chloride	487	1	95	1,300	<1	<1
cobalt	487	1	<0.012	0.16	0.076	0.23
fluoride	487	1	0.81	34,000	55,000	14
iron	487	1	1.4	310	110	630
magnesium	487	1	36	1,300	370	490

Table V-18 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
LIME TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
manganese	487	1	0.013	5.0	1.6	8.1
molybdenum	487	1	0.005	0.26	0.11	0.53
phosphate	487	1	<0.732	56	13	20
sodium	487	1	17	810	420	270
sulfate	487	1	1,400	21,000	1,500	320
tin	487	1	<0.12	<0.12	<0.12	<0.12
titanium	487	1	0.73	9.1	4.2	13
total dissolved solids (TDS)	487	1	550	4,900	20,000	16,000
total organic carbon (TOC)	487	1	<1	19	300	550
total solids (TS)	487	1	550	150,000	20,000	17,000
vanadium	487	1	<0.006	1.1	0.39	1.8
yttrium	487	1	<0.001	<0.001	<0.001	<0.001

Table V-18 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
LIME TANK EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	487	1	<1	18	<1	6
total suspended solids (TSS)	487	1	4	130,000	420	29
pH (standard units)	487	1	6.84	10.40	11.20	9.28

†Sample Type Code: 1 - One-time grab

Table V-19

PRIMARY BERYLLIUM SAMPLING DATA
STRIPPER EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	488	1	<0.003	<0.003	<0.003	<0.003
115. arsenic	488	1	<0.003	0.53	<0.003	0.15
117. beryllium	488	1	<0.001	340	39	480
118. cadmium	488	1	<0.004	0.18	0.014	0.019
119. chromium (total)	488	1	0.017	11	0.91	0.33
120. copper	488	1	0.47	3.2	5.7	4.5
121. cyanide (total)	488	1	0.12	4.2	2.4	<0.02
122. lead	488	1	<0.16	1.8	0.19	0.20
123. mercury	488	1	<0.0002	<0.0002	<0.0002	<0.0002
124. nickel	488	1	<0.006	<0.006	0.34	0.15
125. selenium	488	1	<0.003	<0.003	<0.003	<0.003
126. silver	488	1	<0.0005	0.15	0.025	0.013
127. thallium	488	1	<0.002	<0.002	<0.002	<0.002
128. zinc	488	1	0.018	4.0	0.63	0.41

Table V-19 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
STRIPPER EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	488	1	<1	<1	<1	<1
alkalinity	488	1	311	9,900	6,000	25
aluminum	488	1	<0.100	<0.100	32	43
ammonia nitrogen	488	1	6.6	<0.02	<0.02	<0.02
barium	488	1	0.20	3.9	1.7	1.6
boron	488	1	<0.018	18	17	8.4
calcium	488	1	57	16,000	7,300	7,500
chemical oxygen demand (COD)	488	1	<1	<1	1,300	1,320
chloride	488	1	95	130	<1	1,700
cobalt	488	1	<0.012	0.21	0.067	0.051
fluoride	488	1	0.81	40,000	9,700	23
iron	488	1	1.4	550	50	26
magnesium	488	1	36	2,600	290	160

Table V-19 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
STRIPPER EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
manganese	488	1	0.013	8.1	1.2	0.62
molybdenum	488	1	0.005	0.39	0.073	0.11
phosphate	488	1	<0.732	56	2.1	<0.732
sodium	488	1	17	700	220	510
sulfate	488	1	1,400	15,000	1,000	420
tin	488	1	<0.12	<0.12	<0.12	<0.12
titanium	488	1	0.73	12	2.5	3.2
total dissolved solids (TDS)	488	1	550	13,000	16,000	6,200
total organic carbon (TOC)	488	1	<1	920	190	490
total solids (TS)	488	1	550	160,000	25,000	6,300
vanadium	488	1	<0.006	1.5	0.23	0.21
yttrium	488	1	<0.001	<0.001	<0.001	<0.001

Table V-19 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
STRIPPER EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	488	1	<1	11	<1	18
total suspended solids (TSS)	488	1	4	150,000	12,000	68
pH (standard units)	488	1	6.84	8.61	7.85	9.09

†Sample Type Code: 1 - One-time grab

Table V-20

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 5 LAGOON

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	480	1	<0.003	<0.003		
115. arsenic	480	1	<0.003	<0.003		
117. beryllium	480	1	<0.001	0.74		
118. cadmium	480	1	<0.004	<0.004		
119. chromium (total)	480	1	0.017	0.043		
120. copper	480	1	0.47	0.17		
121. cyanide (total)	480	1	0.12			
122. lead	480	1	<0.16	<0.168		
123. mercury	480	1	<0.0002	<0.0002		
124. nickel	480	1	<0.006	0.11		
125. selenium	480	1	<0.003	<0.003		
126. silver	480	1	<0.0005	0.093		
127. thallium	480	1	<0.002	<0.003		
128. zinc	480	1	0.018	0.034		

Table V-20 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 5 LAGOON

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	480	1	<1	<1		
alkalinity	480	1	311	180		
aluminum	480	1	<0.100	0.19		
ammonia nitrogen	480	1	6.6	53		
barium	480	1	0.20	0.22		
boron	480	1	<0.018	1.5		
calcium	480	1	57	100		
chemical oxygen demand (COD)	480	1	<1	31		
chloride	480	1	95	570		
cobalt	480	1	<0.012	0.024		
fluoride	480	1	0.81	43		
iron	480	1	1.4	0.41		
magnesium	480	1	36	57		

Table V-20 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 5 LAGOON

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
manganese	480	1	0.013	0.059		
molybdenum	480	1	0.005	0.21		
phosphate	480	1	<0.732	2.8		
sodium	480	1	17	4,400		
sulfate	480	1	1,400	16,000		
tin	480	1	<0.12	<0.12		
titanium	480	1	0.73	<0.010		
total dissolved solids (TDS)	480	1	550	19,000		
total organic carbon (TOC)	480	1	<1	7.0		
total solids (TS)	480	1	550	20,000		
vanadium	480	1	<0.006	0.017		
yttrium	480	1	<0.001	<0.001		

Table V-20 (Continued)

PRIMARY BERYLLIUM SAMPLING DATA
NUMBER 5 LAGOON

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants						
oil and grease	480	1	<1	<1		
total suspended solids (TSS)	480	1	4	54		
pH (standard units)	480	1	6.84	8.89		

†Sample Type Code: 1 - One-time grab

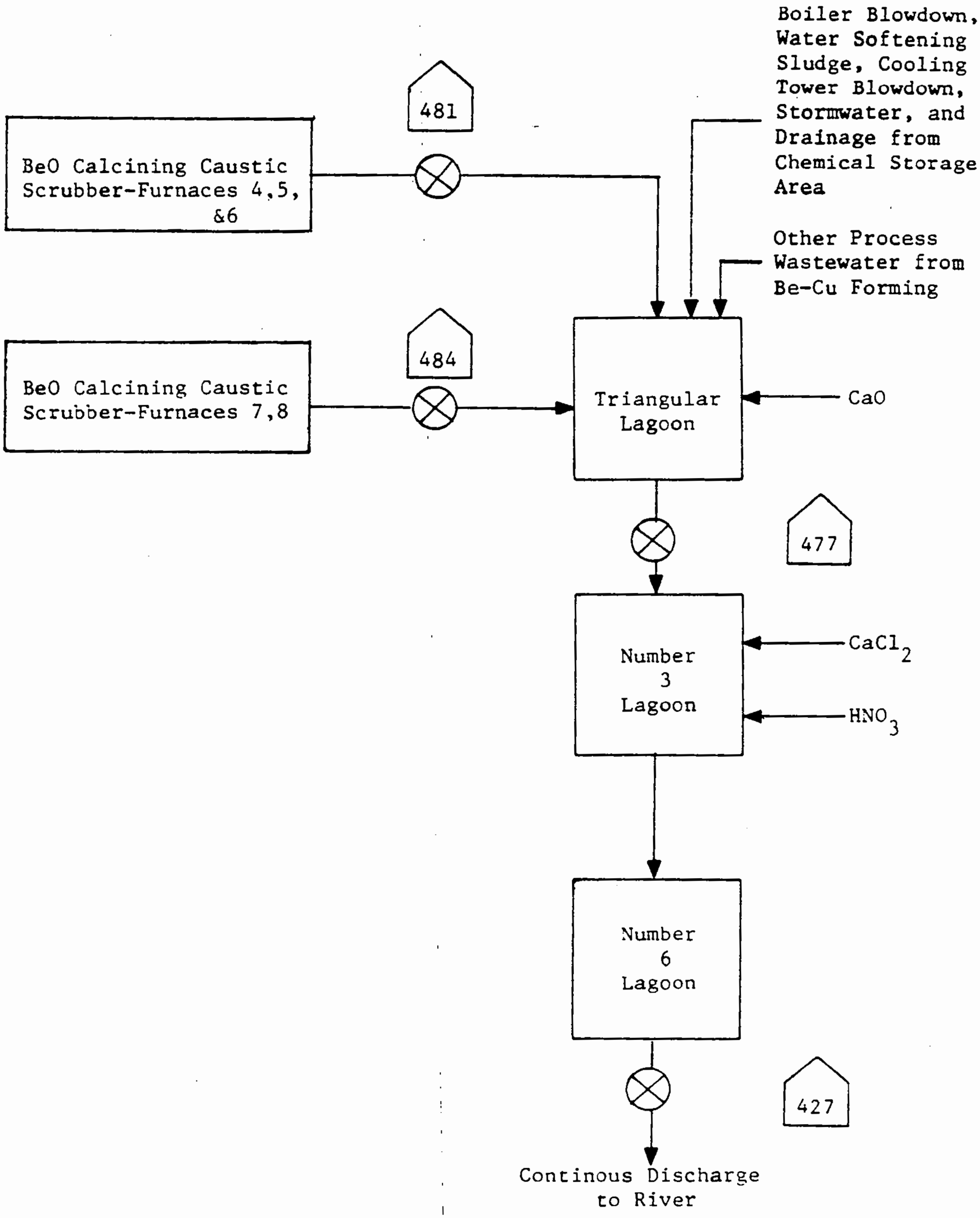

Figure V-1

SAMPLING LOCATIONS AT BERYLLIUM PLANT A - BERYLLIUM OXIDE PRODUCTION AREA

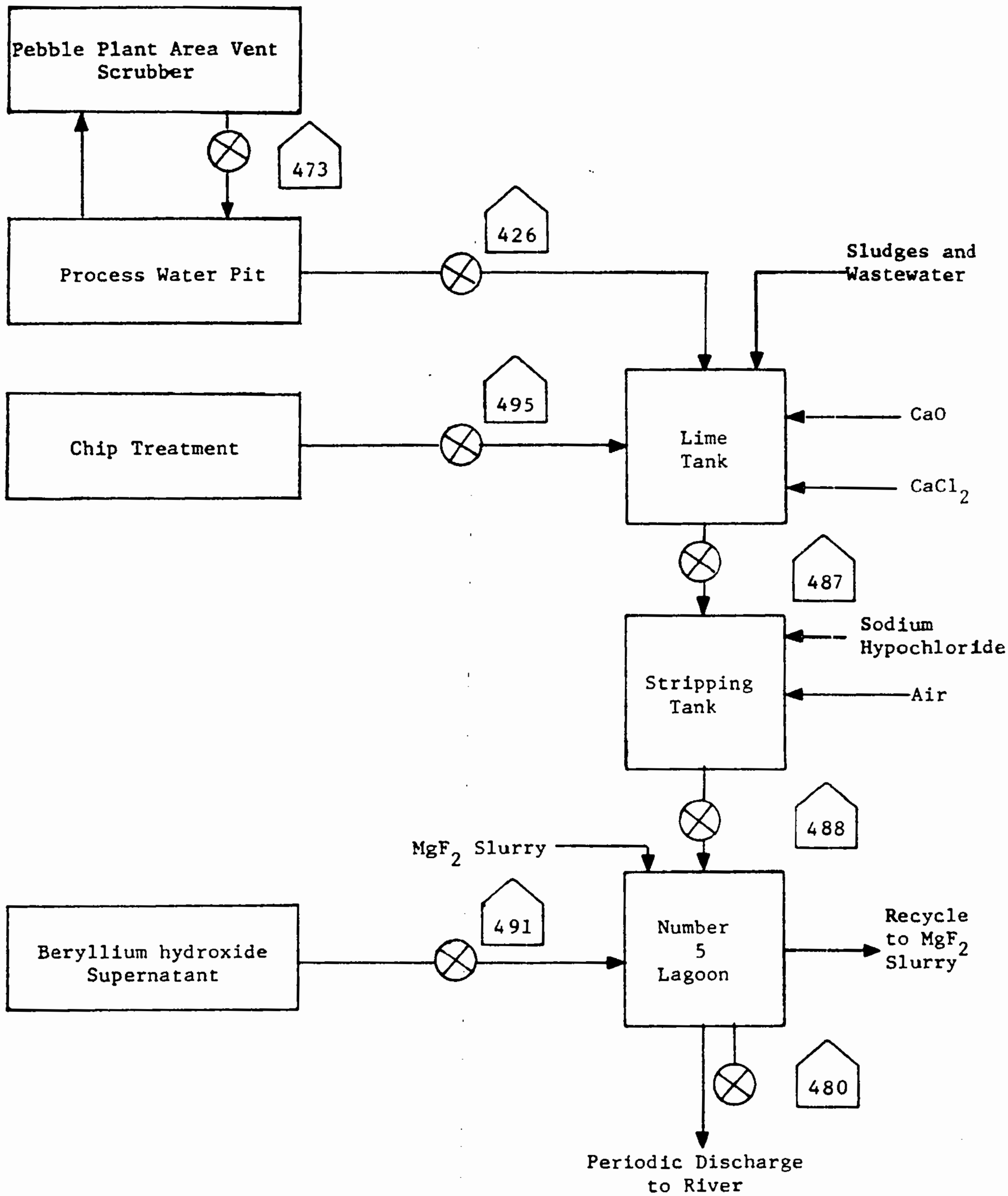

Figure V-2

SAMPLING LOCATIONS AT BERYLLIUM PLANT A - BERYLLIUM METAL PRODUCTION AREA

SECTION VI

SELECTION OF POLLUTANT PARAMETERS

Section V of this supplement presented data from primary beryllium plant sampling visits and subsequent chemical analyses. This section examines that data and discusses the selection or exclusion of pollutants for potential limitation.

Each pollutant selected for potential limitation is discussed in Section VI of Vol. I. That discussion provides information concerning the nature 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.

The discussion that follows presents and briefly discusses the selection of conventional and nonconventional pollutants for effluent limitations. Also described is the analysis that was performed to select or exclude toxic priority pollutants for further consideration for limitations and standards. Pollutants will be considered for limitation if they are present in concentrations treatable by the technologies considered in this analysis. The treatable concentrations used for the priority metals were the long-term performance values achievable by chemical precipitation. sedimentation, and filtration. The treatable concentrations used for the priority organics were the long-term performance values achievable by carbon adsorption.

<u>CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS</u>

This study examined samples from the primary beryllium subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and two nonconventional pollutant parameters (ammonia and fluoride).

Other nonconventional pollutants were analyzed for, including aluminum, barium, boron, cobalt, iron, magnesium, manganese, molybdenum, tin, titanium, and vanadium. These nonconventional pollutants were not selected for limitations in this subcategory because they were generally not found in treatable concentrations in raw wastewater samples, and there is no reason to believe these pollutants should be present based on an examination of the raw materials and production processes involved. In addition, the Agency believes these nonconventional pollutants will be effectively controlled by the limitations established for the selected priority metal pollutants.

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

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

ammonia
fluoride
total suspended solids (TSS)
pH

Although ammonia was not proposed for limitations, the Agency stated that it was considering limiting ammonia in the Notice of Data Availability, based on data received in a comment. Ammonia is selected for regulation in this subcategory. In samples split and analyzed by the primary beryllium plant sampled, up to 4,300 mg/l of NH_3 were found in samples of process water. Ammonia compounds are used throughout the beryllium production process and are expected to be present in wastewaters generated by the process. Therefore, the Agency is selecting this pollutant for regulation.

Fluoride was detected in all 14 raw wastewater samples analyzed. Eleven of the observed concentrations were above the treatable concentration of 14.5 mg/l. The treatable concentrations observed ranged from 35 to 6,650 mg/l. For this reason, fluoride is selected for limitation in this subcategory.

TSS concentrations ranging from less than 1 to 370 mg/l were observed in the 13 raw waste samples analyzed for this study. Ten of the concentrations are above the 2.6 mg/l treatable concentration. Most of the specific methods used to remove toxic metals do so by converting these metals to precipitates, and these toxic-metal-containing precipitates should not be discharged. Meeting a limitation on total suspended solids helps ensure that removal of these precipitated toxic metals has been effective. For these reasons, total suspended solids are selected for limitation in this subcategory.

The 14 pH values observed during this study ranged from 0.97 to 11.5. Effective removal of toxic metals by precipitation requires careful control of pH. Since pH control within the desirable limits is readily attainable by available treatment, pH is selected for limitation in this subcategory.

TOXIC PRIORITY POLLUTANTS

The frequency of occurrence of the priority metal pollutants and cyanide in the raw wastewater samples taken is presented in Table VI-1 (page 3739). Table VI-1 is based on the raw wastewater data from streams 481. 484. 491, 426. 473, and 495 (see Section V). These data provide the basis for the categorization of specific pollutants, as discussed below. Treatment plant samples were not considered in the frequency count.

Some samples were analyzed for toxic organic pollutants, and although these analytical data were not available in sufficient time prior to the regulatory proposal to allow for thorough analysis. these data are presented in Section V and have been used in the selection of pollutant parameters for limitation for the promulgated regulation.

TOXIC POLLUTANTS NEVER DETECTED

The toxic pollutants listed in Table VI-2 (page 3742) were not detected in any raw wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

The toxic pollutants listed in Table VI-3 (page 3744) were never found above their analytical quantification concentration in any raw wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

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 raw wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

114. arsenic
123. mercury

Arsenic was detected above its quantifiable concentration of 0.01 mg/l in four out of 14 raw wastewater samples analyzed. The quantifiable concentrations observed ranged from 0.042 to 0.19 mg/l, all of which are below the concentration considered achievable by available treatment technology (0.34 mg/l).

Arsenic is therefore not selected for further consideration for regulation.

Mercury was detected above the analytical quantification concentration in six out of 14 raw wastewater samples analyzed. The largest concentration observed is 0.0009 mg/l, which is well below the treatable concentration of 0.036 mg/l. Mercury is therefore not selected for further consideration for regulation.

TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

The toxic pollutants listed below were not selected for limitation because they were detectable in the effluent from only a small number of sources within the subcategory and are uniquely related to only those sources.

3. acrylonitrile
4. benzene
6. carbon tetrachloride

10. 1,2-dichloroethane
13. 1,1-dichloroethane
15. 1,1,2,2-tetrachloroethane
19. 2-chloroethyl vinyl ether
22. p-chloro-m-cresol
23. chloroform
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
32. 1,2-propropane
33. 1,3-dichloropropene
44. methylene chloride
47. bromoform
48. dichlorobromomethane
51. chlorodibromomethane
68. di-n-butyl phthalate
70. diethyl phthalate
85. tetrachloroethylene
86. toluene
87. trichloroethylene
118. cadmium
122. lead
124. nickel
126. silver
128. zinc

Acrylonitrile was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 1.68. 4.59 and 4.56 mg/l. The Agency has no reason to believe that treatable concentrations of acrylonitrile should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Acrylonitriile is therefore not selected for further consideration for limitation.

Benzene was detected above the level considered achievable by identified treatment technology in three out of three raw wastewater samples. The treatable concentrations observed are 0.188, 0.207, and 0.617 mg/l. The Agency has no reason to believe that treatable concentrations of benzene should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Benzene is therefore not selected for further consideration for limitation.

Carbon tetrachloride was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.069, 0.161 and 0.164 mg/l. The Agency has no reason to believe that treatable concentrations of carbon tetrachloride should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Carbon tetrachloride is therefore not selected for further consideration for limitation.

1,2-Dichloroethane was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in two out of three raw wastewater samples. The treatable concentrations observed are 0.211 and 0.142 mg/l. The Agency has no reason to believe that treatable concentrations of 1 2-dichloroethane should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. 1,2-Dichloroethane is therefore not selected for further consideration for limitation.

1,1-Dichloroethane was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.019, 0.043, and 0.043 mg/l. The Agency has no reason to believe that treatable concentrations of 1,1-dichloroethane should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. 1,1-Dichloroethane is therefore not selected for further consideration for limitation.

1,1,2,2-Tetrachloroethane was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in one out of three raw wastewater samples. The treatable concentration observed is 0.078 mg/l. The Agency has no reason to believe that treatable concentrations of 1,1,2,2-tetrachloroethane should be present in primary beryllium wastewaters. The Agency believes that the observed value is not representative and may be due to analytical error or site specific factors. 1,1,2,2-Tetrachloroethane is therefore not selected for further consideration for limitation.

2-Chloroethyl vinyl ether was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.101, 0.014, and 0.030 mg/l. The Agency has no reason to believe that treatable concentrations of 2-chloroethyl vinyl ether should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. 2-Chloroethyl vinyl ether is therefore not selected for further consideration for limitation.

Parachlorometacresol was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in one out of three raw wastewater samples. The treatable concentration observed is 0.072 mg/l. The Agency has no reason to believe that treatable concentrations of parachlorometacresol should be present in primary beryllium wastewaters. The Agency believes that the observed value is not representative and may be due to analytical error or site specific factors. Parachlorometacresol is therefore not selected for further consideration for limitation.

Chloroform was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.044, 0.106, and 0.109 mg/l. The Agency has no reason to believe that treatable concentrations of chloroform should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Chloroform is therefore not selected for further consideration for limitation.

1,1-Dichloroethylene was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.047, 0.111, and 0.115 mg/l. The Agency has no reason to believe that treatable concentrations of 1,1-dichloroethylene should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. 1,1-Dichloroethylene is therefore not selected for further consideration for limitation.

1,2-Trans-dichloroethylene was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.053, 0.134, and 0.133 mg/l. The Agency has no reason to Believe that treatable concentrations of 1,2-trans-dichloroethylene should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. 1,2-Trans-dichloroethylene is therefore not selected for further consideration for limitation.

1,2-Dichloropropane was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.043, 0.113, and 0.104 mg/l. The Agency has no reason to believe that treatable concentrations of 1,2-dichloropropane should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or sire specific factors. 1,2-Dichloropropane is therefore not selected for further consideration for limitation.

1,3-Dichloropropene was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in two out of three raw wastewater samples. The treatable concentrations observed are 0.036 and 0.023 mg/l. The Agency has no reason to believe that treatable concentrations of 1,3-dichloropropene should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. 1,3-Dichloropropene is therefore not selected for further consideration for limitation.

Methylene chloride was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three out of three raw wastewater samples. The treatable concentrations observed are 0.114, 0.211, and 0.208 mg/l. The Agency has no reason to believe that treatable concentrations of methylene chloride should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Methylene chloride is therefore not selected for further consideration for limitation.

Bromoform was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in two out of three raw wastewater samples. The treatable concentrations observed are 0.130 and 0.077 mg/l. The Agency has no reason to believe that treatable concentrations of bromoform should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Bromoform is therefore not selected for further consideration for limitation.

Dichlorobromomethane was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three of three raw wastewater samples. The treatable concentrations observed are 0.021, 0.041. and 0.041 mg/l. The Agency has no reason to believe that treatable concentrations of dichlorobromomethane should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Dichlorobromomethane is therefore not selected for further consideration for limitation.

Chlorodibromomethane was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three of three raw wastewater samples. The treatable concentrations observed are 0.080, 0.288, and 0.139 mg/l. The Agency has no reason to believe that treatable concentrations of chlorodibromomethane should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Chlorodibromomethane is therefore not selected for further consideration for limitation.

Di-n-butyl phthalate was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in two out of three raw wastewater samples. The treatable concentrations observed are 0.034 and 0.134 mg/l. The Agency has no reason to believe that treatable concentrations of di-n-butyl phthalate should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Di-n-butyl phthalate is therefore not selected for further consideration for limitation.

Diethyl phthalate was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in one out of three raw wastewater samples. The treatable concentration observed is 0.270 mg/l. The Agency has no reason to believe that treatable concentrations of diethyl phthalate should be present in primary beryllium wastewaters. The Agency believes that the observed value is not representative and may be due to analytical error or site specific factors. Diethyl phthalate is therefore not selected for further consideration for limitation.

Tetrachloroethylene was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three of three raw wastewater samples. The treatable concentrations observed are 0.184, 0.474, and 0.481 mg/l. The Agency has no reason to believe that treatable concentrations of tetrachloroethylene should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Tetrachloroethylene is therefore not selected for further consideration for limitation.

Toluene was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three of three raw wastewater samples. The treatable concentrations observed are 0.029, 0.084, and 0.064 mg/l. The Agency has no reason to believe that treatable concentrations of toluene should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Toluene is therefore not selected for further consideration for limitation.

Trichloroethylene was detected above the level considered achievable by identified treatment technology (0.010 mg/l) in three of three raw wastewater samples. The treatable concentrations observed are 0.017, 0.014, and 0.086 mg/l. The Agency has no reason to believe that treatable concentrations of trichloroethylene should be present in primary beryllium wastewaters. The Agency believes that these observed values are not representative and may be due to analytical error or site specific factors. Trichloroethylene is therefore not selected for further consideration for limitation.

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

Cadmium detected above the concentration considered achievable by identified treatment technology (0.049 mg/l) in one out of 14 raw wastewater samples. The treatable concentration observed is 0.063 mg/l. The Agency has no reason to believe that treatable cadmium concentrations should be present in primary beryllium wastewaters and believes that this one value is not representative of the subcategory. Cadmium is therefore not selected for further consideration for limitation.

Lead was detected above the concentration considered achievable by identified treatment technology (0.08 mg/l) in one out of 14 raw wastewater samples. The treatable concentration observed is 0.20 mg/l. The Agency has no reason to believe that treatable lead concentrations should be present in primary beryllium wastewaters and believes that this one value is not representative of the subcategory. Lead is therefore not selected for limitation.

Nickel was detected above the concentration considered achievable by identified treatment technology (0.204 mg/l) in one out of 14 raw wastewater samples. The treatable concentration observed is 0.78 mg/l. The Agency has no reason to believe that treatable nickel concentrations should be present in primary beryllium wastewaters, and does not believe that this one value is representative of the subcategory. Nickel is therefore not selected for further consideration for limitation.

Silver was detected above the concentration considered achievable by identified treatment technology (0.07 mg/l) in three out of 14 raw wastewater samples The treatable concentrations observed range from 0.10 mg/l to 0.32 mg/l. The Agency has no reason to believe that treatable silver concentrations should be present in primary beryllium wastewaters. Silver is therefore not selected for further consideration for limitation.

Zinc was detected above the concentration considered achievable by identified treatment technology (0.23 mg/l) in one out of 14 raw wastewater samples. The treatable concentration observed is 7.2 mg/l. The Agency has no reason to believe that treatable zinc concentrations should be present in primary beryllium wastewaters, and does not believe that this one value is representative. Zinc is therefore not selected for further consideration for limitation.

TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION IN ESTABLISHING LIMITATIONS AND STANDARDS

The priority pollutants listed below are selected for further consideration in establishing limitations and standards for this subcategory. The toxic pollutants selected for further consideration for limitation are each discussed following the list.

117. beryllium
119. chromium
120. copper
121. cyanide

Beryllium was detected above the concentration considered achievable by identified treatment technology (0.20 mg/l) in all 14 raw wastewater samples. The treatable concentrations observed range from 0.49 mg/l to 3,300 mg/l. Beryllium is therefore selected for further consideration for limitation.

Chromium was detected above the concentration considered achievable by identified treatment technology (0.07 mg/l) in eight out of 14 raw wastewater samples. The treatable concentrations observed range from 0.086 mg/l to 7.5 mg/l. Chromium is therefore selected for further consideration for limitation.

Copper was detected above the concentration considered achievable by identified treatment technology (0.39 mg/l) in nine out of 14 raw wastewater samples. The treatable concentrations observed range from 0.50 mg/l to 1.6 mg/l. Copper is therefore selected for further consideration for limitation.

Although cyanide was not proposed for limitations, the Agency stated that it was considering limiting cyanide in the Notice of Data Availability, based on data received in a comment. Cyanide was detected above the concentration considered achievable by identified treatment technology (0.047 mg/l) in the only sample for which the Agency has reliable cyanide data. This sample was a split sample from the Agency's sampling visit which was analyzed by the facility. The observed concentration of 32.6 mg/l was verified by the plant as being a representative value for process water. Cyanide is formed in the carbon lined induction furnaces which are used to produce BeF_4 from $(NH_4)2BeF_4$. The cyanide is picked up in the fluorine furnace scrubber which discharges an ammonium fluoride solution to various plant processes.

Table VI-1

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
PRIMARY BERYLLIUM SUBCATEGORY
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	0.010	1	3		3		
2.	acrolein	0.010	0.010	1	3	3			
3.	acrylonitrile	0.010	0.010	1	3				3
4.	benzene	0.010	0.010	1	3				3
5.	benzidine	0.010	0.010	1	3	3			
6.	carbon tetrachloride	0.010	0.010	1	3				3
7.	chlorobenzene	0.010	0.010	1	3		3		
8.	1,2,4-trichlorobenzene	0.010	0.010	1	3	3			
9.	hexachlorobenzene	0.010	0.010	1	3	3			
10.	1,2-dichlorobenzene	0.010	0.010	1	3		1		2
11.	1,1,1-trichlorobenzene	0.010	0.010	1	3		3		
12.	hexachloroethane	0.010	0.010	1	3	1	2		
13.	1,1-dichloroethane	0.010	0.010	1	3				3
14.	1,1,2-trichloroethane	0.010	0.010	1	3		3		
15.	1,1,2,2-tetrachloroethane	0.010	0.010	1	3		2		1
16.	chloroethane	0.010	0.010	1	3	2	1		
17.	bis(chloromethyl)ether	0.010	0.010	1	3	3			
18.	bis(2-chloroethyl)ether	0.010	0.010	1	3	3			
19.	2-chloroethyl vinyl ether	0.010	0.010	1	3				3
20.	2-chloronaphthalene	0.010	0.010	1	3	3			
21.	2,4,6-trichlorophenol	0.010	0.010	1	3	3			
22.	parachlorometa cresol	0.010	0.010	1	3	1	1		1
23.	chloroform	0.010	0.010	1	3				3
24.	2-chlorophenol	0.010	0.010	1	3	3			
25.	1,2-dichlorobenzene	0.010	0.010	1	3	3			
26.	1,3-dichlorobenzene	0.010	0.010	1	3	3			
27.	1,4-dichlorobenzene	0.010	0.010	1	3	3			
28.	3,3'-dichlorobenzidine	0.010	0.010	1	3	3			
29.	1,1-dichloroethylene	0.010	0.010	1	3				3
30.	1,2-_trans_-dichloroethylene	0.010	0.010	1	3				3
31.	2,4-dichlorophenol	0.010	0.010	1	3	3			
32.	1,2-dichloropropane	0.010	0.010	1	3				3
33.	1,3-dichloropropylene	0.010	0.010	1	3	3	1		2
34.	2,4-dimethylphenol	0.010	0.010	1	3	3			
35.	2,4-dintrotoluene	0.010	0.010	1	3	3			
36.	2,6-dintrotoluene	0.010	0.010	1	3		3		
37.	1,2-diphenylhydrazine	0.010	0.010	1	3		3		
38.	ethylbenzene	0.010	0.010	1	3		3		
39.	fluoranthene	0.010	0.010	1	3	2	1		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
PRIMARY BERYLLIUM SUBCATEGORY
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
40.	4-chlorophenyl phenyl ether	0.010	0.010	1	3	3			
41.	4-bromophenyl phenyl ether	0.010	0.010	1	3	3			
42.	bis(2-chloroisopropyl)ether	0.010	0.010	1	3	3			
43.	bis(2-chloroethoxy)methane	0.010	0.010	1	3	2	1		
44.	methylene chloride	0.010	0.010	1	3				3
45.	methyl chloride	0.010	0.010	1	3		3		
46.	methyl bromide	0.010	0.010	1	3		3		
47.	bromoform	0.010	0.010	1	3		1		2
48.	dichlorobromomethane	0.010	0.010	1	3				3
49.	trichlorofluoromethane	0.010	0.010	1	3	3			
50.	dichlorodifluoromethane	0.010	0.010	1	3	3			
51.	chlorodibromomethane	0.010	0.010	1	3				3
52.	hexachlorobutadiene	0.010	0.010	1	3	3			
53.	hexachlorocyclopentadiene	0.010	0.010	1	3	3			
54.	isophorone	0.010	0.010	1	3	3			
55.	naphthalene	0.010	0.010	1	3		3		
56.	nitrobenzene	0.010	0.010	1	3	2	1		
57.	2-nitrophenol	0.010	0.010	1	3	3			
58.	4-nitrophenol	0.010	0.010	1	3	3			
59.	2,4-dinitrophenol	0.010	0.010	1	3	3			
60.	4,6-dinitro-o-cresol	0.010	0.010	1	3	3			
61.	n-nitrosodimethylamine	0.010	0.010	1	3	2	1		
62.	n-nitrosodiphenylamine	0.010	0.010	1	3	1	2		
63.	n-nitroso-n-propylamine	0.010	0.010	1	3	3			
64.	pentachlorophenol	0.010	0.010	1	3	3			
65.	phenol	0.010	0.010	1	3	3			
66.	bis(2-ethylhexyl)phthalate	0.010	0.010	1	3		3		
67.	butyl benzyl phthalate	0.010	0.010	1	3		3		
68.	di-n-butyl phthalate	0.010	0.010	1	3	1			2
69.	di-n-octyl phthalate	0.010	0.010	1	3	3			
70.	diethyl phthalate	0.010	0.010	1	3		2		1
71.	dimethyl phthalate	0.010	0.010	1	3	1	2		
72.	benzo(a)anthracene	0.010	0.010	1	3	3			
73.	benzo(a)pyrene	0.010	0.010	1	3	3			
74.	3,4-benzofluoranthene	0.010	0.010	1	3	2	1		
75.	benzo(k)fluoranthene	0.010	0.010	1	3	2	1		
76.	chrysene	0.010	0.010	1	3	3			
77.	acenaphthylene	0.010	0.010	1	3	1	2		
78.	anthracene	0.010	0.010	1	3		3		
79.	benzo(g,h,i)perylene	0.010	0.010	1	3	2	1		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS PRIMARY BERYLLIUM SUBCATEGORY 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
80. fluorene	0.010	0.010	1	3		3		
81. phenanthrene	0.010	0.010	1	3		3		
82. dibenzo(a,h)anthracene	0.010	0.010	1	3	3			
83. indeno(1,2,3-cd)pyrene	0.010	0.010	1	3	3			
84. pyrene	0.010	0.010	1	3	2	1		
85. tetrachloroethylene	0.010	0.010	1	3				3
86. toluene	0.010	0.010	1	3				3
87. trichloroethylene	0.010	0.010	1	3				3
88. vinyl chloride	0.010	0.010	1	3		3		
114. antimony	0.100	0.47	6	14		14		
115. arsenic	0.010	0.34	6	14		10	4	
117. beryllium	0.010	0.20	6	14				14
118. cadmium	0.002	0.049	6	14		4	9	1
119. chromium	0.005	0.07	6	14			6	8
120. copper	0.009	0.39	6	14			5	9
121. cyanide (c)	0.02	0.047	1	1				1
122. lead	0.020	0.08	6	14		13		1
123. mercury	0.0001	0.036	6	14		8	6	
124. nickel	0.005	0.22	6	14			13	1
125. selenium	0.01	0.20	6	14		14		
126. silver	0.02	0.07	6	14		6	5	3
127. thallium	0.100	0.34	6	14		14		
128. zinc	0.050	0.23	6	14		4	9	1

(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) 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.

TABLE VI-2

TOXIC POLLUTANTS NEVER DETECTED

2. acrolein
5. benzidine
8. 1.2,4-trichlorobenzene
9. hexachlorobenzene
17. bis (chloromerhyl) ether (deleted)
18. bis (2-chloroethyl) ether
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. 2-chlorophenol
23. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
31. 2,4-dichlorophenol
33. 1,2-dichloropropylene (1,3-dichloropropene)
34. 2,4-dimethylphenol
35. 2.4-dinitrotoluene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
49. drichlorofluoromethane (deleted)
50. dichlorodifluoromethane (delered)
60. 4.6-dinicro-o-cresol
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol
69. di-n-octyl phthalate
72. benzo (a)anthracene (1,2-benzanthracene)
73. benzo (a)pyrene (3,4-benzopyrene)
76. chrysene
82. dibenzo (a,h)anthracene (1.2.5.6-dibenzanthracene)
83. indeno (1.2.3-cd)pyrene (w,e,-o-phenylenepyrene)
89. aldrin*
90. dieldrin*
91. chlordane (technical mixture and metabolites)*
92. 4,4'-DDT*
93. 4,4'-DDE(p,p'DDX)*
94. 4,4'-DDD(p,p'TDE)*
95. Alpha-endosulfan*
96. Beta-endosulfan*
97. endosulfan sulfate*
98. endrin*
99. endrin aldehyde*
100. heptachlor*

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

101. heptachlor epoxide*
102. Alpha-BHC*
103. Beta-BHC*
104. Gamma-BHC (lindane)*
105. Delta-BHC*
106. PCB-1244 (Arochlor 1242)*
107. PCB-1254 (Arochlor 1244)*
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)*
113. toxaphene*
116. asbestos (fibrous)
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

*The Agency 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 judgment of the manufacturing process operations.

TABLE VI-3

PRIORITY POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

1. acenaphthene
7. chlorobenzene
11. 1,1,1-trichloroethane
12. hexachloroethane
14. 1,1,2-trichloroethane
16. chloroethane
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
43. bis(2-chloroethoxy)methane
44. methyl chloride
46. methyl bromide
55. naphthalene
56. nitrobenzene
61. N-nitrosodidimethylamine
62. N-nirrosodiphenylamine
66. bis(2-ethylhexyl)phthalate
67. butyl benzyl phthalare
71. dimethyl phthalate
72. 3,4-benzofluoranthene
73. benzo(k)fluoranthene
77. acenaphthylene
78. anthracene
79. benzo(g,h,i)perylene
80. fluorene
81. phenanthrene
84. pyrene
88. vinyl chloride
114. antimony
125. selenium
127. thallium

SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from primary beryllium plants. This section summarizes the description of these wastewaters and indicates the treatment technologies which are currently practiced in the primary beryllium subcategory for each waste stream. Secondly, this section presents the control and treatment technology options which were examined by the Agency for possible application to the primary beryllium subcategory.

CURRENT CONTROL AND TREATMENT PRACTICES

This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the primary beryllium subcategory is characterized by the presence of the toxic metal pollutants and suspended solids. This analysis is supported by the raw (untreated) wastewater data presented for specific sources as well as combined waste streams in Section V. Generally, these pollutants are present in each of the waste streams at concentrations above treatability, and these wastewater streams are commonly combined for treatment. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economies of scale and in some instances to combine streams of different alkalinity to reduce treatment chemical requirements. One plant in this subcategory currently has a combined wastewater treatment system consisting of chemical precipitation and sedimentation. None have chemical precipitation, sedimentation and filtration. As such, three options have been selected for consideration for BPT, BAT, NSPS, and pretreatment based on combined treatment of these compatible waste streams.

BERYLLIUM HYDROXIDE PRODUCTION

There is currently only one facility in the United Stated which produces beryllium hydroxide from bertrandite or beryl ore. This facility is in a net evaporation area and achieves zero discharge, through the use of evaporation ponds, of all wastewater streams associated with beryllium hydroxide production from ore. These ten wastewater streams are listed below:

(a) Solvent extraction raffinate from bertrandite ore,
(b) Solvent extraction raffinate from beryl ore,
(c) Beryllium carbonate filtrate,
(d) Beryllium hydroxide filtrate,
(k) Beryl ore gangue dewatering,
(l) Bertrandite ore gangue dewatering,

(m) Beryl ore processing,
(n) AIS area wastewater,
(o) Bertrandite ore leaching scrubber, and
(p) Bertrandite ore counter current decantation scrubber.

BERYLLIUM OXIDE AND BERYLLIUM METAL PRODUCTION FROM BERYLLIUM HYDROXIDE

There is currently only one facility in the United States which produces beryllium oxide and beryllium metal from beryllium hydroxide. This plant is a direct discharger and treats all of the wastewater streams associated with beryllium oxide and beryllium metal production with chemical precipitation and sedimentation technology. These six wastewater streams are listed below:

(e) Beryllium oxide calcining furnace wet air pollution control,
(f) Beryllium hydroxide supernatant,
(g) Process water,
(h) Fluoride furnace scrubber,
(i) Chip treatment wastewater, and
(j) Beryllium pebble plant area vent wet air pollution control.

The process water stream is used in the beryllium pebble plant scrubbing system prior to treatment and discharge. Two plants produce beryllium copper master alloy from beryllium hydroxide using a dry process.

CONTROL AND TREATMENT OPTIONS

The Agency examined two control and treatment technology options that are applicable to the primary beryllium subcategory. The options selected for evaluation represent a combination of pretreatment and end-of-pipe treatment technologies.

OPTION A

Option A for the primary beryllium subcategory requires control and treatment technologies to reduce the discharge of wastewater pollutant mass.

The Option A treatment scheme consists of recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation and sedimentation technology. Specifically, lime or some other alkaline compound is used to precipitate metal ions as metal hydroxides. The metal hydroxides and suspended solids settle out and the sludge is collected. Vacuum filtration is used to dewater sludge.

OPTION C

Option C for the primary beryllium subcategory consists of all control and treatment requirements of Option A (recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment steps, chemical precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme. Multimedia filtration is used to remove suspended solids, including precipitates of metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed-media type, although other forms of filters, such as rapid sand filters or pressure filters would perform satisfactorily. The addition of filters also provides consistent removal during periods of time in which there are rapid increases in flows or loadings of pollutants to the treatment system.

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SECTION VIII

COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section presents a summary of compliance costs for the primary beryllium subcategory and a description of the treatment options and subcategory-specific assumptions used to develop these estimates. Together with the estimated pollutant reduction performance presented in Sections IX, X, XI, and XII of this supplement, these cost estimates provide a basis for evaluating each regulatory option. These cost estimates are also used in determining the probable economic impact of regulation on the subcategory at different pollutant discharge levels. In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution. solid wastes, and energy requirements, which are specific to the primary beryllium subcategory.

TREATMENT OPTIONS FOR EXISTING SOURCES

As discussed in Section VII, two treatment options have been developed for existing primary beryllium sources. The treatment schemes for each option are summarized below and schematically presented in Figures X-1 and X-2 (pages 3791 and 3792).

OPTION A

Option A consists of recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment followed by chemical precipitation and sedimentation end-of-pipe technology.

OPTION C

Option C requires recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment, followed by end-of-pipe treatment technology consisting of chemical precipitation, sedimentation, and multimedia filtration.

COST METHODOLOGY

A detailed discussion of the methodology used to develop the compliance costs is presented in Section VIII of Vol. I. These compliance costs calculate incremental costs, above treatment already in place, necessary to comply with the promulgated effluent limitations and standards. The costs developed for the final regulation are presented in Table VIII-1 (page 3752). No subcategory-specific assumptions were used in developing compliance costs for the primary beryllium subcategory.

NONWATER QUALITY ASPECTS

Nonwater quality impacts specific to the primary beryllium subcategory, including energy requirements, solid waste and air pollution, are discussed below.

ENERGY REQUIREMENTS

Energy requirements for Option A are estimated at 1,136,000 kwh/yr. Option C, which includes filtration, is estimated to increase energy consumption over Option A by approximately one percent. Further, the total energy requirement for Option C is approximately two percent of the estimated total plant energy usage. It is therefore concluded that the energy requirements of the treatment options considered will have no significant impact on total plant energy consumption.

SOLID WASTE

Sludge generated in the primary beryllium subcategory is due to the precipitation of metal hydroxides and carbonates using lime. Sludges associated with the primary beryllium subcategory will necessarily contain quantities of toxic metal pollutants. Except for sludges produced by cyanide precipitation, these sludges are not subject to regulation as hazardous wastes since wastes generated by primary smelters and refiners are currently exempt from regulation by Act of Congress (Resource Conservation and Recovery Act (RCRA), Section 3001(b)), as interpreted by EPA. If a small excess (5-10 %) of lime is added during treatment, the Agency does not believe these sludges would be identified as hazardous under RCRA in any case. (Compliance costs include this amount of lime.) This judgment is based on the results of Extraction Procedure (EP) toxicity tests performed on similar sludges (toxic metal-bearing sludges) generated by other industries such as the iron and steel industry. A small amount of excess lime was added during treatment, and the sludges subsequently generated passed the toxicity test. See CFR 8261.24. Thus, the Agency believes that the wastewater sludges will similarly not be EP toxic if the recommended technology is applied.

Throughout this study, sludges generated as a result of cyanide precipitation have been considered as hazardous, and appropriate costs for disposal have been included in the compliance cost estimates.

Although it is the Agency's view that solid wastes generated as a result of these guidelines are not expected to be hazardous, generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste (see 40 CFR 262.11).

If these wastes should be identified or are listed as hazardous, they will come within the scope of RCRA's "cradle to grave" hazardous waste management program, requiring regulation, from the point of generation to point of final disposition. EPA s generator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off-site treatment, storage, or disposal facility. See 40 CFR 262.20, 45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). The transporter regulations require transporters of hazardous wastes to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR 263.20, 45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). Finally, RCRA regulations establish standards for hazardous waste treatment, storage, and disposal facilities allowed to receive such wastes. See 40 CFR Part 464, 46 FR 2802 (January 12, 1981), and 47 FR 32274 (July 26, 1982).

Even if these wastes are not identified as hazardous, they still must be disposed of in compliance with the Subtitle D open dumping standards, implementing Section 4004 of RCRA. See 44 FR 53438 (September 13, 1979). The Agency has calculated as part of the costs for wastewater treatment the cost of hauling and disposing of these wastes.

It is estimated that 696 metric tons per year of sludge will be generated as a result of these promulgated regulations for the primary beryllium subcategory. Sixty-five metric tons of this sludge is considered to be hazardous.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of chemical precipitation, sedimentation, and multimedia filtration. These technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

TABLE VIII-1

COST OF COMPLIANCE FOR THE PRIMARY BERYLLIUM SUBCATEGORY
DIRECT DISCHARGERS

(March 1982 Dollars)

Option	Capital Cost	Annual Cost
A	226500	251200
B	256200	265600

SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

This section defines the effluent characteristics attainable through the application of best practicable control technology currently available (BPT). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the primary beryllium subcategory, as well as the established performance of the recommended BPT systems. Particular consideration is given to the treatment already in place at plants within the data base.

The factors considered in identifying BPT include the total cost of applying the technology in relation to the effluent reduction benefits from such application, the age of equipment and facilities involved, the manufacturing processes used, nonwater quality environmental impacts (including energy requirements), and other factors the Administrator considers appropriate. In general, the BPT level represents the average of the existing performances of plants of various ages, sizes. processes, or other common characteristics. Where existing performance is uniformly inadequate, BPT may be transferred from a different subcategory or category. Limitations based on transfer of technology are supported by a rationale concluding that the technology is indeed transferable, and a reasonable prediction that it will be, capable of achieving the prescribed effluent limits. BPT focuses on end-of-pipe treatment rather than process changes or internal controls except where such practices are common industry practice.

TECHNICAL APPROACH TO BPT

The Agency studied the nonferrous metals category to identify the processes used, the wastewaters generated and the treatment processes installed. Information was collected from the category using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. In making technical assessments of data, reviewing manufacturing processes, and assessing wastewater treatment technology options, both indirect and direct dischargers have been considered as a single group. An examination of plants and processes did not indicate any process differences based on the type of discharge, whether it be direct or indirect.

As explained in Section IV, the primary beryllium subcategory has been subdivided into 16 potential wastewater sources. Since the water use, discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations will be developed for each of the 16 subdivisions.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations The first requirement to calculate these limitations is to account for production and flow variability from plant to plant. Therefore, a unit of production or production normalizing parameter (PNP) was determined for each waste stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Each plant within the Subcategory was then analyzed to determine (1) which subdivisions were present, (2) the specific flow rates generated for each subdivision, and (3) the specific production normalized flows for each subdivision. This analysis is discussed in detail in Section V. Nonprocess wastewaters such as rainfall runoff and noncontact cooling water are not considered in the analysis.

Production normalized flows for each subdivision were then analyzed to determine the flow to be used as part of the basis for BPT mass limitations. The selected flow (sometimes referred to as a BPT regulatory flow or BPT discharge rate) reflects the water use controls which are common practices within the category. The BPT regulatory flow is based on the average of all applicable data. Plants with normalized flows above the average may have to implement some method of flow reduction to achieve the BPT limitations.

The second requirements to calculate mass limitations is the set of concentrations that are achievable by application of the BPT level of treatment technology. Section VII discusses the various control and treatment technologies which are currently in place for each wastewater source. In most cases, the current control and treatment technologies consist of chemical precipitation and sedimentation (lime and settle technology) and a combination of reuse and recycle to reduce flow.

Using these regulatory flows and the achievable concentrations, the next step is to calculate mass loadings for each wastewater source or subdivision. This calculation was made on a stream stream-by-stream basis, primarily because plants in this subcategory may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per kilogram of production unit - mg/kg) are based on multiplying the BPT regulatory flow (l/kkg) by the concentration achievable by the BPT level of treatment technology (mg/l) for each pollutant parameter to be limited under BPT. These mass loadings are published in the Federal Register and in 40 CFR Part 421 as the effluent limitations guidelines.

The mass loadings which are allowed under BPT for each plant will be the sum of the individual mass loadings for the various wastewater sources which are found at particular plants. Accordingly, all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at primary beryllium plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/kkg) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each plant.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

In balancing costs in relation to pollutant removal estimates, EPA considers the volume and nature of existing discharges, the volume and nature of discharges expected after application of BPT, the general environmental effects of the pollutants, and the cost and economic impacts of the required pollution control level. The Act does not require or permit consideration of water quality problems attributable to particular point sources or industries, or water quality improvements in particular water quality bodies. Accordingly, water quality considerations were not the basis for selecting the proposed or promulgated BPT.

The methodology for calculating pollutant removal estimates and plant compliance costs is discussed in Section X. Pollutant removal estimates have been revised since proposal to correspond to the new costs generated for promulgation. Table X-1 (page 3781) shows the estimated pollutant removal estimates for each treatment option for direct dischargers. Compliance costs for each option are presented in Table X-2 (page 3782).

BPT OPTION SELECTION - PROPOSAL

The technology basis for the proposed BPT limitations was Option A, chemical precipitation and sedimentation technology to remove metals and solids from combined wastewaters and to control pH and fluoride. This technology is already in-place at the one discharger in the subcategory. The pollutants specifically proposed for regulation at BPT were beryllium, chromium, copper, fluoride, TSS, and pH. The Agency was also considering ammonia limitations based on ammonia steam stripping and cyanide limitations based on cyanide precipitation.

Because the one discharging facility in the primary beryllium subcategory already has the BPT technology in-place, and our data indicated that the technology is achieving the proposed BPT limitations, no pollutant removal above the current discharge level and no incremental capital or annual costs were expected at proposal.

BPT OPTION SELECTION - PROMULGATION

The technology basis for the promulgated BPT limitations is Option A, recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment for selected waste streams, and chemical precipitation and sedimentation technology to remove metals and solids from combined wastewaters and to control pH and fluoride. The Agency decided to promulgate ammonia and cyanide limitations based on ammonia steam stripping and cyanide precipitation because data submitted in comments confirmed the presence of ammonia and cyanide in process waters generated in the beryllium industry. The remaining pollutants specifically promulgated for regulation at BPT are beryllium, chromium, copper, fluoride, TSS, and pH.

Ammonia steam stripping is demonstrated at six facilities in the nonferrous metals manufacturing category. These facilities are treating ammonia bearing wastewaters associated with the production of primary tungsten, primary columbium and tantalum, primary molybdenum, secondary tungsten and cobalt, and primary zirconium and hafnium. EPA believes that performance data from the iron and steel manufacturing category provide a valid measure of this technology's performance on nonferrous metals manufacturing category wastewater because raw wastewater concentrations of ammonia are of the same order of magnitude in the respective raw wastewater matrices.

Chemical analysis data were collected of raw waste (treatment influent) and treated waste (treatment effluent) from one coke plant of the iron and steel manufacturing category. A contractor for EPA, using EPA sampling and chemical analysis protocols, collected six paired samples in a two-month period. These data are the data base for determining the effectiveness of ammonia steam stripping technology and are contained within the public record supporting this document. Ammonia treatment at this coke plant consisted of two steam stripping columns in series with steam injected countercurrently to the flow of the wastewater. A lime reactor for pH adjustment separated the two stripping columns.

The Agency has verified the promulgated steam stripping performance values using steam stripping data collected at a zirconium-hafnium plant, which has raw ammonia levels as high as any in the nonferrous metals manufacturing category. Data collected by the plant represent almost two years of daily operations, and support the long-term mean used to establish treatment effectiveness.

In addition, data submitted by a primary columbium-tantalum plant, which also has significant raw ammonia levels, verifies the promulgated steam stripping performance values.

Cyanide precipitation technology is required for the primary beryllium subcategory because existing treatment within the subcategory does not effectively remove cyanide. Cyanide precipitation is directed at control of free and complexed cyanides. This subcategory collectively discharges approximately 536 kg/yr of cyanide. The achievable performance is transferred from three well-operated coil coating plants in the coil coating category, and are contained within the public record supporting this document. The Agency believes this technology, and the achievable concentration limits, are transferable to the primary beryllium subcategory because raw wastewater cyanide concentrations (prior to dilution with waste streams without cyanide) are of the same order of magnitude in both categories. Further, no pollutants were identified in primary beryllium wastewater that would interfere with the operation or performance of this technology.

Implementation of the promulgated BPT limitations is estimated to remove 2,698 kilograms of priority pollutants, 70,000 kilograms of ammonia and 313 kilograms of TSS from raw wastewater annually. The estimated capital cost for achieving promulgated BPT is $226,500 and the annual cost is estimated at $251,200 (1982 dollars). A schematic representation of the selected BPT treatment option is presented in Figure IX-1 (page 3763).

Revisions to the promulgated BPT limitations are identical to the revisions to the promulgated BAT limitations which are discussed in Section X.

WASTEWATER DISCHARGE RATES

A BPT discharge rate is calculated for each subdivision based on the average of the flows of all representative existing plants, as determined from analysis of dcp. The discharge rate is used with the achievable treatment concentrations to determine BPT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the 16 wastewater sources are discussed below and summarized in Table IX-1. The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table IX-1.

Section V of this document further describes the discharge flow rates and presents the water use and discharge flow rates for each plant by subdivision in Tables V-1 through V-10 (pages 3663 - 3666).

As discussed in Section V of this document, six new building blocks have been added to this subcategory, and the production normalized flow for one additional building block, beryllium hydroxide filtrate, was revised based on more detailed data acquired since promulgation of the original rulemaking.

SOLVENT EXTRACTION RAFFINATE FROM BERTRANDITE ORE

The proposed and promulgated BPT wastewater discharge rate for solvent extraction raffinate from bertrandite ore is 2,246,000 l/kkg (538,200 gal/ton) of beryllium carbonate precipitated (as beryllium). This rate is allocated only for those plants which extract beryllium from an acid solution generated by leaching bertrandite ore. There is currently only one plant which practices this operation.

Water use and discharge rates are presented in Table V-1 (page 3663). The BPT wastewater discharge rate for solvent extraction raffinate from bertrandite ore is based on the value reported by the one facility which currently generates this waste stream.

SOLVENT EXTRACTION RAFFINATE FROM BERYL ORE

The BPT wastewater discharge rate proposed for solvent extraction raffinate from beryl ore was 200,000 l/kkg (47,900 gal/ton) of beryllium carbonate precipitated (as beryllium). This rate was allocated only for those plants which extract beryllium from an acid solution generated by leaching beryl ore. After proposal, EPA received comments from the industry requesting an increase in the discharge allowance for this waste stream. The Agency evaluated the new flow and production data submitted and based on that it is promulgating a new discharge rate.

The BPT wastewater discharge rate promulgated for solvent extraction raffinate from beryl ore is 220,000 l/kkg (52,720 gal/ton) of beryllium carbonate precipitated (as beryllium). This rate is allocated only for those plants which extract beryllium from an acid solution generated by leaching beryl ore.

Water use and discharge rates are presented in Table V-2 (page 3663). The BPT wastewater discharge rate for solvent extraction raffinate from beryl ore processing is based on the value reported by the one facility reporting this waste stream.

BERYLLIUM CARBONATE FILTRATE

The proposed and promulgated BPT wastewater discharge rate for beryllium carbonate filtrate is 214,500 l/kkg (51,400 gal/ton) of beryllium carbonate precipitated (as beryllium). This rate is allocated only for those plants which precipitate beryllium from solution as beryllium carbonate. There is currently only one plant which practices this operation.

Water use and discharge rates are presented in Table V-3 (page 3663). The BPT wastewater discharge rate for beryllium carbonate filtrate is based on the value reported by the one facility which currently generates this waste stream.

BERYLLIUM HYDROXIDE FILTRATE

The proposed and promulgated BPT wastewater discharge rate for beryllium hydroxide filtrate was 52,660 l/kkg (12,620 gal/ton) of beryllium hydroxide produced (as beryllium). However, based on more detailed information not available at the time of the original rulemaking, EPA has revised the BPT wastewater discharge rate to be 136,000 l/kkg (32,600 gal/ton) of beryllium hydroxide produced (as beryllium). This rate is allocated only for those plants which produce beryllium hydroxide from bertrandite or beryl ore. Water use and discharge rates are presented in Table V-4 (page 3664).

BERYLLIUM OXIDE CALCINING FURNACE WET AIR POLLUTION CONTROL

The proposed and promulgated BPT wastewater discharge rate for beryllium oxide calcining furnace wet air pollution control is 263,700 l/kkg (63,190 gal/ton) of beryllium oxide produced. Since proposal, industry comments to EPA have indicated that recycle is presently practiced for this waste stream at a rate of greater than 90 percent. This rate is allocated only for those plants which use wet air pollution control devices to control emissions from beryllium oxide calcining furnaces. Water use and discharge rates are presented in Table V-5 (page 3664).

BERYLLIUM HYDROXIDE SUPERNATANT

The BPT wastewater discharge rate proposed for beryllium hydroxide supernatant was 104,324 l/kkg (25,000 gal/ton) of beryllium hydroxide produced from scrap and residues (as beryllium). This rate was allocated only for those plants which recover beryllium from residues and scrap by dissolution in sulfuric acid and precipitation of beryllium as beryllium hydroxide. After proposal, EPA received comments from the industry requesting an increase in the discharge allowance for this waste stream. The Agency evaluated the new flow and production data submitted and based on that it is promulgating a new discharge rate. The BPT wastewater discharge rate promulgated for beryllium hydroxide supernatant is 430,000 l/kkg (54,120 gal/ton) of beryl-lium hydroxide produced from scrap and residues (as beryllium). This rate is allocated only for those plants which recover beryl-lium from residues and scrap by dissolution in sulfuric acid and precipitation of beryllium as beryllium hydroxide.

This discharge allowance includes all water generated from the beryllium hydroxide recovery operation. Because this operation includes scrap recycled from external sources, it is technically a secondary as well as primary beryllium operation. The Agency is, however, considering this as a primary beryllium operation for the purposes of this regulation. In establishing the BPT flow rate, it has given full consideration to the amount of wastewater generated due to the secondary nature of this operation. Water use and discharge rates are presented in Table V-6 (page 3664).

PROCESS WATER

At proposal, this waste stream was called process condensates. At proposal no BPT wastewater discharge allowance for process condensates was provided. Based on the available data, EPA believed that this facility reuses all of this water in scrubbing systems and other plant uses.

Industry comments after proposal clarified the process condensates collection and reuse system, and indicated that periodic discharges have to be made from the process water pit to prevent dissolved solids build-up. Information was supplied to the Agency so that a discharge rate for process water could be calculated.

The BPT wastewater discharge rate promulgated for process water is 174,800 l/kkg (41,890 gal/ton) of beryllium pebbles produced. This rate is allocated only for those plants which collect process condensates generated from the manufacture of beryllium metal and discharge this process water after extensive recycle in various plant applications. Water use and discharge rates are presented in Table V-7 (page 3668).

FLUORIDE FURNACE SCRUBBER

The BPT wastewater discharge rate proposed for fluoride furnace scrubber water was 2,205 l/kkg (530 gal/ton) of beryllium metal pebbles produced. This rate was allocated only for those plants which produce beryllium fluoride (BeF_2) intermediate by heating ammonium beryllium fluoride in a furnace.

Industry comments submitted to the EPA after proposal regarding the fluoride furnace scrubber indicated that this scrubber does not generate a discharge. Scrubber liquor is extensively recycled, makeup water is taken from the process water pit, and a bleed stream is reused in ammonium bifluoride preparation. For this reason, EPA is not providing a discharge allowance for the fluoride furnace scrubber water.

The BPT wastewater discharge rate promulgated for fluoride furnace scrubber water is zero. The Agency believes that, based on demonstrated practice, any facility which operates a fluoride furnace scrubber can achieve zero discharge through recycle and reuse.

CHIP TREATMENT WASTEWATER

At proposal, this waste stream was called chip leaching. The BPT wastewater discharge rate for proposed chip leaching wastewater was 4,742 l/kkg (1,138 gal/ton) of beryllium scrap chips treated. This rate was allocated only for those plants which treat beryllium scrap chips with nitric acid prior to vacuum casting. After proposal, EPA received comments from the industry requesting an increase in the discharge allowance for this waste stream. The Agency evaluated the new flow and production data submitted and based on those, it is promulgating a new discharge rate.

The BPT wastewater discharge rate promulgated for chip treatment wastewater is 7.750 l/kkg (1,860 gal/ton) of beryllium scrap chips treated. This rate is allocated only for those plants which treat beryllium scrap chips with nitric acid prior to vacuum casting. Water use and discharge rates are presented in Table V-9 (page 3665).

BERYLLIUM PEBBLE PLANT AREA VENT WET AIR POLLUTION CONTROL

A BPT pollutant discharge allowance for beryllium pebble plant area vent scrubber wastewater was not proposed because of incomplete information about the scrubbers that use water from or recirculate into the process water pit. Industry comments have clarified the recycle, reuse, and discharge practices of these scrubbers. After evaluating the new information, EPA has added a tenth subdivision.

The BPT wastewater discharge rate used at promulgation for beryllium pebble plant area vent scrubber wastewater is zero. Presently, one plant operates a pebble plant scrubber which obtains makeup water from the process water pit, and discharges a scrubber liquor bleed stream back to the process water pit. Because a separate discharge allowance is being promulgated for process water discharge, the Agency did not believe it necessary to give an additional discharge allowance for the beryllium pebble plant scrubber wastewater.

ADDITIONAL BUILDING BLOCKS

The BPT discharge rates for the six new building blocks are identical to the production normalized wastewater flows presented for these streams in Section V. These BPT flows would be applicable to plants processing bertrandite ore and beryl ore into beryllium hydroxide or beryllium carbonate products.

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination and evaluation was presented in Section VI. A total of eight pollutants or pollutant parameters are selected for limitation under BPT and are listed below:

117. beryllium
119. chromium
120. copper
121. cyanide
ammonia
fluoride
TSS
pH

EFFLUENT LIMITATIONS

The treatable concentrations achievable by application of the promulgated BPT are discussed in Section VII of Vol. I and summarized there in Table VII-21 (page 248), with one exception. The one exception is the fluoride treatment effectiveness concentration for the beryllium hydroxide supernatant subdivision, which has been revised from 14.6 mg/l to 170 mg/l, based on the unusually high concentration of total dissolved solids (TDS) in that wastewater stream. These treatable concentrations (both one day maximum and monthly average values) are multiplied by the BPT normalized discharge flows summarized in Table IX-1 (page 3781) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the BPT effluent limitations and are presented in Table IX-2 (page 3782) for each individual waste stream.

TABLE IX-1

BPT WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	BPT Normalized Discharge Rate 103 l/kkg	BPT Normalized Discharge Rate 103 gal/ton	Productin Normalized Parameter
Solvent extraction raffinate from bertrandite ore	2,246	538.2	Beryllium carbonate produced from bertrandite ore as beryllium
Solvent extraction raffinate from beryl ore	220.0	52.72	Beryllium carbonate produced from beryl ore as beryllium
Beryllium carbonate filtrate	214.5	51.40	Beryllium carbonate produced as beryllium
Beryllium hydroxide filtrate	136.0	32.6	Beryllium hydroxide produced as beryllium
Beryllium oxide calcining furnace wet air pollution control	263.7	63.19	Beryllium oxide produced
Beryllium hydroxide supernatant	230.0	55.12	Beryllium hydroxide produced from scrap and residues as beryllium
Process water	174.8	41.89	Beryllium pebbles produced
Fluoride furnace scrubber	0	0	Beryllium pebbles produced
Chip treatment wastewater	7.75	1.86	Beryllium scrap chips treated
Beryllium pebble plant area vent wet air pollution control	0	0	Beryllium pebbles produced

TABLE IX-1 (Continued)

BPT WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	BPT Normalized Discharge Rate 103 l/kkg	103 gal/ton	Productin Normalized Parameter
Beryllium ore gangue dewatering	1.043	0.25	Beryllium ore processed
Bertrandite ore gangue dewatering	2.665	0.639	Bertrandite ore processed
Beryllium ore processing	7.303	1.75	Beryllium ore processed
AIS area wastewater	468.0	112.1	Total beryllium carbonate produced as beryllium
Bertrandite ore leaching scrubber	1.511	0.362	Bertrandite ore processed
Bertrandite ore counter current decantation scrubber	0.101	0.024	Bertrandite ore processed

TABLE IX-2

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(a) Solvent Extraction Raffinate from Bertrandite Ore BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore (as Be)		
Beryllium	2,763.000	1,235.000
Chromium	988.200	404.300
Copper	4,267.000	2,246.000
Cyanide	651.300	269.500
Ammonia	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000
TSS	92,090.000	43,800.000
pH	Within the range of 7.5 to 10.0 at all times	

(b) Solvent Extraction Raffinate from Beryl Ore BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore (as Be)		
Beryllium	270.600	121.000
Chromium	96.800	39.600
Copper	418.000	220.000
Cyanide	63.800	26.400
Ammonia	29,330.000	12,890.000
Fluoride	7,700.000	4,378.000
TSS	9,020.000	4,290.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(c) Beryllium Carbonate Filtrate BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced (as Be)		
Beryllium	.800	118.000
Chromium	94.380	38.610
Copper	407.600	214.500
Cyanide	62.210	25.740
Ammonia	28,590.000	12,570.000
Fluoride	7,508.000	4,269.000
TSS	8,795.000	4,183.000
pH	Within the range of 7.5 to 10.0 at all times	

(d) Beryllium Hydroxide Filtrate BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced (as Be)		
Beryllium	167.300	74.800
Chromium	59.840	24.480
Copper	258.400	136.000
Cyanide	39.440	16.320
Ammonia	18,130.000	7,970.000
Fluoride	4,760.000	2,706.000
TSS	5,576.000	2,652.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(e) Beryllium Oxide Calcining Furnace Wet APC BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	324.400	145.000
Chromium	116.000	47.470
Copper	501.000	263.700
Cyanide	76.470	31.640
Ammonia	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000
TSS	10,810.000	5,142.000
pH	Within the range of 7.5 to 10.0 at all times	

(f) Beryllium Hydroxide Supernatant BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced from scrap and residues (as Be)		
Beryllium	282.900	126.500
Chromium	101.200	41.400
Copper	437.000	230.000
Cyanide	66.700	27.600
Ammonia	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000
TSS	9,430.000	4,485.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(g) Process Water BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	215.000	96.140
Chromium	76.910	31.460
Copper	332.100	174.800
Cyanide	50.690	20.980
Ammonia	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000
TSS	7,167.000	3,409.000
pH	Within the range of 7.5 to 10.0 at all times	

(h) Fluoride Furnace Scrubber BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(i) Chip Treatment Wastewater BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	9.533	4.263
Chromium	3.410	1.395
Copper	14.730	7.750
Cyanide	2.248	.930
Ammonia	1,033.000	454.200
Fluoride	271.300	154.200
TSS	317.800	151.100
pH	Within the range of 7.5 to 10.0 at all times	

(j) Beryllium Pebble Plant Area Vent Wet APC BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(k) Beryl Ore Gangue Dewatering BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	1.283	0.574
Chromium (Total)	0.459	0.188
Copper	1.982	1.043
Cyanide (Total)	0.302	0.125
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756
Total Suspended Solids	42.763	20.339
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Bertrandite Ore Gangue Dewatering BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of bertrandite ore processed		
Beryllium	3.279	1.466
Chromium (Total)	1.173	0.480
Copper	5.064	2.665
Cyanide (Total)	0.773	0.320
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034
Total Suspended Solids	109.265	51.968
pH	Within the range of 7.5 to 10.0 at all times.	

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(m) Beryl Ore Processing BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	8.983	4.017
Chromium (Total)	3.213	1.315
Copper	13.876	7.303
Cyanide (Total)	2.118	0.876
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330
Total Suspended Solids	299.423	142.409
pH	Within the range of 7.5 to 10.0 at all times.	

BPT
(n) Aluminum Iron Sludge (AIS) Area Wastewater BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (pounds per million pounds) of total beryllium carbonate produced (as Be)		
Beryllium	575.640	257.400
Chromium (Total)	205.920	84.240
Copper	889.200	468.000
Cyanide (Total)	135.720	56.160
Ammonia (as N)	62384.400	27424.800
Fluoride	16380.000	9313.200
Total Suspended Solids	19188.000	9126.000
pH	Within the range of 7.5 to 10.0 at all times.	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(o) Bertrandite Ore Leaching Scrubber BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kg of bertrandite ore processed	
Beryllium	1.859	0.831
Chromium (Total)	0.665	0.272
Copper	2.871	1.511
Cyanide (Total)	0.438	0.181
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069
Total Suspended Solids	61.951	29.465
pH	Within the range of 7.5 to 10.0 at all times.	

(p) Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kg of bertrandite ore processed	
Beryllium	0.124	0.056
Chromium (Total)	0.044	0.018
Copper	0.192	0.101
Cyanide (Total)	0.029	0.012
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010
Total Suspended Solids	4.141	1.970
pH	Within the range of 7.5 to 10.0 at all times.	

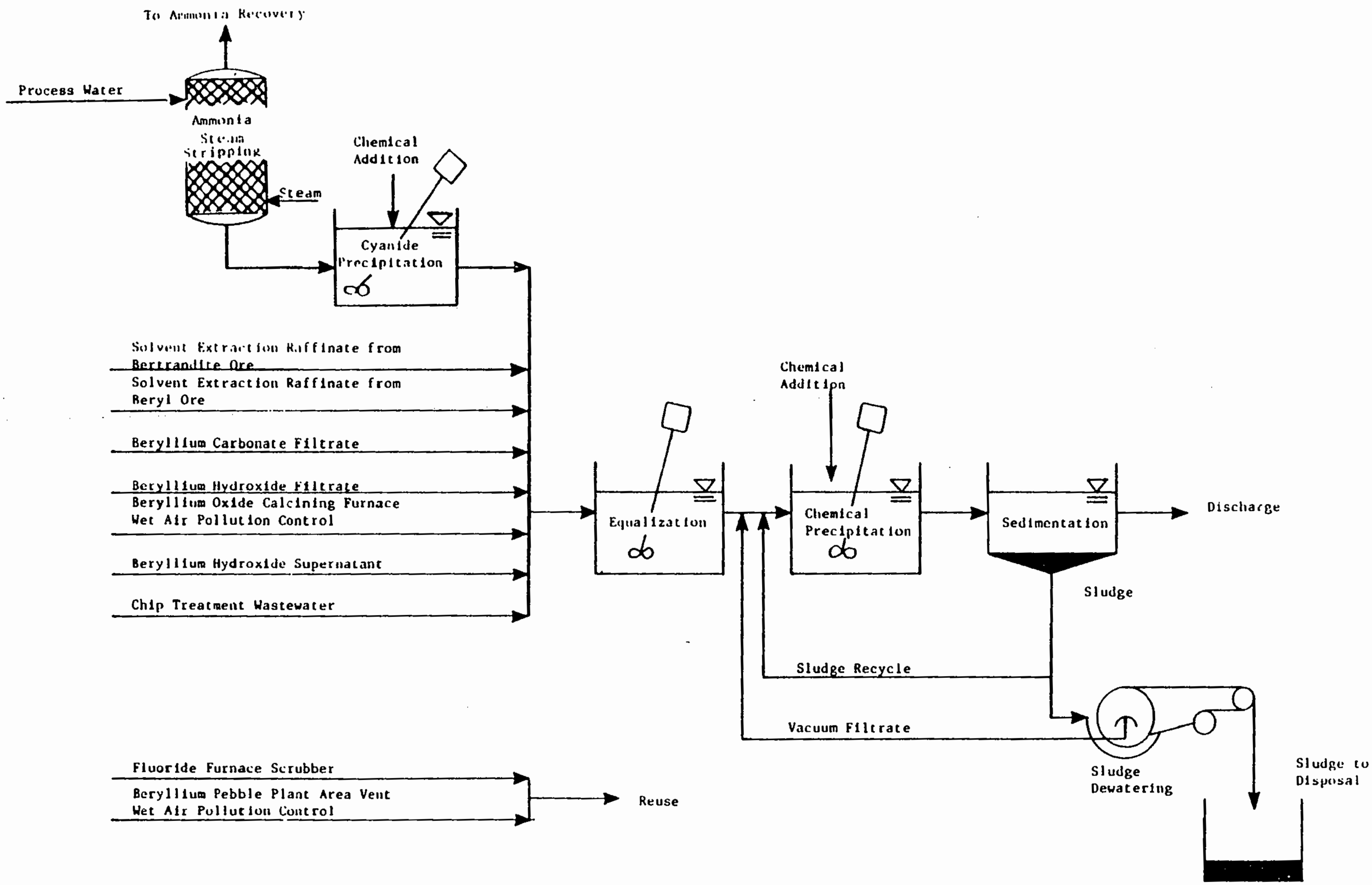

Figure IX-1

BPT TREATMENT SCHEME

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SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

These effluent limitations 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. BAT represents the best available technology economically achievable at plants of various ages, sizes, processes, or other characteristics. BAT may be transferred from a different subcategory or category and 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 pollutant removals. However, in assessing BAT, the Agency has given substantial weight to the economic achievability of the technology.

TECHNICAL APPROACH TO BAT

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 two technology options which could be applied to the primary beryllium subcategory as alternatives for the basis of BAT effluent limitations.

For the development of BAT effluent limitations, mass loadings were calculated for each wastewater source or subdivision in the subcategory using the same technical approach as described in Section IX for BPT limitations development. The differences in the mass loadings for BPT and BAT are due to increased treatment effectiveness achievable with the more sophisticated BAT treatment technology and reductions in the effluent flows allocated to various waste streams.

The treatment technologies considered for BAT are summarized below:

Option A (Figure X-1, page 3791) is based on:

- o Recycle of scrubber liquors

- o Ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams
- o Chemical precipitation and sedimentation

Option C (Figure X-2, page 3792) is based on:

- o Recycle of scrubber liquors
- o Ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams
- o Chemical precipitation and sedimentation
- o Multimedia filtration

The two options examined for BAT are discussed in greater detail on the following pages. The first option considered (Option A) is the same as the BPT treatment and control technology which was presented in the previous section. The section option represents substantial progress toward the reduction of pollutant discharges above and beyond the progress achievable by BPT.

OPTION A

Option A for the primary beryllium subcategory is equivalent to the control and treatment technologies which were analyzed for BPT in Section IX (see Figure X-1). The BPT end-of-pipe treatment scheme includes recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation and sedimentation. The discharge rates for Option A are Equal to the discharge rates allocated to each stream as a BPT discharge flow.

OPTION C

Option C for the primary beryllium subcategory consists of all control and treatment requirements of Option A (recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment, followed by chemical precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme (see Figure X-2). Multimedia filtration is used to remove suspended solids, including precipitates of toxic metals, beyond the concentrations attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other forms of filters, such as rapid sand filters or pressure filters, would perform satisfactorily.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

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

POLLUTANT REMOVAL ESTIMATES

A complete description of the methodology used to calculate the estimated pollutant removal achieved by the application of the various treatment options is presented in Section X of Vol. I. The pollutant removal estimates have been revised from proposal because of new production normalized flows for several subdivisions. The methodology for calculating pollutant removals has not changed, and the data used to estimate removals are the same as those used to revise compliance costs.

Sampling data collected during the field sampling program were used to characterize the major waste streams considered for regulation. At each sampled facility, the sampling data was production normalized for each unit operation (i.e., mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste, was used to estimate the mass of toxic pollutants generated within the primary beryllium subcategory. The pollutant removal estimates were calculated for each plant by first estimating the total mass of each pollutant in the untreated wastewater. This was calculated by first multiplying the raw waste values by the corresponding production value for that stream and then summing these values for each pollutant for every stream generated by the plant.

Next, the volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable with the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed is the difference between the estimated mass of pollutant generated by each plant in the subcategory and the mass of pollutant discharged after application of the treatment option. The pollutant removal estimates for direct dischargers in the primary beryllium subcategory are presented in Table X-1 (page 3981).

COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop a cost estimation model, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied the model to each plant. The plant's investment and operating costs are determined by what treatment it has in place and by its individual process wastewater discharge flow. As discussed above, this flow is either the actual or the BAT regulatory flow, whichever is lesser. The final step was to annualize the capital costs, and to sum the annualized capital costs, and the operating and maintenance costs for each plant, yielding the cost of compliance for the subcategory. A comparison of the costs developed for proposal and the revised costs for promulgation are presented in Table X-2 (page 3782) for direct dischargers in the primary beryllium subcategory. These costs were used in assessing economic achievability.

BAT OPTION SELECTION - PROPOSAL

Our proposed BAT limitations for this subcategory were based on chemical precipitation and sedimentation (BPT technology), with the addition of in-process wastewater reduction, and filtration. Flow reduction was based on 90 percent recycle of beryllium oxide calcining furnace wet air pollution control. The pollutants specifically limited under BAT were beryllium, chromium, copper, and fluoride.

Implementation of the proposed BAT limitations would remove annually an estimated 257 kg of priority pollutants, which is 8 kg of priority metals over the estimated BPT discharge.

BAT OPTION SELECTION - PROMULGATION

EPA promulgated BAT limitations for the primary beryllium subcategory based on recycle of scrubber liquors, ammonia steam stripping, and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation, sedimentation, and multimedia filtration technology. Flow reduction beyond what is currently practiced was not promulgated because industry comments to the Agency indicated that this scrubber is presently operated with recycle. The Agency decided that further recycle for this scrubber is not feasible.

The pollutants specifically limited under promulgated BAT are beryllium, chromium, copper, cyanide, ammonia, and fluoride. The Agency decided to promulgate ammonia and cyanide limitations based on ammonia steam stripping and cyanide precipitation because data submitted in comments confirmed the presence of ammonia and cyanide in process waters generated in the beryllium industry.

Implementation of the promulgated BAT limitations would remove annually an estimated 2,705 kilograms of priority pollutants and 524 kilograms of TSS, which is 7 kilograms of priority metals and 211 kilograms of TSS over the estimated BPT removals. The estimated capital cost of promulgated BAT is $256,200 and the estimated annual cost is $265,600 (1982 dollars). The end-of-pipe treatment configuration for Option C is presented in Figure X-2.

FINAL AMENDMENTS TO THE REGULATION

For the Primary Beryllium Subcategory, EPA prepared a settlement agreement in April 1987 which would amend the regulation promulgated on September 20, 1985, (50 FR 38276), concerning four topics, which are briefly described here.

EPA agreed to revise the treatment effectiveness concentration for fluoride in the beryllium hydroxide supernatant subdivision, based on the unusually high concentration of total dissolved solids in this waste stream.

EPA agreed to revise the regulatory flow for the beryllium hydroxide filtrate building block based upon more detailed information not available to EPA at the time of the original rulemaking.

EPA agreed to add new building blocks for the following six processes in this subcategory: beryl ore gangue dewatering, bertrandite ore gangue dewatering, beryl ore processing (comprises quench pit, scrubber and washdown), AIS area wastewater, bertrandite ore leaching scrubber, and bertrandite ore countercurrent decantation scrubber.

EPA agreed to allow modification of the monitoring requirements for cyanide at any beryllium manufacturing facility which certifies that it does not use or generate cyanide at the facility. This modification would allow yearly cyanide monitoring.

WASTEWATER DISCHARGE RATES

A BAT discharge rate was calculated for each subdivision based upon the flows of the existing plants, as determined from analysis of the data collection portfolios. The discharge rate is used with the achievable treatment concentrations to determine BAT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the 10 wastewater sources were determined and are summarized in Table 10-3. The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table X-4 (page 3785).

At proposal, the BAT discharge rates reflected the flow reduction requirements of the selected BAT option. For this reason, the one scrubber water which was targeted for flow reduction through recycle for BAT had a lower flow rate than the corresponding BPT flow. Since several plants in other subcategories have demonstrated sufficient ability to achieve substantial recycle of similar wastewaters, lower flow allowances for this steam were believed to represent the best available technology economically achievable.

The proposed BAT discharge rate for beryllium oxide calcining furnace wet air pollution control water was based on 90 percent recycle of the scrubber effluent (refer to Section VII of the General Development Document). Consequently, the proposed BAT production normalized discharge flow for beryllium oxide calcining furnace wet air pollution control was 26,373 l/kkg (6,320 gal/ton) of beryllium oxide produced.

Since proposal, industry comments to EPA have indicated that recycle is presently practiced for the beryllium oxide calcining furnace scrubber, and to require additional recycle at BAT would be unachievable. Upon evaluation of the data, the Agency decided not to require any recycle beyond what is presently practiced. Thus, the promulgated BAT discharge allowance for beryllium oxide calcining furnace wet air pollution control is 263,700 l/kkg (63,190 gal/ton) of beryllium oxide produced. This discharge rate is equivalent to that promulgated at BPT.

REGULATED POLLUTANT PARAMETERS

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 was presented in Section VI. The pollutants selected for specific limitation are listed below:

117. beryllium
119. chromium
120. copper
121. cyanide
ammonia
fluoride

EFFLUENT LIMITATIONS

The concentrations achievable by application of BAT are discussed in Section VII. The treatable concentrations both one day maximum and monthly average values are multiplied by the BAT normalized discharge flows summarized in Table X-3 (page 3783) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the BAT effluent limitations and are presented in Table X-4 (page 3785) for each waste stream.

Table X-1

POLLUTANT REMOVAL ESTIMATES
PRIMARY BERYLLIUM SUBCATEGORY

Pollutant	Raw Waste (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)
Antimony	0.0225	0.0225	0.0000	0.0225	0.0000
Arsenic	1.7080	1.7080	0.0000	1.7080	0.0000
Beryllium	2,157.5560	6.7420	2,150.8140	4.4947	2,153.0613
Cadmium	0.4495	0.4495	0.0000	0.4495	0.0000
Chromium (Total)	2.2698	1.8878	0.3820	1.5731	0.6967
Copper	26.0466	13.0346	13.0121	8.7646	17.2820
Cyanide (Total)	535.7427	1.5731	534.1696	1.0562	534.6864
Lead	0.0225	0.0225	0.0000	0.0225	0.0000
Mercury	0.0225	0.0225	0.0000	0.0225	0.0000
Nickel	0.9439	0.9439	0.0000	0.9439	0.0000
Selenium	0.0000	0.0000	0.0000	0.0000	0.0000
Silver	0.4944	0.4944	0.0000	0.4944	0.0000
Thallium	0.0000	0.0000	0.0000	0.0000	0.0000
Zinc	2.1574	2.1574	0.0000	2.1574	0.0000
TOTAL PRIORITY POLLUTANTS	2,727.4358	29.0581	2,698.3777	21.7093	2,705.7265
Ammonia	70,666.2800	723.6426	69,942.6374	723.6426	69,942.6374
Fluoride	58,657.8587	325.8639	58,331.9949	325.8639	58,331.9949
TOTAL NONCONVENTIONALS	129,324.1387	1,049.5064	128,274.6323	1,049.5064	128,274.6323
TSS	582.2401	269.6805	312.5596	58.4308	523.8093
Oil and Grease	179.6746	179.6746	0.0000	179.6746	0.0000
TOTAL CONVENTIONALS	761.9147	449.3551	312.5596	238.1054	523.8093
TOTAL POLLUTANTS	132,813.4892	1,527.9196	131,285.5696	1,309.3211	131,504.1681

TABLE X-2

COST OF COMPLIANCE FOR THE PRIMARY BERYLLIUM SUBCATEGORY
DIRECT DISCHARGERS

(March 1982 Dollars)

Option	Capital Cost	Annual Cost
A	226500	251200
B	256200	265600

Table X-3

BAT WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rate 103 l/kkg	BAT Normalized Discharge Rate 103 gal/ton	Productin Normalized Parameter
Solvent extraction raffinate from bertrandite ore	2,246	538.2	Beryllium carbonate produced from bertrandite ore as beryllium
Solvent extraction raffinate from beryl ore	220.0	52.72	Beryllium carbonate produced from beryl ore as beryllium
Beryllium carbonate filtrate	214.5	51.40	Beryllium carbonate produced as beryllium
Beryllium hydroxide filtrate	136.0	32.6	Beryllium hydroxide produced as beryllium
Beryllium oxide calcining furnace wet air pollution control	263.7	63.19	Beryllium oxide produced
Beryllium hydroxide supernatant	230.0	55.12	Beryllium hydroxide produced from scrap and residues as beryllium
Process water	174.8	41.89	Beryllium pebbles produced
Fluoride furnace scrubber	0	0	Beryllium pebbles produced
Chip treatment wastewater	7.75	1.86	Beryllium scrap chips treated
Beryllium pebble plant area vent wet air pollution control	0	0	Beryllium pebbles produced

Table X-3 (Continued)

BAT WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rate 103 l/kkg	BAT Normalized Discharge Rate 103 gal/ton	Productin Normalized Parameter
Beryllium ore gangue dewatering	1.043	0.25	Beryllium ore processed
Bertrandite ore gangue dewatering	2.665	0.639	Bertrandite ore processed
Beryllium ore processing	7.303	1.75	Beryllium ore processed
AIS area wastewater	468.0	112.1	Total beryllium carbonate produced as beryllium
Bertrandite ore leaching scrubber	1.511	0.362	Bertrandite ore processed
Bertrandite ore counter current decantation scrubber	0.101	0.024	Bertrandite ore processed

TABLE X-4

BAT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(a) Solvent Extraction Raffinate from Bertrandite Ore BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore (as Be)		
Beryllium	1,842.000	831.000
Chromium	831.000	336.900
Copper	2,875.000	1,370.000
Cyanide	449.200	179.700
Ammonia	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000

(b) Solvent Extraction Raffinate from Beryl Ore BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore (as Be)		
Beryllium	180.400	81.400
Chromium	81.400	33.000
Copper	281.600	134.200
Cyanide	44.000	17.600
Ammonia	29,330.000	12,890.000
Fluoride	7,700.000	4,378.000

(c) Beryllium Carbonate Filtrate BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced (as Be)		
Beryllium	175.900	79.370
Chromium	79.370	32.180
Copper	274.600	130.800
Cyanide	42.900	17.160
Ammonia	28,590.000	12,570.000
Fluoride	7,508.000	4,269.000

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(d) Beryllium Hydroxide Filtrate BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced (as Be)		
Beryllium	111.520	50.320
Chromium	50.320	20.400
Copper	174.080	82.960
Cyanide	27.200	10.880
Ammonia	18,128.800	7,969.600
Fluoride	4,760.000	2,706.400

(e) Beryllium Oxide Calcining Furnace Wet APC BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	216.200	97.570
Chromium	97.570	39.560
Copper	337.500	160.900
Cyanide	52.740	21.100
Ammonia	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000

(f) Beryllium Hydroxide Supernatant BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced,from scrap and residues (as Be)		
Beryllium	188.600	85.100
Chromium	85.100	34.500
Copper	294.400	140.300
Cyanide	46.000	18.400
Ammonia	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(g) Process Water BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	143.300	64.680
Chromium	64.680	26.220
Copper	223.700	106.600
Cyanide	34.960	13.980
Ammonia	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000

(h) Fluoride Furnace Scrubber BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000

(i) Chip Treatment Wastewater BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	6.355	2.868
Chromium	2.868	1.163
Copper	9.920	4.728
Cyanide	1.550	.620
Ammonia	1,033.000	454.200
Fluoride	271.300	154.200

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(j) Beryllium Pebble Plant Area Vent Wet APC BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000

(k) Beryl Ore Gangue Dewatering BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	0.855	0.386
Chromium (Total)	0.386	0.156
Copper	1.335	0.636
Cyanide (Total)	0.209	0.083
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756

(l) Bertrandite Ore Gangue Dewatering BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of bertrandite ore processed		
Beryllium	2.185	0.986
Chromium (Total)	0.986	0.400
Copper	3.411	1.626
Cyanide (Total)	0.533	0.213
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(m) Beryl Ore Processing BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	5.988	2.702
Chromium (Total)	2.702	1.095
Copper	9.348	4.455
Cyanide (Total)	1.461	0.584
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330

(n) Aluminum Iron Sludge (AIS) Area Wastewater BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of total beryllium carbonate produced (as Be)		
Beryllium	383.760	173.160
Chromium (Total)	173.160	70.200
Copper	599.040	285.480
Cyanide (Total)	93.600	37.440
Ammonia (as N)	62,384.400	27,424.800
Fluoride	16,380.000	9,313.200

(o) Bertrandite Ore Leaching Scrubber BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg of bertrandite ore processed		
Beryllium	1.239	0.559
Chromium (Total)	0.559	0.227
Copper	1.934	0.922
Cyanide (Total)	0.302	0.121
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(p) Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg of bertrandite ore processed	
Beryllium	0.083	0.037
Chromium (Total)	0.037	0.015
Copper	0.129	0.062
Cyanide (Total)	0.020	0.008
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010

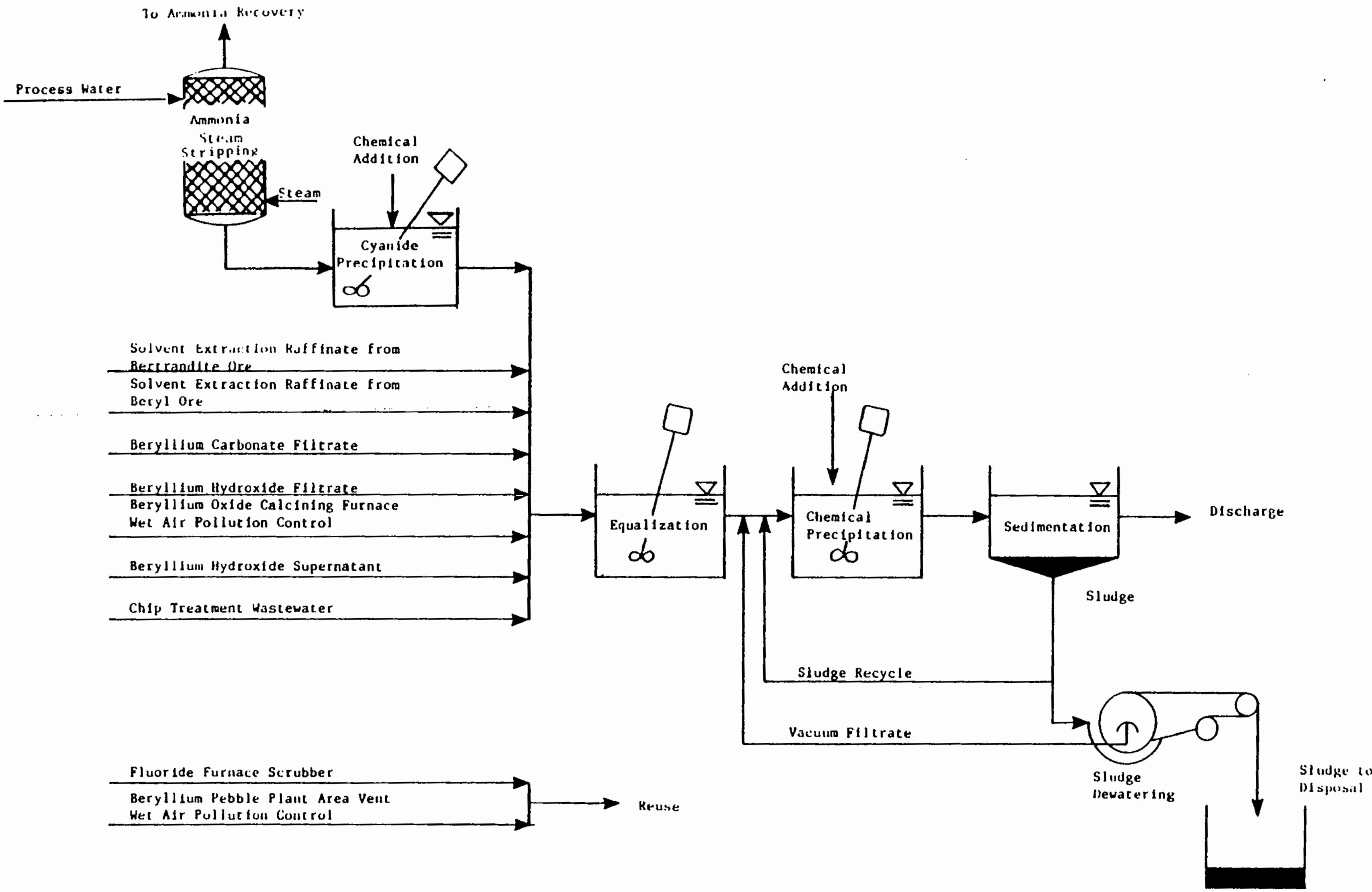

Figure X-1

BAT TREATMENT SCHEME FOR OPTION A

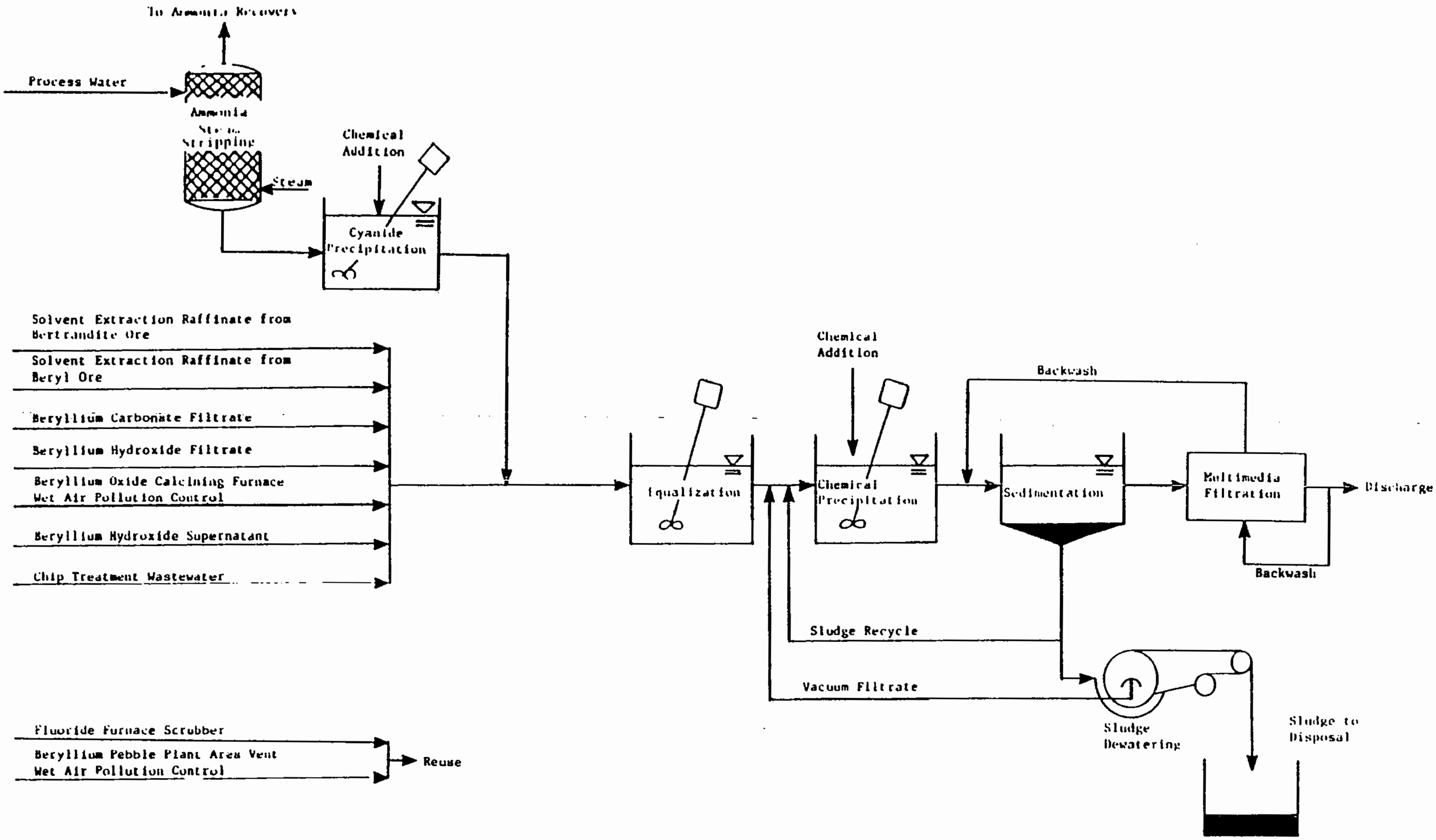

Figure X-2

BAT TREATMENT SCHEME FOR OPTION C

SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

This section describes the technologies for treatment of wastewater from new sources and presents mass discharge standards for regulated pollutants for NSPS in the primary beryllium subcategory, based on the selected treatment technology. 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, the best demonstrated process changes, in-plant controls, and end-of-pipe treatment technologies which reduce pollution to the maximum extent feasible are considered as a basis for BDT.

TECHNICAL APPROACH TO NSPS

New source performance standards are equivalent to the best available technology (BAT) selected for currently existing primary beryllium plants. This result is a consequence of careful review by the Agency of a wide range of technical options for new source treatment systems which is discussed in Section XI of Vol. I. 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. Consequently, BAT production normalized discharge rates, which are based on the best existing practices of the subcategory, can also be applied to new sources. These rates are presented in Table XI-1 (page 3796).

Treatment technologies considered for the NSPS options are identical to the treatment technologies considered for the BAT options. These options are:

OPTION A

- o Recycle of scrubber liquors
- o Ammonia steam stripping and cyanide precipitation for selected waste streams
- o Chemical precipitation and sedimentation

OPTION C

- o Recycle of scrubber liquors
- o Ammonia steam stripping and cyanide precipitation pre-treatment for selected waste streams
- o Chemical precipitation and sedimentation
- o Multimedia filtration

NSPS OPTION SELECTION - PROPOSAL

EPA proposed that the best available demonstrated technology for the primary beryllium subcategory be equivalent to Option C. At proposal, Option C included in-process flow reduction, chemical precipitation, sedimentation, and multimedia filtration technology. The Agency was also considering regulation of ammonia based on ammonia steam stripping technology, and regulation of cyanide based on cyanide precipitation.

The wastewater flow rates for NSPS were the same as the proposed BAT flow rates. Flow reduction measures beyond those proposed at BAT were not considered feasible because no new demonstrated technologies existed within the subcategory that improved on discharge practices. The pollutants proposed for regulation at NSPS were the same as those proposed for regulation at BAT, with the addition of TSS and pH.

NSPS OPTION SELECTION - PROMULGATION

EPA is promulgating best available demonstrated technology for the primary beryllium subcategory equivalent to Option C. In contrast to Option C at proposal, Option C at promulgation includes ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation, sedimentation, and multimedia filtration.

Our review of the subcategory indicates that no new demonstrated technologies that improve on BAT technology exist. We do not believe that new plants could achieve any further flow reduction beyond that already promulgated for BAT. Because NSPS is equal to BAT we believe that the promulgated NSPS will not have a detrimental impact on the entry of new plants into this subcategory.

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 selected for limitation under promulgated NSPS, in accordance with the rationale of Sections VI and X, are identical to those selected for promulgated BAT. The conventional pollutant parameters TSS and pH are also selected for limitation.

NEW SOURCE PERFORMANCE STANDARDS

The NSPS discharge flows for each wastewater source are the same as the discharge rates for BAT and are shown in Table XI-1 (page 3786). The mass of pollutant allowed to be discharged per mass of product (mg/kg) is based on the product of the appropriate treatable concentration (mg/l) and the production normalized wastewater discharge flows (l/kkg). The treatment effectiveness concentrations are listed in Table VII-21 (page 248) of Vol. I with the exception of fluoride for beryllium hydroxide supernatant, as discussed in Section IX. The results of these calculations are the production based new source performance standards. These standards are presented in Table XI-2.

TABLE XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	NSPS Normalized Discharge Rate 103 l/kkg	NSPS Normalized Discharge Rate 103 gal/ton	Productin Normalized Parameter
Solvent extraction raffinate from bertrandite ore	2,246	538.2	Beryllium carbonate produced from bertrandite ore as beryllium
Solvent extraction raffinate from beryl ore	220.0	52.72	Beryllium carbonate produced from beryl ore as beryllium
Beryllium carbonate filtrate	214.5	51.40	Beryllium carbonate produced as beryllium
Beryllium hydroxide filtrate	136.0	32.6	Beryllium hydroxide produced as beryllium
Beryllium oxide calcining furnace wet air pollution control	263.7	63.19	Beryllium oxide produced
Beryllium hydroxide supernatant	230.0	55.12	Beryllium hydroxide produced from scrap and residues as beryllium
Process water	174.8	41.89	Beryllium pebbles produced
Fluoride furnace scrubber	0	0	Beryllium pebbles produced
Chip treatment wastewater	7.75	1.86	Beryllium scrap chips treated
Beryllium pebble plant area vent wet air pollution control	0	0	Beryllium pebbles produced

TABLE XI-1 (Continued)

NSPS WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	NSPS Normalized Discharge Rate 103 1/kkg	NSPS Normalized Discharge Rate 103 gal/ton	Productin Normalized Parameter
Beryllium ore gangue dewatering	1.043	0.25	Beryllium ore processed
Bertrandite ore gangue dewatering	2.665	0.639	Bertrandite ore processed
Beryllium ore processing	7.303	1.75	Beryllium ore processed
AIS area wastewater	468.0	112.1	Total beryllium carbonate produced as beryllium
Bertrandite ore leaching scrubber	1.511	0.362	Bertrandite ore processed
Bertrandite ore counter current decantation scrubber	0.101	0.024	Bertrandite ore processed

TABLE XI-2

NSPS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(a) Solvent Extraction Raffinate from Bertrandite Ore NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore (as Be)	
Beryllium	1,842.000	831.000
Chromium	831.000	336.900
Copper	2,875.000	1,370.000
Cyanide	449.200	179.700
Ammonia	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000
TSS	33,690.000	26,950.000
pH	Within the range of 7.5 to 10.0 at all times	

(b) Solvent Extraction Raffinate from Beryl Ore NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore (as Be)	
*Beryllium	180.400	81.400
*Chromium	81.400	33.000
*Copper	281.600	134.200
*Cyanide	44.000	17.600
*Ammonia	29,330.000	12,890.000
*Fluoride	7,700.000	4,378.000
*TSS	3,300.000	2,640.000
*pH	Within the range of 7.5 to 10.0 at all times	

(c) Beryllium Carbonate Filtrate NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of beryllium carbonate produced (as Be)	
Beryllium	175.900	79.370
Chromium	79.370	32.180
Copper	274.600	130.800
Cyanide	42.900	17.160
Ammonia	28,590.000	12,570.000
Fluoride	7,508.000	4,269.000
TSS	3,218.000	2,574.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(d) Beryllium Hydroxide Filtrate NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced (as Be)		
Beryllium	111.520	50.320
Chromium	50.320	20.400
Copper	174.080	82.960
Cyanide	27.200	10.880
Ammonia	18,128.800	7,969.600
Fluoride	4,760.000	2,706.400
TSS	2,040.000	1,632.000
pH	Within the range of 7.5 to 10.0 at all times	

(e) Beryllium Oxide Calcining Furnace Wet APC NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	216.200	97.570
Chromium	97.570	39.560
Copper	337.500	160.900
Cyanide	52.740	21.100
Ammonia	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000
TSS	3,956.000	3,164.000
pH	Within the range of 7.5 to 10.0 at all times	

(f) Beryllium Hydroxide Supernatant NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced from scrap and residues (as Be)		
Beryllium	188.600	85.100
Chromium	85.100	34.500
Copper	294.400	140.300
Cyanide	46.000	18.400
Ammonia	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000
TSS	3,450.000	2,760.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(g) Process Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	143.300	64.680
Chromium	64.680	26.220
Copper	223.700	106.600
Cyanide	34.960	13.980
Ammonia	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000
TSS	2,622.000	2,098.000
pH	Within the range of 7.5 to 10.0 at all times	

(h) Fluoride Furnace Scrubber NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(i) Chip Treatment Wastewater NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	6.355	2.868
Chromium	2.868	1.163
Copper	9.920	4.728
Cyanide	1.550	.620
Ammonia	1,033.000	454.200
Fluoride	271.300	154.200
TSS	116.300	93.000
pH	Within the range of 7.5 to 10.0 at all times	

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(j) Beryllium Pebble Plant Area Vent Wet APC NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000
TSS	0.000	0.000
pH	Within the range of 7.5 to 10.0 at all times	

(k) Beryl Ore Gangue Dewatering NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	0.855	0.386
Chromium (Total)	0.386	0.156
Copper	1.335	0.636
Cyanide (Total)	0.209	0.083
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756
Total Suspended Solids	15.645	12.516
pH	Within the range of 7.5 to 10.0 at all times	

(l) Bertrandite Ore Gangue Dewatering NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of bertrandite ore processed		
Beryllium	2.185	0.986
Chromium (Total)	0.986	0.400
Copper	3.411	1.626
Cyanide (Total)	0.533	0.213
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034
Total Suspended Solids	39.975	31.980
pH	Within the range of 7.5 to 10.0 at all times	

TABLE IX-2 (Continued)

NSPS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(m) Beryl Ore Processing NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	5.988	2.702
Chromium (Total)	2.702	1.095
Copper	9.348	4.455
Cyanide (Total)	1.461	0.584
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330
Total Suspended Solids	109.545	87.636
pH	Within the range of 7.5 to 10.0 at all times	

(n) Aluminum Iron Sludge (AIS) Area Wastewater NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of total beryllium carbonate produced (as Be)		
Beryllium	383.760	173.160
Chromium (Total)	173.160	70.200
Copper	599.040	285.480
Cyanide (Total)	93.600	37.440
Ammonia (as N)	62,384.400	27,424.800
Fluoride	16,380.000	9,313.200
Total Suspended Solids	7,020.000	5,616.000
pH	Within the range of 7.5 to 10.0 at all times	

(o) Bertrandite Ore Leaching Scrubber NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg of bertrandite ore processed		
Beryllium	1.239	0.559
Chromium (Total)	0.559	0.227
Copper	1.934	0.922
Cyanide (Total)	0.302	0.121
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069
Total Suspended Solids	22.665	18.132
pH	Within the range of 7.5 to 10.0 at all times	

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(p) Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg of bertrandite ore processed	
Beryllium	0.083	0.037
Chromium (Total)	0.037	0.015
Copper	0.129	0.062
Cyanide (Total)	0.020	0.008
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010
Total Suspended Solids	1.515	1.212
pH	Within the range of 7.5 to 10.0 at all times	

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SECTION XII

PRETREATMENT STANDARDS

This section describes the control and treatment technologies for pretreatment of process wastewaters from new sources in the primary beryllium subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology. Pretreatment standards are to be technology based, analogous to the best available technology for removal of toxic pollutants.

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

TECHNICAL APPROACH TO PRETREATMENT

Before proposing and promulgating pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements, is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant.

This definition of pass-through satisfies two competing objectives set by Congress: (1) that standards for indirect dischargers be equivalent to standards for direct dischargers while at the same time, (2) that the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers.

The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources or the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

PRETREATMENT STANDARDS FOR NEW SOURCES

Options for pretreatment of wastewaters from new sources are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Sections X and XI. The options for PSNS, therefore, are the same as the BAT options discussed in Section X.

Treatment technologies considered for the PSNS options are:

OPTION A

- o Recycle of scrubber liquors
- o Ammonia steam stripping and cyanide precipitation for selected waste streams
- o Chemical precipitation and sedimentation

OPTION C

- o Recycle of scrubber liquors
- o Ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams
- o Chemical precipitation and sedimentation

PSNS OPTION SELECTION - PROPOSAL

EPA proposed that the pretreatment standards technology base for the primary beryllium subcategory be equivalent to Option C, inprocess flow reduction, chemical precipitation, sedimentation, and multimedia filtration. EPA was considering addition of ammonia steam stripping and cyanide precipitation for control of ammonia and cyanide.

The wastewater discharge rates proposed for PSNS were equivalent to the proposed BAT discharged races. No flow reduction was considered feasible beyond the recycle proposed for BAT. The pollutants proposed for regulation at PSNS were the same as those proposed for regulation at BAT.

PSNS OPTION SELECTION - PROMULGATION

The technology basis for promulgated PSNS is identical to NSPS and BAT. It includes ammonia steam stripping and cyanide precipitation pretreatment for selected waste streams, followed by chemical precipitation, sedimentation, and multimedia filtration technology. It is necessary to promulgate PSNS to prevent passthrough of beryllium, chromium, copper, cyanide, ammonia, and fluoride. We know of no economically feasible, demonstrated technology that is better than BAT technology. No additional flow reduction for new sources is feasible. Because PSNS does not include any additional costs compared to NSPS and BAT, we do not believe it will prevent entry of new plants. The PSNS discharge rates are shown in Table XII-1 (page 3808).

REGULATED POLLUTANT PARAMETERS

Pollutants selected for limitation, in accordance with the rationale of Sections VI and X, are identical to those selected for limitation for BAT.

PRETREATMENT STANDARDS FOR NEW SOURCES

Pretreatment standards for new sources are based on the treatable concentrations from the selected treatment technology, (Option C), and the discharge rates determined in Section X for BAT. A mass of pollutant per mass of product (mg/kg) allocation is given for each subdivision within the subcategory. This pollutant allocation is based on the product of the treatment effectiveness concentration from the model treatment (mg/l) and the production normalized wastewater discharge rate (l/kkg). The achievable treatment effectiveness concentrations for BAT are identical to those for PSNS. PSNS are presented in Table XII-2.

TABLE XII-1

PSNS WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	PSNS Normalized Discharge Rate 103 l/kkg	103 gal/ton	Productin Normalized Parameter
Solvent extraction raffinate from bertrandite ore	2,246	538.2	Beryllium carbonate produced from bertrandite ore as beryllium
Solvent extraction raffinate from beryl ore	220.0	52.72	Beryllium carbonate produced from beryl ore as beryllium
Beryllium carbonate filtrate	214.5	51.40	Beryllium carbonate produced as beryllium
Beryllium hydroxide filtrate	136.0	32.6	Beryllium hydroxide produced as beryllium
Beryllium oxide calcining furnace wet air pollution control	263.7	63.19	Beryllium oxide produced
Beryllium hydroxide supernatant	230.0	55.12	Beryllium hydroxide produced from scrap and residues as beryllium
Process water	174.8	41.89	Beryllium pebbles produced
Fluoride furnace scrubber	0	0	Beryllium pebbles produced
Chip treatment wastewater	7.75	1.86	Beryllium scrap chips treated
Beryllium pebble plant area vent wet air pollution control	0	0	Beryllium pebbles produced

TABLE XII-1 (Continued)

PSNS WASTEWATER DISCHARGE RATES FOR THE PRIMARY BERYLLIUM SUBCATEGORY

Wastewater Stream	PSNS Normalized Discharge Rate 103 l/kkg	PSNS Normalized Discharge Rate 103 gal/ton	Productin Normalized Parameter
Beryllium ore gangue dewatering	1.043	0.25	Beryllium ore processed
Bertrandite ore gangue dewatering	2.665	0.639	Bertrandite ore processed
Beryllium ore processing	7.303	1.75	Beryllium ore processed
AIS area wastewater	468.0	112.1	Total beryllium carbonate produced as beryllium
Bertrandite ore leaching scrubber	1.511	0.362	Bertrandite ore processed
Bertrandite ore counter current decantation scrubber	0.101	0.024	Bertrandite ore processed

TABLE XII-2

PSNS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(a) Solvent Extraction Raffinate from Bertrandite Ore PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced from bertrandite ore (as Be)		
Beryllium	1,842.000	831.000
Chromium	831.000	336.900
Copper	2,875.000	1,370.000
Cyanide	449.200	179.700
Ammonia	299,400.000	131,600.000
Fluoride	78,610.000	44,700.000

(b) Solvent Extraction Raffinate from Beryl Ore PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced from beryl ore (as Be)		
Beryllium	180.400	81.400
Chromium	81.400	33.000
Copper	281.600	134.200
Cyanide	44.000	17.600
Ammonia	29,330.000	12,890.000
Fluoride	7,700.000	4,378.000

(c) Beryllium Carbonate Filtrate PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium carbonate produced (as Be)		
Beryllium	175.900	79.370
Chromium	79.370	32.180
Copper	274.600	130.800
Cyanide	42.900	17.160
Ammonia	28,590.000	12,570.000
Fluoride	7,508.000	4,269.000

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(d) Beryllium Hydroxide Filtrate PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced (as Be)		
Beryllium	111.520	50.320
Chromium	50.320	20.400
Copper	174.080	82.960
Cyanide	27.200	10.880
Ammonia	18,128.800	7,969.600
Fluoride	4,760.000	2,706.400

(e) Beryllium Oxide Calcining Furnace Wet APC PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium oxide produced		
Beryllium	216.200	97.570
Chromium	97.570	39.560
Copper	337.500	160.900
Cyanide	52.740	21.100
Ammonia	35,150.000	15,450.000
Fluoride	9,230.000	5,248.000

(f) Beryllium Hydroxide Supernatant PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium hydroxide produced from scrap and residues (as Be)		
Beryllium	188.600	85.100
Chromium	85.100	34.500
Copper	294.400	140.300
Cyanide	46.000	18.400
Ammonia	30,660.000	13,480.000
Fluoride	160,300.000	71,200.000

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(g) Process Water PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	143.300	64.680
Chromium	64.680	26.220
Copper	223.700	106.600
Cyanide	34.960	13.980
Ammonia	23,300.000	10,240.000
Fluoride	6,118.000	3,479.000

(h) Fluoride Furnace Scrubber PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000

(i) Treatment Wastewater PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium scrap chips treated		
Beryllium	6.355	2.868
Chromium	2.868	1.163
Copper	9.920	4.728
Cyanide	1.550	.620
Ammonia	1,033.000	454.200
Fluoride	271.300	154.200

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(j) Beryllium Pebble Plant Area Vent Wet APC PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of beryllium pebbles produced		
Beryllium	0.000	0.000
Chromium	0.000	0.000
Copper	0.000	0.000
Cyanide	0.000	0.000
Ammonia	0.000	0.000
Fluoride	0.000	0.000

(k) Ore Gangue Dewatering PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	0.855	0.386
Chromium (Total)	0.386	0.156
Copper	1.335	0.636
Cyanide (Total)	0.209	0.083
Ammonia (as N)	139.032	61.120
Fluoride	36.505	20.756

(l) Bertrandite Ore Gangue Dewatering PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of bertrandite ore processed		
Beryllium	2.185	0.986
Chromium (Total)	0.986	0.400
Copper	3.411	1.626
Cyanide (Total)	0.533	0.213
Ammonia (as N)	355.245	156.169
Fluoride	93.275	53.034

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(m) Beryl Ore Processing PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of beryl ore processed		
Beryllium	5.988	2.702
Chromium (Total)	2.702	1.095
Copper	9.348	4.455
Cyanide (Total)	1.461	0.584
Ammonia (as N)	973.490	427.956
Fluoride	255.605	145.330

(n) Aluminum Iron Sludge (AIS) Area Wastewater PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (pounds per million pounds) of total beryllium carbonate produced (as Be)		
Beryllium	383.760	173.160
Chromium (Total)	173.160	70.200
Copper	599.040	285.480
Cyanide (Total)	93.600	37.440
Ammonia (as N)	62,384.400	27,424.800
Fluoride	16,380.000	9,313.200

(o) Bertrandite Ore Leaching Scrubber PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg of bertrandite ore processed		
Beryllium	1.239	0.559
Chromium (Total)	0.559	0.227
Copper	1.934	0.922
Cyanide (Total)	0.302	0.121
Ammonia (as N)	201.416	88.545
Fluoride	52.885	30.069

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY BERYLLIUM SUBCATEGORY

(p) Bertrandite Ore Countercurrent and Decantation (CCD) Scrubber PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg of bertrandite ore processed	
Beryllium	0.083	0.037
Chromium (Total)	0.037	0.015
Copper	0.129	0.062
Cyanide (Total)	0.020	0.008
Ammonia (as N)	13.463	5.919
Fluoride	3.535	2.010

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SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control technology (BCT) limitations for the primary beryllium subcategory at this time.

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NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Primary Nickel and Cobalt Subcategory

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May 1989

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Office of Water
Office of Water Regulations and Standards
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Washington, D. C. 20460

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SECTION I

SUMMARY AND CONCLUSIONS

This document provides the technical basis for promulgating effluent limitations based on best practicable technology (BPT) and best available technology (BAT) for existing direct dischargers, pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS) for plants in the primary nickel and cobalt subcategory.

The primary nickel and cobalt subcategory consists of one plant which discharges directly to a surface water. There are no indirect dischargers presently operating.

EPA first studied the primary nickel and cobalt 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 the sources and volume of water used, the processes used, the sources of pollutants and wastewaters in the plant, and 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:

- o Raw material dust control,
- o Cobalt reduction decant,
- o Nickel reduction decant, and
- o Nickel wash water.

Several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the primary nickel and cobalt subcategory were identified. 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 various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each of the control and treatment options considered for the subcategory. These costs were then used by the Agency to estimate the impact of implementing the various options on the subcategory. For each control and treatment option that the Agency found to be most effective and technically feasible in controlling the discharge of pollutants, 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 Effluent Limitations and Standards for the Nonferrous Metals Manufacturing Industry.

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on chemical precipitation and sedimentation technology is the basis for the BPT limitations. Steam stripping was selected as the technology basis for ammonia limitations. To meet the BPT effluent limitations based on this technology, the primary nickel and cobalt subcategory is expected to incur a capital cost of $71,362 and an annual cost of $27,184.

For BAT, the Agency has built upon the BPT technology basis by adding filtration as an effluent polishing step to the end-of-pipe treatment scheme. To meet the BAT effluent limitations based on this technology, the primary nickel and cobalt subcategory is estimated to incur a capital cost of $86,500 and an annual cost of $31,800.

NSPS is equivalent to BAT. In selecting NSPS, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technology. As such, the technology basis of BAT has been determined as the best demonstrated technology.

The Agency is not promulgating PSES for this subcategory because there are no indirect dischargers. For PSNS, the Agency selected end-of-pipe treatment and in-process flow reduction control techniques equivalent to NSPS.

The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. BCT is not being promulgated because the methodology for BCT has not yet been finalized.

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

SECTION II

CONCLUSIONS

EPA has divided the primary nickel and cobalt subcategory into four subdivisions or building blocks for the purpose of effluent limitations and standards. These subdivisions are:

(a) Raw material dust control,
(b) Cobalt reduction decant,
(c) Nickel reduction decant, and
(d) Nickel wash water.

BPT is promulgated based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following BPT effluent limitations are promulgated:

(a) <u>Raw Material Dust Control</u> BPT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material		
Copper	0.146	0.077
Nickel	0.148	0.098
Ammonia (as N)	10.260	4.512
Cobalt	0.016	0.007
TSS	3.157	1.502
pH	Within the range of 7.5 to 10.0 at all times	

(b) <u>Cobalt Reduction Decant</u> BPT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cobalt produced		
Copper	40.660	21.400
Nickel	41.080	27.180
Ammonia (as N)	2,852.000	1,254.000
Cobalt	4.494	1.926
TSS	877.300	417.300
pH	Within the range of 7.5 to 10.0 at all times	

(c) Nickel Reduction Decant BPT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of nickel produced		
Copper	24.120	12.700
Nickel	24.370	16.120
Ammonia (as N)	1,692.000	743.900
Cobalt	2.666	1.143
TSS	520.500	247.600
pH	Within the range of 7.5 to 10.0 at all times	

(d) Nickel Wash Water BPT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of nickel powder washed		
Copper	0.064	0.034
Nickel	0.065	0.043
Ammonia (as N)	4.515	1.985
Cobalt	0.007	0.003
TSS	1.389	0.660
pH	Within the range of 7.5 to 10.0 at all times	

BAT is promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following BAT effluent limitations are promulgated:

(a) Raw Material Dust Control BAT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material		
Copper	0.099	0.047
Nickel	0.042	0.028
Ammonia (as N)	10.260	4.512
Cobalt	0.011	0.005

(b) Cobalt Reduction Decant BAT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kg (lb/million lbs) of cobalt produced	
Copper	27.390	13.050
Nickel	11.770	7.917
Ammonia (as N)	2,852.000	1,254.000
Cobalt	2.996	1.498

(c) Nickel Reduction Decant BAT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kg (lb/million lbs) of nickel produced	
Copper	16.250	7.744
Nickel	6.982	4.697
Ammonia (as N)	1,692.000	743.900
Cobalt	1.777	0.889

(d) Nickel Wash Water BAT

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kg (lb/million lbs) of nickel powder washed	
Copper	0.043	0.021
Nickel	0.019	0.013
Ammonia (as N)	4.515	1.985
Cobalt	0.005	0.002

NSPS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following NSPS are promulgated for new sources:

(a) Raw Material Dust Control NSPS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material		
Copper	0.099	0.047
Nickel	0.042	0.028
Ammonia (as N)	10.260	4.512
Cobalt	0.011	0.005
TSS	1.155	0.924
pH	Within the range of 7.5 to 10.0 at all times	

(b) Cobalt Reduction Decant NSPS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cobalt produced		
Copper	27.390	13.050
Nickel	11.770	7.917
Ammonia (as N)	2,852.000	1,254.000
Cobalt	2.996	1.498
TSS	321.000	256.800
pH	Within the range of 7.5 to 10.0 at all times	

(c) Nickel Reduction Decant NSPS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of nickel produced		
Copper	16.250	7.744
Nickel	6.982	4.697
Ammonia (as N)	1,692.000	743.900
Cobalt	1.777	0.889
TSS	190.400	152.300
pH	Within the range of 7.5 to 10.0 at all times	

(d) Nickel Wash Water NSPS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of nickel powder washed		
Copper	0.043	0.021
Nickel	0.019	0.013
Ammonia (as N)	4.515	1.985
Cobalt	0.005	0.002
TSS	0.508	0.406
pH	Within the range of 7.5 to 10.0 at all times	

PSES are not promulgated for this subcategory since there are no indirect dischargers.

PSNS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following PSNS are promulgated for new sources:

(a) Raw Material Dust Control PSNS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material		
Copper	0.099	0.047
Nickel	0.042	0.028
Ammonia (as N)	10.260	4.512
Cobalt	0.011	0.005

(b) Cobalt Reduction Decant PSNS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cobalt produced		
Copper	27.390	13.050
Nickel	11.770	7.917
Ammonia (as N)	2,852.000	1,254.000
Cobalt	2.996	1.498

(c) Nickel Reduction Decant PSNS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kg (lb/million lbs) of nickel produced	
Copper	16.250	7.744
Nickel	6.982	4.697
Ammonia (as N)	1,692.000	743.900
Cobalt	1.777	0.889

(d) Nickel Wash Water PSNS

Pollutant or Pollutant property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kg (lb/million lbs) of nickel powder washed	
Copper	0.043	0.021
Nickel	0.019	0.013
Ammonia (as N)	4.515	1.985
Cobalt	0.005	0.002

EPA is not promulgating BCT for this subcategory at this time.

SECTION III

INDUSTRY PROFILE

This section of the primary nickel and cobalt supplement describes the raw materials and processes used in smelting and refining primary nickel and cobalt and presents a profile of the primary nickel and cobalt plants identified in this study.

Both nickel and cobalt can be produced from primary and secondary materials. Production of these metals is regulated under three distinct subcategories: production of nickel from secondary materials, production of cobalt from secondary materials, and production of nickel and cobalt from primary materials. This subcategory consists of one plant which manufactures primary nickel and cobalt. Secondary nickel is regulated as a separate subcategory, as is secondary cobalt (secondary cobalt is regulated with secondary tungsten).

The principle use for nickel is as an alloying agent, particularly in the iron and steel products. Nickel imparts strength and corrosion resistance over a wide range of temperatures. Cobalt's value is also as an alloying element, and is used for cutting tools, jet engine parts, electrical devices, permanent magnets, catalysts, and pigments and dyes. Cobalt imparts qualities such as heat resistance, high strength, wear resistance, and magnetic properties.

DESCRIPTION OF PRIMARY NICKEL AND COBALT PRODUCTION

The production of primary nickel and cobalt can be divided into three principal processing steps: leaching, cobalt precipitation and reduction, and nickel reduction. The primary nickel and cobalt production process is presented schematically in Figure III-1 (page 3840), and described below.

RAW MATERIALS

Domestic primary nickel and cobalt production begins with an imported copper-nickel-cobalt ore concentrate or matte.

LEACHING

The raw material, called matte, is crushed and then ground in a wet ball mill, prior to being fed to a sulfuric acid leaching system. Dust and particulate matter from the crushing and grinding area are controlled by a baghouse. The dust and fines are slurried with water to facilitate transporting them from the baghouse. Slurrying results in a process wastewater stream.

In the leaching process, the ground matte is reacted with a copper sulfate - sulfuric acid solution, in order to separate the copper as a solid from the nickel and cobalt, which remain in solution. The solids, containing most of the copper, iron, and some nickel and cobalt, are sent to the copper recovery circuit. From this circuit, a recycle stream containing nickel and cobalt is returned to the acid leaching process. The liquids produced in the acid leaching process are sent to the nickel and cobalt recovery system.

COBALT PRECIPITATION AND REDUCTION

Separation of nickel from cobalt is accomplished by precipitating the cobalt and most impurities from solution with ammonium persulfate. The nickel-containing solution is routed to nickel reduction.

The solids from the cobalt precipitation step are routed to a cobalt purification system. Among other impurities, the solids contain a large nickel concentration. The solids are dissolved and then treated by the "pentammine process" in which ammonia is added to the solution to form cobalt pentammine and nickel diammine. After oxidizing the cobalt with air, acid is added to the solution which causes the nickel and un-oxidized cobalt to crystallize. These crystals are removed, and the cobaltic pentammine solution is passed through an ion-exchange column to remove any remaining traces of nickel. The nickel is recycled to the nickel reduction process. The nickel-free cobalt solution is converted to cobalt powder by reduction in a hydrogen autoclave furnace. The liquid effluent from the cobalt reduction furnace is routed to the ammonium sulfate by-product recovery system.

NICKEL REDUCTION

The nickel solution contains few impurities at this stage. Reduction of nickel in solution to nickel powder is effected in an autoclave. The liquid effluent from the autoclave contains a large concentration of ammonium sulfate and is sent to an ammonium sulfate by-product recovery process. The nickel powder produced in the reduction furnace is washed with water which is discharged to wastewater treatment.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in primary nickel and cobalt production, the significant wastewater sources that are associated with the primary nickel and cobalt subcategory can be subdivided as follows:

1. Raw material dust control,
2. Cobalt reduction decant,
3. Nickel reduction decant, and
4. Nickel wash water.

OTHER WASTEWATER SOURCES

There may be other wastewater streams associated with the primary nickel and cobalt subcategory. These streams may include stormwater runoff, maintenance and cleanup water, and noncontact cooling and heating water (such as steam condensates from heat exchangers). These wastewaters are not considered as part of this rulemak-ing. EPA believes that the flows and pollutant loadings associ-ated with these wastewater streams are insignificant relative to the waste streams selected and are best handled by the appropriate permit authority on a case-by-case basis under authority of Section 402 of the Clean Water Act.

AGE, PRODUCTION, AND PROCESS PROFILE

The one primary nickel and cobalt plant in the United States is located in Southern Louisiana in order to take advantage of shipping lanes. This plant began operations in 1959, and came under its present ownership in 1973. Nickel production is between 40,000 and 50,000 tons/year; and cobalt production is less than 1,000 tons/year.

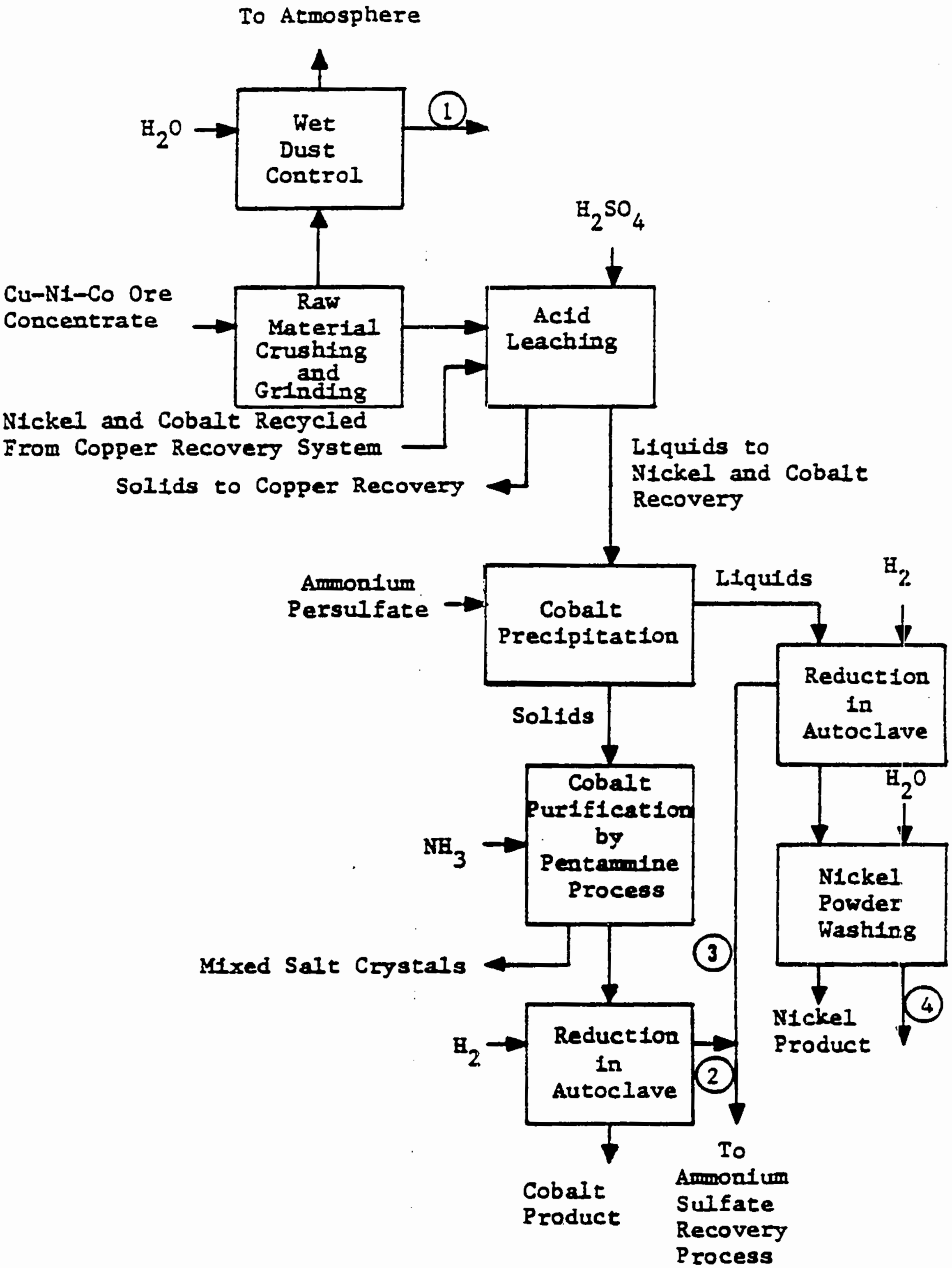

Figure III-1

PRIMARY NICKEL AND COBALT MANUFACTURING PROCESS

SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the related subdivisions of the primary nickel and cobalt subcategory. Production normalizing parameters for each subdivision will also be discussed.

FACTORS CONSIDERED IN SUBDIVIDING THE PRIMARY NICKEL AND COBALT SUBCATEGORY

The factors listed in Vol. I for general subcategorization were each evaluated when considering subdivision of the primary nickel and cobalt subcategory. In the discussion that follows, the factors will be described as they pertain to this particular subcategory.

The rationale for considering segmentation of the primary nickel and cobalt subcategory is based primarily on differences in the production processes and raw materials 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. While primary nickel and cobalt is considered a single subcategory, a thorough examination of the production processes has illustrated the need for limitations and standards based on a specific set of waste streams. Limitations will be based on specific flow allowances for the following subdivisions:

1. Raw material dust control,
2. Cobalt reduction decant,
3. Nickel reduction decant, and
4. Nickel wash water.

These subdivisions follow directly from differences between the processing steps of primary nickel and cobalt production. Leaching, cobalt precipitation and reduction, and nickel reduction each have various steps which may generate wastewaters.

Raw material crushing and grinding creates a need for the first subdivision - raw material dust control. Although a dry baghouse is used to control dust and particulate matter generated by the mills that crush and grind the raw material, water is used to slurry the solids collected by the baghouse to the treatment plant.

Washing the nickel powder produced in the hydrogen reduction furnace creates a need for the fourth subdivision - nickel wash water. This water is used to remove traces of acid and impurities from the nickel product. Excess solution containing significant concentrations of ammonium sulfate decanted from the nickel reduction autoclave creates a need for the third subdivision - nickel reduction decant. Excess solution from the cobalt reduction autoclave creates a need for the second subdivision -cobalt reduction decant.

OTHER FACTORS

The other factors considered in this evaluation were shown to be inappropriate bases for further segmentation. Air pollution control methods, treatment costs, and total energy requirements are functions of the selected subcategorization factors--metal product, raw materials, and production processes. Certain other factors, such as plant age, plant size, and the number of employees, were also evaluated and determined to be inappropriate for use as bases for subdivision of the nonferrous metals category.

PRODUCTION NORMALIZING PARAMETERS

As discussed previously, the effluent limitations and standards developed in this document establish mass limitations on the discharge of specific pollutant parameters. To allow these regulations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP). The PNPs for the four subdivisions are as follows:

Subdivision	PNP
1. Raw material dust control	copper, nickel, and cobalt in the crushed raw material
2. Cobalt reduction decant	cobalt produced
3. Nickel reduction decant	nickel produced
4. Nickel wash water	nickel powder washed

Other PNPs were considered. The use of production capacity instead of actual production was eliminated from consideration because the mass of pollutant generated is more a function of true production than of installed capacity.

The PNP selected for raw material dust control is metric tons of copper, nickel, and cobalt in the crushed raw material. This PNP was selected because the amount of water generated by this process is most directly related to the amount of raw material crushed, and the composition of the crushed raw material. Because this plant recovers copper as well as nickel and cobalt from the crushed raw material, the appropriate PNP to select is metric tons of copper, nickel, and cobalt in the crushed raw material.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the primary nickel and cobalt subcategory. Water use and discharge rates are explained and then summarized in tables at the end of this section. Data used to characterize the wastewaters are presented. Finally, the specific source, water use and discharge flows, and wastewater characteristics for each separate wastewater source are discussed.

The two principal data sources used in the development of effluent limitations and standards for this subcategory are data collection portfolios (dcp) and field sampling results. Data collection portfolios contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from primary nickel and cobalt plants, a field sampling program was conducted. 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 Vol. I. Samples were analyzed for 124 of the 126 priority 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. Samples were also never analyzed for asbestos. There is no reason to expect that TCDD or asbestos would be present in nonferrous metals manufacturing wastewater. In general, the samples were analyzed for three classes of pollutants: organic toxic pollutants, metal toxic pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

No additional sampling data for this subcategory were obtained from EPA sampling efforts or industry comments between proposal and promulgation. Characterization of primary nickel and cobalt subcategory wastewaters (Section V), and selection of pollutant parameters for limitation (Section VI) is based upon the same data used at proposal.

As described in Section IV of this supplement, the primary nickel and cobalt subcategory has been divided into four subdivisions or wastewater sources, so that the promulgated regulation contains mass discharge limitations and standards for four unit processes discharging process wastewater. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow. These wastewater sources are:

1. Raw material dust control,
2. Cobalt reduction decant.

3. Nickel reduction decant, and
4. Nickel wash water.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios were calculated for each stream. The two ratios, water use and wastewater discharge flow, are differentiated by the flow value used in calculation. Water use is defined as the volume of water required for a given process per mass of nickel and cobalt product and is therefore based on the sum of recycle and make-up flows to a given process. Wastewater flow discharged after pretreatment or recycle (if these are present) is used in calculating the production normalized flow--the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of nickel and cobalt produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carry-over on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. As an example, nickel powder wash water wastewater flow is related to nickel powder production. As such, the discharge rate is expressed in liters of nickel wash water discharged per metric ton of nickel powder washed.

The production normalized flows were compiled and statistically analyzed by stream type. These production normalized water use and discharge flows are presented by subdivision in Tables V-1 through V-4 (pages 3848 - 3851) at the end of this section. Where appropriate, an attempt was made to identify factors that could account for variations in water use. This information is summarized in this section. A similar analysis of factors affecting the wastewater flows is presented in Sections IX X, XI, and XII where representative BPT, BAT, NSPS, and pretreatment discharge flows are selected for use in calculating the effluent limitations and standards.

WASTEWATER CHARACTERISTICS DATA

Data used to characterize the various wastewaters associated with primary nickel and cobalt production come from two sources--data collection portfolios and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolio, the primary nickel and cobalt plant was asked to specify the presence or absence of toxic pollutants in its wastewater. The plant indicated that toxic organic pollutants were believed to be absent from the effluent. The plant stated that some of the priority metals were known to be present in their effluent. This plant listed chromium, copper, nickel, and zinc as known to be present in the effluent.

FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from primary nickel and cobalt plants, wastewater samples were collected at the one plant. A diagram indicating the sampling sites and contributing production processes is shown in Figure V-1 (page 3872).

The sampling data for the primary nickel and cobalt subcategory are presented in Tables V-5 and V-6 (pages 3852 and 3862). The stream codes displayed in Tables V-5 and V-6 may be used to identify the location of each of the samples on the process flow diagram in Figure V-1. 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 generally are 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 for metals and conventional and nonconventional pollutants 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. For data considered as detected but below quantifiable concentrations, a value of zero is used for averaging. Priority organic, nonconventional, and conventional pollutant data reported with a "less than" sign are considered as detected, but not further quantifiable. A value of zero is also used for averaging. If a pollutant is reported as not detected, it is assigned a value of zero in calculating the average. Finally, priority metal values reported as less than a certain value were considered as not quantifiable, and consequently were assigned a value of zero in the calculation of the average.

Finally, appropriate source water concentrations are presented with the summaries of 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

Since primary nickel and cobalt production involves four principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately. A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

RAW MATERIAL DUST CONTROL

Primary nickel and cobalt raw material, called matte, is crushed and ground prior to undergoing copper separation via a leaching process. Dust and particulates generated by the crushing and grinding operations may be controlled by a baghouse. Water is used to slurry the collected material in the baghouse and transport it to treatment. One plant reported generating this waste stream, as shown in Table V-1 (page 3848). This table shows water use and discharge rates for this waste stream.

Sampling data were collected on a combined process waste stream which included raw material dust control water. The sampling data are presented in Table V-5 (page 3852). The data presented show copper, nickel, and ammonia above treatable concentrations.

COBALT REDUCTION DECANT

When cobalt is reduced in a hydrogen autoclave from a cobalt-rich solution, excess solution, containing significant quantities of ammonium sulfate, is decanted. Although the one plant currently generating this waste stream does not discharge it by means of a by-product recovery operation, it may be discharged at some time in the future. The need to discharge this waste stream may result from poor marketability of the by-product or excessive cost of operating the recovery plant. Water use and discharge rates for cobalt reduction decant are shown in Table V-2 (page 3849).

No samples were taken of this waste stream; however, it is expected to have high concentrations of ammonia (as NH_4^+) and sulfate (as $SO_4^=$), along with treatable concentrations of priority metals, cobalt, and suspended solids.

NICKEL REDUCTION DECANT

When nickel is reduced in a hydrogen autoclave from a nickel-rich solution, the excess solution, containing significant quantities of ammonium sulfate, is decanted. Although the one plant currently generating this waste stream does not discharge it by means of a by-product recovery operation, it may be discharged at some time in the future. The need to discharge this waste stream may result from poor marketability of the by-product or excessive cost of operating the recovery plant. Water use and discharge rates for this waste stream are shown in Table V-3 (page 3850).

No samples were taken of this waste stream; however, it is expected to have high concentrations of ammonia (as NH_4^+) and sulfate (as $SO_4^=$), along with treatable concentrations of priority metals (principally nickel) and suspended solids.

NICKEL WASH WATER

After reducing primary nickel raw material to a powder in a hydrogen autoclave, the nickel may be washed with water. This produces a waste stream. One plant reported this waste stream, and Table V-4 (page 3851) presents its water use and discharge rates.

Sampling data were collected on a combined process waste stream which included nickel wash water. The sampling data are presented in Table V-5 (page 3852). The data show copper, nickel, and ammonia above treatable concentrations; several priority organics were detected.

TABLE V-1

WATER USE AND DISCHAGRE RATES FOR

RAW MATERIAL DUST CONTROL

(l/kkg of copper, nickel and cobalt in the crushed raw materials)

Plant Code	Percent Recycle or reuse	Production Normalized Water Use Flow	Production Normalized Discharge Flow
1062	0	77	77

TABLE V-2

WATER USE AND DISCHAGRE RATES FOR

COBALT REDUCTION DECANT

(1/kkg of cobalt produced)

Plant Code	Percent Recycle or reuse	Production Normalized Water Use Flow	Production Normalized Discharge Flow
1062	100	21398	0

TABLE V-3

WATER USE AND DISCHAGRE RATES FOR

NICKEL REDUCTION DECANT

(l/kkg of nickel produced)

Plant Code	Percent Recycle or reuse	Production Normalized Water Use Flow	Production Normalized Discharge Flow
1062	100	12695	0

TABLE V-4

WATER USE AND DISCHAGRE RATES FOR

NICKEL WASH WATER

(l/kkg of nickel powder washed)

Plant Code	Percent Recycle or reuse	Production Normalized Water Use Flow	Production Normalized Discharge Flow
1062	0	33.87	33.87

Table V-5

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	367	6		ND		
2. acrolein	367	1		ND		
3. acrylonitrile	367	1		ND		
4. benzene	367	1		*		
5. benzidine	367	6		ND		
6. carbon tetrachloride	367	1		ND		
7. chlorobenzene	367	1		ND		
8. 1,2,4-trichlorobenzene	367	6		ND		
9. hexachlorobenzene	367	6		ND		
10. 1,2-dichloroethane	367	1		ND		
11. 1,1,1-trichloroethane	367	1		ND		
12. hexachloroethane	367	6		ND		
13. 1,1-dichloroethane	367	1		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
14. 1,1,2-trichloroethane	367	1		ND		
15. 1,1,2,2-tetrachloroethane	367	1		ND		
16. chloroethane	367	1		ND		
17. bis(chloromethyl)ether	367	1		ND		
18. bis(2-chloroethyl)ether	367	1		ND		
19. 2-chloroethyl vinyl ether	367	1		ND		
20. 2-chloronaphthalene	367	6		ND		
21. 2,4,6-trichlorophenol	367	6		ND		
22. p-chloro-m-cresol	367	6		ND		
23. chloroform	367	1		ND		
24. 2-chlorophenol	367	6		ND		
25. 1,2-dichlorobenzene	367	6		ND		
26. 1,3-dichlorobenzene	367	6		ND		
27. 1,4-dichlorobenzene	367	6		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
28. 3,3'-dichlorobenzidine	367	6		ND		
29. 1,1-dichloroethylene	367	1		ND		
30. 1,2-trans-dichloroethylene	367	1		ND		
31. 2,4-dichlorophenol	367	6		ND		
32. 1,2-dichloropropane	367	1		ND		
33. 1,3-dichloropropene	367	1		ND		
34. 2,4-dimethylphenol	367	6		ND		
35. 2,4-dinitrotoluene	367	6		ND		
36. 2,6-dinitrotoluene	367	6		ND		
37. 1,2-diphenylhydrazine	367	6		ND		
38. ethylbenzene	367	1		ND		
39. fluoranthene	367	6		ND		
40. 4-chlorophenyl phenyl ether	367	6		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
41. 4-bromophenyl phenyl ether	367	6		ND		
42. bis(2-chloroisopropyl)ether	367	6		ND		
43. bis(2-choroethoxy)methane	367	6		ND		
44. methylene chloride	367	1		ND		
45. methyl chloride (chloromethane)	367	1		ND		
46. methyl bromide (bromomethane)	367	1		ND		
47. bromoform (tribromomethane)	367	1		ND		
48. dichlorobromomethane	367	1		ND		
49. trichlorofluoromethane	367	1		ND		
50. dichlorodifluoromethane	367	1		ND		
51. chlorodibromomethane	367	1		ND		
52. hexachlorobutadiene	367	6		ND		
53. hexachlorocyclopentadiene	367	6		ND		
54. isophorone	367	6		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
55. naphthalene	367	6		ND		
56. nitrobenzene	367	6		ND		
57. 2-nitrophenol	367	6		ND		
58. 4-nitrophenol	367	6		ND		
59. 2,4-dinitrophenol	367	6		ND		
60. 4,6-dinitro-o-cresol	367	6		ND		
61. N-nitrosodimethylamine	367	6		ND		
62. N-nitrosodiphenylamine	367	6		ND		
63. N-nitrosodi-n-propylamine	367	6		ND		
64. pentachlorophenol	367	6		ND		
65. phenol	367	6		ND		
66. bis(2-ethylhexyl) phthalate	367	6		.010		
67. butyl benzyl phthalate	367	6		ND		
68. di-n-butyl phthalate	367	6		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
69. di-n-octyl phthalate	367	6		ND		
70. diethyl phthalate	367	6		ND		
71. dimethyl phthalate	367	6		ND		
72. benzo(a)anthracene	367	6		ND		
73. benzo(a)pyrene	367	6		ND		
74. benzo(b)fluoranthene	367	6		ND		
75. benzo(k)fluoranthane	367	6		ND		
76. chrysene	367	6		ND		
77. acenaphthylene	367	6		ND		
78. anthracene	367	6		ND		
79. benzo(ghi)perylene	367	6		ND		
80. fluorene	367	6		ND		
81. phenanthrene	367	6		ND		
82. dibenzo(a,h)anthracene	367	6		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
83. indeno (1,2,3-c,d)pyrene	367	6		ND		
84. pyrene	367	6		ND		
85. tetrachloroethylene	367	1		ND		
86. toluene	367	1		*		
87. trichloroethylene	367	1		ND		
88. vinyl chloride (chloroethylene)	367	1		ND		
89. aldrin	367	6		ND		
90. dieldrin	367	6		ND		
91. chlordane	367	6		ND		
92. 4,4'-DDT	367	6		ND		
93. 4,4'-DDE	367	6		ND		
94. 4,4'-DDD	367	6		ND		
95. alpha-endosulfan	367	6		ND		
96. beta-endosulfan	367	6		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
97. endosulfan sulfate	367	6		ND		
98. endrin	367	6		ND		
99. endrin aldehyde	367	6		ND		
100. heptachlor	367	6		ND		
101. heptachlor epoxide	367	6		ND		
102. alpha-BHC	367	6		ND		
103. beta-BHC	367	6		ND		
104. gamma-BHC	367	6		ND		
105. delta-BHC	367	6		ND		
106. PCB-1242 (b)	367	6		ND		
107. PCB-1254 (b)	367	6		ND		
108. PCB-1221 (b)	367	6		ND		
109. PCB-1232 (c)	367	6		ND		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
110. PCB-1248 (c)	367	6		ND		
111. PCB-1260 (c)	367	6		ND		
112. PCB-1016 (c)	367	6		ND		
113. toxaphene	367	6		ND		
114. antimony	367	6		0.019		
115. arsenic	367	6		<0.10		
117. beryllium	367	6		0.001		
118. cadmium	367	6		0.007		
119. chromium (total)	367	6		<0.05		
120. copper	367	6		1.43		
122. lead	367	6		<0.005		
123. mercury	367	6		0.0002		
124. nickel	367	6		40.0		
125. selenium	367	6		0.18		

Table V-5 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
COMBINED WASTEWATER - INFLUENT TO TREATMENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
126. silver	367	6		<0.001		
127. thallium	367	6		<0.05		
128. zinc	367	6		0.377		
Nonconventional Pollutants						
Ammonia Nitrogen	367	6		440		
Chemical Oxygen Demand	367	6		69.0		
Cobalt	367	6		4.6		
Phosphorus	367	6		<0.2		
Conventional Pollutants						
pH (standard units)	367	6		7.6		

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

(a),(b),(c) Reported together

*Less than 0.01 mg/l.

Table V-6

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	364	6		ND		
2. acrolein	364	1		ND		
3. acrylonitrile	364	1		ND		
4. benzene	364	1		ND		
5. benzidine	364	6		ND		
6. carbon tetrachloride	364	1		ND		
7. chlorobenzene	364	1		ND		
8. 1,2,4-trichlorobenzene	364	6		ND		
9. hexachlorobenzene	364	6		ND		
10. 1,2-dichloroethane	364	1		ND		
11. 1,1,1-trichloroethane	364	1		ND		
12. hexachloroethane	364	6		ND		
13. 1,1-dichloroethane	364	1		ND		
14. 1,1,2-trichloroethane	364	1		ND		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
19. 2-chloroethyl vinyl ether	364	1		ND		
20. 2-chloronaphthalene	364	6		ND		
21. 2,4,6-trichlorophenol	364	6		ND		
22. p-chloro-m-cresol	364	6		ND		
23. chloroform	364	1		*		
24. 2-chlorophenol	364	6		ND		
25. 1,2-dichlorobenzene	364	6		ND		
26. 1,3-dichlorobenzene	364	6		ND		
27. 1,4-dichlorobenzene	364	6		ND		
28. 3,3'-dichlorobenzidine	364	6		ND		
29. 1,1-dichloroethylene	364	1		*		
30. 1,2-*trans*-dichloroethylene	364	1		ND		
31. 2,4-dichlorophenol	364	6		ND		
32. 1,2-dichloropropane	364	1		ND		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
33. 1,3-dichloropropene	364	1		ND		
34. 2,4-dimethylphenol	364	6		ND		
35. 2,4-dinitrotoluene	364	6		ND		
36. 2,6-dinitrotoluene	364	6		ND		
37. 1,2-diphenylhydrazine	364	6		ND		
38. ethylbenzene	364	1		ND		
39. fluoranthene	364	6		ND		
40. 4-chlorophenyl phenyl ether	364	6		ND		
41. 4-bromophenyl phenyl ether	364	6		ND		
42. bis(2-chloroisopropyl)ether	364	6		ND		
43. bis(2-choroethoxy)methane	364	6		ND		
44. methylene chloride	364	1		*		
45. methyl chloride (chloromethane)	364	1		ND		
46. methyl bromide (bromomethane)	364	1		ND		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
47. bromoform (tribromomethane)	364	1		ND		
48. dichlorobromomethane	364	1		ND		
49. trichlorofluoromethane	364	1		ND		
50. dichlorodifluoromethane	364	1		ND		
51. chlorodibromomethane	364	1		ND		
52. hexachlorobutadiene	364	6		ND		
53. hexachlorocyclopentadiene	364	6		ND		
54. isophorone	364	6		ND		
55. naphthalene	364	6		ND		
56. nitrobenzene	364	6		0.025		
57. 2-nitrophenol	364	6		ND		
58. 4-nitrophenol	364	6		ND		
59. 2,4-dinitrophenol	364	6		ND		
60. 4,6-dinitro-o-cresol	364	6		ND		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
61. N-nitrosodimethylamine	364	6		ND		
62. N-nitrosodiphenylamine	364	6		ND		
63. N-nitrosodi-n-propylamine	364	6		ND		
64. pentachlorophenol	364	6		ND		
65. phenol	364	6		ND		
66. bis(2-ethylhexyl) phthalate	364	6		ND		
67. butyl benzyl phthalate	364	6		*		
68. di-n-butyl phthalate	364	6		ND		
69. di-n-octyl phthalate	364	6		ND		
70. diethyl phthalate	364	6		ND		
71. dimethyl phthalate	364	6		ND		
72. benzo(a)anthracene	364	6		ND		
73. benzo(a)pyrene	364	6		ND		
74. benzo(b)fluoranthene	364	6		ND		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
75. benzo(k)fluoranthane	364	6		ND		
76. chrysene	364	6		ND		
77. acenaphthylene	364	6		ND		
78. anthracene	364	6		ND		
79. benzo(ghi)perylene	364	6		ND		
80. fluorene	364	6		ND		
81. phenanthrene	364	6		ND		
82. dibenzo(a,h)anthracene	364	6		ND		
83. indeno (1,2,3-c,d)pyrene	364	6		ND		
84. pyrene	364	6		ND		
85. tetrachloroethylene	364	1		ND		
86. toluene	364	1		*		
87. trichloroethylene	364	1		ND		
88. vinyl chloride (chloroethylene)	364	1		ND		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
89. aldrin	364	6		**		
90. dieldrin	364	6		**		
91. chlordane	364	6		**		
92. 4,4'-DDT	364	6		**		
93. 4,4'-DDE	364	6		**		
94. 4,4'-DDD	364	6		**		
95. alpha-endosulfan	364	6		**		
96. beta-endosulfan	364	6		**		
97. endosulfan sulfate	364	6		**		
98. endrin	364	6		**		
99. endrin aldehyde	364	6		**		
100. heptachlor	364	6		**		
101. heptachlor epoxide	364	6		**		
102. alpha-BHC	364	6		**		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
103. beta-BHC	364	6		**		
104. gamma-BHC	364	6		**		
105. delta-BHC	364	6		**		
106. PCB-1242 (b)	364	6		**		
107. PCB-1254 (b)	364	6		**		
108. PCB-1221 (b)	364	6		**		
109. PCB-1232 (c)	364	6		**		
110. PCB-1248 (c)	364	6		**		
111. PCB-1260 (c)	364	6		**		
112. PCB-1016 (c)	364	6		**		
113. toxaphene	364	6		**		
114. antimony	364	6		<0.1		
115. arsenic	364	6		<0.1		
117. beryllium	364	6		0.0018		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
118. cadmium	364	6		<0.001		
119. chromium (total)	364	6		<0.056		
120. copper	364	6		0.225		
122. lead	364	6		<0.005		
123. mercury	364	6		0.0033		
124. nickel	364	6		5.60		
125. selenium	364	6		0.15		
126. silver	364	6		<0.001		
127. thallium	364	6		<0.05		
128. zinc	364	6		0.067		
Nonconventional Pollutants						
Ammonia Nitrogen	364	6		500		
Chemical Oxygen Demand	364	6		56.0		

Table V-6 (Continued)

PRIMARY NICKEL AND COBALT SUBCATEGORY
TREATED PLANT EFFLUENT

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
Cobalt	364	6		0.46		
Phosphorus	364	6		<0.2		
Conventional Pollutants						
pH (standard units)	364	6		12.7		

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

(a),(b),(c) Reported together

*Less than 0.01 mg/l.

**Less than 0.005 mg/l.

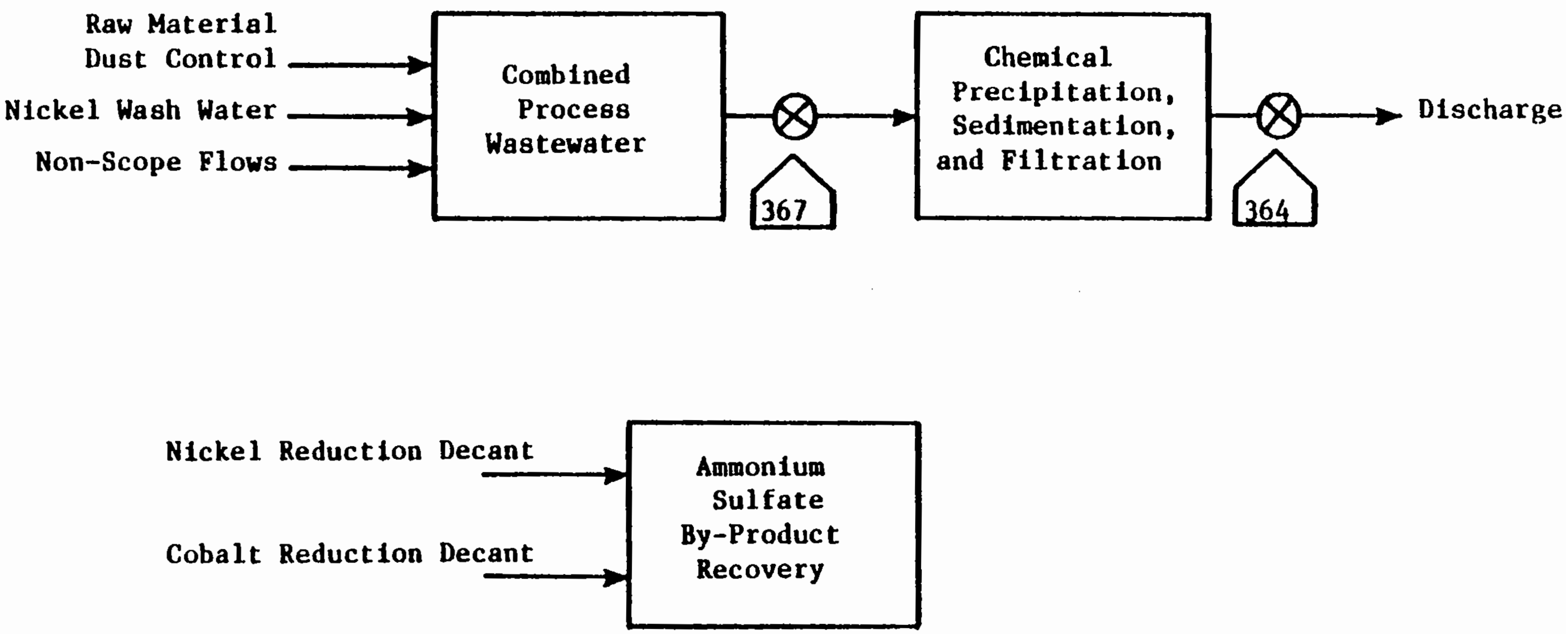

Figure V-1

SAMPLING SITES AT PRIMARY NICKEL AND COBALT PLANT A

SECTION VI

SELECTION OF POLLUTANTS

This section examines chemical analysis data presented in Section V and discusses the selection or exclusion of priority pollutants for potential limitation. Also, conventional and nonconventional pollutants are selected or excluded for limitation in this section. The basis for the regulation of toxic and other pollutants, along with a discussion of each pollutant selected for potential limitation, is discussed in Section VI of Vol. I. That discussion provides information about the nature 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.

The discussion that follows describes the analysis that was performed to select or exclude priority pollutants for further consideration for limitations and standards. The data from wastewater samples are considered in this analysis. A combined wastewater sample was taken of the influent to treatment, which includes the two currently discharged process wastewater streams, and other non-scope streams. Priority pollutants will be selected for further consideration if they are present in concentrations treatable by the technologies considered in this analysis. In Sections IX through XII, a final selection of the pollutants to be limited will be made, based on relative factors.

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

This study examined samples one primary nickel and cobalt plant for two conventional pollutant parameters (TSS and pH) and two nonconventional pollutant parameters (ammonia and cobalt).

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

ammonia
cobalt
total suspended solids (TSS)
pH

Ammonia is used extensively throughout the primary nickel and cobalt manufacturing process. Two of the wastewater streams, nickel and cobalt reduction decants, contain very high concentrations of ammonia. Ammonia is selected for limitation in this subcategory because of its presence in high concentrations in the nickel and cobalt reduction decant streams.

Cobalt was observed in the one raw wastewater sample in this subcategory at a concentration of 4.6 mg/l. This concentration is above the concentration considered achievable by treatment technology (0.034 mg/l), and cobalt is expected to be present in the raw wastewater as a result of raw materials used. For these reasons, cobalt is selected for regulation.

Although total suspended solids (TSS) was not analyzed for in this subcategory, it is selected for regulation. This is because TSS is expected to be present in the raw wastewater samples above treatable concentration (2.6 mg/l), and most of the specific methods used to remove toxic metals do so by converting these metals to precipitates, and these toxic-metal-containing precipitates should not be discharged. Meeting a limitation on total suspended solids helps ensure that removal of these precipitated toxic metals has been effective.

The pH value observed was 7.6. Although this pH value is within the 7.5 to 10.0 range considered desirable, effective removal of toxic metals by precipitation requires careful control of pH. Also, the combined waste stream may not accurately reflect the pH values of the raw waste streams which may be outside the desirable range. For these reasons, pH is selected for limitation in this subcategory.

TOXIC PRIORITY POLLUTANTS

The frequency of occurrence of the priority pollutants in the wastewater samples considered in this analysis is presented in Table VI-1 (page 3877). These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater sampling data from stream 367. Stream 364 was sampled after treatment and was not used in the frequency count.

TOXIC POLLUTANTS NEVER DETECTED

The priority pollutants listed in Table VI-2 (page 3881) were not detected in any wastewater samples from this subcategory. Therefore, they are not selected for consideration in establishing effluent limitations and standards.

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

The priority 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 effluent limitations and standards.

4. benzene
86. toluene
114. antimony
115. arsenic
117. beryllium
119. chromium

122. lead
126. silver
127. thallium

TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

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

66. bis (2-ethylhexyl) phthalate
118. cadmium
123. mercury
125. selenium

Bis (2-ethylhexyl) phthalate was detected at its analytical quantification limit in the one sample analyzed. The observed concentration was 0.01 mg/l, and this is equal to the concentration achievable by treatment. Also, this compound is a plasticizer commonly used in laboratory and field sampling equipment, and is not used or formed as a by-product in this subcategory. For these reasons, bis (2-ethylhexyl) phthalate was not selected for limitation.

Cadmium was detected above its analytical quantification limit in the one sample analyzed. The observed concentration was 0.007 mg/l. This value is below the concentration achievable by treatment (0.049 mg/l). Therefore, cadmium is not selected for limitation.

Mercury was detected above its analytical quantification limit in the one sample analyzed. The observed concentration was 0.0002 mg/l. This value is below the concentration achievable by treatment (0.036 mg/l). Therefore, mercury is not selected for limitation.

Selenium was detected above its analytical quantification limit in the one sample analyzed. The observed concentration was 0.18 mg/l. This value is less than the treatable concentration (0.20 mg/l). Therefore, selenium is not selected for limitation.

TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION IN ESTABLISHING LIMITATIONS AND STANDARDS

The priority pollutants listed below are selected for further consideration in establishing limitations and standards for this subcategory. The priority pollutants selected are each discussed following the list.

120. copper
124. nickel

122. zinc

Copper was detected above its treatable concentration (0.39 mg/l) in the one sample analyzed. The observed concentration was 1.43 mg/l. Since copper was present in a concentration exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Nickel was detected above its treatable concentration (0.22 mg/l) in the one sample analyzed. The observed concentration was 40.0 mg/l. Since nickel was present in a concentration exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Zinc was detected above its treatable concentration (0.23 mg/l) in the one sample analyzed. The observed concentration was 0.377 mg/l. Since zinc was present in a concentration exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
PRIMARY NICKEL AND COBALT SUBCATEGORY
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	1	1	1			
3. acrylonitrile	0.010	0.01	1	1	1			
4. benzene	0.010	0.01	1	1		1		
5. benzidine	0.010	0.01	1	1	1			
6. carbon tetrachloride	0.010	0.01	1	1	1			
7. chlorobenzene	0.010	0.01	1	1	1			
8. 1,2,4-trichlorobenzene	0.010	0.01	1	1	1			
9. hexachlorobenzene	0.010	0.01	1	1	1			
10. 1,2-dichloroethane	0.010	0.01	1	1	1			
11. 1,1,1-trichloroethane	0.010	0.01	1	1	1			
12. hexachloroethane	0.010	0.01	1	1	1			
13. 1,1-dichloroethane	0.010	0.01	1	1	1			
14. 1,1,2-trichloroethane	0.010	0.01	1	1	1			
15. 1,1,2,2-tetrachloroethane	0.010	0.01	1	1	1			
16. chloroethane	0.010	0.01	1	1	1			
17. bis(chloromethyl) ether	0.010	0.01	1	1	1			
18. bis(2-chloroethyl) ether	0.010	0.01	1	1	1			
19. 2-chloroethyl vinyl ether	0.010	0.01	1	1	1			
20. 2-chloronaphthalene	0.010	0.01	1	1	1			
21. 2,4,6-trichlorophenol	0.010	0.01	1	1	1			
22. parachlorometa cresol	0.010	0.01	1	1	1			
23. chloroform	0.010	0.01	1	1	1			
24. 2-chlorophenol	0.010	0.01	1	1	1			
25. 1,2-dichlorobenzene	0.010	0.01	1	1	1			
26. 1,3-dichlorobenzene	0.010	0.01	1	1	1			
27. 1,4-dichlorobenzene	0.010	0.01	1	1	1			
28. 3,3'-dichlorobenzidine	0.010	0.01	1	1	1			
29. 1,1-dichloroethylene	0.010	0.01	1	1	1			
30. 1,2-trans-dichloroethylene	0.010	0.01	1	1	1			
31. 2,4-dichlorophenol	0.010	0.01	1	1	1			
32. 1,2-dichloropropane	0.010	0.01	1	1	1			
33. 1,3-dichloropropylene	0.010	0.01	1	1	1			
34. 2,4-dimethylphenol	0.010	0.01	1	1	1			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
PRIMARY NICKEL AND COBALT SUBCATEGORY
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	1	1	1			
36. 2,6-dinitrotoluene	0.010	0.01	1	1	1			
37. 1,2-diphenylhydrazine	0.010	0.01	1	1	1			
38. ethylbenzene	0.010	0.01	1	1	1			
39. fluoranthene	0.010	0.01	1	1	1			
40. 4-chlorophenyl phenyl ether	0.010	0.01	1	1	1			
41. 4-bromophenyl phenyl ether	0.010	0.01	1	1	1			
42. bis(2-chloroisopropyl) ether	0.010	0.01	1	1	1			
43. bis(2-chloroethoxy) methane	0.010	0.01	1	1	1			
44. methylene chloride	0.010	0.01	1	1	1			
45. methyl chloride	0.010	0.01	1	1	1			
46. methyl bromide	0.010	0.01	1	1	1			
47. bromoform	0.010	0.01	1	1	1			
48. dichlorobromomethane	0.010	0.01	1	1	1			
49. trichlorofluoromethane	0.010	0.01	1	1	1			
50. dichlorodifluoromethane	0.010	0.01	1	1	1			
51. chlorodibromomethane	0.010	0.01	1	1	1			
52. hexachlorobutadiene	0.010	0.01	1	1	1			
53. hexachlorocyclopentadiene	0.010	0.01	1	1	1			
54. isophorone	0.010	0.01	1	1	1			
55. naphthalene	0.010	0.01	1	1	1			
56. nitrobenzene	0.010	0.01	1	1	1			
57. 2-nitrophenol	0.010	0.01	1	1	1			
58. 4-nitrophenol	0.010	0.01	1	1	1			
59. 2,4-dinitrophenol	0.010	0.01	1	1	1			
60. 4,6-dinitro-o-cresol	0.010	0.01	1	1	1			
61. N-nitrosodimethylamine	0.010	0.01	1	1	1			
62. N-nitrosodiphenylamine	0.010	0.01	1	1	1			
63. N-nitrosodi-n-propylamine	0.010	0.01	1	1	1			
64. pentachlorophenol	0.010	0.01	1	1	1			
65. phenol	0.010	0.01	1	1	1			
66. bis(2-ethylhexyl) phthalate	0.010	0.01	1	1				
67. butyl benzyl phthalate	0.010	0.01	1	1	1			
68. di-n-butyl phthalate	0.010	0.01	1	1	1			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
PRIMARY NICKEL AND COBALT SUBCATEGORY
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
69. di-n-octyl phthalate	0.010	0.01	1	1	1			
70. diethyl phthalate	0.010	0.01	1	1	1			
71. dimethyl phthalate	0.010	0.01	1	1	1			
72. benzo(a)anthracene	0.010	0.01	1	1	1			
73. benzo(a)pyrene	0.010	0.01	1	1	1			
74. 3,4-benzofluoranthene	0.010	0.01	1	1	1			
75. benzo(k)fluoranthene	0.010	0.01	1	1	1			
76. chrysene	0.010	0.01	1	1	1			
77. acenaphthylene	0.010	0.01	1	1	1			
78. anthracene (c)	0.010	0.01	1	1	1			
79. benzo(ghi)perylene	0.010	0.01	1	1	1			
80. fluorene	0.010	0.01	1	1	1			
81. phenanthrene (c)	0.010	0.01	1	1	1			
82. dibenzo(a,h)anthracene	0.010	0.01	1	1	1			
83. indeno(1,2,3-cd)pyrene	0.010	0.01	1	1	1			
84. pyrene	0.010	0.01	1	1	1			
85. tetrachloroethylene	0.010	0.01	1	1	1			
86. toluene	0.010	0.01	1	1				
87. trichloroethylene	0.010	0.01	1	1	1			
88. vinyl chloride	0.010	0.01	1	1	1			
89. aldrin	0.005	0.01	1	1	1			
90. dieldrin	0.005	0.01	1	1	1			
91. chlordane	0.005	0.01	1	1	1			
92. 4,4'-DDT	0.005	0.01	1	1	1			
93. 4,4'-DDE	0.005	0.01	1	1	1			
94. 4,4'-DDD	0.005	0.01	1	1	1			
95. alpha-endosulfan	0.005	0.01	1	1	1			
96. beta-endosulfan	0.005	0.01	1	1	1			
97. endosulfan sulfate	0.005	0.01	1	1	1			
98. endrin	0.005	0.01	1	1	1			
99. endrin aldehyde	0.005	0.01	1	1	1			
100. heptachlor	0.005	0.01	1	1	1			
101. heptachlor epoxide	0.005	0.01	1	1	1			
102. alpha-BHC	0.005	0.01	1	1	1			
103. beta-BHC	0.005	0.01	1	1	1			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
PRIMARY NICKEL AND COBALT SUBCATEGORY
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
104. gamma-BHC	0.005	0.01	1	1	1			
105. delta-BHC	0.005	0.01	1	1	1			
106. PCB-1242 (d)	0.005	0.01	1	1	1			
107. PCB-1254 (d)	0.005	0.01	1	1	1			
108. PCB-1221 (d)	0.005	0.01	1	1	1			
109. PCB-1232 (e)	0.005	0.01	1	1	1			
110. PCB-1248 (e)	0.005	0.01	1	1	1			
111. PCB-1260 (e)	0.005	0.01	1	1	1			
112. PCB-1016 (e)	0.005	0.01	1	1	1			
113. toxaphene	0.005	0.01	1	1	1			
114. antimony	0.100	0.47	1	1		1		
115. arsenic	0.010	0.34	1	1		1		
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	1	1		1		
118. cadmium	0.002	0.049	1	1			1	
119. chromium	0.005	0.07	1	1		1		
120. copper	0.009	0.39	1	1				1
121. cyanide	0.02	0.047	0					
122. lead	0.020	0.08	1	1		1		
123. mercury	0.0001	0.036	1	1			1	
124. nickel	0.005	0.22	1	1				1
125. selenium	0.01	0.20	1	1			1	
126. silver	0.02	0.07	1	1		1		
127. thallium	0.100	0.34	1	1		1		
128. zinc	0.050	0.23	1	1				1
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)			0					

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

(b) Treatable concentrations for metals are based on performance of lime precipitation, sedimentation, and filtration; for organics, treatable concentrations are based on performance of activated carbon.

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

TABLE VI-2

TOXIC POLLUTANTS NEVER DETECTED

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidine
6. carbon tetrachloride (tetrachloromethane)
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
21. 4,6-trichlorophenol
22. parachlorometa cresol
23. chloroform (trichloromethane)
24. 2-chlorophenol
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
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene (1,3-dichloropropene)
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-choroethoxy) methane
44. methylene chloride (dichloromethane)
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
47. bromoform (tribromomethane)
48. dichlorobromomethane
49. trichlorofluoromethane (deleted)

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

50. dichlorodifluoromethane (deleted)
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
56. nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,6-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N.nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo (a)anthracene (1,2-benzanthracene)
73. benzo (a)pyrene (3,4-benzopyrene)
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthane (11,12-benzofluoranthene)
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene (1,11-benzoperylene)
80. fluorene
81. phenanthrene
82. dibenzo (a,h)anthracene (1,2,5,6-dibenzanthracene)
83. indeno (1,2,3-cd)pyrene (w,e,-o-phenylenepyrene)
84. pyrene
85. tetrachloroethylene
87. trichloroethylene
88. vinyl chloride (chloroethylene)
89. aldrin
90. dieldrin
91. chlordane (technical mixture and metabolites)
92. 4,4'-DDT
93. 4,4 -DDE(p,p'DDX)
94. 4,4'-DDD(p.p'TDE)
95. Alpha-endosulfan
96. Beta-endosulfan
97. endosulfan sulfate
98. endrin
99. endrin aldehyde

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

100. heptachlor
101. heptachlor epoxide
102. Alpha-BHC
103. Beta-BHC
104. Gamma-BHC (lindane)
105. Delta-BHC
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)
113. toxaphene
116. asbestos (Fibrous)
121. cyanide*
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

*We did not analyze for this pollutant in samples of raw wastewater from this subcategory. This pollutant is not believed to be present based on the Agency's best engineering judgment which includes consideration of raw materials and process operations.

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SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from primary nickel and cobalt plants. This section summarizes the description of these wastewaters and indicates the treatment technologies which are currently practiced in the primary nickel and cobalt subcategory for each wastewater stream. Secondly, this section presents the control and treatment technology options which were examined by the Agency for possible application to the primary nickel and cobalt subcategory.

CURRENT CONTROL AND TREATMENT PRACTICES

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 primary nickel and cobalt subcategory is characterized by the presence of the toxic metal pollutants and suspended solids. This analysis is supported by raw (untreated) wastewater data presented for a combined waste stream in Section V. Generally, these pollutants are present in each of the waste streams at treatable concentrations, and these waste streams are commonly combined for treatment. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economies of scale and, in some instances, to combine streams of differing alkalinity to reduce treatment chemical requirements. The one plant in this subcategory currently has a combined wastewater treatment system, consisting of chemical precipitation, sedimentation, and filtration. Two options have been selected for consideration for BPT, BAT, NSPS, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

RAW MATERIAL DUST CONTROL

Copper matte is crushed and ground as a preliminary step in the processing of primary nickel and cobalt. Dust and particulates generated by the crushing and grinding operations are controlled with a dry baghouse, and then slurried with water for transportation to treatment. One plant treats this waste stream as a combined wastewater with chemical precipitation, sedimentation, and filtration prior to direct discharge.

COBALT REDUCTION DECANT

The excess solution from the cobalt reduction autoclave furnace is discharged, along with the nickel reduction decant, to a by-product recovery system. In by-product recovery, the ammonium sulfate values are recovered in a fertilizer product. There is no wastewater treatment for this stream.

NICKEL REDUCTION DECANT

The excess solution from the nickel reduction autoclave furnace is discharged to a by-product recovery system. In by-product recovery, the ammonium sulfate values are recovered in a fertilizer product. There is no wastewater treatment for this stream.

NICKEL WASH WATER

After reducing nickel to powder in a hydrogen furnace, the powder is washed with water. The wastewater produced here is combined with other wastes and treated using lime, settle, and filter technology described for the previous waste stream. Nickel wash water is discharged directly after treatment.

CONTROL AND TREATMENT OPTIONS

The Agency examined two control and treatment technology options that are applicable to the primary nickel and cobalt subcategory. The options selected for evaluation represent a combination of preliminary treatment technologies applicable to individual waste screams and end-of-pipe treatment technologies. The effectiveness of these technologies is presented in Section VII of the General Development Document.

OPTION A

Option A for the primary nickel and cobalt subcategory requires control and treatment technologies to reduce the discharge of wastewater pollutant mass.

The Option A treatment scheme consists of ammonia steam stripping preliminary treatment to reduce the concentration of ammonia in selected streams, and chemical precipitation and sedimentation technology. Specifically, lime or some other alkaline compound is used to precipitate metal ions as metal hydroxides. The metal hydroxides and suspended solids settle out and the sludge is collected. Vacuum filtration is used to dewater sludge.

OPTION C

Option C for the primary nickel and cobalt subcategory consists of all control and treatment requirements of Option A (ammonia steam stripping, chemical precipitation, and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme. Multimedia filtration is used to remove suspended solids, including precipitates of metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed-media type, although other forms of filters, such as rapid sand filters or pressure filters would perform satisfactorily. The addition of filters also provides consistent removal during periods of time in which there are rapid increases in flows or loadings of pollutants to the treatment system.

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SECTION VIII

COSTS, ENERGY AND NONWATER QUALITY ASPECTS

This section presents a summary of compliance costs for the primary nickel and cobalt subcategory and a description of the treatment options and subcategory-specific assumptions used to develop these estimates. Together with the estimated pollutant reduction performance presented in Sections IX, X, XI, and XII of this supplement, these cost estimates provide a basis for evaluating each regulatory option. These cost estimates are also used in determining the probable economic impact of regulation on the subcategory at different pollutant discharge levels. In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution, solid wastes, and energy requirements, which are specific to the primary nickel and cobalt subcategory.

TREATMENT OPTIONS FOR EXISTING SOURCES

As discussed in Section VII, two treatment options have been developed for existing primary nickel and cobalt sources. The treatment schemes for each option are summarized below and schematically presented in Figures X-1 and X-2 (pages 3916 and 3917).

OPTION A

Option A consists of ammonia steam stripping preliminary treatment, where required and chemical precipitation and sedimentation end-of-pipe technology.

OPTION C

Option C consists of all control and treatment technology for Option A (ammonia steam stripping preliminary treatment, chemical precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme.

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 for the nonferrous metals manufacturing category have been revised as necessary following proposal. These revisions calculate incremental costs, above treatment already in place, necessary to comply with the promulgated effluent limitations and standards and are presented in the administrative record supporting this regulation. A comparison of the costs developed for proposal and the revised costs for the final regulation are presented in Table VIII-1 (page 3893) for the direct discharger.

Each of the general assumptions used to develop compliance costs is presented in Section VIII of the General Development Document. Each subcategory contains a unique set of waste streams requiring certain subcategory-specific assumptions to develop compliance costs. The major assumptions relevant to cost estimates for the primary nickel and cobalt subcategory are discussed briefly below.

(1) Caustic is used instead of lime in chemical precipitation for this plant, because the one direct discharger in the subcategory currently uses caustic.

(2) Raw material dust control wastewater is assumed to have a pH = 5 because of sulfides present, and a concentration of TSS = 12 mg/l. Nickel wash water is also assumed to have pH = 5 and a concentration of TSS = 12 mg/l.

(3) Sampling data indicate that the raw material dust control and nickel wash waste streams contain treatable concentrations of ammonia. However, examination of the processes involved and correspondence with plant personnel indicate that the reported ammonia level is not due to the presence of ammonia in the process streams. Rather, ammonia enters the treatment system influent (sample number 367) through spills in the process areas. Consequently, these two process streams do not require ammonia steam stripping.

Revised direct discharge compliance cost estimates for this subcategory reflect a correction in the treatment-in-place credit assumptions made at proposal. Plant 1062 presently operates chemical precipitation, sedimentation, and filtration, and treats a combined wastewater consisting of nonferrous metals manufacturing wastewater and plant stormwater. Because stormwater is the major component of the wastewater, and because it is not in the scope of this regulation, compliance costing at proposal estimated the cost to segregate process wastewater and treat it in a separate treatment system. However, treatment-inplace credit for lime and settle was incorrectly attributed to the plant; therefore, proposal costs did not accurately reflect the cost to the direct discharger for compliance with the proposed and promulgated rulemaking. EPA believes that the existing filter can continue to be used if a holding tank is installed after lime and settle treatment of raw material dust slurry water and nickel wash water. The costs for this holding tank are included in EPA's compliance cost estimate. The revised compliance cost estimates prepared for promulgation are presented in Table VIII-1.

NONWATER QUALITY ASPECTS

Nonwater quality impacts specific to the primary nickel and cobalt 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 the two options considered are estimated at 20,600 kwh/yr and 28,570 kwh/yr for Options A and C, respectively. Option C, which includes filtration, increases energy consumption over Option A by approximately 39 percent. Option C represents less than 1 percent of a typical plant's electrical energy usage. It is therefore concluded that the energy requirements of the treatment options considered will have no significant impact on total plant energy consumption.

SOLID WASTE

Sludge generated in the primary nickel and cobalt subcategory is due to the precipitation of metal hydroxides and carbonates using lime or various other chemicals. Sludges associated with the primary nickel and cobalt subcategory will necessarily contain quantities of toxic metal pollutants. These sludges are not subject to regulation as hazardous wastes since wastes generated by primary smelters and refiners are currently exempt from regulation by Act of Congress (Resource Conservation and Recovery Act (RCRA), Section 3001(b)), as interpreted by EPA. If a small excess of lime is added during treatment, the Agency does not believe these sludges would be identified as hazardous under RCRA in any case. (Compliance costs include this amount of lime.) This judgment is based on the results of Extraction Procedure (EP) toxicity tests performed on similar sludges (toxic metal-bearing sludges) generated by other categories such as the iron and steel industry. A small amount of excess lime was added during treatment, and the sludges subsequently generated passed the toxicity test. See CFR §261.24. Thus, the Agency believes that the wastewater sludges will similarly not be EP toxic if the recommended technology is applied.

Although it is the Agency's view that solid wastes generated as a result of these guidelines are not expected to be hazardous, generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste.

If these wastes should be identified or are listed as hazardous, they will come within the scope of RCRA's "cradle to grave" hazardous waste management program, requiring regulation, from the point of generation to point of final disposition. EPA's gener-ator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off-site treatment, storage, or disposal facility. See 40 CFR 262.20, 45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). The transporter regulations require transporters of hazardous wastes to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR 263.20, 45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). Finally, RCRA regulations establish standards for hazardous waste treat-ment, storage, and disposal facilities allowed to receive such wastes. See 40 CFR Part 464, 46 FR 2802 (January 12, 1981), and 47 FR 32274 (July 26, 1982).

Even if these wastes are not identified as hazardous, they still must be disposed of in compliance with the Subtitle D open dumping standards, implementing 4004 of RCRA. See 44 FR 53438 (September 13, 1979). The Agency has calculated as part of the costs for wastewater treatment the cost of hauling and disposing of these wastes.

Sludge generation for the primary nickel and cobalt subcategory is estimated at 10.41 metric tons per year when implementing the promulgated BPT technology. Sludge generation for promulgated BAT is not expected to be significantly different.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of ammonia steam stripping, chemical precipitation, sedimentation, and multimedia filtration. Ammonia steam stripping yields an aqueous ammonia stream. The other technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

Table VIII-1

COST OF COMPLIANCE FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY
DIRECT DISCHARGERS

(March, 1982 Dollars)

Option	Proposal Costs		Promulgation Costs	
	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	31,075	20,053	71,400	27,200
C	31,075	27,844	86,500	31,800

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SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

This section defines the effluent characteristics attainable through the application of best practicable control technology currently available (BPT). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the primary nickel and cobalt subcategory, as well as the established performance of the recommended BPT systems. Particular consideration is given to the treatment already in place at plants within the data base.

The factors considered in identifying BPT include the total cost of applying the technology in relation to the effluent reduction benefits from such application, the age of equipment and facilities involved, the manufacturing processes used, nonwater quality environmental impacts (including energy requirements), and other factors the Administrator considers appropriate. In general, the BPT level represents the average of the existing performances of plants of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, BPT may be transferred from a different subcategory or category. Limitations based on transfer of technology are supported by a rationale concluding that the technology is, indeed, transferable, and a reasonable prediction that it will be capable of achieving the prescribed effluent limits BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common industry practice.

TECHNICAL APPROACH TO BPT

The Agency studied the nonferrous metals category to identify the processes used, the wastewaters generated, and the treatment processes installed. Information was collected from the category using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. In making technical assessments of data, reviewing manufacturing processes, and assessing wastewater treatment technology options, both indirect and direct dischargers have been considered as a single group. An examination of plants and processes did not indicate any process differences based on the type of discharge, whether it be direct or indirect. As explained in Section IV, the primary nickel and cobalt subcategory has been subdivided into four potential wastewater sources. Since the water use, discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations will be developed for each of the four subdivisions.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations. The first requirement to calculate these limitations is to account for production and flow variability from plant to plant. Therefore, a unit of production or production normalizing parameter (PNP) was determined for each waste stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Each process within the subcategory was then analyzed to determine which subdivisions were present, the specific flow rates generated for each subdivision, and the specific production normalized flows for each subdivision. This analysis is discussed in detail in Section V. Nonprocess wastewaters such as rainfall runoff and noncontact cooling water are not considered in the analysis.

Production normalized flows for each subdivision were then analyzed to determine the flow to be used as part of the basis for BPT mass limitations. The selected flow (sometimes referred to as a BPT regulatory flow or BPT discharge flow) reflects the water use controls which are common practices within the category. The BPT regulatory flow is based on the average of all applicable data. Plants with normalized flows above the average may have to implement some method of flow reduction to achieve the BPT limitations.

The second requirement to calculate mass limitations is the set of concentrations that are achievable by application of the BPT level of treatment technology. Section VII discusses the various control and treatment technologies which are currently in place for each wastewater source. In most cases, the current control and treatment technologies consist of chemical precipitation and sedimentation (lime and settle technology) and a combination of reuse and recycle to reduce flow. Ammonia steam stripping is applied to streams with treatable concentrations of ammonia.

Using these regulatory flows and the achievable concentrations, the next step is to calculate mass loadings for each wastewater source or subdivision. This calculation was made on a stream-by stream basis, primarily because plants in this subcategory may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per kilogram of production - mg/kg) are based on multiplying the BPT regulatory flow (l/kkg) by the concentration achievable by the BPT level of treatment technology (mg/l) for each pollutant parameter to be limited under BPT. These mass loadings are published in the Federal Register and in CFR Part 421 as the effluent limitations.

The mass loadings which are allowed under BPT for each plant will be the sum of the individual mass loadings for the various wastewater sources which are found at particular plants. Accordingly. all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at primary nickel and cobalt plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/kkg) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each plant.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

In balancing costs in relation to pollutant removal estimates. EPA considers the volume and nature of existing discharges, the volume and nature of discharges expected after application of BPT, the general environmental effects of the pollutants, and the cost and economic impacts of the required pollution control level. The Act does not require or permit consideration of water quality problems attributable to particular point sources or industries, or water quality improvements in particular water quality bodies. Accordingly, water quality considerations were not the basis for selecting the proposed or promulgated BPT.

The methodology for calculating pollutant removal estimates and plant compliance costs is discussed in Section X. Table X-1 (page 3911) shows the pollutant removal estimates for each treatment option. Compliance costs are presented in Table X-2 (page 3912).

BPT OPTION SELECTION

The technology basis for the proposed and promulgated BPT limitations is Option A, chemical precipitation and sedimentation technology to remove metals and solids from combined wastewaters and to control pH, and ammonia steam stripping to remove ammonia.

Chemical precipitation and sedimentation technology is already in-place in the subcategory. The pollutants specifically promulgated for regulation at BPT are copper, nickel, cobalt, ammonia, TSS, and pH.

Ammonia steam stripping is demonstrated at six facilities in the nonferrous metals manufacturing category. These facilities are treating ammonia-bearing wastewaters associated with the production of primary tungsten, primary columbium and tantalum, primary molybdenum, secondary tungsten and cobalt, and primary zirconium and hafnium. EPA believes that performance data from the iron and steel manufacturing category provide a valid measure of this technology's performance on nonferrous metals manufacturing category wastewater because raw wastewater concentrations of ammonia are of the same order of magnitude in the respective raw wastewater matrices.

Chemical analysis data were collected of raw waste (treatment influent) and treated waste (treatment effluent) from one coke plant of the iron and steel manufacturing category. A contractor for EPA, using EPA sampling and chemical analysis protocols, collected six paired samples in a two-month period. These data are the data base for determining the effectiveness of ammonia steam stripping technology and are contained with the public record supporting this document. Ammonia treatment at this coke plant consisted of two steam stripping columns in series with steam injected countercurrently to the flow of the wastewater. A lime reactor for pH adjustment separated the two stripping columns.

The raw untreated wastewater samples from the coke facility contained ammonia concentrations of 599, 226, 819, 502, 984, and 797 mg/l. Raw untreated wastewater samples from the primary nickel and cobalt subcategory should have ammonia concentrations on a similar order of magnitude.

The Agency has verified the promulgated steam stripping performance values using steam stripping data collected at a primary zirconium and hafnium plant which has raw ammonia levels as high as any in the nonferrous metals manufacturing category. Data collected by the plant represent almost two years of daily operations, and support the long-term mean used to establish treatment effectiveness.

In addition, data submitted by a primary columbium-tantalum plant, which also has significant raw ammonia levels, verifies the promulgated steam stripping performance values.

Implementation of the promulgated BPT limitations will remove annually an estimated 241 kg of toxic metals. The Agency projects capital and annual costs of $71,400 and $27,200 (1982 dollars), respectively for the discharging facility to achieve the promulgated BPT regulations. The BPT treatment configuration is presented in Figure IX-1 (page 3904).

More stringent technology options were not selected for BPT since they require in-process changes or end-of-pipe technologies less widely practiced in the subcategory, and, therefore, are more appropriately considered under BAT.

WASTEWATER DISCHARGE RATES

A BPT discharge rate is calculated for each subdivision based on the average of the flows of the existing plants, as determined from analysis of dcp. The discharge rate is used with the achievable treatment concentrations to determine BPT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the four wastewater sources are discussed below and summarized in Table IX-1 (page 3901). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table IX-1.

Section V of this document further describes the discharge flow rates and presents the water use and discharge flow rates for each subdivision by plant in Tables V-1 through V-4.

RAW MATERIAL DUST CONTROL

The BPT wastewater discharge rate used at proposal and promulgation for raw material dust control is 77 liters/kkg (18.5 gal/ton) of copper, nickel, and cobalt in the crushed raw material. This rate is allocated only for those plants which produce nickel and cobalt from an ore concentrate raw material and transport dust from the baghouse over the crushing and grinding operations with a water slurry system. Water use and wastewater discharge rates are presented in Table V-1 (page 3848). The BPT flow is based on the reported rate of 77 liters/kkg).

COBALT REDUCTION DECANT

The BPT wastewater discharge rate used at proposal and promulgation for cobalt reduction decant is 21,398 liters/kkg (5.128 gal/ton) of cobalt produced. The BPT flow is based on the water use rate reported, as shown in Table V-2 (page 3849). This rate is allocated only for those plants which reduce cobalt from solution in a hydrogen autoclave, and decant excess solution.

NICKEL REDUCTION DECANT

The proposed and promulgated BPT wastewater discharge rate for nickel reduction decant is 12,695 liters/kkg (3,042 gal/ton) of nickel produced. The BPT flow is based on the water use rate reported by the only plant with this process waste stream, as shown in Table V-3 (page 3850). This rate is allocated only for those plants which reduce nickel from solution in a hydrogen autoclave, and decant excess solution.

NICKEL WASH WATER

The proposed and promulgated BPT wastewater discharge rate for nickel wash water is 33.87 liters/kkg (8.12 gal/ton) of nickel powder washed. This rate is allocated only for those plants which produce nickel from primary sources via a hydrogen reduction autoclave, and then wash the product with water. Water use and wastewater discharge rates are presented in Table V-4 (page 3851). The BPT flow is based on the reported rate of 33.87 liters/kkg.

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination and evaluation was presented in Section VI. A total of six pollutants or pollutant parameters were selected for limitation under the promulgated BPT and are listed below:

120. copper
124. nickel
ammonia (as N)
cobalt
total suspended solids (TSS)
pH

EFFLUENT LIMITATIONS

The pollutant concentrations achievable by application of the BPT technology are discussed in Section VII of this supplement. These achievable concentrations (both one day maximum and monthly average values) are multiplied by the BPT normalized discharge flows summarized in Table IX-1 to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the BPT effluent limitations and are presented in Table IX-2 (page 3902) for each individual waste stream.

Table IX-1

BPT WASTEWATER DISCHARGE RATES FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

Wastewater Stream	BPT Normalized Discharge Rate l/kkg	BPT Normalized Discharge Rate gal/ton	Production Normalizing Parameter
1. Raw Material Dust Control	77	18.5	Copper, nickel, and cobalt in the crushed raw material
2. Cobalt Reduction Decant	21,398	5,128	Cobalt produced
3. Nickel Reduction Decant	12,695	3.042	Nickel produced
4. Nickel Wash Water	33.87	8.12	Nickel powder washed

TABLE IX-2

BPT MASS LIMITATIONS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(a) Raw Material Dust Control BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material	
*Copper	0.146	0.077
*Nickel	0.148	0.098
Zinc	0.112	0.047
*Ammonia	10.260	4.512
*Cobalt	0.016	0.007
*TSS	3.157	1.502
*pH	Within the range of 7.5 to 10.0 at all times	

(b) Cobalt Reduction Decant BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of cobalt produced	
*Copper	40.660	21.400
*Nickel	41.080	27.180
Zinc	31.240	13.050
*Ammonia	2,852.000	1,254.000
*Cobalt	4.494	1.926
*TSS	877.300	417.300
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(c) Nickel Reduction Decant BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of nickel produced	
*Copper	24.120	12.700
*Nickel	24.370	16.120
Zinc	18.530	7.744
*Ammonia	1,692.000	743.900
*Cobalt	2.666	1.143
*TSS	520.500	247.600
*pH	Within the range of 7.5 to 10.0 at all times	

(d) Nickel Wash Water BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of nickel powder washed	
*Copper	0.064	0.034
*Nickel	0.065	0.043
Zinc	0.050	0.021
*Ammonia	4.515	1.985
*Cobalt	0.007	0.003
*TSS	1.389	0.660
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

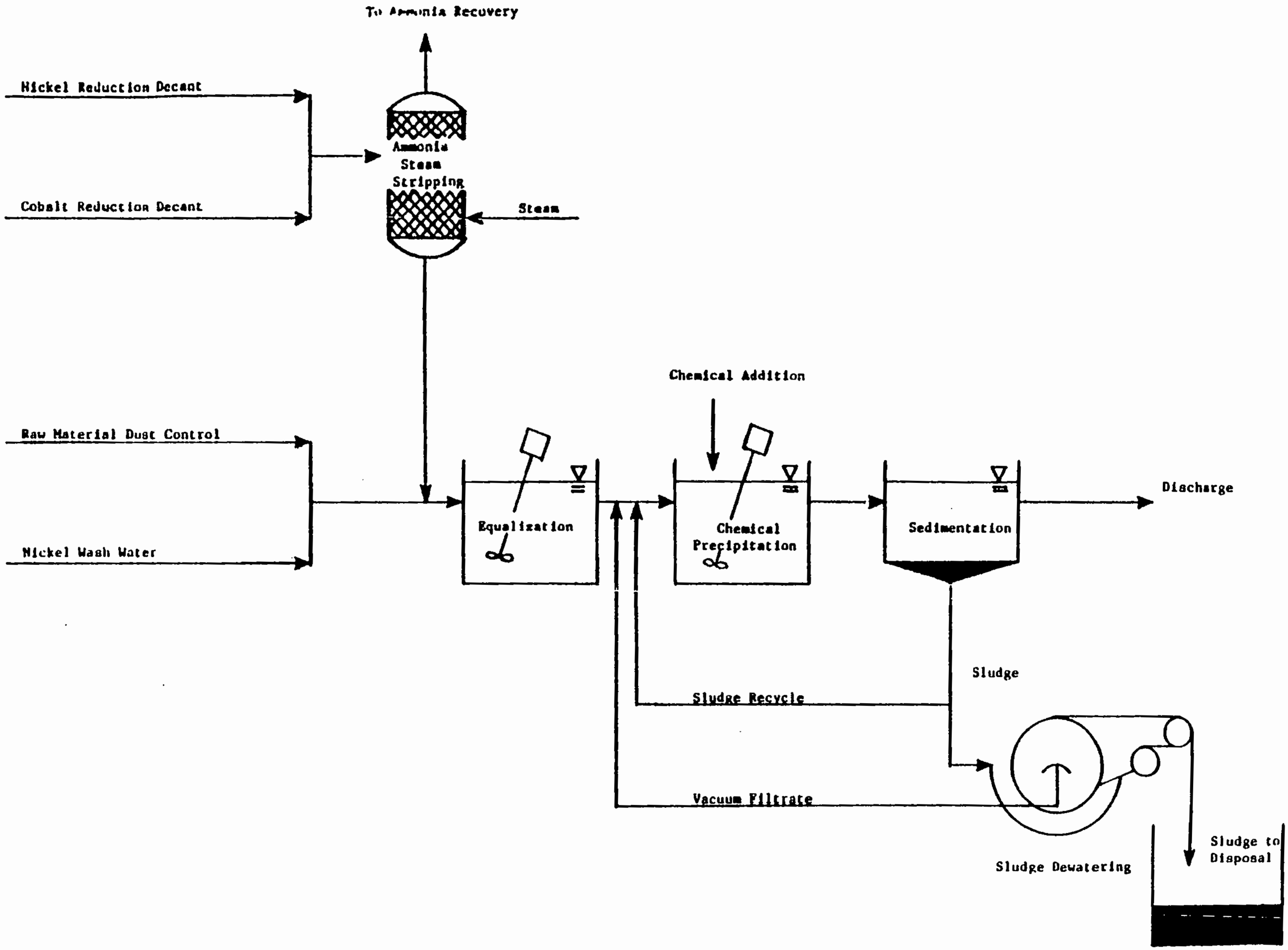

Figure IX-1

BPT TREATMENT SCHEME FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

These effluent limitations 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 from which it is 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. 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 pollutant removals However, in assessing the proposed and promulgated BAT the Agency has given substantial weight to the economic achievability of the technology.

TECHNICAL APPROACH TO BAT

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 two technology options which could be applied to the primary nickel and cobalt subcategory as alternatives for the basis of BAT effluent limitations.

For the development of BAT effluent limitations, mass loadings were calculated for each wastewater source or subdivision in the subcategory using the same technical approach as described in Section IX for BPT limitations development. The differences in the mass loadings for BPT and BAT are due to increased treatment effectiveness achievable with the more sophisticated BAT treatment technology.

The treatment technologies considered for BAT are summarized below:

Option A (Figure X-1, page 3916) is based on:

- o Ammonia steam stripping preliminary treatment (where required)
- o Chemical precipitation and sedimentation

Option C (Figure X-2, page 3917) is based on:

- o Ammonia steam stripping preliminary treatment (where required)
- o Chemical precipitation and sedimentation
- o Multimedia filtration

The first option considered (Option A) is the same as the BPT treatment and control technology which was presented in the previous section. The second option represents substantial progress toward the reduction of pollutant discharges above and beyond the progress achievable by BPT.

OPTION A

Option A for the primary nickel and cobalt subcategory is equivalent to the control and treatment technologies which were analyzed for BPT in Section IX (see Figures IX-1 or X-1). The BPT end-of-pipe treatment scheme includes ammonia steam stripping pretreatment, chemical precipitation, and sedimentation. The discharge rates for Option A are equal to the discharge rates allocated to each stream as a BPT discharge flow.

OPTION C

Option C for the primary nickel and cobalt subcategory consists of all control and treatment requirements of Option A (ammonia steam stripping, chemical precipitation, and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme (see Figure X-2). Multimedia filtration is used to remove suspended solids, including precipitates of toxic metals, beyond the concentrations attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other forms of filters, such as rapid sand filters or pressure filters, would perform satisfactorily.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

As one means of evaluating each technology option, EPA developed estimates of the pollutant removals and compliance costs associated with each option. 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 various treatment options is presented in Section X of Vol. I. In short, sampling data collected during the field sampling program were used to characterize the major waste streams considered for regulation. At each sampled facility the sampling data were production normalized for each unit operation (i.e. mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste, was used to estimate the mass of toxic pollutants generated within the primary nickel and cobalt subcategory. The pollutant removal estimates were calculated for each plant by first estimating the total mass of each pollutant in the untreated wastewater. This was calculated by first multiplying the raw waste values by the corresponding production value for that stream and then summing these values for each pollutant for every stream generated by the plant.

The volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable with the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed is the difference between the estimated mass of pollutant generated within the subcategory and the mass of pollutant discharged after application of the treatment option. The pollutant removal estimates for direct dischargers in the primary nickel and cobalt subcategory are presented in Table X-1 (page 3911). These pollutant removal estimates are equivalent to those presented at proposal.

COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop a cost estimation model, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied the model to each plant. The plant's investment and operating costs are determined by what treatment it has in place and by its individual process wastewater discharge flow. As discussed above, this flow is either the actual or the BAT regulatory flow, whichever is lesser. The final step was to annualize the capital costs, and to sum the annualized capital costs, and the operating and maintenance costs for each plant, yielding the cost of compliance for the subcategory (see Table X-2, page 3912). These costs were used in assessing economic achievability.

BAT OPTION SELECTION - PROPOSAL

EPA proposed BAT limitations for the primary nickel and cobalt subcategory based on Option C, preliminary treatment consisting of ammonia steam stripping followed by end-of-pipe treatment consisting of chemical precipitation, sedimentation, and filtration. The pollutants specifically proposed for regulation under BAT were copper, nickel, ammonia, and cobalt.

Implementation of the proposed BAT limitations was estimated to remove 246 kilograms of priority metals annually. The projected capital and annual costs for the proposed BAT technology were estimated to be $31,075 and $27,844 (1982 dollars), respectively.

BAT OPTION SELECTION - PROMULGATION

Our promulgated BAT limitations for this Subcategory are based on Option C, preliminary treatment of ammonia steam stripping followed by end-of-pipe treatment consisting of chemical precipitation and sedimentation (BPT technology), and filtration. Filters are presently utilized by the one plant in this subcategory.

We are promulgating filtration as part of the BAT technology because this technology is demonstrated in the primary nickel and cobalt subcategory (the one discharger in this subcategory presently has a filter, and a total of 25 facilities in eight nonferrous metals manufacturing subcategories currently have filters), and results in additional removals of toxic metals. In addition, filtration adds reliability to the treatment system by making it less susceptible to operator error and to sudden changes in raw wastewater flows and concentrations.

The pollutants specifically limited under BAT are cobalt, copper, nickel, and ammonia. The toxic pollutant zinc was also considered for regulation because it was found at treatable concentrations in the raw wastewaters from this subcategory. This pollutant was not selected for specific regulation because it will be effectively controlled when the regulated toxic metals are treated to the concentrations achievable by the model BAT technology.

Implementation of the promulgated BAT limitations would remove annually an estimated 246 kg of priority metals, which is 5 kg of toxic metals greater than the estimated BPT removal. The Agency projects capital and annual costs of $86,500 and $31,800 (1982 dollars), respectively for technology required to achieve the promulgated BAT regulations. The BAT treatment scheme is presented in Figure X-2.

WASTEWATER DISCHARGE RATES

A BAT discharge rate was calculated for each subdivision based upon the flows of the existing plants, as determined from analysis of the data collection portfolios. The discharge rate is used with the achievable treatment concentrations to determine BAT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the four wastewater sources were determined and are summarized in Table X-3 (page

3913). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table X-3.

The BAT discharge rates reflect the flow reduction requirements of the selected BAT option. Since no flow reduction beyond the flow reduction practices of BPT is required for this subcategory, BAT discharge rates are identical to BPT discharge rates.

REGULATED POLLUTANT PARAMETERS

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 was presented in Section VI. The Agency, however, has chosen not to regulate all three toxic pollutants selected in this analysis.

The high cost associated with analysis for toxic metal pollutants has prompted EPA to develop an alternative method for regulating and monitoring toxic pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent mass limitations and standards for each of the toxic metals found in treatable concentrations in the raw wastewater from a given subcategory, the Agency is promulgating effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal estimates. The pollutants selected for specific limitation are listed below:

120. copper
124. nickel
cobalt

By establishing limitations and standards for certain priority metal pollutants, discharges will attain the same degree of control over priority metal pollutants as they would have been required to achieve had all the priority metal pollutants been directly limited.

This approach is technically justified since the treatable concentrations used for chemical precipitation and sedimentation technology are based on optimized treatment for concomitant multiple metals removal. Thus, even though metals have somewhat different theoretical solubilities, they will be removed at very nearly the same rate in a chemical precipitation and sedimentation treatment system operated for multiple metals removal. Filtration as part of the technology basis is likewise justified because this technology removes metals non-preferentially.

The toxic metal pollutants selected for specific limitation in the primary nickel and cobalt subcategory to control the discharges of toxic metal pollutants are copper and nickel. The following toxic metal pollutant is excluded from limitation on the basis that it is effectively controlled by the limitations developed for copper and nickel:

128. zinc

The nonconventional pollutants ammonia and cobalt will be limited in the primary nickel and cobalt subcategory along with the priority pollutants nickel and copper. It is necessary to limit ammonia because the treatment technology used to control copper and nickel (chemical precipitation and sedimentation) does not remove ammonia. The priority metal pollutants copper and nickel, as well as the nonconventional metal pollutant cobalt, are specifically limited to ensure the control of the excluded priority metal pollutant. These pollutants are indicators of the performance of the treatment technology.

EFFLUENT LIMITATIONS

The concentrations achievable by application of BAT are discussed in Section VII of this supplement. The treatable concentrations both one day maximum and monthly average values are multiplied by the BAT normalized discharge flows summarized in Table X-3 to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the BAT effluent limitations and are presented in Table X-4 (page 3914) for each waste stream.

Table X-1

POLLUTANT REMOVAL ESTIMATES FOR DIRECT DISCHARGERS
PRIMARY NICKEL AND COBALT SUBCATEGORY

Pollutant	Raw Waste (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)
Antimony	0.11	0.11	0	0.11	0
Arsenic	0	0	0	0	0
Cadmium	0.04	0.04	0	0.04	0
Chromium (Total)	0	0	0	0	0
Copper	8.58	3.47	5.11	2.34	6.24
Cyanide (Total)	0	0	0	0	0
Lead	0	0	0	0	0
Mercury	0	0	0	0	0
Nickel	239.96	4.43	235.53	1.32	238.64
Selenium	1.08	1.08	0	1.08	0
Silver	0	0	0	0	0
Thallium	0	0	0	0	0
Zinc	2.26	1.98	0.29	1.38	0.88
TOTAL PRIORITY POLLUTANTS	252.04	11.12	240.92	6.27	245.77
Ammonia	2,639.55	2,635.23	4.32	2,635.23	4.32
Cobalt	27.60	0.30	27.30	0.20	27.39
TOTAL NONCONVENTIONALS	2,667.15	2,635.53	31.62	2,635.43	31.71
TSS	71.98	71.87	0.11	15.57	56.41
TOTAL CONVENTIONALS	71.98	71.87	0.11	15.57	56.41
TOTAL POLLUTANTS	2,991.16	2,718.51	272.65	2,657.27	333.89

Option A - Ammonia steam stripping, chemical precipitation, and sedimentation
Option C - Ammonia steam stripping, chemical precipitation, sedimentation, and filtration

Table X-2

COST OF COMPLIANCE FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY
DIRECT DISCHARGERS

(March, 1982 Dollars)

	Proposal Costs		Promulgation Costs	
Option	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	31,075	20,053	71,400	27,200
C	31,075	27,844	86,500	31,800

Table X-3

BAT WASTEWATER DISCHARGE RATES FOR THE
PRIMARY NICKEL AND COBALT SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rate l/kkg	BAT Normalized Discharge Rate gal/ton	Production Normalizing Parameter
1. Raw Material Dust Control	77	18.5	Copper, nickel, and cobalt in the crushed raw material
2. Cobalt Reduction Decant	21,398	5,128	Cobalt produced
3. Nickel Reduction Decant	12,695	3,042	Nickel produced
4. Nickel Wash Water	33.87	8.12	Nickel powder washed

TABLE X-4

BAT MASS LIMITATIONS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(a) Raw Material Dust Control BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material		
*Copper	0.099	0.047
*Nickel	0.042	0.029
Zinc	0.079	0.032
*Ammonia	10.260	4.512
*Cobalt	0.011	0.005

(b) Cobalt Reduction Decant BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of cobalt produced		
*Copper	27.390	13.050
*Nickel	11.770	7.917
Zinc	21.830	8.987
*Ammonia	2,852.000	1,254.000
*Cobalt	2.996	1.498

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(c) Nickel Reduction Decant BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of nickel produced		
*Copper	16.250	7.744
*Nickel	6.982	4.697
Zinc	12.950	5.332
*Ammonia	1,692.000	743.900
*Cobalt	1.777	0.889

(d) Nickel Wash Water BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of nickel powder washed		
*Copper	0.043	0.021
*Nickel	0.019	0.013
Zinc	0.035	0.014
*Ammonia	4.515	1.985
*Cobalt	0.005	0.002

*Regulated Pollutant

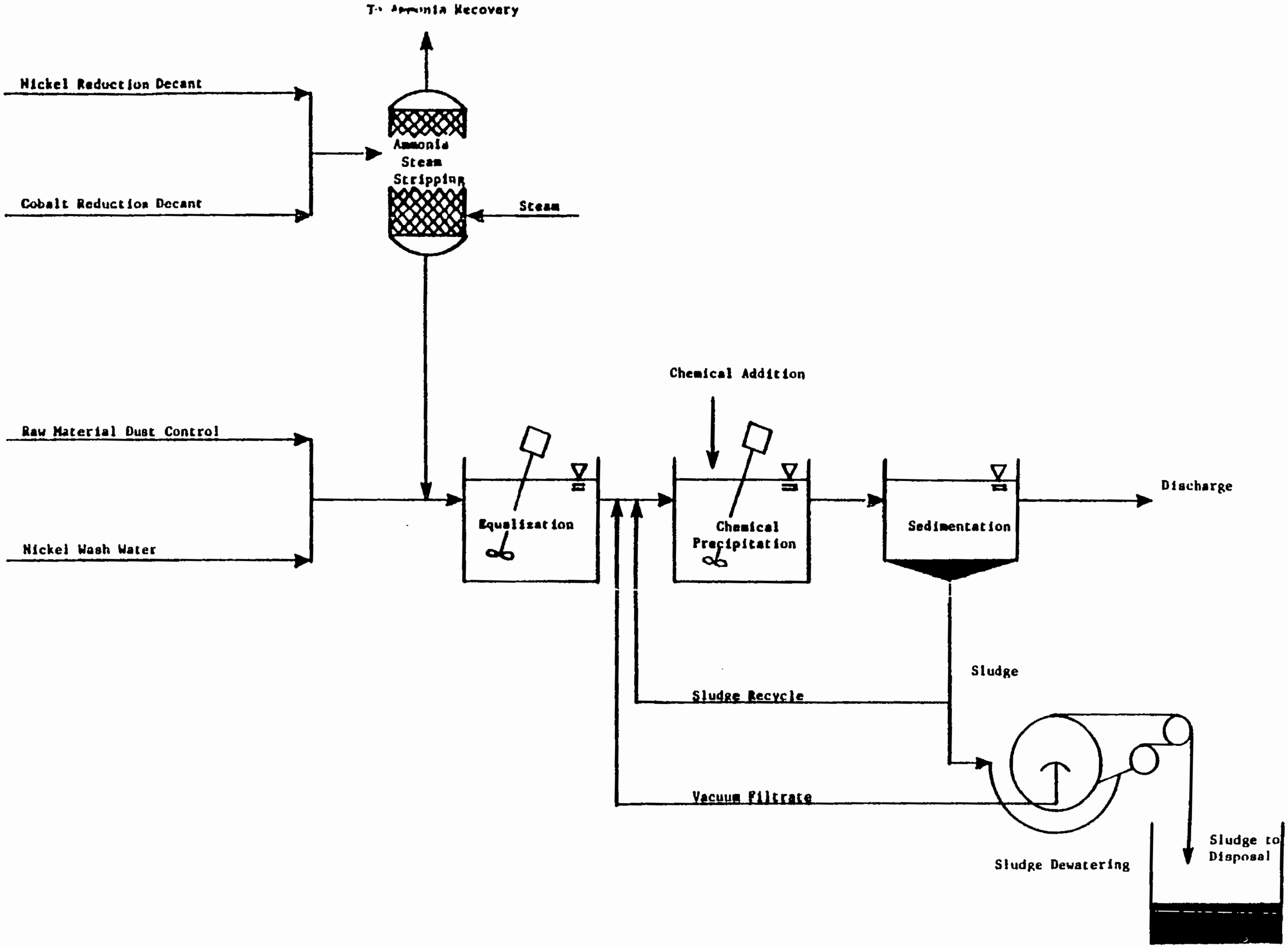

Figure X-1

BAT TREATMENT SCHEME FOR OPTION A

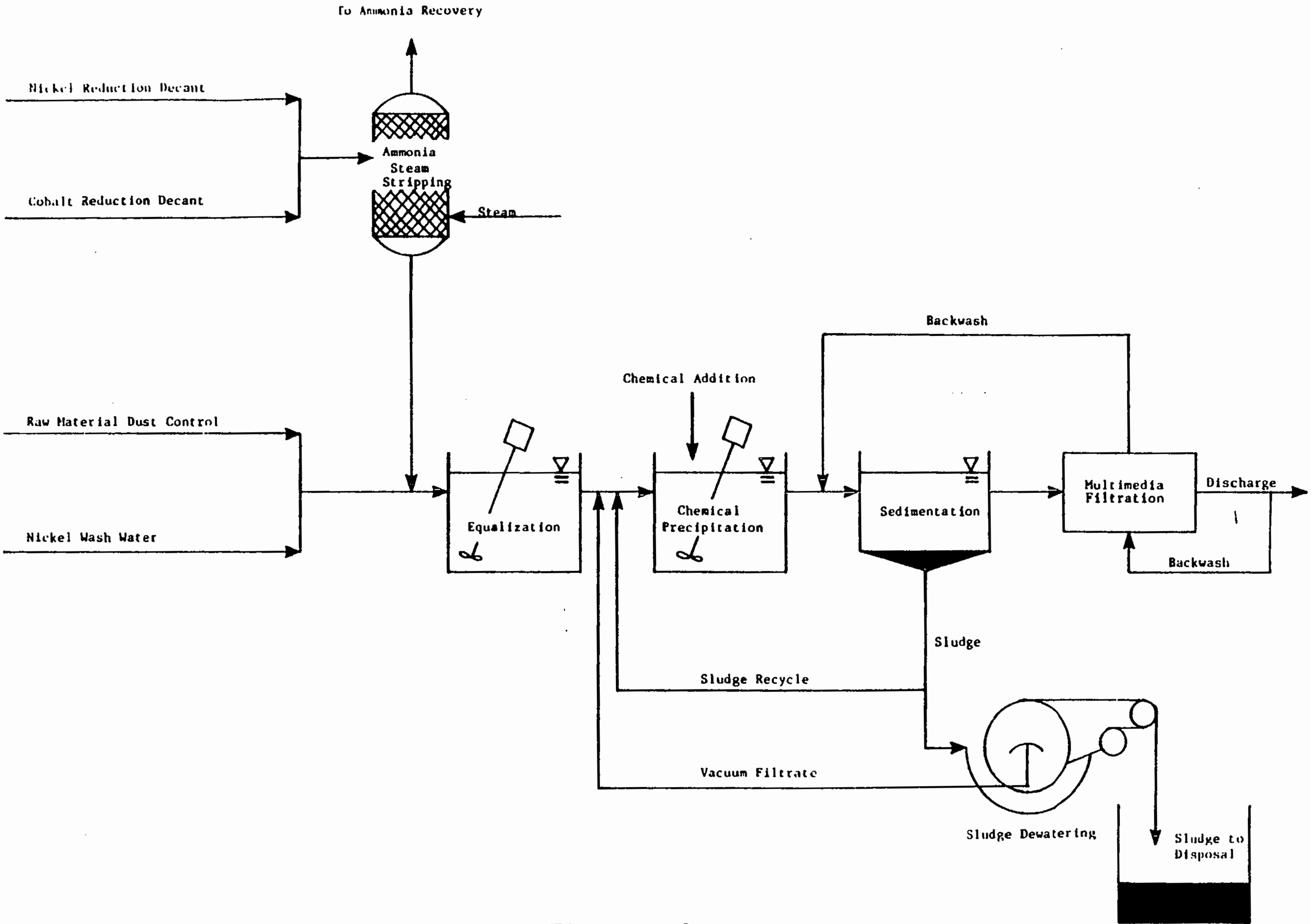

Figure X-2

BAT TREATMENT SCHEME FOR OPTION C

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SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

The basis for new source performance standards (NSPS) 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, EPA has considered 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 mass discharge standards for regulated pollutants for NSPS in the primary nickel and cobalt subcategory, based on the selected treatment technology.

TECHNICAL APPROACH TO NSPS

New source performance standards are equivalent to the best available technology (BAT) selected for currently existing primary nickel and cobalt plants. This result is a consequence of careful review by the Agency of a wide range of technical options for new source treatment systems. 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. Consequently, BAT production normalized discharge rates, which are based on the best existing practices of the subcategory, can also be applied to new sources. These rates are presented in Table XI-1 (page 3921).

Treatment technologies considered for the NSPS options are identical to the treatment technologies considered for the BAT options. These options are:

OPTION A

- o Preliminary treatment with ammonia steam stripping (where required)
- o Chemical precipitation and sedimentation

OPTION C

- o Preliminary treatment with ammonia steam stripping (where required)
- o Chemical precipitation and sedimentation
- o Multimedia filtration

NSPS OPTION SELECTION - PROPOSAL

EPA proposed that the technology basis for NSPS be equal to that for BAT (preliminary treatment consisting of ammonia steam stripping, chemical precipitation, sedimentation, and filtration). The same pollutants were proposed for regulation at NSPS as at BAT, and the proposed wastewater discharge rates for NSPS were equivalent to those proposed for BAT.

NSPS OPTION SELECTION - PROMULGATION

We are promulgating NSPS equal to BAT. We believe that new plants could not achieve any flow reduction beyond the allowances promulgated for BAT. Because NSPS is equal to BAT we believe that the promulgated NSPS will not pose a barrier to the entry of new plants into this subcategory.

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 selected for limitation under NSPS, in accordance with the rationale of Sections VI and X, are identical to those selected for BAT. The conventional pollutant parameters TSS and pH are also selected for limitation.

NEW SOURCE PERFORMANCE STANDARDS

The NSPS discharge flows for each wastewater source are the same as the discharge rates for BAT and are shown in Table XI-1. The mass of pollutant allowed to be discharged per mass of product is based on the product of the appropriate treatable concentration (mg/l) and the production normalized wastewater discharge flows (l/kkg). The results of these calculations are the production-based new source performance standards. These standards are presented in Table XI-2 (page 3922).

Table XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

Wastewater Stream	NSPS Normalized Discharge Rate l/kkg	NSPS Normalized Discharge Rate gal/ton	Production Normalizing Parameter
1. Raw Material Dust Control	77	18.5	Copper, nickel, and cobalt in the crushed raw material
2. Cobalt Reduction Decant	21,398	5,128	Cobalt produced
3. Nickel Reduction Decant	12,695	3.042	Nickel produced
4. Nickel Wash Water	33.87	8.12	Nickel powder washed

Table XI-2

NSPS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(a) Raw Material Dust Control NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material	
*Copper	0.099	0.047
*Nickel	0.042	0.029
Zinc	0.079	0.032
*Ammonia	10.260	4.512
*Cobalt	0.011	0.005
*TSS	1.155	0.924
*pH	Within the range of 7.5 to 10.0 at all times	

(b) Cobalt Reduction Decant NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of cobalt produced	
*Copper	27.390	13.050
*Nickel	11.770	7.917
Zinc	21.830	8.987
*Ammonia	2,852.000	1,254.000
*Cobalt	2.996	1.498
*TSS	321.000	256.800
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(c) Nickel Reduction Decant NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of nickel produced		
*Copper	16.250	7.744
*Nickel	6.982	4.697
Zinc	12.950	5.332
*Ammonia	1,692.000	743.900
*Cobalt	1.777	0.889
*TSS	190.400	152.300
*pH	Within the range of 7.5 to 10.0 at all times	

(d) Nickel Wash Water NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of nickel powder washed		
*Copper	0.043	0.021
*Nickel	0.019	0.013
Zinc	0.035	0.014
*Ammonia	4.515	1.985
*Cobalt	0.005	0.002
*TSS	0.508	0.406
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

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SECTION XII

PRETREATMENT STANDARDS

PSES are designed to prevent the discharge of pollutants which pass through, interfere with, or are otherwise incompatible with the operation of publicly owned treatment works (POTW). The Clean Water Act requires pretreatment for pollutants, such as toxic metals, that limit POTW sludge management alternatives. New indirect discharge facilities, like new direct discharge facilities, have the opportunity to incorporate the best available demonstrated technologies including process changes in-plant controls, and end-of-pipe treatment technologies, and to use plant site selection co ensure adequate treatment system installation. Pretreatment standards are to be technology based, analogous to the best available technology for removal of toxic pollutants.

EPA is not promulgating pretreatment standards for existing sources in this subcategory because no indirect dischargers exist. However, EPA is promulgating pretreatment standards for new sources because plants may be constructed in the future which may discharge to a POTW.

This section describes the control and treatment technologies for pretreatment of process wastewaters from new sources in the primary nickel and cobalt subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology.

TECHNICAL APPROACH TO PRETREATMENT

Before proposing and promulgating pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements, is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant.

This definition of pass through satisfies the two competing objectives set by Congress that standards for indirect dischargers be equivalent to standards for direct dischargers while at the same time, the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers.

The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources or the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

PRETREATMENT STANDARDS FOR NEW SOURCES

Options for pretreatment of wastewaters from new sources are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Sections X and XI. The options for PSNS are the same as the BAT and NSPS options discussed in Sections X and XI, respectively.

A description of each option is presented in Section X, while a more detailed discussion, including pollutants controlled by each treatment process is presented in Section VII of the General Development Document.

Treatment technologies considered for the PSNS options are:

OPTION A

- Preliminary treatment with ammonia steam stripping (where required)
- Chemical precipitation and sedimentation

OPTION C

- Preliminary treatment with ammonia steam stripping (where required)
- Chemical precipitation and sedimentation
- Multimedia filtration

PSNS OPTION SELECTION - PROPOSAL

EPA proposed the technology basis for PSNS equal to BAT (preliminary treatment consisting of ammonia steam stripping, chemical precipitation, sedimentation, and filtration). The same pollutants were proposed for regulation at PSNS as at BAT, and the proposed wastewater discharge rates for PSNS were equivalent to those proposed for BAT.

PSNS OPTION SELECTION - PROMULGATION

We are promulgating PSNS equal to BAT and NSPS for this subcategory. It is necessary to promulgate PSNS to prevent pass-through of copper, nickel, cobalt, and ammonia. These toxic pollutants are removed by a well-operated POTW at an average of 26 percent, while BAT technology removes approximately 58 percent.

The technology basis for PSNS thus is chemical precipitation and sedimentation, ammonia steam stripping, and filtration. The achievable concentration for ammonia steam stripping is based on iron and steel manufacturing category data, as explained in the discussion of BPT for this subcategory.

We believe that the proposed PSNS are achievable, and that they are not a barrier to entry of new plants into this subcategory.

The PSNS discharge rates are shown in Table XII-1 (page 3928).

REGULATED POLLUTANT PARAMETERS

Pollutants selected for limitation, in accordance with the rationale of Sections VI and X, are identical to those selected for limitation for BAT. It is necessary to promulgate PSNS to prevent the pass-through of copper, nickel, ammonia, and cobalt.

PRETREATMENT STANDARDS FOR NEW SOURCES

Pretreatment standards for new sources are based on the treatable concentrations from the selected treatment technology, (Option C), and the discharge rates determined in Sections X and XI for BAT and NSPS, respectively. A mass of pollutant per mass of product (mg/kg) allocation is given for each subdivision within the subcategory. This pollutant allocation is based on the product of the treatable concentration from the promulgated treatment (mg/l) and the production normalized wastewater discharge rate (l/kkg). The achievable treatment concentrations for PSNS are identical to those for BAT. PSNS are presented in Table XII-2 (page 3929).

Table XII-1

PSNS WASTEWATER DISCHARGE RATES FOR THE
PRIMARY NICKEL AND COBALT SUBCATEGORY

Wastewater Stream	PSNS Normalized Discharge Rate l/kkg	gal/ton	Production Normalizing Parameter
1. Raw Material Dust Control	77	18.5	Copper, nickel, and cobalt in the crushed raw material
2. Cobalt Reduction Decant	21,398	5,128	Cobalt produced
3. Nickel Reduction Decant	12,695	3,042	Nickel produced
4. Nickel Wash Water	33.87	8.12	Nickel powder washed

TABLE XII-2

PSNS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(a) Raw Material Dust Control PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of copper, nickel, and cobalt in the crushed raw material		
*Copper	0.099	0.047
*Nickel	0.042	0.029
Zinc	0.079	0.032
*Ammonia	10.260	4.512
*Cobalt	0.011	0.005

(b) Cobalt Reduction Decant PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of cobalt produced		
*Copper	27.390	13.050
*Nickel	11.770	7.917
Zinc	21.830	8.987
*Ammonia	2,852.000	1,254.000
*Cobalt	2.996	1.498

*Regulated Pollutant

TABLE XII-2 (Continued)

PSNS FOR THE PRIMARY NICKEL AND COBALT SUBCATEGORY

(c) Nickel Reduction Decant PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of nickel produced	
*Copper	16.250	7.744
*Nickel	6.982	4.697
Zinc	12.950	5.332
*Ammonia	1,692.000	743.900
*Cobalt	1.777	0.889

(d) Nickel Wash Water PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of nickel powder washed	
*Copper	0.043	0.021
*Nickel	0.019	0.013
Zinc	0.035	0.014
*Ammonia	4.515	1.985
*Cobalt	0.005	0.002

*Regulated Pollutant

SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control technology (BCT) for the primary nickel and cobalt subcategory at this time.

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NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Secondary Nickel Subcategory

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May 1989

U.S. Environmental Protection Agency
Office of Water
Office of Water Regulations and Standards
Industrial Technology Division
Washington, D. C. 20460

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SECTION I

SUMMARY

This document provides the technical basis for promulgating pretreatment standards for existing indirect dischargers (PSES), pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS)for plants in the secondary nickel subcategory.

The secondary nickel subcategory consists of two plants. One of the two plants discharges to a publicly-owned treatment works, and one achieves zero discharge of process wastewater. There are no plants discharging directly to rivers, streams, or lakes.

EPA first studied the secondary nickel 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 the sources and volume of water used, the processes used, the sources of pollutants and wastewaters in the plant, and the constituents of wastewaters, including toxic pollutants. As a result, three subdivisions have been identified for this subcategory that warrant separate effluent limitations. These include:

- o Slag reclaim tailings,
- o Acid reclaim leaching filtrate, and
- o Acid reclaim leaching belt filter backwash.

Several distinct control and treatment technologies (both in plant and end-of-pipe) applicable to the secondary nickel subcategory were identified. 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 various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each of the control and treatment options considered for the subcategory. These costs were than used by the Agency to estimate the impact of implementing the various options on the subcategory. For each control and treatment option that the Agency found to be most effective and technically feasible in controlling the discharge of pollutants, 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 Effluent Limitations and Standards

for the Nonferrous Metals Manufacturing Industry."

Because there are no direct dischargers in the secondary nickel subcategory, EPA is not promulgating BPT, BAT or BCT.

After examining the various treatment technologies, the Agency selected PSES to consist of metals removal based on chemical precipitation and sedimentation technology. Chemical precipitation and sedimentation technology represents the best existing technology in this subcategory. To meet the pretreatment standards for existing sources, the secondary nickel subcategory is estimated to incur a capital cost of $320,100 and an annual cost of $161,200.

NSPS is equivalent to PSES technology. In selecting NSPS, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technology. As such, the technology basis of PSES has been determined as the best demonstrated technology.

For PSNS, the Agency selected end-of-pipe treatment equivalent to NSPS.

The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. Although the methodology for BCT has not yet been finalized, BCT is not promulgated for this subcategory because there are no direct discharges.

The mass limitations and standards for NSPS, PSES, and PSNS are presented in Section II.

SECTION II

CONCLUSIONS

EPA has divided the secondary nickel subcategory into three subdivisions or building blocks for the purpose of effluent limitations and standards. These subdivisions are:

(a) Slag reclaim tailings,
(b) Acid reclaim leaching filtrate, and
(c) Acid reclaim leaching belt filter backwash.

BPT is not promulgated for this subcategory because there are no direct dischargers.

BAT is not promulgated because there are no direct dischargers.

NSPS are promulgated based on the performance achievable by the application of chemical precipitation and sedimentation technology (lime and settle). The following new source performance standards are promulgated:

(a) <u>Slag Reclaim Tailings</u> NSPS

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of slag input to reclaim process		
Chromium (total)	5.653	2.313
Copper	24.410	12.850
Nickel	24.670	16.320
TSS	526.800	250.500
pH	Within the range of 7.5 to 10.0 at all times	

(b) <u>Acid Reclaim Leaching Filtrate</u> NSPS

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Chromium (total)	2.198	0.089
Copper	9.491	4.995
Nickel	9.590	6.344
TSS	214.800	87.400
pH	Within the range of 7.5 to 10.0 at all times	

(c) <u>Acid Reclaim Leaching Belt Filter Backwash</u> NSPS

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Chromium (total)	0.528	0.216
Copper	2.278	1.199
Nickel	2.302	1.523
TSS	49.160	23.380
pH	Within the range of 7.5 to 10.0 at all times	

PSES are promulgated based on the performance achievable by the application of chemical precipitation and sedimentation technology (lime and settle). The following pretreatment standards for existing sources are promulgated:

(a) <u>Slag Reclaim Tailings</u> PSES

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of slag input to reclaim process		
Chromium (total)	5.653	2.313
Copper	24.410	12.850
Nickel	24.670	16.320

(b) <u>Acid Reclaim Leaching Filtrate</u> PSES

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Chromium (total)	2.198	0.899
Copper	9.491	4.995
Nickel	9.590	6.344

(c) Acid Reclaim Leaching Belt Filter Backwash PSES

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Chromium (total)	0.528	0.216
Copper	2.278	1.199
Nickel	2.302	1.523

PSNS are promulgated based on the performance achievable by application of chemical precipitation and sedimentation (lime and settle). The following pretreatment standards for new sources are promulgated:

(a) Slag Reclaim Tailings PSNS

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of slag input to reclaim process		
Chromium (total)	5.653	2.313
Copper	24.410	12.850
Nickel	24.670	16.320

(b) Acid Reclaim Leaching Filtrate PSNS

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Chromium (total)	2.198	0.899
Copper	9.491	4.995
Nickel	9.590	6.344

(c) Acid Reclaim Leaching Belt Filter Backwash PSNS

Pollutant Pollutant Property	Maximum For Any One Day	Maximum For Monthly Average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Chromium (total)	0.528	0.216
Copper	2.278	1.199
Nickel	2.302	1.523

BCT is not promulgated for this subcategory at this time.

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SECTION III

SUBCATEGORY PROFILE

This section of the secondary nickel supplement describes the raw materials and processes used in smelting and refining secondary nickel and presents a profile of the secondary nickel plants identified in this study.

DESCRIPTION OF SECONDARY NICKEL PRODUCTION

Secondary nickel production can be divided into three distinct operations -- slag reclamation. acid reclamation. and scrap reclamation. Slag reclamation is a wet mechanical granulation operation. Acid reclamation and scrap reclamation are hydrometallurgical refining processes. One plant in the U.S. reclaims nickel from slag and pickling acids, and a second plant reclaims nickel from scrap. Secondary nickel production processes are presented schematically in Figure III-1 (Page 3953) and described below.

RAW MATERIALS

Secondary nickel is reclaimed from three raw materials; nickel melt furnace slag. nickel carbonate produced from waste pickling acids and wastewater treatment sludges from nickel forming operations, and solid nickel scrap from other manufacturing operations. Nickel alloy scrap generated at steel mills may also be recycled within the mills however, no refining of the nickel scrap takes place prior to recycle and therefore, direct recycle of nickel scrap is not considered within this subcategory.

SLAG RECLAMATION

The objective of slag reclamation is to recover the nickel values from the dross or slag produced in nickel melt furnaces. When the nickel ingots are smelted in the presence of fluxing agents, the oxidized metals and impurities rise to the surface of the liquid metal and are removed from the furnace. This slag contains approximately 10 percent metallics.

The dross or slag is first air cooled and solidified, and then mechanically granulated with a jaw crusher and a wet rod mill. It is then fed onto a wet mineral jig, which uses specific gravity differences to recover a nickel concentrate product. The mineral jig is a shaking table. Large volumes of water wash over the crushed slag on the table carrying away the lighter (less dense) non-metallics. The denser, nickel-containing solids are the product. A large volume of tailings wastewater is produced. The nickel product is returned to the melt furnace and the wastewater is discharged.

ACID RECLAMATION

In the acid reclamation process, spent pickling acids and wastewater treatment sludges from nickel forming operations are introduced into a vessel with soda ash (Na_2CO_3) which precipitates the nickel as nickel carbonate. The impure nickel carbonate, which is separated from the liquid phase by filtration, is the raw material for the acid reclaim process.

Impure nickel carbonate is slurried with water to produce a homogeneous solution, and then roasted in an open hearth furnace to produce nickel oxide. The nickel oxide produced by roasting is then leached with water to remove impurities, and filtered. The leaching filtrate may be discharged as a waste stream. After filtering, the filter is backwashed and the backwash water may also be discharged as a waste stream. The nickel oxide product is approximately 35 percent nickel, and is returned to the nickel melting furnaces.

SCRAP RECLAMATION

Scrap resulting from the manufacture of nickel products may be recycled to recover the nickel values. The scrap is fed into a digestion unit with nitric acid and water. The acid removes silver and other impurities, and a 95 percent nickel product is either sold or returned to the manufacturing facility. The resultant solution, which contains significant silver values, is routed to a silver recovery process. The silver recovery process and resultant wastewater are covered by the regulations for secondary silver refining which is part of the nonferrous metals manufacturing category. There are no wastewater streams associated with nickel scrap reclamation which are within the scope of the secondary nickel subcategory.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in secondary nickel production, the significant wastewater sources that are associated with the secondary nickel subcategory can be subdivided into the following building blocks:

1. Slag reclaim tailings,
2. Acid reclaim leaching filtrate, and
3. Acid reclaim leaching belt filter backwash.

OTHER WASTEWATER SOURCES

There may be other wastewater streams associated with the secondary nickel subcategory. These streams include but are not limited to stormwater runoff, maintenance and cleanup water, and noncontact cooling water. These wastewater streams are not considered as a part of this rulemaking. EPA believes that the flows and pollutant loadings associated with these wastewaters are insignificant relative to waste streams selected and 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 (Page 3954) shows the locations of the two secondary nickel plants operating in the United States. Both are located east of the Mississippi River, near the industrial centers of western Pennsylvania.

Table III-1 (Page 3950) illustrates the relative age and discharge status of the secondary nickel plants in the United States. One plant was built in 1923, and the other was built in 1976.

From Table III-2 (Page 3951) it can be seen that of the two facilities which reclaim nickel, one plant reclaims between 500 and 1,000 tons per year, and the other less than 50 tons per year.

Table III-3 (Page 3952) provides a summary of the number of plants generating wastewater for the waste streams associated with the various processes and the number of plants with the process.

TABLE III-1

INITIAL OPERATING YEAR SUMMARY OF PLANTS IN THE SECONDARY NICKEL SUBCATEGORY BY DISCHARGE TYPE

Initial Operating Year
(Plant Age in Years)

Type of Plant	1982-1966 (0-15)	1965-1946 (15-35)	1945-1926 (35-55)	1925-1906 (55-75)	Total
Direct	0	0	0	0	0
Indirect	0	0	0	1	1
Zero	1	0	0	0	1
Total	1	0	0	1	2

TABLE III-2

PRODUCTION RANGES FOR THE SECONDARY NICKEL SUBCATEGORY

Production Ranges for 1982 (Tons/Year)a	Number of Plants
0 - 50	1
50 - 100	0
500 - 1,000	1
Total	2

(a) Based on production of reclaimed nickel

Table III-3

SUMMARY OF SECONDARY NICKEL SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

Process	Number of Plants With the Process	Number of Plants Reporting Generation of Wastewater*
Slag Reclaim	1	
Slag Reclaim Tailings	1	1
Acid Reclaim	1	
Acid Reclaim Leaching Filtrate	1	1
Acid Reclaim Belt Filter Backwash	1	1
Scrap Reclaim	1	

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

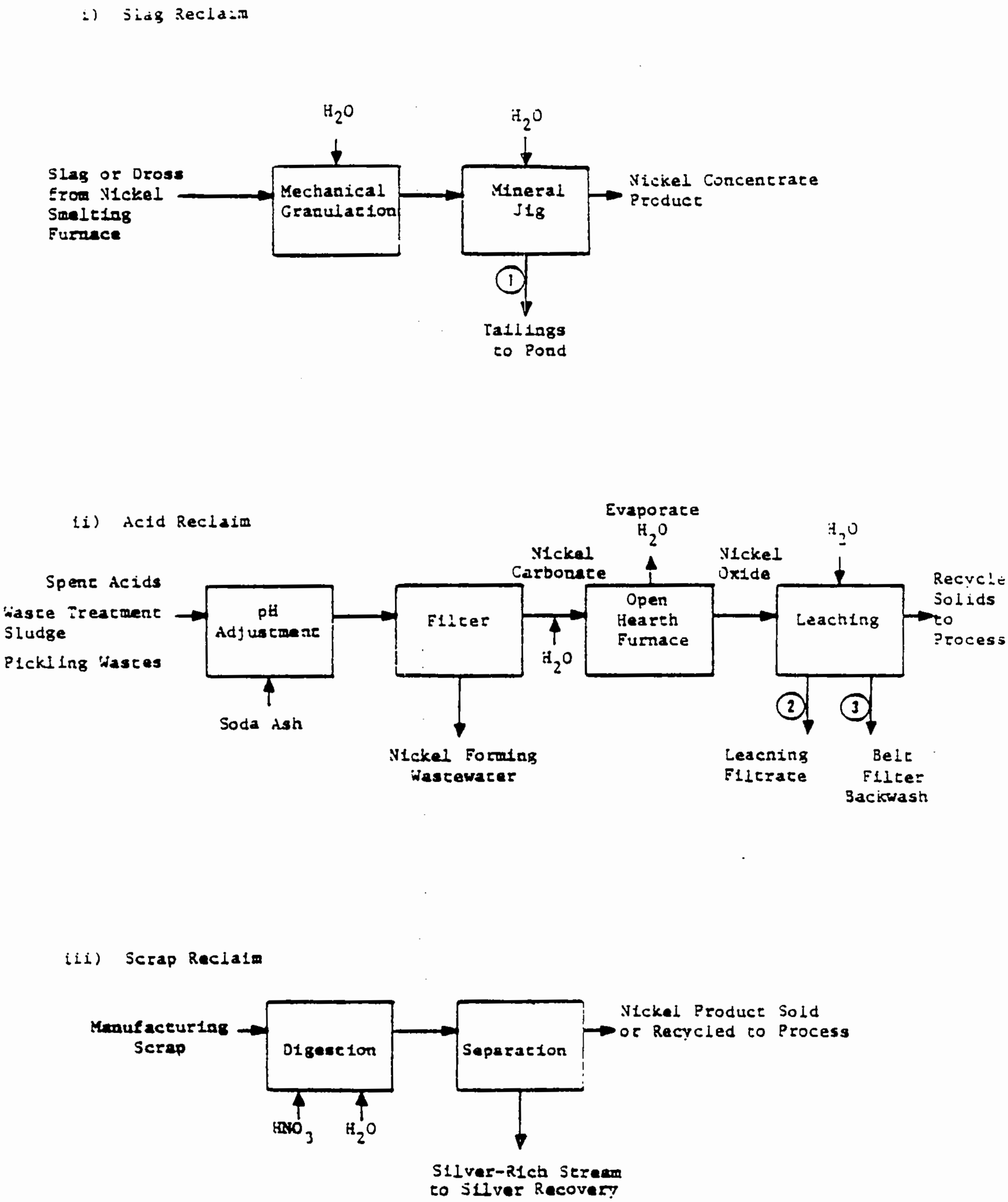

Figure III-1

SECONDARY NICKEL MANUFACTURING PROCESSES

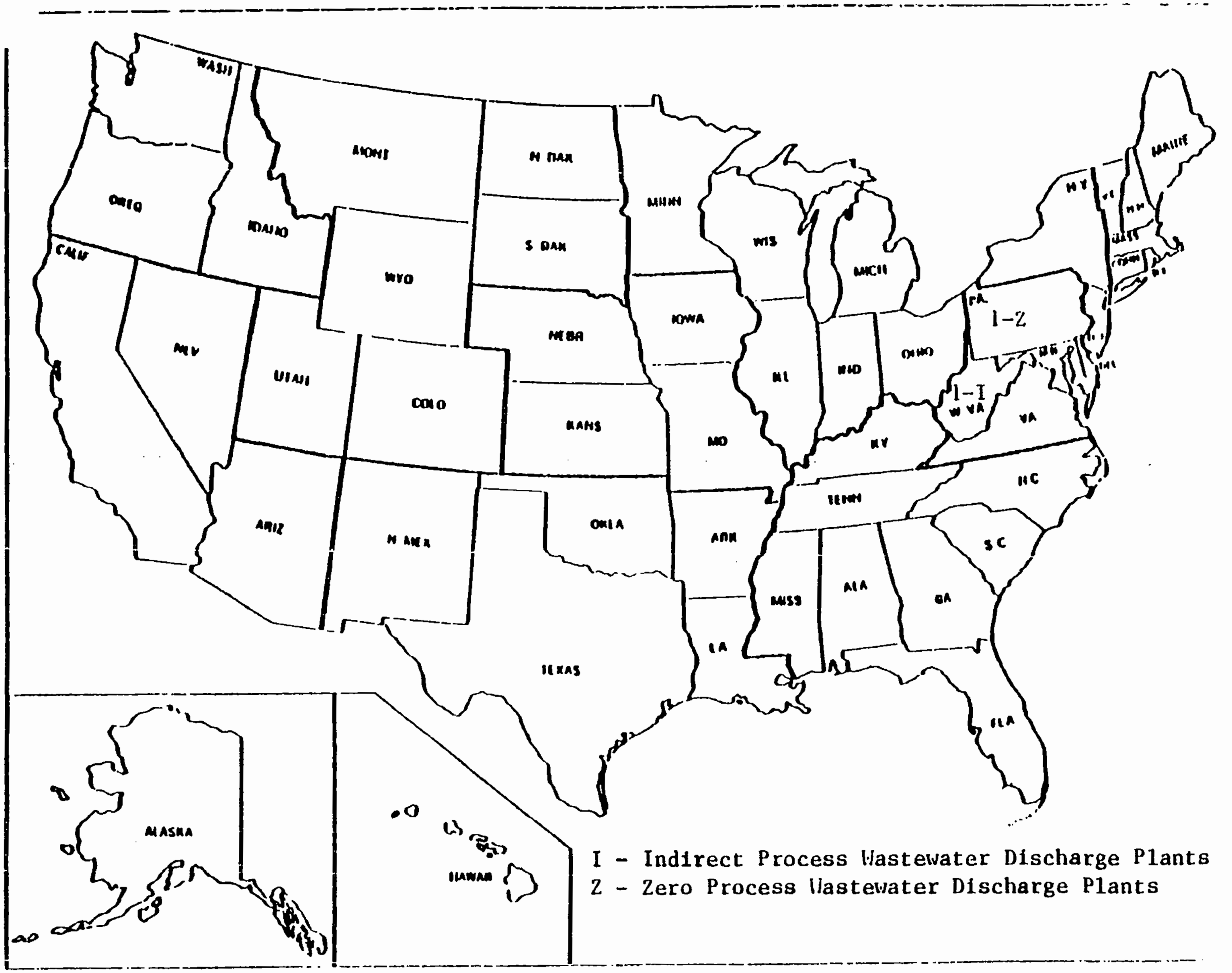

Figure III-2

GEOGRAPHIC LOCATIONS OF SECONDARY NICKEL SUBCATEGORY PLANTS

SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the subdivision of the secondary nickel subcategory. Production normalizing parameters for each subdivision are also discussed.

FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY NICKEL SUBCATEGORY

The factors listed for general subcategorization were each evaluated when considering subdivision of the secondary nickel subcategory. In the discussion that follows, the factors will be described as they pertain to this particular subcategory.

The rationale for considering segmentation of the secondary nickel subcategory is based primarily on differences in the production processes and raw materials 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. While secondary nickel is 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 will be based on specific flow allowances for the following subdivisions:

1. Slag reclaim tailings,
2. Acid reclaim leaching filtrate, and
3. Acid reclaim leaching belt filter backwash.

These subdivisions follow directly from differences between the processing steps of secondary nickel production. Slag reclaim and acid reclaim both have various steps which generate wastewater.
Slag reclamation establishes the need for the first subdivision slag reclaim tailings. After crushing and milling the nickel rich slag, a nickel concentrate is separated from impurities with a wet mineral jig. This produces a tailings waste stream which is discharged.

Acid reclamation establishes the need for the second and third subdivisions -- acid reclaim leaching filtrate, and acid reclaim leaching belt filter backwash. Spent pickling acids and wastewater treatment sludges are added to a tank containing soda ash in order to precipitate nickel as nickel carbonate. After filtration, the precipitate is slurried with water and roasted in an open hearth furnace in order to oxidize the nickel. The nickel oxide is leached with water to remove impurities and then filtered on a belt filter. The acid reclaim leaching filtrate is discharged as a waste stream. The belt filter is backwashed with water, and the backwash water is also discharged as a waste stream.

OTHER FACTORS

The other factors considered in this evaluation were shown to be inappropriate bases for further segmentation. Air pollution control methods, treatment costs, and total energy requirements are functions of the selected subcategorization factors -- metal product, raw materials, and production processes. Certain other factors, such as plant age, plant size, and the number of employees, were also evaluated and determined to be inappropriate for use as the basis for subdivision of the nonferrous metals subcategory.

PRODUCTION NORMALIZING PARAMETERS

As discussed previously, the effluent limitations and standards developed in this document establish mass limitations on the discharge of specific pollutant parameters. To allow these regulations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP). The PNPs for the three subdivisions are as follows:

Subdivision	PNP
1. Slag reclaim tailings	slag input to reclaim process
2. Acid reclaim leaching filtrate	acid reclaim nickel produced
3. Acid reclaim leaching belt filter backwash	acid reclaim nickel produced

At proposal the production normalizing parameter for slag reclaim tailings was the mass of slag reclaim nickel produced. Industry comments on the choice of PNP prompted EPA to consider other parameters. The industry comments included flow and production information which allowed EPA to recalculate the production normalized flow. Based on the new information, EPA concluded that the generation of slag reclaim tailings wastewater is more closely related to raw material input to the reclaim process. Therefore, for promulgation, the PNP for slag reclaim tailings has been changed to the quantity of slag input to the reclaim process.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the secondary nickel subcategory. Water use and discharge rates are explained and then summarized in tables at the end of this section. Data used to characterize the wastewaters are presented. Finally, the specific source, water use and discharge flows, and wastewater characteristics for each separate wastewater source are discussed.

The two principal data sources used in the development of effluent limitations and standards for this subcategory are data collection portfolios and field sampling results. Data collection portfolios contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from secondary nickel plants, a field sampling program was conducted. A complete list of the pollutants considered and a summary of the techniques used in the sampling and laboratory analyses are included in Section V of Vol. I. Samples were analyzed for 124 of the 126 priority 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. samples were also not analyzed for asbestos. There is no reason to expect that TCDD or asbestos would be present in nonferrous metals manufacturing wastewater. One plant was selected for sampling in the secondary nickel subcategory. In general, the samples were analyzed for three classes of pollutants: toxic organic pollutants, toxic metal pollutants. and criteria pollutants (which includes both conventional and nonconventional pollutants).

No additional sampling data for this subcategory were obtained from EPA sampling efforts or industry comments between proposal and promulgation. Characterization of secondary nickel subcategory wastewaters (Section V), and selection of pollutant parameters for limitation (Section VI) has been based on the same data used at proposal.

As described in Section IV of this supplement, the secondary nickel subcategory has been divided into three subdivisions, so that the promulgated regulation contains mass discharge limitations and standards for three unit processes discharging process wastewater. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow. These wastewater sources are:

1. Slag reclaim tailings,
2. Acid reclaim leaching filtrate, and
3. Acid reclaim leaching belt filter backwash.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios were calculated for each stream. The two ratios, water use and wastewater discharge flow, are differentiated by the flow value used in calculation. Water use is defined as the volume of water required for a given process per mass of nickel product and is therefore based on the sum of recycle and make-up flows to a given process. Wastewater flow discharged after pretreatment or recycle (if these are present) is used in calculating the production normalized flow -- the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of nickel produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carry-over on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. As an example, acid reclaim leaching filtrate wastewater flow is related to acid reclaim nickel production. As such, the discharge rate is expressed in liters of leaching filtrate wastewater discharged per metric ton of acid reclaim nickel production.

The production normalized flows were compiled and statistically analyzed by stream type. These production normalized water use and discharge flows are presented by subdivision in Tables V-1 through V-3 (pages 3962 -3964). Where appropriate, an attempt was made to identify factors that could account for variations in water use. This information is summarized in this section. A similar analysis of factors affecting the wastewater values is presented in Sections XI and XII where representative NSPS and pretreatment discharge flows are selected for use in calculating the effluent limitations and standards.

WASTEWATER CHARACTERISTICS DATA

Data used to characterize the various wastewaters associated with secondary nickel production come from two sources -- data collection portfolios and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolios, plants were asked to indicate whether or not any of the priority pollutants were present in their effluent. The one discharging plant indicated that most toxic organic pollutants were believed to be absent from their effluent. The plant indicated that a few of the priority organic pollutants are believed to be present in its effluent. The plant stated that some of the priority metals were known to be present in their effluent. The responses for the toxic metals are summarized below.

Pollutant	Known Present	Believed Present
Antimony	0	0
Arsenic	0	0
Beryllium	0	0
Cadmium	0	0
Chromium	1	1
Copper	1	1
Lead	0	0
Mercury	0	0
Nickel	1	1
Selenium	0	0
Silver	0	0
Thallium	0	0
Zinc	1	1

FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from secondary nickel plants, wastewater samples were collected at one plant. A diagram indicating the sampling sites and contributing production processes is shown in Figure V-1 (Page 3974).

The sampling data for the secondary nickel subcategory are presented in Tables V-4 through V-7 (pages 3965 - 3972). The stream codes displayed in Tables V.4 through V-7 may be used to identify the location of each of the samples on process flow diagrams in Figure V.1. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected.

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.

The statistical analysis of data includes some samples measured at concentrations considered not quantifiable. Priority metal and conventional and nonconventional pollutant values reported as less than a certain value were considered as not quantifiable and a value of zero is used in the calculation of the average.

Appropriate source water concentrations are presented with the summaries of 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

Since secondary nickel production involves three principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately. A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

SLAG RECLAIM TAILINGS

Nickel is recovered from dross or slag generated in nickel smelting furnaces by a wet granulation operation After recovering the nickel values from the granulated slag, the wet residue is discharged to a railings pond and the overflow from the tailings pond is discharged as a waste stream. One plant reported generating this waste stream, and its water use and discharge rates are presented in Table V-1 (Page 3962).

Sampling data for slag reclaim tailings is presented in Table V-4 (page 3965). This waste stream is characterized by the presence of treatable concentrations of arsenic, chromium, copper, nickel, suspended solids, and pH. Sampling data for tailings pond effluent is presented in Table V-5 (page 3967).

ACID RECLAIM LEACHING FILTRATE

After nickel is precipitated from waste pickling acids with sodium carbonate and roasted to produce nickel oxide, the nickel oxide is leached with water to remove impurities. The wet nickel oxide is dewatered on a belt filter and the filtrate is discarded. One plant reported generating this waste stream, and its water use and discharge rates are presented in Table V-2 (page 3963).

Sampling data for acid reclaim leaching belt filtrate is presented in Table V-6 (page 3970). This waste stream is characterized by the presence of treatable concentrations of chromium, copper, nickel, and suspended solids.

ACID RECLAIM LEACHING BELT FILTER BACKWASH

In the acid reclaim process, after the dewatered nickel oxide is scraped from the belt filter, the filter is backwashed with water and the backwash water may be discharged. One plant reported generating this waste stream, and its water use and discharge rates are presented in Table V-3 (page 3964).

Sampling data for acid reclaim leaching belt filter backwash is presented in Table V-7 (page 3972). This waste stream is characterized by the presence of treatable concentrations of chromium, copper, nickel, and suspended solids.

TABLE V-1

WATER USE AND DISCHARGE RATES FOR SLAG RECLAIM TAILINGS

(l/kkg of slag input to reclaim process)

Plant Code	Percent Recycle or Reuse	Production Normalized Water Use Flow	Production Normalized Discharge Flow
1169	0	12,848	12,848

TABLE V-2

WATER USE AND DISCHARGE RATES FOR
ACID RECLAIM LEACHING FILTRATE

(l/kkg of acid reclaim nickel produced)

Plant Code	Percent Recycle or Reuse	Production Normalized Water Use Flow	Production Normalized Discharge Flow
1169	0	4,995	4,995

TABLE V-3

WATER USE AND DISCHARGE RATES FOR
ACID RECLAIM LEACHING BELT FILTER BACKWASH

(l/kkg of acid reclaim nickel produced)

Plant Code	Percent Recycle or Reuse	Production Normalized Water Use Flow	Production Normalized Discharge Flow
1169	0	1,199	1,199

Table V-4

SECONDARY NICKEL SAMPLING DATA
SLAG RECLAIM TAILINGS POND INFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	986	1	<0.002	<0.002		
115. arsenic	986	1	<0.005	0.93		
117. beryllium	986	1	<0.01	<0.02		
118. cadmium	986	1	<0.05	<0.027		
119. chromium (total)	986	1	<0.10	5.35		
120. copper	986	1	0.170	0.59		
121. cyanide (total)	986	1	<0.02	<0.02		
122. lead	986	1	<0.10	<0.2		
123. mercury	986	1	<0.002	<0.002		
124. nickel	986	1	0.20	7.5		
125. selenium	986	1	<0.01	<0.01		
126. silver	986	1	<0.002	<0.002		
127. thallium	986	1	<0.005	<0.002		
128. zinc	986	1	<0.05	0.15		

Table V-4 (Continued)

SECONDARY NICKEL SAMPLING DATA
SLAG RECLAIM TAILINGS POND INFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	986	1	<1	<1		
alkalinity	986	1	61	9,000		
chloride	986	1	12	550		
fluoride	986	1	0.43	22		
sulfate	986	1	130	42		
total solids (TS)	986	1	330	16,000		
Conventional Pollutants						
oil and grease	986	1	<1	10		
total suspended solids (TSS)	986	1	22	16,000		
pH (standard units)	986	1	6.64	11.38		

†Sample Type Code: 1 - One-time grab

Table V-5

SECONDARY NICKEL SAMPLING DATA
SLAG RECLAIM TAILINGS POND EFFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	987	1	<0.002	<0.002		
115. arsenic	987	1	<0.005	0.290		
117. beryllium	987	1	<0.01	<0.02		
118. cadmium	987	1	<0.05	<0.02		
119. chromium (total)	987	1	<0.10	0.170		
120. copper	987	1	0.170	27.0		
121. cyanide (total)	987	1	<0.02	<0.02		
122. lead	987	1	<0.10	<0.20		
123. mercury	987	1	<0.002	<0.002		
124. nickel	987	1	0.20	0.10		
125. selenium	987	1	<0.01	<0.01		
126. silver	987	1	<0.002	<0.002		
127. thallium	987	1	<0.005	<0.002		
128. zinc	987	1	<0.05	<0.02		

Table V-5 (Continued)

SECONDARY NICKEL SAMPLING DATA
SLAG RECLAIM TAILINGS POND EFFLUENT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	987	1	<1	<1		
alkalinity	987	1	61	880		
chloride	987	1	12	25		
fluoride	987	1	0.43	0.41		
sulfate	987	1	130	18		
total solids (TS)	987	1	330	1,800		
Conventional Pollutants						
oil and grease	987	1	<1	12		
total suspended solids (TSS)	987	1	22	670		
pH (standard units)	987	1	6.64	11.01		

†Sample Type Code: 1 - One-time grab

Table V-6

SECONDARY NICKEL SAMPLING DATA
ACID RECLAIM LEACHING FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	004	1	<0.002	<0.002		
115. arsenic	004	1	<0.005	0.029		
117. beryllium	004	1	<0.01	<0.020		
118. cadmium	004	1	<0.05	<0.02		
119. chromium (total)	004	1	<0.10	3.40		
120. copper	004	1	0.170	38.0		
121. cyanide (total)	004	1	<0.02	<0.02		
122. lead	004	1	<0.10	<0.2		
123. mercury	004	1	<0.002	<0.002		
124. nickel	004	1	0.20	49.0		
125. selenium	004	1	<0.01	<0.01		
126. silver	004	1	<0.002	0.008		
127. thallium	004	1	<0.005	<0.002		
128. zinc	004	1	<0.05	0.26		

Table V-6 (Continued)

SECONDARY NICKEL SAMPLING DATA
ACID RECLAIM LEACHING FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	004	1	<1	<1		
alkalinity	004	1	61	52		
chloride	004	1	12	68		
fluoride	004	1	0.43	1.7		
sulfate	004	1	130	1,000		
total solids (TS)	004	1	330	2,800		
Conventional Pollutants						
oil and grease	004	1	<1	10		
total suspended solids (TSS)	004	1	22	350		
pH (standard units)	004	1	6.64	7.39		

†Sample Type Code: 1 - One-time grab

Table V-7

SECONDARY NICKEL SAMPLING DATA
ACID RECLAIM LEACHING BELT FILTER BACKWASH
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	005	1	<0.002	0.004		
115. arsenic	005	1	<0.005	0.013		
117. beryllium	005	1	<0.01	<0.02		
118. cadmium	005	1	<0.05	<0.02		
119. chromium (total)	005	1	<0.10	0.88		
120. copper	005	1	0.170	60.0		
121. cyanide (total)	005	1	<0.02	<0.02		
122. lead	005	1	<0.10	<0.2		
123. mercury	005	1	<0.002	<0.002		
124. nickel	005	1	0.20	96.0		
125. selenium	005	1	<0.01	<0.01		
126. silver	005	1	<0.002	0.008		
127. thallium	005	1	<0.005	<0.002		
128. zinc	005	1	<0.05	0.12		

Table V-7 (Continued)

SECONDARY NICKEL SAMPLING DATA
ACID RECLAIM LEACHING BELT FILTER BACKWASH
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
acidity	005	1	<1	<1		
alkalinity	005	1	61	51		
chloride	005	1	12	22		
fluoride	005	1	0.43	1.7		
sulfate	005	1	130	98		
total solids (TS)	005	1	330	3,760		
Conventional Pollutants						
oil and grease	005	1	<1	9		
total suspended solids (TSS)	005	1	22	2,900		
pH (standard units)	005	1	6.64	6.61		

†Sample Type Code: 1 - One-time grab

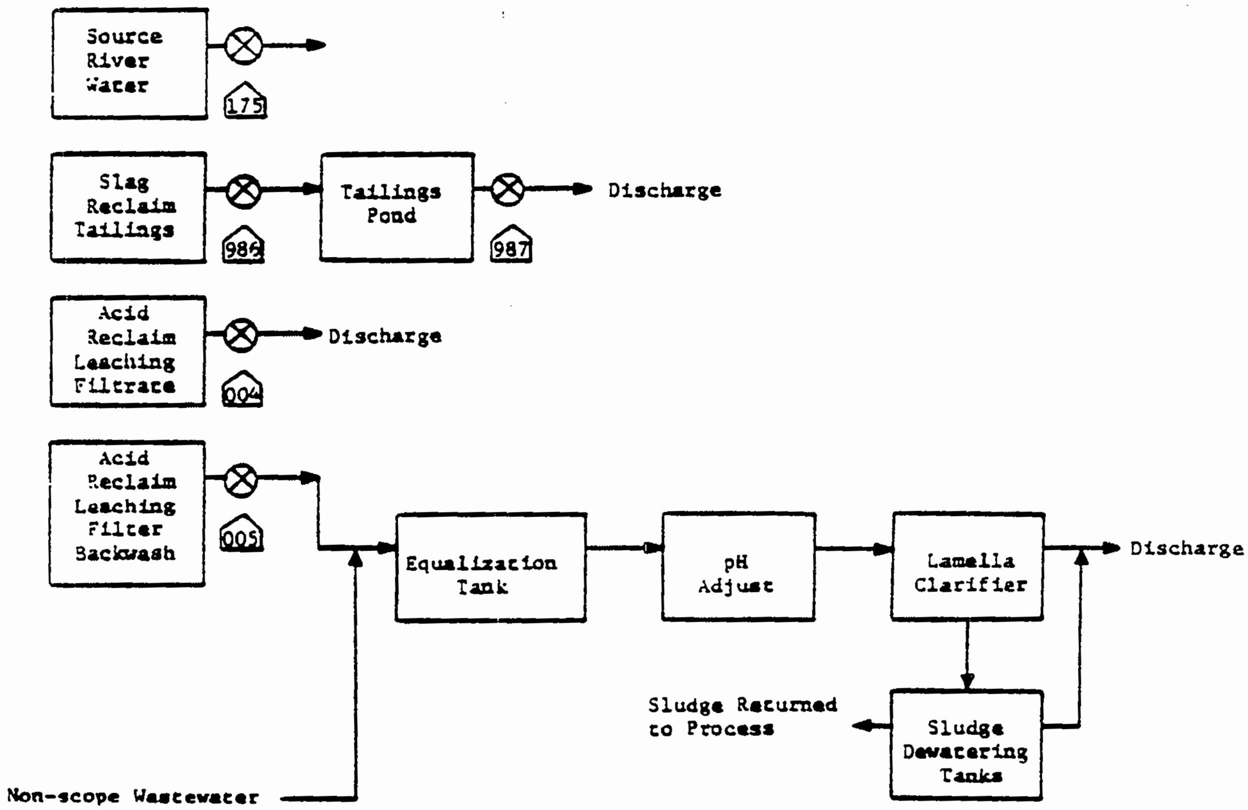

Figure V-1

SAMPLING SITES AT SECONDARY NICKEL PLANT A

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SECTION VI

SELECTION OF POLLUTANTS

This section examines chemical analysis presented in Section V and discusses the selection or exclusion of priority pollutants for potential limitation. Conventional and nonconventional pollutants are selected or excluded for regulation in this section. The basis for the selection of toxic and other pollutants, along with a discussion of each pollutant selected for potential limitation, is discussed in Section VI of Vol. I. That discussion provides information about the nature 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 pollutants in humans and other animals, and behavior of the pollutant in POTW at the concentrations expected in industrial discharges.

The discussion that follows describes the analysis that was performed to select or exclude priority pollutants for further consideration for limitations and standards. The data from three wastewater samples collected at one nickel plant were considered in this analysis. All samples are raw wastewater samples collected on one day at one of the plants. Pollutants will be selected for further consideration if they are present in concentrations treatable by the technologies considered in this analysis. In Sections IX through XII, a final selection of the pollutants to be limited will be made, based on relative factors.

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

This study examined samples from secondary nickel plants for conventional pollutant parameters (oil and grease, total suspended solids, and pH). The conventional and nonconventional pollutants or pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
pH

Total suspended solids (TSS) concentrations in the three samples ranged from 350 mg/l to 16,000 mg/l. AIl of the observed concentrations are above the 2.6 mg/l concentration considered achievable by identified treatment technology. Furthermore, most of the technologies used to remove toxic metals do so by converting these metals to precipitates. A limitation on total suspended solids ensures that sedimentation to remove precipitated toxic metals is effectively operating. For these reasons, total suspended solids is a pollutant parameter selected for limitation in this subcategory.

The pH values observed ranged from 6.6 to 11.4. Effective removal of toxic metals by precipitation requires careful control of pH. Therefore pH is selected for limitation in this subcategory

TOXIC PRIORITY POLLUTANTS

The frequency of occurrence of the toxic pollutants in the wastewater samples considered in this analysis is presented in Table VI-1 (Page 3978). These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater sampling data from streams 986. 004. and 005. Stream 987 was sampled after settling and was not used in the frequency count.

TOXIC POLLUTANTS NEVER DETECTED

The toxic pollutants listed in table VI-2 (page 3979) were not detected in any raw wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

The priority 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 effluent limitations and standards.

114. antimony
117. beryllium
118. cadmium
121. cyanide
122. lead
123. mercury
125. selenium
126. silver
127. thallium

TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION IN ESTABLISHING LIMITATIONS AND STANDARDS

The toxic pollutants selected for further consideration in establishing limitations and standards for this subcategory are listed below:

115. arsenic
119. chromium
120. copper
124. nickel
128. zinc

Arsenic was detected above its treatable concentration (0.34 mg/l) in one of three samples. The quantifiable concentrations ranged from 0.013 mg/l to 0.93 mg/l. Since arsenic was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Chromium was detected above its treatable concentration (0.07 mg/l) in three of three samples. The quantifiable concentrations ranged from 0.88 mg/l to 5.35 mg/l. Since chromium was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Copper was detected above its treatable concentration (0.39 mg/l) in three of three samples. The quantifiable concentrations ranged from 0.59 mg/l to 60 mg/l. Since copper was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Nickel was detected above its treatable concentration (0.22 mg/l) in three of three samples The quantifiable concentrations ranged from 7.5 mg/l to 96 mg/l. Since nickel was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Zinc was detected above its treatable concentration (0.23 mg/l) in one of three samples. The quantifiable concentrations ranged from 0.12 mg/l to 0.26 mg/l. Since zinc was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
SECONDARY NICKEL SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	Not Detected	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
114. antimony	0.100	0.47	3	3		3	0	0
115. arsenic	0.010	0.34	3	3		0	2	1
117. beryllium	0.010	0.20	3	3		3	0	0
118. cadmium	0.002	0.049	3	3		3	0	0
119. chromium	0.005	0.07	3	3		0	0	3
120. copper	0.009	0.39	3	3		0	0	3
121. cyanide (c)	0.02	0.047	3	3		3	0	0
122. lead	0.020	0.08	3	3		3	0	0
123. mercury	0.0001	0.036	3	3		3	0	0
124. nickel	0.005	0.22	3	3		0	0	3
125. selenium	0.01	0.20	3	3		3	0	0
126. silver	0.02	0.07	3	3		3	0	0
127. thallium	0.100	0.34	3	3		3	0	0
128. zinc	0.050	0.23	3	3		0	2	1
oil and grease	5.0	10.0	3	3		0	3	0
total suspended solids (TSS)	1.0	2.6	3	3		0	0	3

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

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

(c) 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.

TABLE VI-2

TOXIC POLLUTANTS NEVER DETECTED

1. acenaphthene*
2. acrolein*
3. acrylonitrile*
4. benzene*
5. benzedine*
6. carbon tetrachloride (tetrachloromethane)*
7. chlorobenzene*
8. 1,2,4-thrichlorobenzene*
9. hexachlorobenzene*
10. 1,2,-dichloroethane*
11. 1,1,1,-thrichloroethane*
12. hexachloroethane*
13. 1,1-dichloroethane*
14. 1,1,2-thrichloroethane*
15. 1,1,2-tetrachloroethane*
16. chloroethane*
17. bis (chloromethyl) ether (deleted)*
18. bis (2-chloroethyl) ether*
19. 2-chloroethyl vinyl ether (mixed)*
20. 2-chloronaphthalene*
21. 2,4,6-trichlorophenol*
22. para-chloro meta-cresol*
23. chloroform (trichloromethane)*
24. 2-chlorophenol*
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*
31. 2,4-dichlorophenol*
32. 1,2-dichloropropane*
33. 1,3-dichloropropylene (1,3-dichloropropene)*
34. 2,4-dimerhylphenol*
35. 2,4-dinitrotoluene*
36. 2,6-dinitrotoluene*
37. 1,2-diphenylhydrazine*
38. ethylbenzene*
39. fluoranrhene*
40. 4-chlorophenyl phenyl ether*
41. 4-bromophenyl phenyl ether*
42. bis (2-chloroisopropyl) ether*
43. bis (2-chloroethoxy) methane*
44 methylene chloride (dichloromethane)*
45. methyl chloride (chloromethane)*
46. methyl bromide (bromomethane)*
47. bromoform (tribromomethane)*
48. dichlorobromomethane*
49. trichlorofluoromethane (deleted)*

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

50. dichlorodifluoromethane (deleted)*
51. chlorodibromomerhane*
52. hexachlorobutadiene*
53. hexachlorocyclopenradiene*
54. isophorone*
55. naphthalene*
56. nitrobenzene*
57. 2-nitrophenol*
58. 4-nitrophenol*
59. 2,4-dinitrophenol*
60. 4,5-dinirro-o-cresol*
61. N-nitrosodimethylamine*
62. N-nitrosodiphenylamine*
63. N-nitrosodi-n-propylamine*
64. pentachlorophenol*
65. phenol*
66. bis (2-ethylhexyl) phthalate*
67. buryl benzyl phthalate*
68. di-n-butyl phthalate*
69. di-n-octyl phthalate*
70. diethyl phthalate*
71. dimethyl phthalare*
72. benzo (a) anthracene (1,2-benzanthracene)*
73. benzo (a) pyrene (3,4-benzopyrene)*
74. 3,4-benzofluoranthene*
75. benzo (k) fluoranthene*
76. chrysene*
77. acenaphthylene*
78. anthracene*
79. benzo (ghi) perylene (1,12-benzoperylene)*
80. fluorene*
81. phenanthrene*
82. dibenzo (a,h) anthracene (1,2 5,o-dibenzanthracene)*
83. ideno (1,2,3-cd) pyrene (2,3,-o-phenylenepyrene)*
84. pyrene*
85. tetrachloroethylene*
86. roluene.
87. trichloroethylene*
88. vinyl chloride (chloroethylene)*
89. aldrin*
90. dieldrin*
91. chlordan'e (technical mixture and metabclites)*
92. 4,4'-DDT*
93. 4,4'-DDE (p,p'DDX)*
94. 4,4'-DDD (p,p'TDE)*
95. Alpha-endosulfan*
96. Beta-endosulfan*
97. endosulfan sulfate*
98. endrin*
99. endrin aldehyde*

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

100. heptachlor*
101. heptachlor epoxide*
102. Alpha-8HC*
103. Beta-BHC*
104. Gamma-BHC (lindane)*
105. Delta-BHC*
106. PCB-1242 (Arochlor 1242)*
107. FCB-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)*
113. toxaphene*
116. asbestos
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

*The Agency 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 judgment which includes consideration of raw materials and process operations.

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SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from secondary nickel plants. This section summarizes the description of these wastewaters and indicates the treatment technologies which are currently practiced in the secondary nickel subcategory for each waste stream. Secondly, this section presents the control and treatment technology options which were examined by the Agency for possible application to the secondary nickel subcategory.

CURRENT CONTROL AND TREATMENT PRACTICES

This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary nickel subcategory is characterized by the presence of the toxic metal pollutants and suspended solids. This analysis is supported by the raw (untreated) wastewater data presented for specific sources as well as combined waste streams in Section V. Generally, these pollutants are present in each of the waste streams at concentrations above treatability, and these waste streams are commonly combined for treatment. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economic scale and in some instances to combine streams of different alkalinity to reduce treatment chemical requirements. The one discharging plant in this subcategory currently has a combined wastewater treatment system treating nickel forming and acid reclaim wastewater, consisting of lime precipitation and sedimentation. Two options have been selected for consideration for NSPS and pretreatment based on combined treatment of these compatible waste streams.

SLAG RECLAIM TAILINGS

Slag or dross from a nickel smelting furnace may be reclaimed for its nickel values with a wet granulation operation. The tailings generated by this operation are discharged to a railings pond where solids are settled. The tailings pond overflows and discharges to a POTW. The tailings pond acts as a primary settling unit, and no additional treatment is performed on this wastewater. One plant has this waste stream and treatment. The raw waste is characterized by toxic metals and suspended solids.

ACID RECLAIM LEACHING FILTRATE

After nickel is precipitated from spent pickling acids with sodium carbonate and roasted to produce nickel oxide, the nickel oxide is leached with water to remove impurities and then dewatered on a belt filter. One plant discharges the resultant leaching filtrate without treatment to a POTW.

ACID RECLAIM LEACHING BELT FILTER BACKWASH

In the acid reclaim process, after the dewatered nickel oxide is scraped from the belt filter, the filter is backwashed with water. The resultant backwash water is treated as a combined waste stream along with nickel forming wastewaters in a lime precipitation and sedimentation system prior to discharge.

Recycle is not practiced on these three wastewater streams and all are indirectly discharged. All have toxic metals and suspended solids above treatable concentrations.

CONTROL AND TREATMENT OPTIONS

The Agency examined two control and treatment technology options that are applicable to the secondary nickel subcategory. The options selected for evaluation represent a combination of preliminary treatment technologies applicable to individual waste streams and end-of-pipe treatment technologies. The effectiveness of these technologies is presented in Section VII of the General Development Document.

OPTION A

Option A for the secondary nickel subcategory requires control and treatment technologies to reduce the discharge of wastewater pollutant mass.

The Option A treatment scheme consists of chemical precipitation and sedimentation technology. Specifically. lime or some other chemical is used to precipitate metal ions as metal hydroxides. The metal hydroxides and suspended solids settle out and the sludge is collected. Vacuum filtration is used to dewater sludge.

Slag reclaim and acid reclaim wastewaters are treated separately because of economic considerations.

OPTION C

Option C for the secondary nickel subcategory consists of all control and treatment requirements of Option A (chemical precipitation and sedimentation, separate treatment of slag and acid reclaim wastewater) plus multimedia filtration technology added at the end of the Option A treatment scheme. Multimedia filtration is used to remove suspended solids including precipitates of metals, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed-media type, although other forms of filters, such as rapid sand filters or pressure filters would perform satisfactorily. The addition of filters also provides consistent removal during periods of time in which there are rapid increases in flows or loadings of pollutants to the treatment system.

SECTION VIII

COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section presents a summary of compliance costs for the secondary nickel subcategory and a description of the treatment options and subcategory-specific assumptions used to develop these estimates. Together with the estimated pollutant reduction performance presented in Sections XI and XII of this supplement, these cost estimates provide a basis for evaluating each regulatory option. These cost estimates are also used in determining the probable economic impact of regulation on the subcategory at different pollutant discharge levels. In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution, solid wastes, and energy requirements, which are specific to the secondary nickel subcategory.

TREATMENT OPTIONS FOR EXISTING SOURCES

As discussed in Section VII, two treatment options have been developed for existing secondary nickel sources. The treatment schemes for each option are summarized below and schematically presented in Figures XI-1 and XI-2 (pages 4002 - 4003).

OPTION A

Option A consists of chemical precipitation and sedimentation end-of-pipe technology. Slag reclaim tailings is treated separately from acid reclaim wastewater.

OPTION C

Option C consists of Option A (chemical precipitation and sedimentation, and separate treatment of slag and acid reclaim wastewater) with the addition of multimedia filtration to the end of the Option A treatment scheme.

COST METHODOLOGY

Plant-by-plant compliance costs for the nonferrous metals manufacturing category have been revised following proposal because of new flow and production data for slag reclaim wastewater received through industry comments. These revisions calculate incremental costs, above treatment already in place, necessary to comply with the promulgated effluent limitations and standards and are presented in the administrative record supporting this regulation. A comparison of the costs developed for proposal and the revised costs for the final regulation are presented in Table VIII-1 (Page 3989) for the one indirect discharger in the secondary nickel subcategory. Each subcategory contains a unique set of waste streams requiring certain subcategory-specific assumptions to develop compliance costs.

The major assumptions relevant to cost estimates for the secondary nickel subcategory are discussed briefly below.

(1) Compliance costs are based on integrated treatment of the two acid reclaim waste streams (with forming streams) and separate treatment of the slag reclaim tailings stream. Costs attributable to treating the streams associated with acid reclaim operations at this plant are based on flow weighting the integrated treatment costs.

(2) The slag reclaim tailings stream is not recycled at BAT since recycling is not demonstrated on this waste stream. Plant operation shows that numerous attempts have been made to recycle this stream without success.

(3) Costs of treating the slag reclaim railings stream are based on primary settling and removal of the majority of settleable solids in the existing lagoon prior to entering chemical precipitation. Chemical precipitation is accomplished using sulfuric acid as the precipitant rather than lime due to the high pH of the influent (pH 11).

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 secondary nickel 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 the two options considered are estimated at 89,000 kwh/yr and 112,000 kwh/yr for Options A and C, respectively. Option C represents less than one percent of a typical plant's electrical energy usage. It is therefore concluded that the energy requirements of the treatment options considered will not have a significant impact on total plant energy consumption.

SOLID WASTE

Sludge generated in the secondary nickel subcategory is due to the precipitation of metal hydroxides and carbonates using lime or sulfuric acid. Sludges associated with the secondary nickel subcategory will necessarily contain quantities of toxic metal pollutants. Wastes generated by secondary metal industries can be regulated as hazardous. However, the Agency examined the solid wastes that would be generated at secondary nonferrous metals manufacturing plants by the suggested treatment technologies, and believes they are not hazardous wastes under the Agency's regulations implementing Section 3001 of the

Resource Conservation and Recovery Act. The one exception to this is solid wastes generated by cyanide precipitation. These sludges are expected to be hazardous and this judgment was included in this study. None of the non-cyanide wastes are listed specifically as hazardous. Nor are they likely to exhibit a characteristic of hazardous waste. This judgment is made based on the recommended technology of lime precipitation and filtration. By the addition of a small excess of lime during treatment, similar sludges, specifically toxic metal bearing sludges, generated by other industries such as the iron and steel industry passed the Extraction Procedure (EP) toxicity test. See 40 CFR $261.24. Thus, the Agency believes that the wastewater sludges will similarly not be EP toxic if the recommended technology is applied.

Although it is the Agency's view that solid wastes generated as a result of these guidelines are not expected to be hazardous, generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste (see 40 CFR $262.11).

If these wastes identified should be or are listed as hazardous, they will come within the scope of RCRA's "cradle to grave" hazardous waste management program, requiring regulation from the point of generation to point of final disposition. EPA's generator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off-site treatment, storage, or disposal facility. See 40 CFR $262.20 [45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980)]. The transporter regulations require transporters of hazardous waste to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR $263.20 [45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980)]. Finally, RCRA regulations establish standards for hazardous waste treatment, storage, and disposal facilities allowed to receive such wastes. See 40 CFR Part 464 [46 FR 2802 (January 12, 1981), 47 FR 32274 (July 26, 1982)].

Even if these wastes are not identified as hazardous, they still must be disposed of in compliance with the Subtitle D open dumping standards, implementing S4004 of RCRA. See 44 FR 53438 (September 13, 1979). The Agency has calculated as part of the costs for wastewater treatment the cost of hauling and disposing of these wastes.

The Agency estimates that the promulgated PSES regulation for secondary nickel manufacturing facilities will generate 423 metric tons of solid wastes (wet basis) in 1982 as a result of wastewater treatment.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of chemical precipitation, sedimentation, and multimedia filtration. These technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

Table VIII-1

COST OF COMPLIANCE FOR THE SECONDARY NICKEL SUBCATEGORY
INDIRECT DISCHARGERS

(March, 1982 Dollars)

Option	Proposal Costs		Promulgation Costs	
	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	286,137	119,339	320,100	161,200
C	341,274	147,750	387,300	196,200
	(286,549)*	(119,616)*	(320,500)*	(161,500)*

*These costs represent Option C without filtration for slag reclaim tailings.

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SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

The plants within the secondary nickel subcategory were studied as to their wastewater disposal practices and it was determined that BPT and BAT are not applicable to this subcategory. This is because there are no direct dischargers of process wastewater. The secondary nickel subcategory is regulated under New Source Performance Standards in Section XI and Pretreatment Standards in Section XII.

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

As described in Section IX, BAT is not applicable to the secondary nickel subcategory because none of the plants in the subcategory directly discharge any wastewater to surface waters. Regulation of the secondary nickel subcategory is covered in Section XI under New Source Performance Standards and Section XII under Pretreatment Standards.

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SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

This section describes the technologies for treatment of wastewater from new sources and presents mass discharge standards for regulated pollutants for NSPS in the secondary nickel subcategory, based on the selected treatment technology. The basis for new source performance standards (NSPS) 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, EPA has considered the best demonstrated process changes, in-plant controls, and end-of-pipe treatment technologies which reduce pollution to the maximum extent feasible.

TECHNICAL APPROACH TO NSPS

New source performance standards are based on the most effective and beneficial technologies currently available. The Agency reviewed and evaluated a wide range of technology options for new sources. The Agency elected to examine two technology options. applied to combined wastewater streams, which could be applied to the secondary nickel subcategory as alternatives for the basis of NSPS.

Treatment technologies considered for the NSPS options are summarized below:

OPTION A (Figure XI-1, page 4000) is based on:

Chemical precipitation and sedimentation
Separate treatment of slag reclaim tailings wastewater

OPTION C (Figure XI-2, page 4001) is based on:

Chemical precipitation and sedimentation
Multimedia filtration
Separate treatment of slag reclaim tailings wastewater

As explained in Section IV, the secondary nickel subcategory has been subdivided into three potential wastewater sources or building blocks. Since the water use. discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations will be developed for each of the three subdivisions.

For each of the building blocks a specific approach was followed for the development of NSPS. The first requirement to calculate these limitations is to account for production and flow variability from plant to plant. Therefore, a unit of production or production normalizing parameter (PNP) was determined for each waste stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Each plant within the subcategory was then analyzed to determine which subdivisions were present, specific flow rates generated for each subdivision, and the specific production normalized flows for each subdivision. This analysis is discussed in detail in Section V. Nonprocess wastewater such as rainfall runoff and noncontact cooling water is not considered in the analysis.

Production normalized flows for each subdivision were analyzed to determine which flow was to be used as part of the basis for NSPS. The selected flow (sometimes referred to as a NSPS regulatory flow or NSPS discharge flow) reflected the water use controls which are common practice within the industry, The NSPS normalized flow is based on the average of all applicable data. Nothing was 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 second requirement to calculate new source performance standards is the set of concentrations that are achievable by application of NSPS level treatment technology. Section VII discusses the various control and treatment technologies which are currently in place for each wastewater source. In most cases, the current control and treatment technologies consist of chemical precipitation and sedimentation (lime and settle) technology.

Using theses regulatory flows and the achievable concentrations, the next step is to calculate mass loadings for each wastewater source by subdivision or building block. This calculation was made on a stream by stream basis primarily because plants in this subcategory may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per metric ton -- mg/kkg) were calculated by multiplying the NSPS regulatory flow (l/kkg) by the concentration achievable by the NSPS level of treatment technology (mg/l) for each pollutant parameter limited under NSPS. These mass loadings are published in the Federal Register and in 40 CFR part 421 as the effluent limitations.

The mass loadings which are allowed under NSPS for each plant will be the sum of the individual mass loadings for the various wastewater sources which are found at particular plants. Accordingly, all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at secondary nickel plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/kkg) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each subcategory.

POLLUTANT REMOVAL ESTIMATES

As one means of evaluating each technology option, EPA developed estimates of the pollutant removal and the compliance costs associated with each option. Since there are no existing direct dischargers in the secondary nickel subcategory, the estimated pollutant removal analysis was only carried out for indirect dischargers.

A complete description of the methodology used to calculate the estimated pollutant removal, or benefit, achieved by the application of the various treatment options is presented in Section X of Vol. I. Sampling data collected during the field sampling program were used to characterize the major waste streams considered for regulation. At each sampled facility, the sampling data was production normalized for each unit operation (i.e., mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste, was used to estimate the mass of toxic pollutants generated within the secondary nickel subcategory. The pollutant removal estimates were calculated for each plant by first estimating the total mass of each pollutant in the untreated wastewater. This was calculated by first multiplying the raw waste values by the corresponding production value for that stream and then summing these values for each pollutant for every stream generated by the plant.

The volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable with the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed is the difference between the estimated mass of pollutant generated within the subcategory and the mass of pollutant discharged after application of the treatment option. The pollutant removal estimates for indirect dischargers in the secondary nickel subcategory have been revised since proposal based on new flow and production data and are presented in Table XII-1 (Page 4009).

COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop a cost estimation model, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater, discharge. EPA applied the model to each plant. The plant's investment and operating costs are determined by what treatment it has in place and by its individual process wastewater discharge flow. As discussed above, this flow is either the actual or the NSPS regulatory flow, whichever is lesser. The final step was to annualize the capital costs, and to sum the annualized capital costs and the operating and maintenance costs for each plant, yielding the cost of compliance for the subcategory. A comparison of the costs developed for proposal and the revised costs for promulgation is presented in Table XII-2 (Page 4010). These costs were used in assessing economic achievability.

<u>NSPS OPTION SELECTION - PROPOSAL</u>

EPA proposed that NSPS for the secondary nickel subcategory be based on Option C, chemical precipitation, sedimentation, and multimedia filtration. Filtration was proposed for acid reclaim leaching filtrate and acid reclaim leaching belt filter backwash, but not for slag reclaim tailings. Filtration was not proposed for slag reclaim tailings wastewater because it was not found to be cost effective.

The wastewater flow rates for NSPS were equivalent to the proposed PSES flow rates. Flow reduction measures were not considered feasible for the waste streams generated in this subcategory.

<u>NSPS OPTION SELECTION - PROMULGATION</u>

We are promulgating NSPS for the secondary nickel subcategory based on Option A, chemical precipitation and sedimentation. The end-of-pipe treatment configuration for the NSPS option selected is presented in Figure XI-3 (Page 4011). It was determined that filtration for slag reclaim tailings and acid reclaim wastewater would not remove much additional pollutants beyond lime and settle treatment, and therefore, is not justified.

The pollutants and pollutant parameters specifically limited under NSPS are chromium, copper, nickel, total suspended solids and pH. The toxic pollutants arsenic and zinc were also considered for regulation because they are present at treatable concentrations in the raw wastewaters from this subcategory. These pollutants were not selected for-specific regulation because they will be effectively controlled when the regulated toxic metals are treated to the levels achievable by the model technology.

Promulgated NSPS technology and discharge rates are equivalent to promulgated PSES technology and discharge rates. Because NSPS is equal to PSES, we believe that the promulgated NSPS will not have a detrimental impact on the entry of new plants into this subcategory.

WASTEWATER DISCHARGE RATES

A NSPS discharge rate is calculated for each subdivision based on the average of the flows of the existing plants, as determined from analysis of dcp. The discharge rate is used with the achievable treatment concentrations to determine NSPS effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the three wastewater sources are discussed below and summarized in Table XI - 1 (Page 4002). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the product which is produced by the process associated with the wastewater stream in question. These production normalizing parameters, or PNPs, are also listed in Table XI - 1.

Section V of this document further describes the discharge flow rates and presents water use and discharge flow rates for each plant by subdivision in Tables V - 1 through V - 3 (Pages 3962 - 3964).

SLAG RECLAIM TAILINGS

NSPS wastewater discharge allowance at proposal for slag reclaim tailings was 85,600 l/kkg (20,513 gal/ton) of slag reclaim nickel produced. The NSPS allowances were based on the discharge rate at the only plant reporting this stream. Since proposal, industry comments which included flow and production information enabled EPA to recalculate the production normalized flow. In addition, industry comments prompted EPA to reconsider the production normalizing parameter for this stream. Based on the new information submitted, EPA concluded that the generation of slag reclaim tailings wastewater is related more closely to raw material input to the reclaim process than to the quantity of nickel produced from the process.

The NSPS wastewater discharge allowance used at promulgation for slag reclaim tailings is 12,848 l/kkg (3,079 gal/ton) of slag input to the reclaim process. This rate is allocated only for those plants that reclaim nickel from slag generated in melt furnaces with a wet granulation process. The water use and wastewater discharge rates are presented in Table V - 1 (Page 3962).

ACID RECLAIM LEACHING FILTRATE

The NSPS wastewater discharge allowance used for both proposal and promulgation for acid reclaim leaching filtrate is 4,995 l/kkg (1,197 gal/ton) of acid reclaim nickel produced. This rate is allocated only for those plants that reclaim nickel from spent acids, pickling wastes, and wastewater treatment sludges by precipitation or nickel carbonate, followed by roasting to produce nickel oxide and leaching with water. The water use and wastewater discharge rates are presented in Table V - 2 (Page 3963).

ACID RECLAIM LEACHING BELT FILTER BACKWASH

The NSPS wastewater discharge allowance used at both proposal and promulgation for acid reclaim leaching belt filter backwash is 1,199 l/kkg (287 gal/ton) of acid reclaim nickel produced. This rate is allocated only for those plants that reclaim nickel from spent acids, pickling wastes, and wastewater treatment sludges as explained above, and clean the belt filter with water. The water use and wastewater discharge rates are presented in Table V - 3 (Page 3964).

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations form individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination and evaluation was presented in Section VI. A total of five pollutants or pollutant parameters are selected for limitation under NSPS and are listed below:

119. chromium
120. copper
124. nickel
TSS
pH

The Agency has chosen not to regulate all five priority pollutants selected in Section VI for further consideration.

The high cost associated with analysis for priority metal pollutants has prompted EPA to develop an alternative method for regulating and monitoring priority pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent mass limitations and standards for each of the priority metals found above treatable concentrations in the raw wastewater from a given subcategory, the Agency is promulgating effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal analysis.

By establishing limitations and standards for certain priority metal pollutants, dischargers will attain the same degree of control over priority metal pollutants as they would have been required to achieve had all the toxic metal pollutants been directly limited.

This approach is technically justified since the treatable concentrations used for chemical precipitation and sedimentation technology are based on optimized treatment for concomitant multiple metals removal. Thus, even though metals have somewhat different theoretical solubilities, they will be removed at very nearly the same rate in a chemical precipitation and sedimentation treatment system operated for multiple metals removal.

NEW SOURCE PERFORMANCE STANDARDS

The pollutant concentrations achievable by application of the NSPS technology are discussed in Section VII of this supplement. These achievable concentrations (both one day maximum and monthly average values) are multiplied by the NSPS normalized discharge flows summarized in Table XI-1 (Page 4000) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the new source performance standards and are presented in Table XI-2 (Page 4001) for each individual building block.

TABLE XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY NICKEL SUBCATEGORY

Building Block	NSPS Normalized Discharge Rate (l/kkg)	NSPS Normalized Discharge Rate (gal/ton)	Production Normalizing Parameter
Slag Reclaim Tailings	12,848	3,079	slag input to reclaim process
Acid reclaim Leaching Filtrate	4,995	1,197	acid reclaim nickel produced
Acid Reclaim Leaching Belt Filter Backwash	1,199	287	acid reclaim nickel produced

TABLE XI-2

NSPS FOR THE SECONDARY NICKEL SUBCATEGORY

(a) Slag Reclaim Tailings NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of slag input to reclaim process		
Arsenic	26.850	11.950
*Chromium	5.653	2.313
*Copper	24.410	12.850
*Nickel	24.670	16.320
Zinc	18.760	7.837
*TSS	526.800	250.500
*pH	Within the range of 7.5 to 10.0 at all times	

(b) Acid Reclaim Leaching Filtrate NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Arsenic	10.440	4.645
*Chromium	2.198	0.899
*Copper	9.491	4.995
*Nickel	9.590	6.344
Zinc	7.293	3.047
*TSS	204.800	97.400
*pH	Within the range of 7.5 to 10.0 at all times	

(c) Acid Reclaim Leaching Belt Filter Backwash NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Arsenic	2.506	1.115
*Chromium	0.528	0.216
*Copper	2.278	1.199
*Nickel	2.302	1.523
Zinc	1.751	0.731
*TSS	49.160	23.380
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

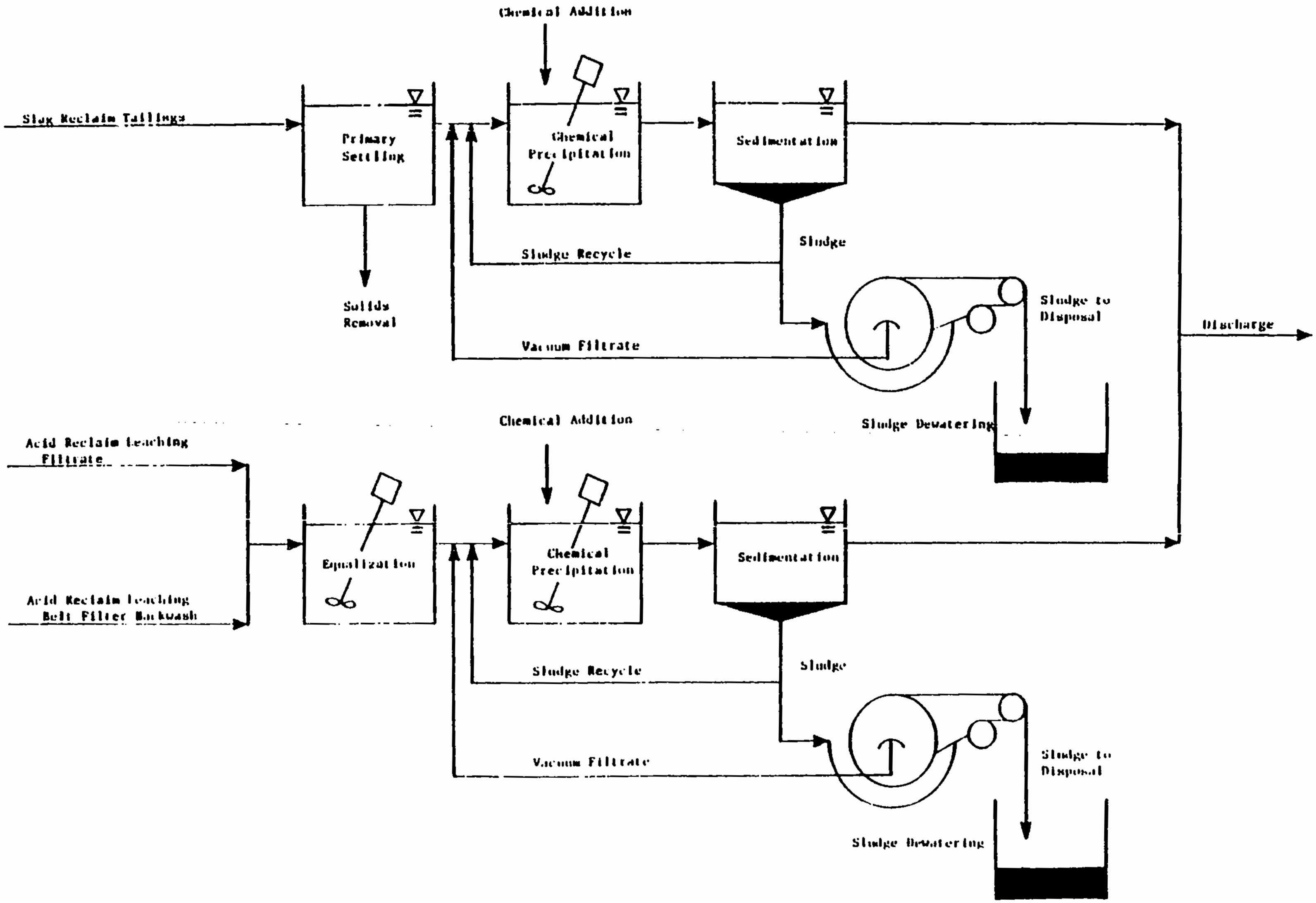

Figure XI-1

NSPS TREATMENT SCHEME FOR OPTION A

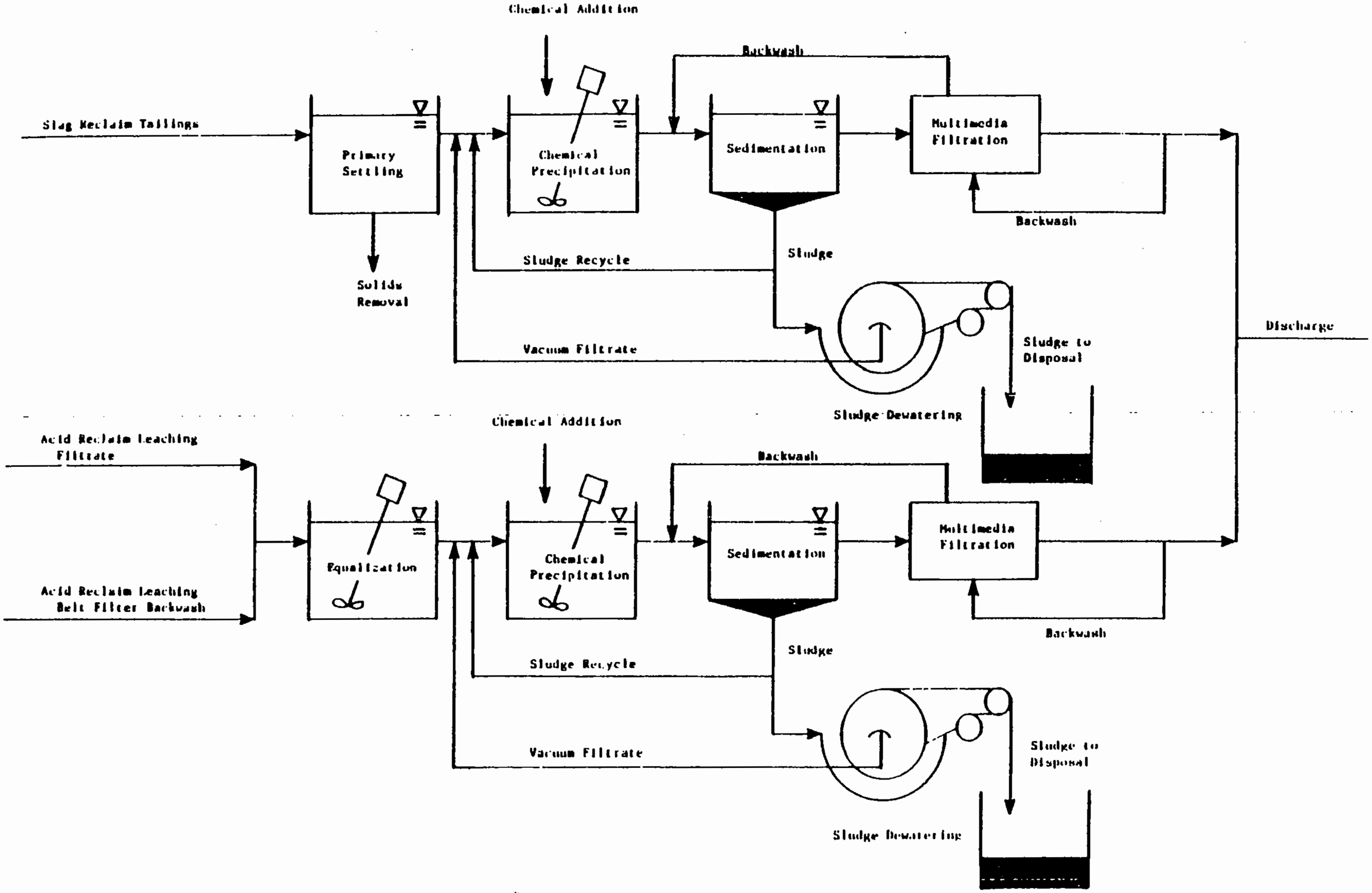

Figure XI-2

NSPS TREATMENT SCHEME FOR OPTION C

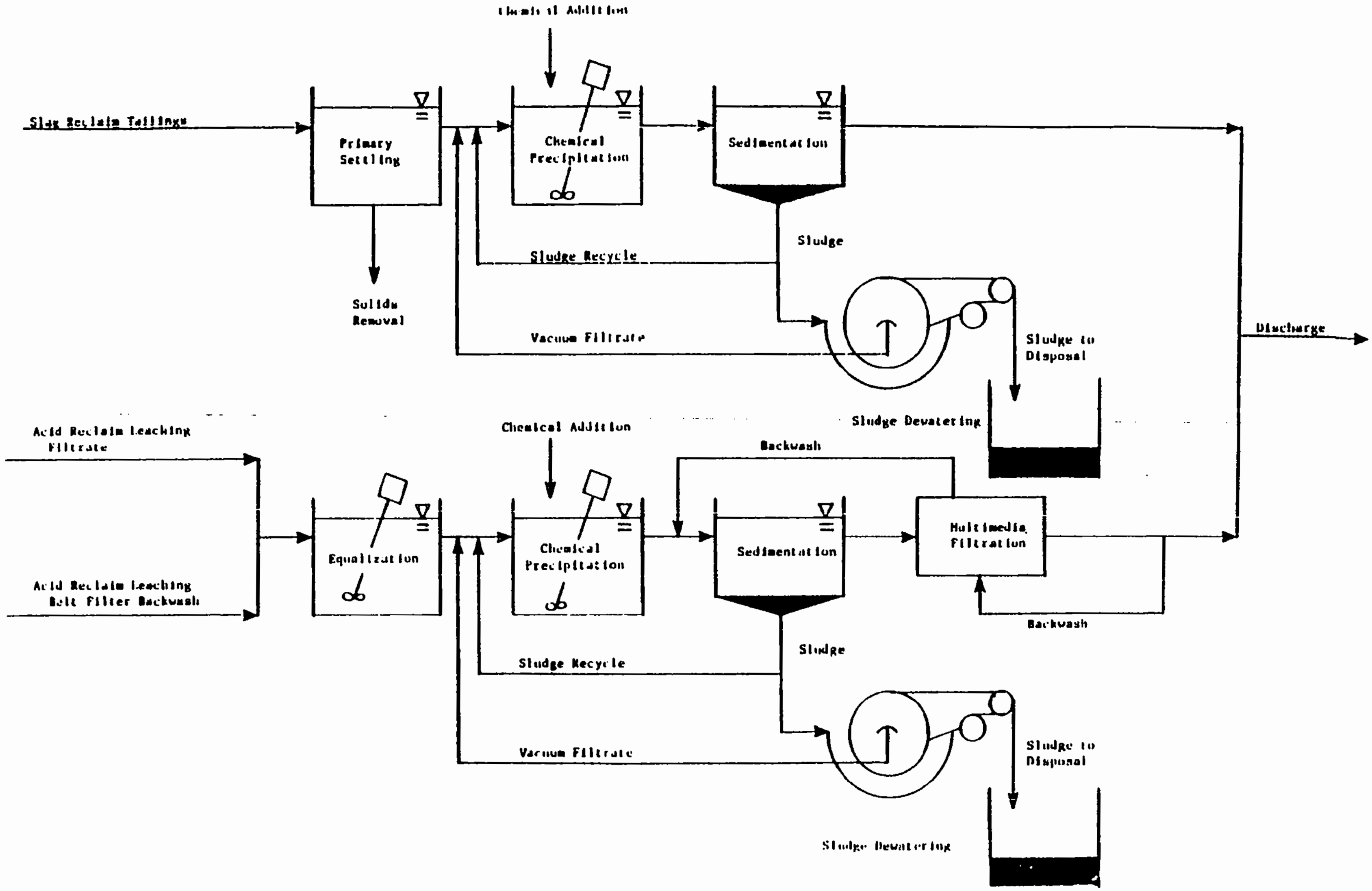

Figure XI-3

NSPS TREATMENT SCHEME FOR OPTION C WITHOUT FILTRATION FOR SLAG RECLAIM TAILINGS

SECTION XII

PRETREATMENT STANDARDS

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the secondary nickel subcategory. PSES are designed to prevent the discharge of pollutants which pass through, interfere with, or are otherwise incompatible with the operation of publicly owned treatment works (POTW). The Clean Water Act requires pretreatment for pollutants, such as toxic metals, that limit POTW sludge management alternatives. New indirect discharge facilities, like new direct discharge facilities, have the opportunity to incorporate the best available demonstrated technologies, including process changes, in-plant controls, and end-of-pipe treatment technologies, and to use plant site selection to ensure adequate treatment system installation. Pretreatment standards are to be technology based, analogous to the best available or best demonstrated technology for removal of toxic pollutants.

Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology.

TECHNICAL APPROACH TO PRETREATMENT

Before proposing or promulgating pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements, is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant.

This definition of pass through satisfies two competing objectives set by Congress that standards for indirect dischargers be equivalent to standards for direct dischargers, while at the same time, the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers.

The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources or the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

The industry cost and pollutant removal estimates of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant removal estimates and plant compliance costs is discussed in Section XI. The compliance costs and pollutant removal estimates have been recalculated since proposal based on new flow and production data for the slag reclaim tailings stream obtained through industry comments. Table XII-1 (Page 4009) shows the revised pollutant removal estimates for indirect dischargers. A comparison of proposal and promulgation compliance costs for indirect dischargers is presented in Table XII-2 (Page 4010).

PRETREATMENT STANDARDS FOR EXISTING AND NEW SOURCES

Options for pretreatment of wastewaters from both existing and new sources are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Section XI. The options for PSNS and PSES, therefore, are the same as the NSPS options discussed in Section XI. A description of each option is presented in Section XI.

Treatment technologies considered for the PSES and PSNS options are:

OPTION A

- o Chemical precipitation and sedimentation
- o Separate treatment of slag reclaim tailings wastewater

OPTION C

- o Chemical precipitation and sedimentation
- o Multimedia filtration
- o Separate treatment of slag reclaim tailings wastewater

PSES OPTION SELECTION PROPOSAL

EPA proposed PSES for the secondary nickel subcategory based on Option C (chemical precipitation, sedimentation, and multimedia filtration). Filtration was proposed for acid reclaim leaching filtrate and acid reclaim leaching filter backwash wastewaters, but not for slag reclaim tailings wastewater. Filtration for slag reclaim tailings wastewater was not found to be cost effective.

Implementation of the proposed PSES limitations was estimated to remove 1,113 kilograms of toxic metal pollutants annually. Capital and annual costs of $286,549 and $119,616 (1982 dollars), respectively, were estimated in order to achieve the proposed PSES.

PSES OPTION SELECTION - PROMULGATION

EPA is promulgating PSES for this subcategory based on Option A, chemical precipitation and sedimentation. Filtration was not found to be cost effective for any subdivisions in this subcategory because it would not remove much additional pollutant beyond that removed with lime and settle treatment. The pollutants specifically regulated under PSES are chromium, copper, and nickel. The toxic pollutants arsenic and zinc were also considered for regulation because they are present at treatable concentrations in the raw wastewaters from this subcategory. These pollutants were not selected for specific regulation because they will be effectively controlled when the regulated toxic metals are treated to the levels achievable by the model technology. We are promulgating PSES to prevent pass-through of chromium, copper, and nickel. These priority pollutants are removed by a well-operated POTW at an average of 32 percent while PSES technology removes approximately 84 percent.

Implementation of the promulgated PSES limitations will remove annually an estimated 1,625 kg of priority metals. We estimate a capital cost of $320,100 and an annualized cost of $161,200 (1982 dollars) to achieve the promulgated PSES. The promulgated PSES will not result in adverse economic impacts.

PSNS OPTION SELECTION - PROPOSAL

EPA proposed PSNS for the secondary nickel subcategory based on Option C (chemical precipitation, sedimentation, and multimedia filtration). Filtration was not proposed for slag reclaim tailings wastewater, however, because it was not shown to be cost effective for this waste stream.

Wastewater discharge rates for PSNS were proposed equivalent to the PSES discharge rates.

PSNS OPTION SELECTION - PROMULGATION

EPA is promulgating PSNS equivalent to promulgated NSPS and PSES. The same pollutants pass through at PSNS as at PSES, for the same reasons.

The PSES flow allowances are based on minimization of process wastewater wherever possible.

The Agency believes that the promulgated PSNS are achievable, and that they are not a barrier to entry of new plants into this subcategory.

The wastewater discharge rates for PSNS are identical to the NSPS discharge rates for each waste stream. The PSNS discharge rates are shown in Table XII-3 (Table 4012).

PRETREATMENT STANDARDS

Pretreatment standards are based on the achievable concentrations from the selected treatment technology and the discharge rates determined in Section XI for NSPS and shown in Table XII-3. A mass of pollutant per mass of product (mg/kg) allocation is given for each subdivision within the subcategory. This pollutant allocation is based on the product of the concentration achievable from the model treatment (mg/l) and the production normalized wastewater discharge rate (l/kkg). The achievable treatment concentrations for NSPS are identical to those for PSES and PSNS. PSES and PSNS are presented in Table XII-4 and XII-5, respectively (pages 4012 - 4013).

Table XII-1

POLLUTANT REMOVAL ESTIMATES FOR INDIRECT DISCHARGERS IN THE SECONDARY NICKEL SUBCATEGORY

Pollutant	Total Raw Discharge (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)	Selected Option Discharge (kg/yr)	Selected Option Removed (kg/yr)
Antimony	0	0	0	0	0	0	0
Arsenic	16.90	16.90	0	16.90	0	16.90	0
Cadmium	0	0	0	0	0	0	0
Chromium (total)	12.20	4.95	7.25	4.13	8.07	4.94	7.26
Copper	1,606.38	34.18	1,572.20	22.98	1,583.40	34.03	1,572.35
Cyanide (total)	0	0	0	0	0	0	0
Lead	0	0	0	0	0	0	0
Mercury	0	0	0	0	0	0	0
Nickel	51.68	6.41	45.27	6.00	45.68	6.00	45.68
Selenium	0	0	0	0	0	0	0
Silver	0	0	0	0	0	0	0
Thallium	0	0	0	0	0	0	0
Zinc	0.19	0.19	0	0.17	0.02	0.17	0.02
TOTAL PRIORITY POLLUTANTS	1,687.35	62.63	1,624.72	50.18	1,637.17	62.04	1,625.31
Ammonia	0	0	0	0	0	0	0
Cobalt	0	0	0	0	0	0	0
Fluoride	23.89	23.89	0	23.89	0	23.89	0
TOTAL NONCONVENTIONALS	23.89	23.89	0	23.89	0	23.89	0
TSS	932,833.74	707.09	932,126.65	153.20	932,680.54	699.68	932,134.06
Oil & Grease	699.12	581.35	117.77	581.35	117.77	581.35	117.77
TOTAL CONVENTIONALS	933,532.86	1,288.44	932,244.42	734.55	932,798.31	1,281.03	932,251.83
TOTAL POLLUTANTS	935,244.10	1,374.96	933,869.14	808.62	934,435.48	1,366.96	933,877.14

Option A = Chemical precipitation and sedimentation

Option C = Chemical precipitation, sedimentation, and filtration

Table XII-2

COST OF COMPLIANCE FOR THE SECONDARY NICKEL SUBCATEGORY
INDIRECT DISCHARGERS

(March, 1982 Dollars)

	Proposal Costs		Promulgation Costs	
Option	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	286,137	119,339	320,100	161,200
C	341,274	147,750	387,300	196,200
	(286,549)*	(119,616)*	(320,500)*	(161,500)*

*These costs represent Option C without filtration for slag reclaim tailings.

TABLE XII-3

PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY NICKEL SUBCATEGORY

Wastewater Stream	PSES and PSNS Normalized Discharge Rate (l/kkg)	(gal/ton)	Production Normalizing Parameter
Slag Reclaim Tailings	12,848	3.079	slag input to reclaim process
Acid reclaim Leaching Filtrate	4,995	1,197	acid reclaim nickel produced
Acid Reclaim Leaching Belt Filter Backwash	1,199	287	acid reclaim nickel produced

TABLE XII-4

PSES FOR THE SECONDARY NICKEL SUBCATEGORY

(a) Slag Reclaim Tailings PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of slag input to reclaim process		
Arsenic	26.850	11.950
*Chromium	5.653	2.313
*Copper	24.410	12.850
*Nickel	24.670	16.320
Zinc	18.760	7.837

(b) Acid Reclaim Leaching Filtrate PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Arsenic	10.440	4.645
*Chromium	2.198	0.899
*Copper	9.491	4.995
*Nickel	9.590	6.344
Zinc	7.293	3.047

(c) Acid Reclaim Leaching Belt Filter Backwash PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Arsenic	2.506	1.115
*Chromium	0.528	0.216
*Copper	2.278	1.199
*Nickel	2.302	1.523
Zinc	1.751	0.731

*Regulated Pollutant

TABLE XII-5

PSNS FOR THE SECONDARY NICKEL SUBCATEGORY

(a) Slag Reclaim Tailings PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of slag input to reclaim process		
Arsenic	26.850	11.950
*Chromium	5.653	2.313
*Copper	24.410	12.850
*Nickel	24.670	16.320
Zinc	18.760	7.837

(b) Acid Reclaim Leaching Filtrate PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Arsenic	10.440	4.645
*Chromium	2.198	0.899
*Copper	9.491	4.995
*Nickel	9.590	6.344
Zinc	7.293	3.047

(c) Acid Reclaim Leaching Belt Filter Backwash PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of acid reclaim nickel produced		
Arsenic	2.506	1.115
*Chromium	0.528	0.216
*Copper	2.278	1.199
*Nickel	2.302	1.523
Zinc	1.751	0.731

*Regulated Pollutant

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SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control for the secondary nickel subcategory at this time.

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Pages 4017 and 4018 are omitted.

NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

DEVELOPMENT DOCUMENT SUPPLEMENT

for the

Secondary Tin Subcategory

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May 1989

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Office of Water
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Industrial Technology Division
Washington, D. C. 20460

SECONDARY TIN SUBCATEGORY

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SECTION I

SUMMARY

This document provides the technical basis for promulgating effluent limitations based on best practicable technology (BPT) and best available technology (BAT) for existing direct dischargers, pretreatment standards for existing indirect dischargers (PSES), pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS).

The secondary tin subcategory consists of twelve plants. Of the twelve plants, three discharge directly to rivers, lakes, or streams; one discharges to a publicly owned treatment works (POTW); and eight achieve zero discharge of process wastewater.

EPA first studied the secondary tin 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 the sources and volume of water used, the processes used, the sources of pollutants and wastewaters in the plant, and the constituents of wastewaters, including toxic priority pollutants. As a result, nine subdivisions or building blocks have been identified for this subcategory that warrant separate effluent limitations. These include:

(a) Tin smelter SO_2 scrubber,
(b) Dealuminizing rinse,
(c) Tin mud acid neutralization filtrate,
(d) Tin hydroxide wash,
(e) Spent electrowinning solution from new scrap,
(f) Spent electrowinning solution from municipal solid waste,
(g) Tin hydroxide supernatant from scrap,
(h) Tin hydroxide supernatant from plating solutions and sludges, and
(i) Tin hydroxide filtrate.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary tin 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 various flow reduction techniques reported in the data collection portfolios (dcp) and plant visits.

Engineering costs were prepared for each of the control and treatment options considered for the subcategory. These costs were then used by the Agency to estimate the impact of implementing the various options on the subcategory. For each control and treatment option that the Agency found to be most effective and technically feasible in controlling the discharge of pollutants, we estimated the number of potential closures, number of employees affected, and impact on price. These results are reported in a separate document entitled "The Economic Impact Analysis of Effluent Limitations and Standards for the Nonferrous Metals Manufacturing Industry."

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on chemical precipitation and sedimentation technology is the basis for the BPT limitations. Cyanide precipitation was selected as the basis for cyanide limitations. To meet the BPT effluent limitations based on this technology, the secondary tin subcategory is expected to incur capital and annual costs. However, these costs are not presented here because they are based on information claimed to be confidential.

For BAT, the Agency has built upon the BPT technology basis by adding filtration as an effluent polishing step to the end-of-pipe treatment scheme. To meet the BAT effluent limitations based on this technology, the secondary tin subcategory is estimated to incur capital and annual costs. However, these costs are not presented here because the data on which they are based has been claimed to be confidential.

NSPS, which are based on best demonstrated technology, are equivalent to 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, the technology basis of BAT has been determined as the best demonstrated technology for this subcategory.

The technology basis for PSES is equivalent to BAT. To meet the pretreatment standards for existing sources, the secondary tin subcategory is estimated to incur a capital cost of $160,187 and an annual cost of $50,044. For PSNS, the Agency selected end-of-pipe treatment and in-process flow reduction control techniques equivalent to NSPS.

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

SECTION II

CONCLUSIONS

EPA has divided the secondary tin subcategory into nine subdivisions for the purpose of effluent limitations and standards. These subdivisions are:

(a) Tin smelter SO_2 scrubber,
(b) Dealuminizing rinse,
(c) Tin mud acid neutralization filtrate,
(d) Tin hydroxide wash,
(e) Spent electrowinning solution from new scrap,
(f) Spent electrowinning solution from municipal solid waste,
(g) Tin hydroxide supernatant from scrap,
(h) Tin hydroxide supernatant from plating solutions and sludges, and
(i) Tin hydroxide filtrate.

BPT is promulgated based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology, along with preliminary treatment consisting of cyanide precipitation for selected waste streams. The following BPT limitations are promulgated:

(a) <u>Tin Smelter SO_2 Scrubber BPT</u>

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of crude tapped tin produced		
Arsenic	19.220	8.554
Lead	3.863	1.840
Iron	11.040	5.611
Tin	3.495	2.024
TSS	377.100	179.400
pH	Within the range of 7.5 to 10.0 at all times	

(b) Dealuminizing Rinse BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Lead	0.015	0.007
Cyanide (total)	0.010	0.004
Fluoride	1.225	0.700
Tin	0.013	0.008
TSS	1.435	0.683
pH	Within the range of 7.5 to 10.0 at all times	

(c) Tin Mud Acid Neutralization Filtrate BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of neutralized dewatered tin mud produced		
Lead	2.120	1.009
Cyanide (total)	1.464	0.606
Fluoride	176.600	100.400
Tin	1.918	1.110
TSS	206.900	98.420
pH	Within the range of 7.5 to 10.0 at all times	

(d) Tin Hydroxide Wash BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin hydroxide washed		
Lead	5.020	2.391
Cyanide (total)	3.466	1.434
Fluoride	418.400	237.900
Tin	4.542	2.630
TSS	490.100	233.100
pH	Within the range of 7.5 to 10.0 at all times	

(e) Spent Electrowinning Solution from New Scrap BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cathode tin produced		
Lead	7.056	3.360
Cyanide (total)	4.872	2.016
Fluoride	588.000	334.300
Tin	6.384	3.696
TSS	688.800	327.600
pH	Within the range of 7.5 to 10.0 at all times	

(f) Spent Electrowinning Solution from Municipal Solid Waste BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of MSW scrap used as raw material		
Lead	0.050	0.024
Cyanide (total)	0.035	0.014
Fluoride	4.165	2.368
Tin	0.045	0.026
TSS	4.879	2.321
pH	Within the range of 7.5 to 10.0 at all times	

(g) Tin Hydroxide Supernatant from Scrap BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from scrap		
Lead	23.370	11.130
Cyanide (total)	16.140	6.677
Fluoride	1,947.000	1,107.000
Tin	21.140	12.240
TSS	2,281.000	1,085.000
pH	Within the range of 7.5 to 10.0 at all times	

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges		
Lead	48.300	23.000
Cyanide (total)	33.350	13.800
Fluoride	4,025.000	2,289.000
Tin	43.700	25.300
TSS	4,715.000	2,243.000
pH	Within the range of 7.5 to 10.0 at all times	

(i) Tin Hydroxide Filtrate BPT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal produced		
Lead	10.520	5.009
Cyanide (total)	7.263	3.005
Fluoride	876.500	498.400
Tin	9.517	5.510
TSS	1,027.000	488.400
pH	Within the range of 7.5 to 10.0 at all times	

BAT is promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology along with preliminary treatment consisting cyanide precipitation for selected waste streams. The following BAT effluent limitations are promulgated:

(a) Tin Smelter SO_2 Scrubber BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of crude tapped tin produced		
Arsenic	12.790	5.703
Lead	2.575	1.196
Iron	11.040	5.611
Tin	3.495	2.024

(b) Dealuminizing Rinse BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Lead	0.010	0.005
Cyanide (total)	0.007	0.0028
Fluoride	1.225	0.697
Tin	0.013	0.008

(c) Tin Mud Acid Neutralization Filtrate BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of neutralized dewatered tin mud produced		
Lead	1.413	0.656
Cyanide (total)	1.009	0.404
Fluoride	176.600	100.400
Tin	1.918	1.110

(d) Tin Hydroxide Wash BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin hydroxide washed		
Lead	3.347	1.554
Cyanide (total)	2.391	0.956
Fluoride	418.400	237.900
Tin	4.542	2.630

(e) Spent Electrowinning Solution from New Scrap BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cathode tin produced		
Lead	4.704	2.184
Cyanide (total)	3.360	1.344
Fluoride	588.000	334.300
Tin	6.384	3.696

(f) Spent Electrowinning Solution from Municipal Solid Waste BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of MSW scrap used as raw material		
Lead	0.033	0.015
Cyanide (total)	0.024	0.010
Fluoride	4.165	2.368
Tin	0.045	0.026

(g) Tin Hydroxide Supernatant from Scrap BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from scrap		
Lead	15.580	7.233
Cyanide (total)	11.130	4.451
Fluoride	1,947.000	1,107.000
Tin	21.140	12.240

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges		
Lead	32.200	14.950
Cyanide (total)	23.000	9.200
Fluoride	4,025.000	2,289.000
Tin	43.700	25.300

(i) Tin Hydroxide Filtrate BAT

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal produced		
Lead	7.012	3.256
Cyanide (total)	5.009	2.004
Fluoride	876.500	498.400
Tin	9.517	5.510

NSPS are based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle and filter) technology, along with preliminary treatment consisting of cyanide precipitation for selected waste streams. The following effluent standards are promulgated for new sources:

(a) Tin Smelter SO_2 Scrubber NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of crude tapped tin produced		
Arsenic	12.790	5.703
Lead	2.575	1.196
Iron	11.040	5.611
Tin	3.495	2.024
TSS	138.000	110.400
pH	Within the range of 7.5 to 10.0 at all times	

(b) Dealuminizing Rinse NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Lead	0.010	0.005
Cyanide (total)	0.007	0.003
Fluoride	1.225	0.697
Tin	0.013	0.008
TSS	0.525	0.420
pH	Within the range of 7.5 to 10.0 at all times	

(c) Tin Mud Acid Neutralization Filtrate NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of neutralized dewatered tin mud produced		
Lead	1.413	0.656
Cyanide (total)	1.009	0.404
Fluoride	176.600	100.400
Tin	1.918	1.110
TSS	75.710	60.560
pH	Within the range of 7.5 to 10.0 at all times	

(d) Tin Hydroxide Wash NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin hydroxide washed		
Lead	3.347	1.554
Cyanide (total)	2.391	0.956
Fluoride	418.400	237.900
Tin	4.542	2.630
TSS	179.300	143.400
pH	Within the range of 7.5 to 10.0 at all times	

(e) Spent Electrowinning Solution from New Scrap NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cathode tin produced		
Lead	4.704	2.184
Cyanide (total)	3.360	1.344
Fluoride	588.000	334.300
Tin	6.384	3.696
TSS	252.000	201.600
pH	Within the range of 7.5 to 10.0 at all times	

(f) Spent Electrowinning Solution from Municipal Solid Waste NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of MSW scrap used as raw material		
Lead	0.033	0.015
Cyanide (total)	0.024	0.001
Fluoride	4.165	2.368
Tin	0.045	0.026
TSS	1.785	1.428
pH	Within the range of 7.5 to 10.0 at all times	

(g) Tin Hydroxide Supernatant from Scrap NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from scrap		
Lead	15.580	7.233
Cyanide (total)	11.130	4.451
Fluoride	1,947.000	1,107.000
Tin	21.140	12.240
TSS	834.600	667.700
pH	Within the range of 7.5 to 10.0 at all times	

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges		
Lead	32.200	14.950
Cyanide (total)	23.000	9.200
Fluoride	4,025.000	2,289.000
Tin	43.700	25.300
TSS	1,725.000	1,380.000
pH	Within the range of 7.5 to 10.0 at all times	

(i) Tin Hydroxide Filtrate NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal produced		
Lead	7.012	3.256
Cyanide (total)	5.009	2.004
Fluoride	876.500	498.400
Tin	9.517	5.510
TSS	375.700	300.500
pH	Within the range of 7.5 to 10.0 at all times	

PSES are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle and filter) technology, along with preliminary treatment consisting of cyanide precipitation for selected waste streams. The following pretreatment standards are promulgated for existing sources:

(a) Tin Smelter SO_2 Scrubber PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of crude tapped tin produced		
Arsenic	12.790	5.703
Lead	2.575	1.196
Iron	11.040	5.611
Tin	3.495	2.024

(b) Dealuminizing Rinse PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Lead	0.010	0.005
Cyanide (total)	0.007	0.003
Fluoride	1.225	0.697
Tin	0.013	0.008

(c) Tin Mud Acid Neutralization Filtrate PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of neutralized dewatered tin mud produced		
Lead	1.413	0.656
Cyanide (total)	1.009	0.404
Fluoride	176.600	100.400
Tin	1.918	1.110

(d) Tin Hydroxide Wash PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin hydroxide washed		
Lead	3.347	1.554
Cyanide (total)	2.391	0.956
Fluoride	418.400	237.900
Tin	4.542	2.630

(e) Spent Electrowinning Solution from New Scrap PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cathode tin produced		
Lead	4.704	2.184
Cyanide (total)	3.360	1.344
Fluoride	588.000	334.300
Tin	6.384	3.696

(f) Spent Electrowinning Solution from Municipal Solid Waste PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of MSW scrap used as raw material		
Lead	0.033	0.015
Cyanide (total)	0.024	0.010
Fluoride	4.165	2.368
Tin	0.045	0.026

(g) Tin Hydroxide Supernatant from Scrap PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from scrap		
Lead	15.580	7.233
Cyanide (total)	11.130	4.451
Fluoride	1,947.000	1,107.000
Tin	21.140	12.240

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges		
Lead	32.200	14.950
Cyanide (total)	23.000	9.200
Fluoride	4,025.000	2,289.000
Tin	43.700	25.300

(i) Tin Hydroxide Filtrate PSES

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal produced		
Lead	7.012	3.256
Cyanide (total)	5.009	2.004
Fluoride	876.500	498.400
Tin	9.517	5.510

PSNS are promulgated based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle and filter) technology, along with preliminary treatment consisting of cyanide precipitation for selected waste streams. The following pretreatment standards are promulgated for new sources.

(a) Tin Smelter SO_2 Scrubber PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of crude tapped tin produced		
Arsenic	12.790	5.703
Lead	2.575	1.196
Iron	11.040	5.611
Tin	3.495	2.024

(b) Dealuminizing Rinse PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Lead	0.010	0.005
Cyanide (total)	0.007	0.003
Fluoride	1.225	0.697
Tin	0.013	0.008

(c) Tin Mud Acid Neutralization Filtrate PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of neutralized dewatered tin mud produced		
Lead	1.413	0.656
Cyanide (total)	1.009	0.404
Fluoride	176.600	100.400
Tin	1.918	1.110

d) Tin Hydroxide Wash PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin hydroxide washed		
Lead	3.347	1.554
Cyanide (total)	2.391	0.956
Fluoride	418.400	237.900
Tin	4.542	2.630

e) Spent Electrowinning Solution from New Scrap PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of cathode tin produced		
Lead	4.704	2.184
Cyanide (total)	3.360	1.344
Fluoride	588.000	334.300
Tin	6.384	3.696

f) Spent Electrowinning Solution from Municipal Solid Waste PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of MSW scrap used as raw material		
Lead	0.033	0.015
Cyanide (total)	0.024	0.010
Fluoride	4.165	2.368
Tin	0.045	0.026

(g) <u>Tin Hydroxide Supernatant from Scrap</u> PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from scrap		
Lead	15.580	7.233
Cyanide (total)	11.130	4.451
Fluoride	1,947.000	1,107.000
Tin	21.140	12.240

(h) <u>Tin Hydroxide Supernatant from Plating Solutions and Sludges</u> PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges		
Lead	32.200	14.950
Cyanide (total)	23.000	9.200
Fluoride	4,025.000	2,289.000
Tin	43.700	25.300

(i) <u>Tin Hydroxide Filtrate</u> PSNS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kg (lb/million lbs) of tin metal produced		
Lead	7.012	3.256
Cyanide (total)	5.009	2.004
Fluoride	876.500	498.400
Tin	9.517	5.510

EPA is not promulgating BCT for the secondary tin subcategory at this time.

SECTION III

SUBCATEGORY PROFILE

This section of the secondary tin supplement describes the raw materials and processes used in the production of secondary tin and presents a profile of the secondary tin plants identified in this study.

The largest total use of tin is in solders which are manufactured from both primary tin and secondary tin. The low melting point of tin (232^{o}C) makes it ideal for this application. Tin plated steel products represent the second largest use of tin. Only primary tin is used for this application.

Tin is also used in a number of alloys such as brass, bronze, and white metal alloys including babbitt. White metal alloys are low melting point alloys consisting primarily of tin or lead. These alloys may also contain lesser amounts of copper, zinc and antimony and are used primarily in bearings.

DESCRIPTION OF SECONDARY TIN PRODUCTION

Tin is produced by smelting tin concentrates with limestone and coke. The crude tin is then electrolytically refined and cast. The process is presented schematically in Figure III-1 (page 4052).

Tin may also be produced by smelting tin residues, particularly detinners mud from secondary tin recovery operations. Most secondary tin, however, is produced by dissolving tin from tin plated steel scrap, and recovering the tin by electrowinning. Tin may also be recovered from solution by precipitation of tin as tin hydroxide, $Sn(OH)_4$. A smaller amount of secondary tin is recovered from tin plating sludges which are generated by tin plated steel production operations. These secondary tin production operations can be divided into four major operations: alkaline detinning, electrowinning, tin hydroxide precipitation, and reduction to tin metal. These operations are shown schematically in Figure III-2 (page 4053).

RAW MATERIALS

Tin concentrates used in tin production are imported from South America and Malaysia. EPA considers these tin concentrates to be secondary raw materials for the purpose of establishing effluent limitations. There are no tin producing facilities in the United States that manufacture tin from concentrates alone.

The other principal raw material for the secondary tin industry is tin plated steel scrap. Virtually all of this scrap comes from fabrication plants which produce cans and a variety of other tin plated steel products. Such scrap may include punched sheets, rolls and bundles. One producer also reported tin recovery from tin plated steel separated from municipal solid waste. Two producers reported that they recovered tin from spent tin electroplating solutions and plating sludges.

TIN SMELTING

There is currently one tin smelter in the United States. Tin residues (and sometimes concentrates) are smelted in a kaldo furnace with limestone, magnesium oxide, and coke at 2,000 to 2,400°F. When the tin content of the residual slag reaches 5 to 7 percent, pyrite is added to liberate additional tin as volatile tin sulfide. The tin sulfide is contacted with atmospheric oxygen which results in the generation of sulfur dioxide and tin oxide particles which are captured in a baghouse and later recycled to the furnace. Sulfur dioxide emissions from the smelting furnace are controlled with a scrubber employing a slurry of finely ground aragonite and water as the scrubbing solution. Crude molten tin is periodically tapped from the furnace, fire refined and cast into anodes. The anodes are consumed in an electrolytic refining process and the purified tin is cast into ingots.

ALKALINE DETINNING

The first step in recovering tin from tin plated scrap is hot alkaline detinning. Tin plated scrap is loaded into perforated steel detinning baskets and placed in a detinning tank which contains a solution of sodium hydroxide and sodium nitrate. The solution is heated to near the boiling point and the tin dissolves into solution as sodium stannate, Na_2SnO_3. The chemical reaction is as follows:

$$9Sn + 6NaNO_3 + 12NaOH + 9H_2O \longrightarrow$$

$$9Na_2SnO_3 \cdot H_2O + 2NH_3 + 2N_2 + 3H_2O$$

The detinning cycle is complete after 4 to 12 hours. Scrap containing aluminum is pretreated in a solution of sodium hydroxide, in which the aluminum dissolves. After rinsing, the dealuminized scrap is sent to the detinning tanks.

There are two variations of the alkaline detinning process: the saturated process and the unsaturated process. In the saturated process, the sodium stannate solution is allowed to become supersaturated and sodium stannate crystals precipitate from solution. The sodium stannate is recovered from the solution in a filter press and the solution is returned to the detinning tanks. The sodium stannate filter cake may then be sold as a product or redissolved in water for further processing or electrowinning.

In the unsaturated process, the sodium stannate concentration in the solution is kept below the saturation point and the solution is pumped directly to further processing or electrowinning. In both the saturated and the unsaturated process, the sodium stannate solution is purified by adding sodium sulfide, Na_2S or sodium hydrosulfide, NaHS, to precipitate lead and other metal impurities as insoluble metal sulfides. The precipitated residue is called tin mud or detinners mud and is sold to tin smelters.

Detinners mud may also include residues removed from the bottoms of detinning tanks. This mud contains 3 to 5 percent tin and is sold as a by-product to tin smelters. The tin mud is usually rinsed to recover any soluble tin which may be present. The rinse water is recycled to the detinning tanks. One producer reported an acid neutralization step in which sulfuric acid is added to the mud. The neutralized mud is then dewatered in a filter press and sold as a by-product containing approximately 10 percent tin.

When the detinning cycle is complete, the detinned steel is removed from the detinning tanks. The steel is then rinsed to recover any tin solution which may be adhering to it, pressed or baled, and sold as a product. The rinse water is recycled to the detinning tanks to recover tin.

ELECTROWINNING

The purified sodium stannate solution is sent to electrolytic cells where pure tin metal is deposited onto cathodes. The tin is then removed from the cathodes, melted and cast. The electrowinning solution is then recycled to the detinning tanks. A blowdown stream must periodically be discharged from the electrowinning circuit in order to control the concentration of aluminum, carbonates, and other impurities in the solution.

One producer reported the use of tin hydroxide, $Sn(OH)_4$, as a raw material. The tin hydroxide is first washed with water and then dissolved in a solution of sodium hydroxide. The resultant sodium stannate solution is then purified and added to the sodium stannate solution from alkaline detinning and the combined solution enters the electrowinning tanks.

PRECIPITATION OF TIN HYDROXIDE

As an alternative to electrowinning, tin can be recovered from solution as tin hydroxide, $Sn(OH)_4$. Sulfuric acid is added to lower the pH to 7 and sodium carbonate is then added to raise the pH to 7.8. At this point tin hydroxide will precipitate from the solution. The one plant which uses this process precipitates tin from a solution which is a mixture of alkaline detinning solution, spent plating solution, and a solution generated by dissolving tin electroplating sludge in water.

REDUCTION TO TIN METAL

The tin hydroxide is dried and calcined in a furnace to produce tin dioxide, SnO_2. The tin dioxide is then charged to a reduction furnace with carbon where it is reduced to tin metal.

PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in secondary tin production, the process wastewater sources can be subdivided as follows:

(a) Tin smelter SO_2 scrubber,
(b) Dealuminizing rinse,
(c) Tin mud acid neutralization filtrate,
(d) Tin hydroxide wash,
(e) Spent electrowinning solution from new scrap,
(f) Spent electrowinning solution from municipal solid waste,
(g) Tin hydroxide supernatant from scrap,
(h) Tin hydroxide supernatant from plating solutions and sludges, and
(i) Tin hydroxide filtrate.

OTHER WASTEWATER SOURCES

There may be other waste streams associated with the secondary tin subcategory. These streams may include noncontact cooling water, stormwater runoff, and maintenance and cleanup water. These wastewater streams are not considered as a part of this rulemaking. EPA believes that the flows and pollutant loadings associated with these streams are insignificant relative to the wastewater streams selected and 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

Table III-1 (page 4049) shows the relative age and discharge status of the secondary tin plants. The average plant age is between 16 and 25 years. All of the plants have been built since 1940. Table III-2 (page 4050) shows the 1982 production for secondary tin. Eleven of the 12 secondary tin plants have production levels less than 1,000 kkg/yr. One tin producer has a production level between 1,000 and 5,000 kkg/yr.

Table III-3 (page 4051) provides a summary of the number of plants with the various production processes and the number of plants which generate wastewater from each process. Alkaline detinning is practiced by 10 of the 12 secondary tin plants. Of these 10 plants, eight also practice electrowinning. Figure III-3 (page 4054) shows the geographic locations of the secondary tin facilities in the United States by discharge status.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS IN THE SECONDARY TIN SUBCATEGORY BY DISCHARGE TYPE

Discharge Type	Initial Operating Year (Range) (Plant Age in Years) 1982-1973 (0-10)	1972-1968 (11-15)	1967-1958 (16-25)	1957-1948 (26-35)	1947-1938 (36-45)	Total
Direct	0	0	1	1	1	3
Indirect	0	0	1	0	0	1
Zero	2	1	3	1	1	8
TOTAL	2	1	5	2	2	12

TABLE III-2

PRODUCTION RANGES FOR SECONDARY TIN PLANTS FOR 1982

Discharge Type	Production Range -- kkg/yr 0-100	100-1000	1000-5000	Total
Direct	*	*	*	3
Indirect	1	0	0	1
Zero	4	4	0	8
Total	*	*	*	12

* Direct discharge production data have been withheld because the information on which they are based has been claimed to be confidential.

Table III-3

SUMMARY OF SECONDARY TIN SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

Process and Waste Streams	Number of Plants With Process or Waste Stream	Number of Plants Reporting Generation of Wastewater*
Tin Smelting	1	
- Smelter SO_2 scrubber	1	1
Alkaline Detinning	10	
- Dealuminizing rinse	1	1
- Tin mud acid neutralization filtrate	1	1
Electrowinning	8	
- Tin hydroxide wash	1	1
- Spent electrowinning solution from new scrap	8	7
- Spent electrowinning solution from municipal solid waste	1	1
Tin Hydroxide Precipitation	2	
- Supernatant from scrap	1	1
- Supernatant from plating solutions and sludges	2	1
- Tin hydroxide filtrate	1	1
Reduction to Tin Metal	1	

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

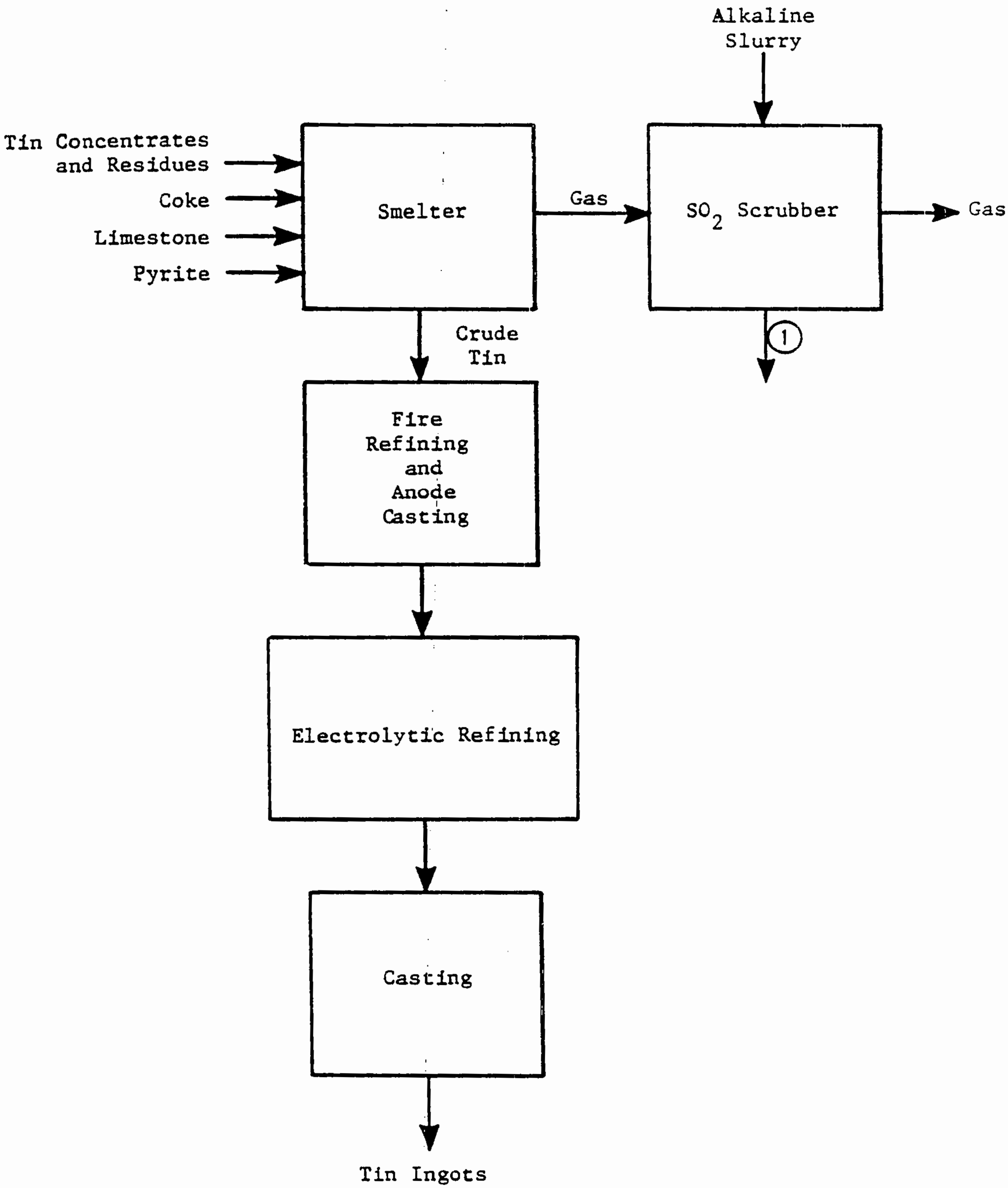

Figure III-1

TIN SMELTING PRODUCTION PROCESS

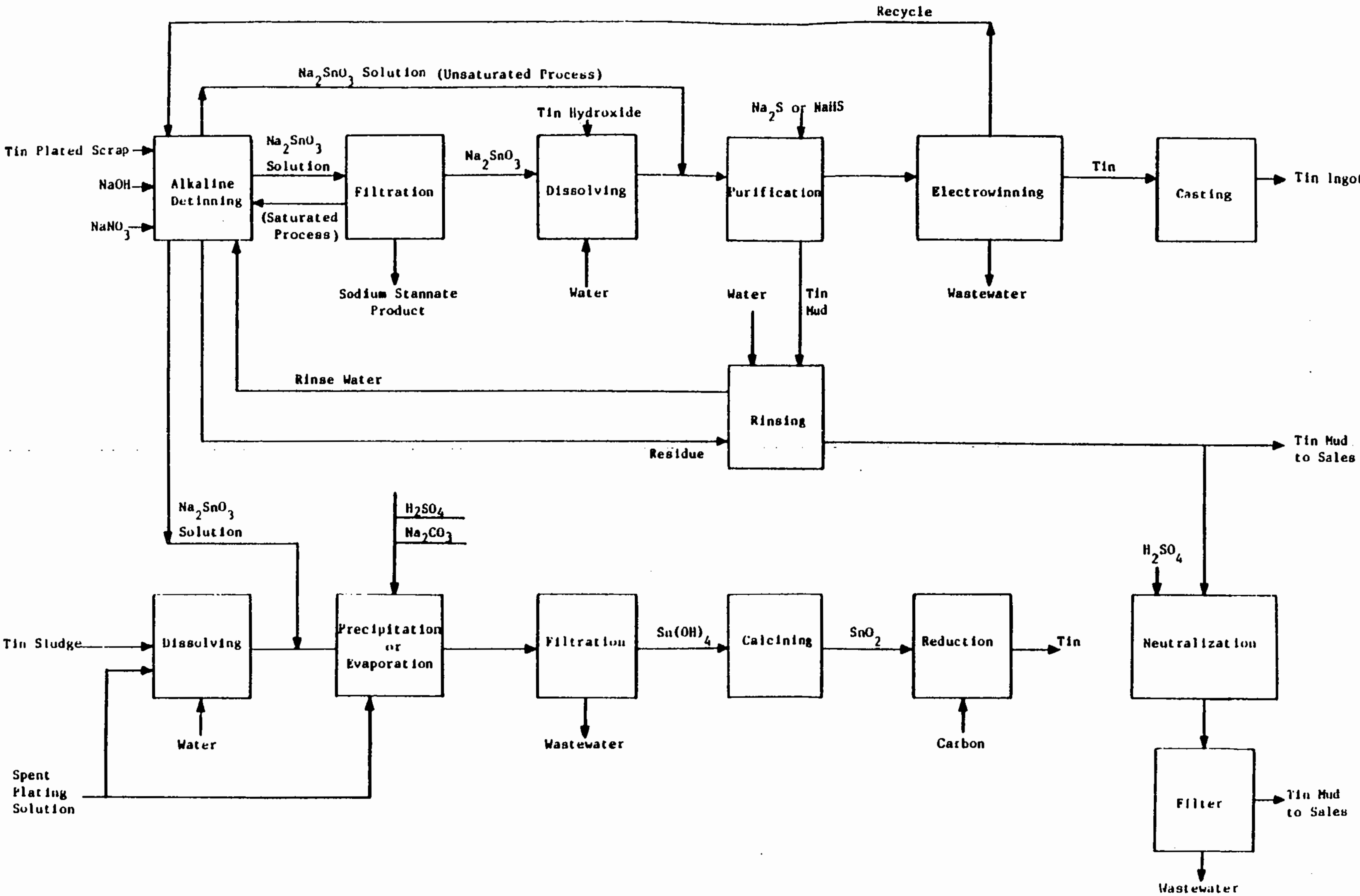

Figure III-2

OTHER TIN PRODUCTION PROCESSES

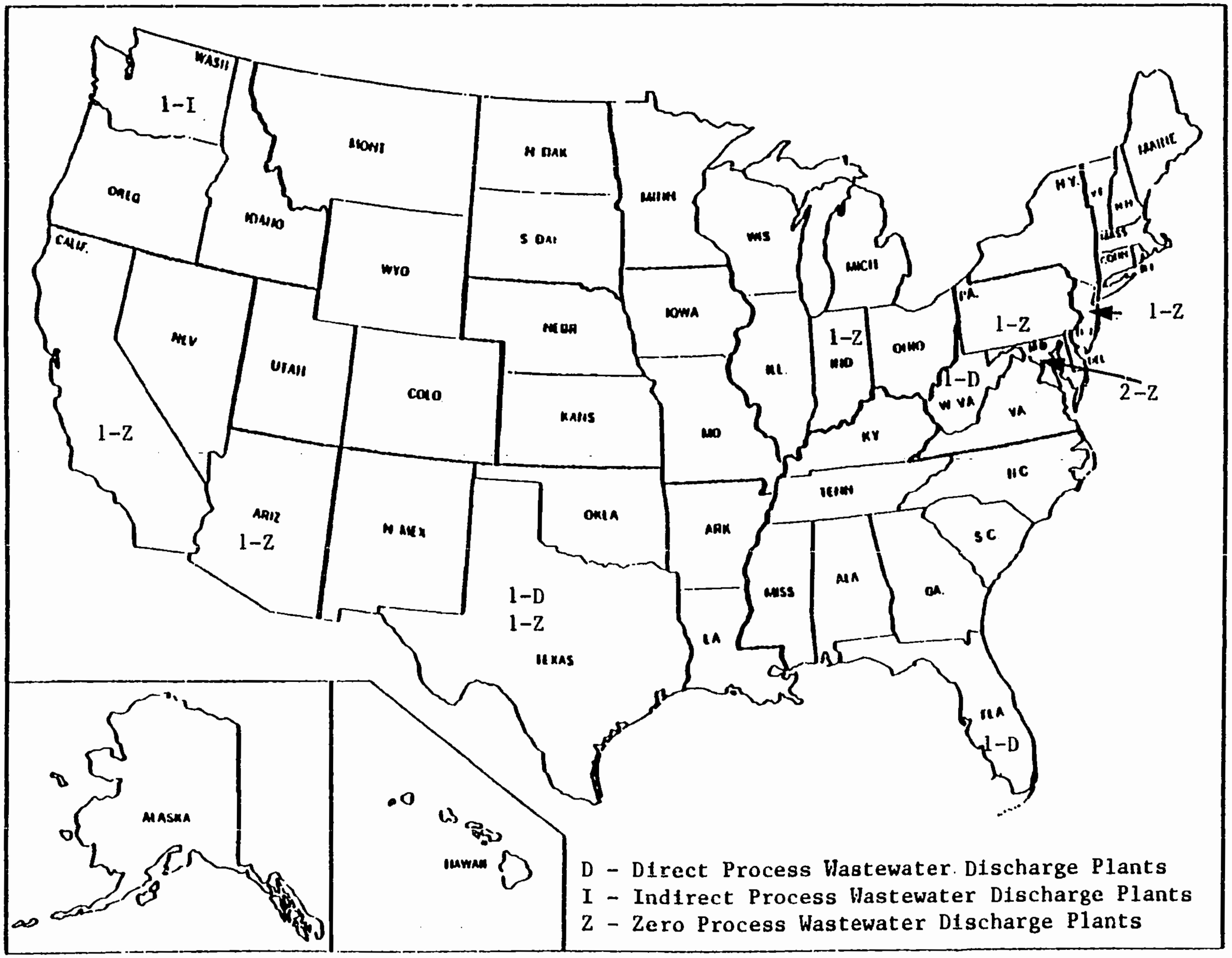

Figure III-3

GEOGRAPHIC LOCATIONS OF THE ~~PRIMARY AND~~ SECONDARY TIN SUBCATEGORY PLANTS

SECTION IV

SUBCATEGORIZATION

This section summarizes the factors considered during the designation of the related subdivisions or building blocks of the secondary tin subcategory. Following proposal, the Agency decided to revise the name of this subcategory to Secondary Tin, instead of Primary and Secondary Tin, to more accurately reflect the nature of the raw materials used in this subcategory. The same plants and operations that were included in this Subcategory at proposal are included for promulgation.

FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY TIN SUBCATEGORY

The factors listed for general subcategorization were each evaluated when considering subdivision of the secondary tin subcategory. In the discussion that follows, the factors will be described as they pertain to this particular subcategory.

The rationale for considering segmentation of the secondary tin subcategory is based primarily on differences in the production processes and raw materials 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. While secondary tin 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 will be based on specific flow allowances for the following subdivisions:

(a) Tin smelter SO_2 scrubber,
(b) Dealuminizing rinse,
(c) Tin mud acid neutralization filtrate,
(d) Tin hydroxide wash,
(e) Spent electrowinning solution from new scrap,
(f) Spent electrowinning solution from municipal solid waste,
(g) Tin hydroxide supernatant from scrap,
(h) Tin hydroxide supernatant from plating solutions and sludges, and
(i) Tin hydroxide filtrate.

These subdivisions follow directly from differences within the five production processes which may be used in the production of secondary tin: tin smelting, alkaline detinning, electrowinning, precipitation and reduction.

The smelting of tin gives rise to the first subdivision. The control of sulfur dioxide emissions from smelter flue gases is accomplished through the use of a wet alkaline scrubbing system. Blowdown of scrubbing solution comprises the wastewater stream associated with this subdivision.

Although alkaline detinning is a net consumer of water because of evaporation losses, a number of wastewater streams may be generated. When tin scrap containing aluminum is used, the scrap is leached with a sodium hydroxide solution prior to entering the detinning tanks. The aluminum dissolves in the caustic solution and the scrap is then rinsed with water. The spent caustic leaching solution and rinse water are discharged as a waste stream.

Another wastewater stream associated with alkaline detinning is tin mud acid neutralization filtrate. Tin mud may consist of residues from the detinning tanks, precipitates formed when sodium sulfide or sodium hydrosulfide is added to the sodium stannate solution to precipitate base metal impurities, or a combination of the two. This "detinners mud" typically contains from 3 to 5 percent tin by weight. The mud is rinsed with fresh water to recover soluble tin compounds which are returned to the detinning tanks. The rinsed mud is filtered and eventually sold to smelters. One producer neutralizes this mud with sulfuric acid prior to dewatering in a pressure filter. The filtrate cannot be returned to the detinning tanks and is therefore discharged as a waste stream. The mud has been upgraded to a product that is approximately 10 percent tin.

Electrowinning is the principal means of recovering tin from the sodium stannate solution which is generated in alkaline detinning operations. One producer reported the use of tin hydroxide as an additional raw material to the electrowinning solution. Prior to being dissolved in the sodium stannate solution the tin hydroxide is washed with water to remove impurities. The wash water is then discharged as a wastewater stream. The most significant wastewater stream associated with electrowinning is spent electrowinning solution. The partially depleted sodium stannate solution is recycled to the detinning tanks where additional tin is taken into solution. A bleed stream is required, however, in order to control the buildup of impurities, particularly aluminum and carbonates, in the solution. This bleed stream comprises a wastewater stream associated with the electrowinning operation.

When municipal solid waste is used as a raw material to alkaline detinning operations, a much larger discharge of spent electrowinning solution results. This larger blowdown stream is necessitated by impurities which are introduced into the sodium stannate solution by the raw material. Consequently, spent electrowinning solution from municipal solid waste processing is identified as a separate subdivision.

As an alternative to electrowinning, tin may be precipitated from solution as tin hydroxide. The tin hydroxide sludge is dewatered in a filter press, dried and sold or calcined to tin oxide in a furnace, and reduced with carbon in a reduction furnace to produce tin metal. The supernatant and filtrate streams associated with tin hydroxide precipitation comprise wastewater streams associated with this operation.

The flow rates and characteristics of the tin hydroxide supernatant stream vary significantly depending on the raw materials used. Because of this, separate subdivisions have been identified for tin hydroxide supernatant from each of two types of raw materials: tin plated steel scrap, and plating solutions and sludges. Tin hydroxide filtrate from dewatering the precipitated tin hydroxide is also designated as a separate subdivision.

Following proposal, the Agency decided to combine tin hydroxide supernatant from spent plating solutions and tin plating sludge solids into one subdivision because there is only one plant discharging these streams, as discussed in Section V.

OTHER FACTORS

The other factors considered in this evaluation were shown to be inappropriate bases for subdivision. Air pollution control methods, treatment costs, and total energy requirements are functions of the selected subcategorization factors--metal product, raw materials, and production processes. Therefore, they are not independent factors and do not affect the subcategorization which has been developed. As discussed in Section IV of the General Development Document, certain other factors, such as plant age, plant size, and the number of employees, were also evaluated and determined to be inappropriate for use as bases for subdivision of nonferrous metals plants.

PRODUCTION NORMALIZING PARAMETERS

As discussed previously, the effluent limitations and standards developed in this document establish mass limitations on the discharge of specific pollutant parameters. To allow these regulations to be applied to plants with various production capacities, the mass of pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP).

In general, for each production process which has a wastewater associated with it, the actual mass of tin product, intermediate or raw material processed will be used as the PNP. Thus, the PNPs for the nine subdivisions are as follows:

Building Block	PNP
1. Tin smelter SO_2 scrubber	kkg of crude tapped tin produced
2. Dealuminizing rinse	kkg of dealuminized scrap produced

3. Tin mud acid neutralization filtrate	kkg of neutralized, dewatered tin mud produced
4. Tin hydroxide wash	kkg of tin hydroxide washed
5. Spent electrowinning solution from new scrap	kkg of cathode tin produced
6. Spent electrowinning solution from municipal solid waste	kkg of MSW scrap used as raw material
7. Tin hydroxide supernatant from scrap	kkg of tin metal recovered
8. Tin hydroxide supernatant from plating solutions and sludges	kkg of tin metal recovered from plating solutions and sludges
9. Tin hydroxide filtrate	kkg of tin metal produced

The PNP for subdivision 1, tin smelter SO_2 scrubber, has been changed following proposal to kkg of crude tapped tin produced. This change was made based on information obtained during a visit to a facility generating this wastewater stream.

Subdivision 8, tin hydroxide supernatant from plating solutions and sludges, is a new subdivision for promulgation, consisting of the proposed subdivisions 8 and 9. As such, the PNP for subdivision 8 is a combination of the proposed PNPs for subdivisions 8 and 9; that is, kkg of tin metal recovered from plating solutions and sludges.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the secondary tin subcategory. Water use and discharge rates are explained and then summarized in tables at the end of this section. Data used to characterize the wastewaters are presented. Finally, the specific source, water use and discharge flows, and wastewater characteristics for each separate wastewater source are discussed. Data collection portfolios (dcp) and field sampling results were used in the development of effluent limitations and standards for this subcategory. Data collection portfolios contain information regarding wastewater flows and production levels.

In order to quantify the pollutant discharge from secondary tin plants, a field sampling program was conducted. 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. Samples were analyzed for 124 of the 126 priority 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. Samples were also not analyzed for asbestos. There is no reason to expect that TCDD or asbestos would be present in wastewater in the secondary tin subcategory. In general, the samples were analyzed for cyanide and three classes of pollutants: priority organic priority pollutants, priority metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

Following proposal, additional data were gathered concerning flow, production, and wastewater characteristics at one of the tin plants identified in this study. These data were obtained during a field sampling episode, and are contained in the administrative record supporting this rulemaking.

In addition, EPA collected more economic information on plants in the secondary tin subcategory, which is contained in the administrative record supporting this rulemaking. Revisions to the economics analysis are discussed in a separate document. Through the economic data gathering, EPA learned that one secondary tin plant had changed discharge status following proposal. Using an evaporation system, plant 1014 changed from being an indirect discharger to a zero discharge facility. Due to this process change, EPA decided to revise the subdivision scheme for this subcategory, by combining 2 subdivisions into 1 subdivision, namely, combining tin hydroxide supernatant from spent plating solutions and tin hydroxide supernatant from sludge solids into tin hydroxide supernatant from plating solutions and sludges. As discussed in Section IV, the PNP for this new subdivision has also been appropriately revised. This revision is being made for regulatory simplification reasons, and will not affect the mass limitations with which any plant in this subcategory must comply. This change is discussed in more detail later in this section and also in section IX.

After proposal, EPA gathered additional wastewater sampling data for two of the subdivisions in this subcategory, tin mud acid neutralization filtrate and dealuminizing rinse. These data were acquired through a self sampling program conducted at the specific request of EPA. The data include analysis for the priority metals antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver, thallium and zinc. The data also include analyses for cyanide and the nonconventional pollutant tin. The data support the assumptions which EPA had made at proposal concerning the presence and concentrations of pollutants in these subdivisions where we did not have analytical data for specific pollutants. For this reason, the selection of pollutant parameters for limitation in this subcategory (Section VI) has not been revised based on this new data.

As described in Section IV of this supplement, the secondary tin subcategory has been divided into 9 subdivisions or wastewater sources, so that the promulgated regulation contains mass discharge limitations and standards for 9 unit processes discharging process wastewater. Differences in the wastewater characteristics associated with these subdivisions are to be expected. For this reason, wastewater streams corresponding to each subdivision are addressed separately in the discussions that follow. These wastewater sources are:

(a) Tin smelter SO_2 scrubber,
(b) Dealuminizing rinse,
(c) Tin mud acid neutralization filtrate,
(d) Tin hydroxide wash,
(e) Spent electrowinning solution from new scrap,
(f) Spent electrowinning solution from municipal solid waste,
(g) Tin hydroxide supernatant from scrap,
(h) Tin hydroxide supernatant from plating solutions and sludges, and
(i) Tin hydroxide filtrate.

WASTEWATER FLOW RATES

Data supplied by dcp responses were evaluated, and two flow-to-production ratios, water use and wastewater discharge, were calculated for each stream. The two ratios are differentiated by the flow value used in the calculation. Water use is defined as the volume of water or other fluid required for a given process per mass of tin product and is therefore based on the sum of recycle and make-up flows to a given process to further treatment, disposal, or discharge per mass of tin produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carry-over on the product. The production values used in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. As an example, tin smelter SO_2 scrubber water flow is related to the production of crude tapped tin. As such, the discharge rate is expressed in liters of scrubber water per metric ton of crude tapped tin (gallons of scrubber water per ton of crude tapped tin).

The production normalized discharge flows were compiled and statistically analyzed by stream type. These production normalized water use and discharge flows are presented by subdivision in Tables V-1 through V-9 (pages 4068 - 4070). Where appropriate, an attempt was made to identify factors that could account for variations in water use and discharge rates. These variations are discussed later in this section by subdivision. A similar analysis of factors affecting the wastewater flows is presented in Sections X, XI, and XII where representative BAT, NSPS, and pretreatment flows are selected for use in calculating the effluent limitations.

The water use and discharge rates shown do not include nonprocess wastewater, such as rainfall runoff and noncontact cooling water.

WASTEWATER CHARACTERISTICS DATA

Data used to characterize the various wastewaters associated with secondary tin production come from two sources -- data collection portfolios and analytical data from field sampling trips.

DATA COLLECTION PORTFOLIOS

In the data collection portfolios, the tin plants that discharge wastewater were asked to specify the presence or absence of priority pollutants in their wastewater. Three of the five discharging plants responded. The responses are summarized below:

Pollutant	Known Present	Believed Present
antimony	1	2
arsenic	1	0
cadmium	1	0
chromium	1	0
copper	1	1
cyanide	1	0
lead	1	1
mercury	0	1
nickel	2	0
selenium	0	1
silver	1	0
zinc	1	1

FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from secondary tin plants, wastewater samples were collected at five plants, which represent more than one-third of the secondary tin plants in the United States. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 through V-5 (pages 4210 - 4214).

Raw wastewater data are summarized in Tables V-10 through V-15 (pages 4071 - 4140). Data from samples of treated and partially treated wastewater streams are presented in Tables V-16 through V-22 (pages 4151 - 4205). The stream numbers listed in the tables correspond to those given in the individual plant sampling site diagrams, Figures V-1 through V-5. 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. The data tables include some samples measured at concentrations considered not quantifiable. The base-neutral extractable, acid extractable, and volatile organics generally are 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.

The detection limits shown on the data tables for priority metals and conventional and nonconventional pollutants 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.

The statistical analysis of data includes some samples measured at concentrations considered not quantifiable. For data considered as detected but below quantifiable concentrations, a value of zero is used for averaging. Priority organic, nonconventional, and conventional pollutant data reported with a "less than" sign are considered as detected, but not further quantifiable. A value of zero is also used for averaging. If one of these pollutants is reported as not detected, it is assigned a value of zero in calculating the average. Finally, priority metal values reported as less than a certain value were considered as below quantification, and consequently were assigned a value of zero in the calculation of the average.

Finally, appropriate source water concentrations are presented with the summaries of 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

Since secondary tin production involves 9 principal sources of wastewater and each has potentially different characteristics and flows, the wastewater characteristics and discharge rates corresponding to each subdivision will be described separately. A brief description of why the associated production processes generate a wastewater and explanations for variations of water use within each subdivision will also be discussed.

TIN SMELTER SO_2 SCRUBBER

There is one facility which produces tin metal through the smelting of tin concentrates and residues. This facility reported the use of a wet scrubbing system to control SO_2s emissions in the smelter flue gas. The scrubber uses a recirculating alkaline solution. A portion of the solution must be discharged in order to maintain effective SO_2 removal. The water use and wastewater discharge rates for this stream are shown in liters per metric ton of crude tapped tin in Table V-1 (page 4049).

Following proposal, the one facility reporting this waste stream was visited and the scrubber blowdown was sampled. It was determined that this scrubber currently operates at greater than 90 percent recycle. The blowdown is directly discharged following equalization, chemical precipitation and sedimentation. Analytical data for this stream are presented in Table V-10 (page 4071). These data show treatable concentrations of arsenic, cadmium, chromium, copper, lead, selenium, zinc, tin, and suspended solids.

DEALUMINIZING RINSE

Aluminum present in tin plated steel scrap may be removed by leaching in a sodium hydroxide solution prior to alkaline detinning. The aluminum dissolves in the caustic solution and the scrap is then rinsed and charged to the alkaline detinning tanks. One plant reported this practice. A portion of their raw material is tin plated steel scrap separated from municipal solid waste. The spent caustic leaching solution and rinse water are discharged as a waste stream. The one facility reporting this waste stream is a direct discharger. The dealuminizing waste stream is treated with sodium sulfide to precipitate metals, chlorinated to destroy cyanide, and neutralized with sulfuric acid. Solids are removed from the neutralized stream in a sedimentation pond prior to discharge. The water use and discharge rates are presented in Table V-2 (page 4068) in liters per metric ton of dealuminized scrap produced.

There was no analytical data for this stream available before proposal and it was expected to be similar to the spent electrowinning solution with a very alkaline pH and treatable levels of cyanide and certain toxic metals including arsenic, lead, nickel and selenium. Data supplied to the Agency after proposal corroborates the assumption that a treatable level of cyanide is present.

TIN MUD ACID NEUTRALIZATION FILTRATE

One facility reported neutralization of tin mud with sulfuric acid prior to dewatering in a filter press. The neutralized, dewatered mud is sold as a by-product. The filtrate from the dewatering step is discharged as a wastewater stream. Water use and discharge rates are presented in Table V-3 (page 4068) in liters per metric ton of neutralized, dewatered tin mud produced.

Analytical data for this wastewater stream were collected after proposal through a self sampling program at the specific request of EPA. These data are presented in Table V-23 (page 4209) and show that this stream contains treatable concentrations of cyanide and zinc.

TIN HYDROXIDE WASH

One facility reported the use of tin hydroxide, $Sn(OH)_4$, as a raw material in their electrolytic tin production process. The tin hydroxide is washed with water to remove impurities, dissolved in a sodium hydroxide solution and mixed with the tin solution from the alkaline detinning operation prior to entering the electrowinning cell. The tin hydroxide wash water is discharged as a waste stream. The one facility reporting this stream achieves zero discharge through the use of an evaporation pond. The water use and discharge rates are shown in liters per metric ton of tin hydroxide washed in Table V-4 (page 4069).

There are no analytical data available for this stream. It is expected to have an alkaline pH and a treatable level of total suspended solids. Also, some priority metals may be present if they are present in the tin hydroxide.

SPENT ELECTROWINNING SOLUTION FROM NEW SCRAP

Electrowinning is the principal method for recovering tin from the alkaline detinning solution. After the tin has been plated onto the cathode and the solution has been depleted, the solution is either recycled to the detinning tank or discarded depending on the amount and type of impurities present. Of the 10 plants which practice alkaline detinning, eight recover tin from solution via electrowinning. Of these eight facilities, six achieve zero discharge through various combinations of recycle, evaporation, contractor disposal and sales. Of the two remaining plants one is a direct discharger; and the other is an indirect discharger. Water use and discharge rates are presented in Table V-5 (page 4069) in liters per metric ton of cathode tin produced.

Table V-11 (page 4082) summarizes the raw wastewater sampling data for the priority and selected conventional and nonconventional pollutants. It can be seen that there are treatable concentrations of several priority metals present including antimony, arsenic, lead, nickel, selenium, thallium and zinc. Also, treatable concentrations of cyanide are present. This wastewater stream has a very alkaline pH (approximately 12) and high concentrations of total suspended solids.

SPENT ELECTROWINNING SOLUTION FROM MUNICIPAL SOLID WASTE

When tin plated steel scrap which was recovered from municipal solid waste (MSW) is used as a raw material for alkaline detinning and electrowinning, a significantly larger discharge of spent electrowinning solution is necessary because of additional impurities introduced into the solution. There is currently one facility using MSW as a source of raw material. The water use and discharge rates for this stream are shown in Table V-6 (page 4069) in liters per metric ton of MSW scrap used as raw material. This flow rate is estimated using a procedure described in Section IX of this document.

The facility reporting this extra discharge of spent electrowinning solution is a direct discharger after treatment consisting of chlorination, acid neutralization and sedimentation. The characteristics of this wastewater are assumed to be similar to the characteristics of spent electrowinning solution as discussed previously.

TIN HYDROXIDE SUPERNATANT FROM SCRAP

Tin may be recovered from solution by precipitation as tin hydroxide, $Sn(OH)_4$. Tin is present in solution as sodium stannate, Na_2SnO_3. Tin hydroxide will precipitate when the pH is lowered to 7.0 with sulfuric acid and sodium carbonate is added to pH 7.8. The characteristics and production normalized flow rates of the resultant supernatant stream are dependent upon the raw material used. The three possible raw materials are tin plated steel scrap, spent plating solutions, and plating sludge solids.

The water use and wastewater discharge rates for tin hydroxide supernatant from scrap are shown in Table V-7 (page 4070) in liters per metric ton of tin metal recovered from scrap. The one facility reporting this stream is a direct discharger after treatment by sedimentation. Table V-12 (page 4102) summarizes the raw wastewater sampling data for the priority and selected conventional and nonconventional pollutants. It can be seen that treatable levels of priority metals are present, particularly antimony at 4.4 mg/l. This waste stream has a pH of 8.3 and treatable levels of oil and grease and total suspended solids (TSS).

TIN HYDROXIDE SUPERNATANT FROM PLATING SOLUTIONS AND SLUDGES

Two plants reported the use of spent tin plating solutions as raw material. One facility recovers tin as tin hydroxide from both spent plating solutions and plating sludge solids. This facility dissolves tin from the sludge solids into the plating solution by adding additional water, while heating and lancing with air. Tin hydroxide is then precipitated from the resultant solution. The second facility uses only spent plating solutions. Following proposal, the Agency learned that the second facility revised their process for recovering tin from solution. Instead of precipitating tin hydroxide using ammonia, and discharging the liquids, the solution is completely evaporated in an oven to produce a tin hydrate product. No process water is discharged from this operation.

The Agency revised this subdivision for promulgation by combining tin hydroxide supernatant from spent plating solutions with tin hydroxide supernatant from tin plating sludge solids to form a new subdivision, namely tin hydroxide supernatant from plating solutions and sludges. The water use and discharge rates for this subdivision are presented in Table V-8 (page 4070). This revision was made to simplify the regulation, and will not change the mass limitations with which any plant must comply.

Sampling data for tin hydroxide supernatant from tin plating solutions and sludges is presented in Table V-13 (page 4113). The samples were collected at the facility which uses both spent plating solutions and tin sludge solids as raw materials to tin hydroxide precipitation operations. It can be seen that treatable concentrations of priority metals are present, particularly antimony which was detected at a maximum concentration of 3.1 mg/l. Cyanide is also present with a maximum observed concentration of 16 mg/l. Very high concentrations of fluoride are present in this wastewater with concentrations from 12,000 to 15,000 mg/l. This fluoride originates from tin fluoroborate and fluoroboric acid which are used in the tin plating baths. This wastewater has a nearly-neutral pH and treatable concentrations of suspended solids.

TIN HYDROXIDE FILTRATE

When tin hydroxide slurry is separated from the supernatant stream, it may be further dewatered in a filter press prior to drying. The resultant filtrate is discharged as a wastewater stream. Water use and discharge rates are presented in Table V-10 (page 4071) in liters per metric ton of tin metal produced.

The one facility reporting this stream is a direct discharger after treatment by sedimentation. Table V-14 (page 4129) summarizes the sampling data for this waste stream. Treatable concentrations of cyanide and priority metals are present including antimony at 2.4 mg/l. Treatable concentrations of fluoride and TSS are also present.

TABLE V-1

WATER USE AND DISCHARGE RATES
TIN SMELTER SO_2 SCRUBBER

(l/kkg of crude tapped tin produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1118	>90	NR	9198

TABLE V-2

WATER USE AND DISCHARGE RATES
DEALUMINIZING RINSE

(l/kkg of dealuminized scrap produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1046	0	35	35

TABLE V-3

WATER USE AND DISCHARGE RATES
TIN MUD ACID NEUTRALIZATION FILTRATE

(l/kkg of neutralized, dewatered tin mud produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1046	0	5047	5047

TABLE V-4

WATER USE AND DISCHARGE RATES
TIN HYDROXIDE WASH

(l/kkg of tin hydroxide washed)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1049	0	11953	11953

TABLE V-5

WATER USE AND DISCHARGE RATES
SPENT ELECTROWINNING SOLUTION FROM NEW SCRAP

(l/kkg of cathode tin produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1047	0	NR	NR
1049	0	24069	24069
1048	NR	NR	21982
1054	0	16609	16609
1046	0	15145	15145
1056	0	12489	12489
1057	0	10498	10498
1144	NR	NR	NR

TABLE V-6

WATER USE AND DISCHARGE RATES
SPENT ELECTROWINNING SOLUTION FROM MUNICIPAL SOLID WASTE

(l/kkg of MSW scrap used as a raw material)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1047	0	119	119

TABLE V-7

WATER USE AND DISCHARGE RATES
TIN HYDROXIDE SUPERNATANT FROM SCRAP

(l/kkg of tin metal recovered from scrap)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1036	0	55640	55640

TABLE V-8

WATER USE AND DISCHARGE RATES
TIN HYDROXIDE SUPERNATANT FROM PLATING SOLUTIONS AND SLUDGES

(l/kkg of tin metal recovered from plating solutions and sludges)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1036	0	115000	115000

TABLE V-9

WATER USE AND DISCHARGE RATES
TIN HYDROXIDE FILTRATE

(l/kkg of tin metal produced)

Plant Code	Percent Recycle	Production Normalized Water Use	Production Normalized Discharge Rate
1118	>90	NR	9198

Table V-10

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	895	6	ND	ND ND		
5. benzidine	895	6	ND	ND ND		
8. 1,2,4-trichlorobenzene	895	6	ND	ND ND		
9. hexachlorobenzene	895	6	ND	ND ND		
12. hexachloroethane	895	6	ND	ND ND		
18. bis(2-chloroethyl)ether	895	6	ND	ND ND		
20. 2-chloronaphthalene	895	6	ND	ND ND		
21. 2,4,6-trichlorophenol	895	6	ND	ND ND		
22. p-chloro-m-cresol	895	6	ND	ND ND		
24. 2-chlorophenol	895	6	ND	ND ND		

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
25. 1,2-dichlorobenzene	895	6	ND	ND ND		
26. 1,3-dichlorobenzene	895	6	ND	ND ND		
27. 1,4-dichlorobenzene	895	6	ND	ND ND		
28. 3,3'-dichlorobenzidine	895	6	ND	ND ND		
31. 2,4-dichlorophenol	895	6	ND	ND ND		
34. 2,4-dimethylphenol	895	6	ND	ND ND		
35. 2,4-dinitrotoluene	895	6	ND	ND		
36. 2,6-dinitrotoluene	895	6	ND	ND		
37. 1,2-diphenylhydrazine	895	6	ND	ND ND		
39. fluoranthene	895	6	ND	ND ND		

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
40. 4-chlorophenyl phenyl ether	895	6	ND	ND ND		
41. 4-bromophenyl phenyl ether	895	6	ND	ND ND		
42. bis(2-chloroisopropyl)ether	895	6	ND	ND ND		
43. bis(2-chloroethoxy)methane	895	6	ND	ND ND		
52. hexachlorobutadiene	895	6	ND	ND ND		
53. hexachlorocyclopentadiene	895	6	ND	ND ND		
54. isophorone	895	6	ND	ND ND		
55. naphthalene	895	6	ND	ND ND		
56. nitrobenzene	895	6	ND	ND ND		

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	895	6	ND	ND ND		
58. 4-nitrophenol	895	6	ND	ND ND		
59. 2,4-dinitrophenol	895	6	ND	ND ND		
60. 4,6-dinitro-o-cresol	895	6	ND	ND ND		
61. N-nitrosodimethylamine	895	6	ND	ND ND		
62. N-nitrosodiphenylamine	895	6	ND	ND ND		
63. N-nitrosodi-n-propylamine	895	6	ND	ND ND		
64. pentachlorophenol	895	6	ND	ND ND		
65. phenol	895	6	ND	ND ND		

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
66. bis(2-ethylhexyl) phthalate	895	6	ND	ND ND		
67. butyl benzyl phthalate	895	6	ND	ND ND		
68. di-n-butyl phthalate	895	6	ND	ND ND		
69. di-n-octyl phthalate	895	6	ND	ND ND		
70. diethyl phthalate	895	6	ND	ND ND		
71. dimethyl phthalate	895	6	ND	ND ND		
72. benzo(a)anthracene	895	6	ND	ND ND		
73. benzo(a)pyrene	895	6	ND	ND ND		
74. benzo(b)fluoranthene	895	6	ND	ND ND		

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
75. benzo(k)fluoranthane	895	6	ND	ND ND		
76. chrysene	895	6	ND	ND ND		
77. acenaphthylene	895	6	ND	ND ND		
78. anthracene (a)	895	6	ND	ND ND		
79. benzo(ghi)perylene	895	6	ND	ND ND		
80. fluorene	895	6	ND	ND ND		
81. phenanthrene (a)	895	6	ND	ND ND		
82. dibenzo(a,h)anthracene	895	6	ND	ND ND		
83. indeno (1,2,3-c,d)pyrene	895	6	ND	ND ND		

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
84. pyrene	895	6	ND	ND ND		
114. antimony	895	6	0.0013	0.047	0.078	0.048
115. arsenic	895	6	0.007	3.20 4.50	4.50	2.10
117. beryllium	895	6	<0.010	<0.010 <0.010	<0.010	<0.010
118. cadmium	895	6	<0.030	0.30 0.30	0.30	0.30
119. chromium	895	6	<0.030	0.10 0.084	0.12	0.99
120. copper	895	6	<0.030	0.35 0.37	0.28	0.60
121. cyanide (total)	895	1	<0.01	<0.01 <0.01	<0.01	<0.01
122. lead	895	6	0.054	3.00 3.70	3.70	2.80
123. mercury	895	6	0.0149	0.0129 0.005	0.013	0.0094

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
124. nickel	895	6	0.052	<0.25 0.15	0.18	0.16
125. selenium	895	6	<0.001	0.33 0.44	0.55	0.40
126. silver	895	6	0.0014	0.0045 0.0133	0.0042	0.0059
127. thallium	895	6	<0.001	0.0026 0.0037	0.0031	0.0030
128. zinc	895	6	0.030	0.14 2.30	2.20	2.10
Nonconventional Pollutants						
Acidity	895	6	10	60 180	50	61
Alkalinity	895	6	160	<1 65	99	80
Aluminum	895	6	2.80	5.50 6.00	7.80	7.50

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
Ammonia Nitrogen	895	6	0.04	2.2 2.4	1.9	1.8
Barium	895	6	0.12	0.18 0.43	0.21	0.27
Boron	895	6	0.17	26.00 40.00	36.00	5.90
Calcium	895	6	0.067	3.40 2,700	4.20	3.00
Chloride	895	6	155	>19,000 >19,000	780	380
Cobalt	895	6	<0.030	0.081 0.11	0.13	0.60
Fluoride	895	6	0.40	9.3 7.5	7.4	7.0
Iron	895	6	2.80	140 190	250	250
Magnesium	895	6	0.018	0.069 58	0.078	0.070
Manganese	895	6	0.11	0.45 0.25	0.47	0.49

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
Molybdenum	895	6	<0.030	<0.030	<0.030	0.40
				<0.030		
Germanium	895	6	<0.50	<0.50	<0.50	<0.50
				<0.50		
Indium	895	6	<0.50	<0.50	<0.50	<0.50
				<0.50		
Sodium	895	6	0.12	0.19	0.20	0.19
				80		
Sulfate	895	6	46	1,200	1,100	1,100
				1,100		
Tin	895	6	<0.25	3.30	0.89	0.92
				1.10		
Titanium	895	6	<0.25	<0.25	<0.25	0.36
				<0.25		
Total Dissolved Solids (TDS)	895	6	510	4,000	4,600	4,200
				3,900		
Total Organic Carbon (TOC)	895	6	13	16	22	45
				13		

Table V-10 (Continued)

SCRUBBER BLOWDOWN
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Total Solids (TS)	895	6	650	6,400 9,300	35,000	1,800
Vanadium	895	6	<0.030	0.048 <0.030	0.067	0.070
Yttrium	895	6	<0.25	<0.25 <0.25	<0.25	<0.25
Conventional Pollutants						
Oil and Grease	895	1	<1	<1 <1	1	4
Total Suspended Solids (TSS)	895	6	5	5,400 9,900	26,000	10,000
pH (standard units)	895		7.20	6.25 6.25	6.20	6.60

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

Table V-11

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
2. acrolein	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
3. acrylonitrile	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
4. benzene	455	1	0.013	0.051		
	843	1	ND	0.047		
	856	1	ND	0.003		
5. benzidine	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
6. carbon tetrachloride	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
7. chlorobenzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
8. 1,2,4-trichlorobenzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
9. acenaphthene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
10. acrolein	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
11. acrylonitrile	455	1	ND	0.066		
	843	1	ND	ND		
	856	1	ND	ND		
12. benzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
13. 1,1-dichloroethane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
14. 1,1,2-trichloroethane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
16. chloroethane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
17. bis(chloromethyl)ether	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
18. bis(2-chloroethyl)ether	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
19. 2-chloroethyl vinyl ether	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
20. 2-chloronaphthalene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
21. 2,4,6-trichlorophenol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
22. p-chloro-m-cresol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
23. chloroform	455	1	0.038	ND		
	843	1	ND	ND		
	856	1	0.037	ND		
24. 2-chlorophenol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
25. 1,2-dichlorobenzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
26. 1,3-dichlorobenzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
27. 1,4-dichlorobenzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
28. 3,3'-dichlorobenzidine	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
30. 1,2-*trans*-dichloroethylene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
31. 2,4-dichlorophenol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
32. 1,2-dichloropropane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
33. 1,3-dichloropropene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
34. 2,4-dimethylphenol	455	1	ND	0.009		
	843	1	ND	ND		
	856	1	ND	ND		
35. 2,4-dinitrotoluene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
36. 2,6-dinitrotoluene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
37. 1,2-diphenylhydrazine	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
38. ethylbenzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
39. fluoranthene	455	1	ND	ND		
	843	1	ND	0.004		
	856	1	ND	ND		
40. 4-chlorophenyl phenyl ether	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
41. 4-bromophenyl phenyl ether	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
42. bis(2-chloroisopropyl)ether	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-chloroethoxy)methane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
44. methylene chloride	455	1	0.019	0.031		
	843	1	ND	ND		
	856	1	0.021	0.025		
45. methyl chloride (chloromethane)	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
46. methyl bromide (bromomethane)	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
47. bromoform (tribromomethane)	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
48. dichlorobromomethane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
49. trichlorofluoromethane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
50. dichlorodifluoromethane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
51. chlorodibromomethane	455	1	0.002	ND		
	843	1	ND	ND		
	856	1	ND	ND		
52. hexachlorobutadiene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
53. hexachlorocyclopentadiene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
54. isophorone	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
55. naphthalene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
56. nitrobenzene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	455	1	ND	ND		
	843	1	ND	0.060		
	856	1	ND	ND		
58. 4-nitrophenol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
59. 2,4-dinitrophenol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
60. 4,6-dinitro-o-cresol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
61. N-nitrosodimethylamine	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
62. N-nitrosodiphenylamine	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
63. N-nitrosodi-n-propylamine	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
64. pentachlorophenol	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
65. phenol	455	1	ND	0.017		
	843	1	ND	0.130		
	856	1	ND	0.020		
66. bis(2-ethylhexyl) phthalate	455	1	0.006	ND		
	843	1	0.054	ND		
	856	1	0.004	ND		
67. butyl benzyl phthalate	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
68. di-n-butyl phthalate	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
69. di-n-octyl phthalate	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
70. diethyl phthalate	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
72. benzo(a)anthracene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
73. benzo(a)pyrene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
74. benzo(b)fluoranthene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
75. benzo(k)fluoranthene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
76. chrysene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
77. acenaphthylene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
78. anthracene (a)	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
79. benzo(ghi)perylene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
80. fluorene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
81. phenanthrene (a)	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
82. dibenzo(a,h)anthracene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
84. pyrene	455	1	ND	ND		
	843	1	ND	0.003		
	856	1	ND	0.063		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	0.399		
86. toluene	455	1	0.001	0.018		
	843	1	0.093	0.017		
	856	1	0.005	0.005		
87. trichloroethylene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	0.007	0.009		
88. vinyl chloride (chloroethylene)	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
89. aldrin	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
90. dieldrin	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
91. chlordane	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
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	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
93. 4,4'-DDE	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
94. 4,4'-DDD	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
95. alpha-endosulfan	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
96. beta-endosulfan	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
97. endosulfan sulfate	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
98. endrin	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
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	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
100. heptachlor	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
101. heptachlor epoxide	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
102. alpha-BHC	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
103. beta-BHC	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
104. gamma-BHC	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
105. delta-BHC	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant			Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)								
106.	PCB-1242	(b)	455	1	ND	ND		
			843	1	ND	ND		
			856	1	ND	ND		
107.	PCB-1254	(b)	455	1	ND	ND		
			843	1	ND	ND		
			856	1	ND	ND		
108.	PCB-1221	(b)	455	1	ND	ND		
			843	1	ND	ND		
			856	1	ND	ND		
109.	PCB-1232	(c)	455	1	ND	ND		
			843	1	ND	ND		
			856	1	ND	ND		
110.	PCB-1248	(c)	455	1	ND	ND		
			843	1	ND	ND		
			856	1	ND	ND		
111.	PCB-1260	(c)	455	1	ND	ND		
			843	1	ND	ND		
			856	1	ND	ND		
112.	PCB-1016	(c)	455	1	ND	ND		
			843	1	ND	ND		
			856	1	ND	ND		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	455	1	ND	ND		
	843	1	ND	ND		
	856	1	ND	ND		
114. antimony	455	1	0.001	5.0		
	843	1	<0.001	0.9		
	856	1	<0.001	0.41		
115. arsenic	455	1	0.002	2.0		
	843	1	0.008	1.9		
	856	1	0.007	6.6		
117. beryllium	455	1	<0.001	0.08		
	843	1	<0.001	0.005		
	856	1	<0.001	0.20		
118. cadmium	455	1	0.020	0.42		
	843	1	<0.001	0.34		
	856	1	0.001	0.29		
119. chromium (total)	455	1	0.003	0.94		
	843	1	0.003	0.30		
	856	1	0.004	0.56		
120. copper	455	1	0.008	0.50		
	843	1	0.14	0.30		
	856	1	0.016	0.41		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
121. cyanide (total)	455	1	0.002	3.6		
	843	1	ND	ND		
	856	1	0.004	2.4		
122. lead	455	1	0.019	2.6		
	843	1	0.001	1.0		
	856	1	0.011	9.0		
123. mercury	455	1	<0.002	<0.002		
	843	1	<0.002	<0.002		
	856	1	0.007	0.026		
124. nickel	455	1	<0.001	2.5		
	843	1	0.001	4.1		
	856	1	0.003	3.7		
125. selenium	455	1	0.033	0.040		
	843	1	3.1	32		
	856	1	<0.005	<0.005		
126. silver	455	1	<0.001	0.40		
	843	1	0.02	0.35		
	856	1	<0.001	0.30		
127. thallium	455	1	0.14	3.1		
	843	1	<0.001	2.0		
	856	1	0.005	2.0		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	455	1	0.08	29		
	843	1	0.06	1.1		
	856	1	0.24	0.24		
Nonconventional Pollutants						
alkalinity	455	1	60	220,000		
aluminum	455	1	1.90	13,000		
ammonia nitrogen	843	1	1.5	20		
	856	1	0.3	92		
calcium	455	1	11	<0.1		
chemical oxygen demand (COD)	455	1	4.0	3,600		
fluoride	455	1	1.2	0.5		
magnesium	455	1	5.5	0.04		
phenolics	455	1	0.011	1.4		
	843	1	0.002	0.006		
	856	1	0.001	0.11		

Table V-11 (Continued)

SPENT ELECTROWINNING SOLUTION
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
tin	455	1	1.6	760		
	843	1	0.28	2,600		
	856	1	1.7	8,800		
Conventional Pollutants						
total suspended solids (TSS)	455	1	1	23,000		
	843	1	19	50,000		
	856	1	9	5,100		
pH (standard units)	455	1	6.2	13.3		
	843	1	6.5	12.5		
	856	1	7			

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-12

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	395	1	ND	ND		
2. acrolein	395	1	ND	ND		
3. acrylonitrile	395	1	ND	ND		
4. benzene	395	1	ND	ND		
5. benzidine	395	1	ND	ND		
6. carbon tetrachloride	395	1	ND	ND		
7. chlorobenzene	395	1	ND	ND		
8. 1,2,4-trichlorobenzene	395	1	ND	ND		
9. hexachlorobenzene	395	1	ND	ND		
10. 1,2-dichloroethane	395	1	ND	ND		
11. 1,1,1-trichloroethane	395	1	ND	ND		
12. hexachloroethane	395	1	ND	ND		
13. 1,1-dichloroethane	395	1	ND	ND		
14. 1,1,2-trichloroethane	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	395	1	ND	ND		
16. chloroethane	395	1	ND	ND		
17. bis(chloromethyl)ether	395	1	ND	ND		
18. bis(2-chloroethyl)ether	395	1	ND	ND		
19. 2-chloroethyl vinyl ether	395	1	ND	ND		
20. 2-chloronaphthalene	395	1	ND	ND		
21. 2,4,6-trichlorophenol	395	1	ND	ND		
22. p-chloro-m-cresol	395	1	ND	ND		
23. chloroform	395	1	ND	ND		
24. 2-chlorophenol	395	1	ND	ND		
25. 1,2-dichlorobenzene	395	1	ND	ND		
26. 1,3-dichlorobenzene	395	1	ND	ND		
27. 1,4-dichlorobenzene	395	1	ND	ND		
28. 3,3'-dichlorobenzidine	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	395	1	<0.01	<0.01		
30. 1,2-trans-dichloroethylene	395	1	ND	ND		
31. 2,4-dichlorophenol	395	1	ND	ND		
32. 1,2-dichloropropane	395	1	ND	ND		
33. 1,3-dichloropropene	395	1	ND	ND		
34. 2,4-dimethylphenol	395	1	ND	ND		
35. 2,4-dinitrotoluene	395	1	ND	ND		
36. 2,6-dinitrotoluene	395	1	ND	ND		
37. 1,2-diphenylhydrazine	395	1	ND	<0.01		
38. ethylbenzene	395	1	ND	0.011		
39. fluoranthene	395	1	ND	ND		
40. 4-chlorophenyl phenyl ether	395	1	ND	ND		
41. 4-bromophenyl phenyl ether	395	1	ND	ND		
42. bis(2-chloroisopropyl)ether	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	395	1	ND	ND		
44. methylene chloride	395	1	<0.01	<0.01		
45. methyl chloride (chloromethane)	395	1	ND	ND		
46. methyl bromide (bromomethane)	395	1	ND	ND		
47. bromoform (tribromomethane)	395	1	ND	ND		
48. dichlorobromomethane	395	1	ND	ND		
49. trichlorofluoromethane	395	1	ND	ND		
50. dichlorodifluoromethane	395	1	ND	ND		
51. chlorodibromomethane	395	1	ND	ND		
52. hexachlorobutadiene	395	1	ND	ND		
53. hexachlorocyclopentadiene	395	1	ND	ND		
54. isophorone	395	1	ND	ND		
55. naphthalene	395	1	ND	ND		
56. nitrobenzene	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	395	1	ND	0.031		
58. 4-nitrophenol	395	1	<0.01	0.026		
59. 2,4-dinitrophenol	395	1	ND	0.086		
60. 4,6-dinitro-o-cresol	395	1	ND	ND		
61. N-nitrosodimethylamine	395	1	ND	ND		
62. N-nitrosodiphenylamine	395	1	ND	ND		
63. N-nitrosodi-n-propylamine	395	1	ND	ND		
64. pentachlorophenol	395	1	ND	<0.01		
65. phenol	395	1	ND	ND		
66. bis(2-ethylhexyl) phthalate	395	1	<0.01	<0.01		
67. butyl benzyl phthalate	395	1	ND	ND		
68. di-n-butyl phthalate	395	1	ND	ND		
69. di-n-octyl phthalate	395	1	ND	ND		
70. diethyl phthalate	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	395	1	ND	ND		
72. benzo(a)anthracene	395	1	ND	ND		
73. benzo(a)pyrene	395	1	ND	ND		
74. benzo(b)fluoranthene	395	1	ND	ND		
75. benzo(k)fluoranthane	395	1	ND	ND		
76. chrysene	395	1	ND	ND		
77. acenaphthylene	395	1	ND	ND		
78. anthracene (a)	395	1	ND	ND		
79. benzo(ghi)perylene	395	1	ND	ND		
80. fluorene	395	1	ND	ND		
81. phenanthrene (a)	395	1	ND	ND		
82. dibenzo(a,h)anthracene	395	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene	395	1	ND	ND		
84. pyrene	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	395	1	ND	ND		
86. toluene	395	1	ND	ND		
87. trichloroethylene	395	1	ND	<0.01		
88. vinyl chloride (chloroethylene)	395	1	ND	0.036		
89. aldrin	395	1	ND	ND		
90. dieldrin	395	1	ND	ND		
91. chlordane	395	1	ND	ND		
92. 4,4'-DDT	395	1	ND	ND		
93. 4,4'-DDE	395	1	ND	ND		
94. 4,4'-DDD	395	1	ND	ND		
95. alpha-endosulfan	395	1	ND	ND		
96. beta-endosulfan	395	1	ND	ND		
97. endosulfan sulfate	395	1	ND	ND		
98. heptachlor	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
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		395	1	ND	ND		
100. heptachlor		395	1	ND	ND		
101. heptachlor epoxide		395	1	ND	ND		
102. alpha-BHC		395	1	ND	ND		
103. beta-BHC		395	1	ND	ND		
104. gamma-BHC		395	1	ND	ND		
105. delta-BHC		395	1	ND	ND		
106. PCB-1242	(b)	395	1	ND	ND		
107. PCB-1254	(b)	395	1	ND	ND		
108. PCB-1221	(b)	395	1	ND	ND		
109. PCB-1232	(c)	395	1	ND	ND		
110. PCB-1248	(c)	395	1	ND	ND		
111. PCB-1260	(c)	395	1	ND	ND		
112. PCB-1016	(c)	395	1	ND	ND		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	395	1	ND	ND		
114. antimony	395	1	0.006	4.4		
115. arsenic	395	1	<0.001	0.135		
117. beryllium	395	1	<0.0005	0.001		
118. cadmium	395	1	<0.001	0.140		
119. chromium (total)	395	1	0.032	0.068		
120. copper	395	1	0.031	0.11		
121. cyanide (total)	395	1	0.040	0.48		
122. lead	395	1	0.12	0.30		
123. mercury	395	1	<0.0002	<0.0002		
124. nickel	395	1	<0.025	0.540		
125. selenium	395	1	<0.008	<0.008		
126. silver	395	1	0.001	0.065		
127. thallium	395	1	<0.001	0.590		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	395	1	0.05	0.210		
Nonconventional Pollutants						
alkalinity	395	1	77	2,200		
ammonia nitrogen	395	1	2	1.1		
calcium	395	1	17	0.16		
chemical oxygen demand (COD)	395	1	<1	170		
fluoride	395	1	0.94	320		
magnesium	395	1	7.2	0.80		
phenolics	395	1	0.026	0.002		
sulfate	395	1	29	2,000		
tin	395	1	<0.025	5.8		
total dissolved solids (TDS)	395	1	160	13,000		
Conventional Pollutants						
oil and grease	395	1	<1	87		

Table V-12 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SCRAP)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
total suspended solids (TSS)	395	1	9	25		
pH (standard units)	395	1	7.3	8.3		

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-13

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
2. acrolein	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
3. acrylonitrile	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
4. benzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
5. benzidine	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
6. carbon tetrachloride	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
7. chlorobenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
8. 1,2,4-trichlorobenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
9. hexachlorobenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
10. 1,2-dichloroethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
11. 1,1,1-trichloroethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
12. hexachloroethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
13. 1,1-dichloroethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
14. 1,1,2-trichloroethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
15. 1,1,2,2-tetrachloroethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
16. chloroethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
17. bis(chloromethyl)ether	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
18. bis(2-chloroethyl)ether	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
19. 2-chloroethyl vinyl ether	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
20. 2-chloronaphthalene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
21. 2,4,6-trichlorophenol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
22. p-chloro-m-cresol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
23. chloroform	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
24. 2-chlorophenol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
25. 1,2-dichlorobenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
26. 1,3-dichlorobenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
27. 1,4-dichlorobenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
28. 3,3'-dichlorobenzidine	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
29. 1,1-dichloroethylene	396	1	<0.01	ND	ND	
	399	1	<0.01	ND	ND	
30. 1,2-trans-dichloroethylene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
31. 2,4-dichlorophenol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
32. 1,2-dichloropropane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
33. 1,3-dichloropropene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
34. 2,4-dimethylphenol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
35. 2,4-dinitrotoluene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
36. 2,6-dinitrotoluene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
37. 1,2-diphenylhydrazine	396	1	ND	ND	ND	
	399	1	ND	<0.01	ND	
38. ethylbenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
39. fluoranthene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
40. 4-chlorophenyl phenyl ether	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
41. 4-bromophenyl phenyl ether	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
42. bis(2-chloroisopropyl)ether	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
43. bis(2-choroethoxy)methane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
44. methylene chloride	396	1	<0.01	1.724	ND	
	399	1	<0.01	<0.01	ND	
45. methyl chloride (chloromethane)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
46. methyl bromide (bromomethane)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
47. bromoform (tribromomethane)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
48. dichlorobromomethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
49. trichlorofluoromethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
50. dichlorodifluoromethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
51. chlorodibromomethane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
52. hexachlorobutadiene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
53. hexachlorocyclopentadiene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
54. isophorone	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
55. naphthalene	396	1	ND	<0.01	<0.01	
	399	1	ND	<0.01	<0.01	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
56. nitrobenzene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
57. 2-nitrophenol	396	1	ND	<0.01	ND	
	399	1	ND	ND	ND	
58. 4-nitrophenol	396	1	<0.01	<0.01	ND	
	399	1	<0.01	ND	ND	
59. 2,4-dinitrophenol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
60. 4,6-dinitro-o-cresol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
61. N-nitrosodimethylamine	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
62. N-nitrosodiphenylamine	396	1	ND	<0.01	<0.01	
	399	1	ND	<0.01	<0.01	
63. N-nitrosodi-n-propylamine	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
64. pentachlorophenol	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
65. phenol	396	1	ND	<0.01	ND	
	399	1	ND	<0.01	ND	
66. bis(2-ethylhexyl) phthalate	396	1	<0.01	0.268	<0.01	
	399	1	<0.01	<0.01	<0.01	
67. butyl benzyl phthalate	396	1	ND	0.025	0.011	
	399	1	ND	0.012	<0.01	
68. di-n-butyl phthalate	396	1	ND	<0.01	<0.01	
	399	1	ND	<0.01	<0.01	
69. di-n-octyl phthalate	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
70. diethyl phthalate	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
71. dimethyl phthalate	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
72. benzo(a)anthracene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
73. benzo(a)pyrene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
74. benzo(b)fluoranthene		396	1	ND	ND	ND	
		399	1	ND	ND	ND	
75. benzo(k)fluoranthane		396	1	ND	ND	ND	
		399	1	ND	ND	ND	
76. chrysene		396	1	ND	ND	ND	
		399	1	ND	ND	ND	
77. acenaphthylene		396	1	ND	ND	ND	
		399	1	ND	ND	ND	
78. anthracene	(a)	396	1	ND	ND	ND	
		399	1	ND	<0.01	ND	
79. benzo(ghi)perylene		396	1	ND	ND	ND	
		399	1	ND	ND	ND	
80. fluorene		396	1	ND	ND	ND	
		399	1	ND	ND	ND	
81. phenanthrene	(a)	396	1	ND	ND	ND	
		399	1	ND	<0.01	ND	
82. dibenzo(a,h)anthracene		396	1	ND	ND	ND	
		399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
83. indeno (1,2,3-c,d)pyrene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
84. pyrene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
85. tetrachloroethylene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
86. toluene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
87. trichloroethylene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
88. vinyl chloride (chloroethylene)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
89. aldrin	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
90. dieldrin	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
91. chlordane	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
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	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
93. 4,4'-DDE	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
94. 4,4'-DDD	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
95. alpha-endosulfan	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
96. beta-endosulfan	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
97. endosulfan sulfate	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
98. endrin	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
99. endrin aldehyde	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
100. heptachlor	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
101. heptachlor epoxide	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
102. alpha-BHC	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
103. beta-BHC	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
104. gamma-BHC	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
105. delta-BHC	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
106. PCB-1242 (b)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
107. PCB-1254 (b)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
108. PCB-1221 (b)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
109. PCB-1232 (c)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
110. PCB-1248 (c)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
111. PCB-1260 (c)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
112. PCB-1016 (c)	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
113. toxaphene	396	1	ND	ND	ND	
	399	1	ND	ND	ND	
114. antimony	396	1	0.006	0.40	3.1	
	399	1	0.006	0.75	2.2	
115. arsenic	396	1	<0.001	0.12	0.34	
	399	1	<0.001	0.13	0.30	
117. beryllium	396	1	<0.0005	<0.0005	0.001	
	399	1	<0.0005	0.02	<0.0005	
118. cadmium	396	1	<0.001	0.03	0.08	
	399	1	<0.001	0.10	0.08	
119. chromium (total)	396	1	0.032	0.020	0.032	
	399	1	0.032	0.031	0.028	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
120. copper	396	1	0.031	0.05	0.12	
	399	1	0.031	0.13	0.16	
121. cyanide (total)	396	1	0.040	2.2	0.49	
	399	1	0.040	3.6	16.0	
122. lead	396	1	0.12	0.075	0.075	
	399	1	0.12	0.03	0.13	
123. mercury	396	1	<0.0002	<0.0002	<0.0002	
	399	1	<0.0002	<0.0002	<0.0002	
124. nickel	396	1	<0.025	0.16	0.35	
	399	1	<0.025	0.41	0.45	
125. selenium	396	1	<0.008	0.05	<0.008	
	399	1	<0.008	0.03	0.62	
126. silver	396	1	0.001	<0.0005	0.001	
	399	1	0.001	<0.0005	0.001	
127. thallium	396	1	<0.001	<0.001	<0.001	
	399	1	<0.001	0.33	0.28	
128. zinc	396	1	0.05	0.06	0.14	
	399	1	0.05	0.16	0.59	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
alkalinity	396	1	77	38,200	30,000	
	399	1	77	39,000	31,000	
ammonia nitrogen	396	1	2	0.8	<0.01	
	399	1	2	1.1	<0.01	
calcium	396	1	17	0.27	0.59	
	399	1	17	0.57	0.64	
chemical oxygen demand (COD)	396	1	<1	34	110	
	399	1	<1	39	120	
fluoride	396	1	0.94	15,000	12,000	
	399	1	0.94	15,000	12,000	
magnesium	396	1	7.2	0.24	0.43	
	399	1	7.2	0.45	0.47	
phenolics	396	1	0.026	0.018	0.018	
	399	1	0.026	0.022	0.006	
sulfate	396	1	29	1,700	1,500	
	399	1	29	1,200	1,700	
tin	396	1	<0.025	60	18	
	399	1	<0.025	13	28	

Table V-13 (Continued)

TIN HYDROXIDE PRECIPITATION SUPERNATANT (FROM SPENT PLATING SOLUTION AND SLUDGES)
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
total dissolved solids (TDS)	396	1	160	26,000	37,000	
	399	1	160	46,000	38,000	
Conventional Pollutants						
oil and grease	396	1	<1	2.9	51	
	399	1	<1	1.3	17	
total suspended solids (TSS)	396	1	9	26	50	
	399	1	9	61	35	
pH (standard units)	396	1	7.3	7.6	7.8	
	399	1	7.3	7.8	8.2	

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-14

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	398	1	ND	ND		
2. acrolein	398	1	ND	ND		
3. acrylonitrile	398	1	ND	ND		
4. benzene	398	1	ND	ND		
5. benzidine	398	1	ND	ND		
6. carbon tetrachloride	398	1	ND	ND		
7. chlorobenzene	398	1	ND	ND		
8. 1,2,4-trichlorobenzene	398	1	ND	ND		
9. hexachlorobenzene	398	1	ND	ND		
10. 1,2-dichloroethane	398	1	ND	ND		
11. 1,1,1-trichloroethane	398	1	0.003	ND		
12. hexachloroethane	398	1	ND	ND		
13. 1,1-dichloroethane	398	1	ND	ND		
14. 1,1,2-trichloroethane	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	398	1	ND	ND		
16. chloroethane	398	1	ND	ND		
17. bis(chloromethyl)ether	398	1	ND	ND		
18. bis(2-chloroethyl)ether	398	1	ND	ND		
19. 2-chloroethyl vinyl ether	398	1	ND	ND		
20. 2-chloronaphthalene	398	1	ND	ND		
21. 2,4,6-trichlorophenol	398	1	ND	ND		
22. p-chloro-m-cresol	398	1	ND	ND		
23. chloroform	398	1	ND	ND		
24. 2-chlorophenol	398	1	ND	ND		
25. 1,2-dichlorobenzene	398	1	ND	ND		
26. 1,3-dichlorobenzene	398	1	ND	ND		
27. 1,4-dichlorobenzene	398	1	ND	ND		
28. 3,3'-dichlorobenzidine	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	398	1	<0.01	ND		
30. 1,2-*trans*-dichloroethylene	398	1	ND	ND		
31. 2,4-dichlorophenol	398	1	ND	ND		
32. 1,2-dichloropropane	398	1	ND	ND		
33. 1,3-dichloropropene	398	1	ND	ND		
34. 2,4-dimethylphenol	398	1	ND	ND		
35. 2,4-dinitrotoluene	398	1	ND	ND		
36. 2,6-dinitrotoluene	398	1	ND	ND		
37. 1,2-diphenylhydrazine	398	1	ND	ND		
38. ethylbenzene	398	1	ND	ND		
39. fluoranthene	398	1	ND	ND		
40. 4-chlorophenyl phenyl ether	398	1	ND	ND		
41. 4-bromophenyl phenyl ether	398	1	ND	ND		
42. bis(2-chloroisopropyl)ether	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	398	1	ND	ND		
44. methylene chloride	398	1	ND	ND		
45. methyl chloride (chloromethane)	398	1	ND	ND		
46. methyl bromide (bromomethane)	398	1	ND	ND		
47. bromoform (tribromomethane)	398	1	ND	ND		
48. dichlorobromomethane	398	1	ND	ND		
49. trichlorofluoromethane	398	1	ND	ND		
50. dichlorodifluoromethane	398	1	ND	ND		
51. chlorodibromomethane	398	1	ND	ND		
52. hexachlorobutadiene	398	1	ND	ND		
53. hexachlorocyclopentadiene	398	1	ND	ND		
54. isophorone	398	1	ND	ND		
55. naphthalene	398	1	ND	ND		
56. nitrobenzene	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	398	1	ND	0.010		
58. 4-nitrophenol	398	1	<0.01	0.025		
59. 2,4-dinitrophenol	398	1	ND	0.033		
60. 4,6-dinitro-o-cresol	398	1	ND	ND		
61. N-nitrosodimethylamine	398	1	ND	ND		
62. N-nitrosodiphenylamine	398	1	ND	<0.010		
63. N-nitrosodi-n-propylamine	398	1	ND	ND		
64. pentachlorophenol	398	1	ND	ND		
65. phenol	398	1	ND	ND		
66. bis(2-ethylhexyl) phthalate	398	1	<0.01	<0.010		
67. butyl benzyl phthalate	398	1	ND	<0.010		
68. di-n-butyl phthalate	398	1	ND	<0.010		
69. di-n-octyl phthalate	398	1	ND	ND		
70. diethyl phthalate	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	398	1	ND	ND		
72. benzo(a)anthracene	398	1	ND	ND		
73. benzo(a)pyrene	398	1	ND	ND		
74. benzo(b)fluoranthene	398	1	ND	ND		
75. benzo(k)fluoranthane	398	1	ND	ND		
76. chrysene	398	1	ND	ND		
77. acenaphthylene	398	1	ND	ND		
78. anthracene (a)	398	1	ND	ND		
79. benzo(ghi)perylene	398	1	ND	ND		
80. fluorene	398	1	ND	ND		
81. phenanthrene (a)	398	1	ND	ND		
82. dibenzo(a,h)anthracene	398	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene	398	1	ND	ND		
84. pyrene	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	398	1	ND	ND		
86. toluene	398	1	ND	ND		
87. trichloroethylene	398	1	ND	ND		
88. vinyl chloride (chloroethylene)	398	1	ND	ND		
89. aldrin	398	1	ND	ND		
90. dieldrin	398	1	ND	ND		
91. chlordane	398	1	ND	ND		
92. 4,4'-DDT	398	1	ND	ND		
93. 4,4'-DDE	398	1	ND	ND		
94. 4,4'-DDD	398	1	ND	ND		
95. alpha-endosulfan	398	1	ND	ND		
96. beta-endosulfan	398	1	ND	ND		
97. endosulfan sulfate	398	1	ND	ND		
98. heptachlor	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
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		398	1	ND	ND		
100. heptachlor		398	1	ND	ND		
101. heptachlor epoxide		398	1	ND	ND		
102. alpha-BHC		398	1	ND	ND		
103. beta-BHC		398	1	ND	ND		
104. gamma-BHC		398	1	ND	ND		
105. delta-BHC		398	1	ND	ND		
106. PCB-1242	(b)	398	1	ND	ND		
107. PCB-1254	(b)	398	1	ND	ND		
108. PCB-1221	(b)	398	1	ND	ND		
109. PCB-1232	(c)	398	1	ND	ND		
110. PCB-1248	(c)	398	1	ND	ND		
111. PCB-1260	(c)	398	1	ND	ND		
112. PCB-1016	(c)	398	1	ND	ND		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	398	1	ND	ND		
114. antimony	398	1	0.006	2.4		
115. arsenic	398	1	<0.001	0.024		
117. beryllium	398	1	<0.0005	0.002		
118. cadmium	398	1	<0.001	0.002		
119. chromium (total)	398	1	0.032	0.04		
120. copper	398	1	0.031	0.280		
121. cyanide (total)	398	1	0.040	10.0		
122. lead	398	1	0.12	0.037		
123. mercury	398	1	<0.0002	<0.0002		
124. nickel	398	1	<0.025	0.380		
125. selenium	398	1	<0.008	0.430		
126. silver	398	1	0.001	0.012		
127. thallium	398	1	<0.001	0.320		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	398	1	0.05	0.220		
Nonconventional Pollutants						
alkalinity	398	1	77	34,000		
ammonia nitrogen	398	1	2	<0.01		
calcium	398	1	17	0.46		
chemical oxygen demand (COD)	398	1	<1	180		
fluoride	398	1	0.94	17,000		
magnesium	398	1	7.2	0.49		
phenolics	398	1	0.26	0.32		
sulfate	398	1	29	2,000		
tin	398	1	<0.025	7.8		
total dissolved solids (TDS)	398	1	160	50,000		
Conventional Pollutants						
oil and grease	398	1	<1	56		

Table V-14 (Continued)

TIN HYDROXIDE FILTRATE
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
total suspended solids (TSS)	398	1	9	32		
pH (standard units)	398	1	7.3	8.1		

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-15

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	456	1	ND	ND		
2. acrolein	456	1	ND	ND		
3. acrylonitrile	456	1	ND	ND		
4. benzene	456	1	0.013	0.008		
5. benzidine	456	1	ND	ND		
6. carbon tetrachloride	456	1	ND	ND		
7. chlorobenzene	456	1	ND	ND		
8. 1,2,4-trichlorobenzene	456	1	ND	ND		
9. hexachlorobenzene	456	1	0.015	0.004		
10. 1,2-dichloroethane	456	1	ND	ND		
11. 1,1,1-trichloroethane	456	1	ND	0.003		
12. hexachloroethane	456	1	ND	ND		
13. 1,1-dichloroethane	456	1	ND	ND		
14. 1,1,2-trichloroethane	456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	456	1	ND	ND		
16. chloroethane	456	1	ND	ND		
17. bis(chloromethyl)ether	456	1	ND	ND		
18. bis(2-chloroethyl)ether	456	1	ND	ND		
19. 2-chloroethyl vinyl ether	456	1	ND	ND		
20. 2-chloronaphthalene	456	1	ND	ND		
21. 2,4,6-trichlorophenol	456	1	ND	ND		
22. p-chloro-m-cresol	456	1	ND	ND		
23. chloroform	456	1	0.038	0.005		
24. 2-chlorophenol	456	1	ND	ND		
25. 1,2-dichlorobenzene	456	1	ND	ND		
26. 1,3-dichlorobenzene	456	1	ND	ND		
27. 1,4-dichlorobenzene	456	1	ND	ND		
28. 3,3'-dichlorobenzidine	456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	456	1	ND	ND		
30. 1,2-trans-dichloroethylene	456	1	ND	ND		
31. 2,4-dichlorophenol	456	1	ND	ND		
32. 1,2-dichloropropane	456	1	ND	ND		
33. 1,3-dichloropropene	456	1	ND	ND		
34. 2,4-dimethylphenol	456	1	ND	0.004		
35. 2,4-dinitrotoluene	456	1	ND	ND		
36. 2,6-dinitrotoluene	456	1	ND	ND		
37. 1,2-diphenylhydrazine	456	1	ND	ND		
38. ethylbenzene	456	1	ND	ND		
39. fluoranthene	456	1	ND	ND		
40. 4-chlorophenyl phenyl ether	456	1	ND	ND		
41. 4-bromophenyl phenyl ether	456	1	ND	ND		
42. bis(2-chloroisopropyl)ether	456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	456	1	ND	ND		
44. methylene chloride	456	1	0.190	0.005		
45. methyl chloride (chloromethane)	456	1	ND	ND		
46. methyl bromide (bromomethane)	456	1	ND	ND		
47. bromoform (tribromomethane)	456	1	ND	ND		
48. dichlorobromomethane	456	1	ND	ND		
49. trichlorofluoromethane	456	1	ND	ND		
50. dichlorodifluoromethane	456	1	ND	ND		
51. chlorodibromomethane	456	1	0.002	ND		
52. hexachlorobutadiene	456	1	ND	ND		
53. hexachlorocyclopentadiene	456	1	ND	ND		
54. isophorone	456	1	ND	ND		
55. naphthalene	456	1	ND	ND		
56. nitrobenzene	456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	456	1	ND	0.020		
58. 4-nitrophenol	456	1	ND	ND		
59. 2,4-dinitrophenol	456	1	ND	ND		
60. 4,6-dinitro-o-cresol	456	1	ND	ND		
61. N-nitrosodimethylamine	456	1	ND	ND		
62. N-nitrosodiphenylamine	456	1	ND	ND		
63. N-nitrosodi-n-propylamine	456	1	ND	ND		
64. pentachlorophenol	456	1	ND	ND		
65. phenol	456	1	ND	0.003		
66. bis(2-ethylhexyl) phthalate	456	1	0.006	0.002		
67. butyl benzyl phthalate	456	1	ND	ND		
68. di-n-butyl phthalate	456	1	ND	ND		
69. di-n-octyl phthalate	456	1	ND	ND		
70. diethyl phthalate	456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
71. dimethyl phthalate		456	1	ND	ND		
72. benzo(a)anthracene		456	1	ND	ND		
73. benzo(a)pyrene		456	1	ND	ND		
74. benzo(b)fluoranthene		456	1	ND	ND		
75. benzo(k)fluoranthane		456	1	ND	ND		
76. chrysene		456	1	ND	ND		
77. acenaphthylene		456	1	ND	ND		
78. anthracene	(a)	456	1	ND	ND		
79. benzo(ghi)perylene		456	1	ND	ND		
80. fluorene		456	1	ND	ND		
81. phenanthrene	(a)	456	1	ND	ND		
82. dibenzo(a,h)anthracene		456	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene		456	1	ND	ND		
84. pyrene		456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	456	1	ND	ND		
86. toluene	456	1	0.001	0.004		
87. trichloroethylene	456	1	ND	ND		
88. vinyl chloride (chloroethylene)	456	1	ND	ND		
89. aldrin	456	1	ND	ND		
90. dieldrin	456	1	ND	ND		
91. chlordane	456	1	ND	ND		
92. 4,4'-DDT	456	1	ND	ND		
93. 4,4'-DDE	456	1	ND	ND		
94. 4,4'-DDD	456	1	ND	ND		
95. alpha-endosulfan	456	1	ND	ND		
96. beta-endosulfan	456	1	ND	ND		
97. endosulfan sulfate	456	1	ND	ND		
98. heptachlor	456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
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		456	1	ND	ND		
100. heptachlor		456	1	ND	ND		
101. heptachlor epoxide		456	1	ND	ND		
102. alpha-BHC		456	1	ND	ND		
103. beta-BHC		456	1	ND	ND		
104. gamma-BHC		456	1	ND	ND		
105. delta-BHC		456	1	ND	ND		
106. PCB-1242	(b)	456	1	ND	ND		
107. PCB-1254	(b)	456	1	ND	ND		
108. PCB-1221	(b)	456	1	ND	ND		
109. PCB-1232	(c)	456	1	ND	ND		
110. PCB-1248	(c)	456	1	ND	ND		
111. PCB-1260	(c)	456	1	ND	ND		
112. PCB-1016	(c)	456	1	ND	ND		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	456	1	ND	ND		
114. antimony	456	1	0.001	12		
115. arsenic	456	1	0.002	3.4		
117. beryllium	456	1	<0.001	0.064		
118. cadmium	456	1	0.02	0.40		
119. chromium (total)	456	1	0.003	0.004		
120. copper	456	1	0.008	0.52		
121. cyanide (total)	456	1	0.0022	1.900		
122. lead	456	1	0.019	11		
123. mercury	456	1	<0.0002	0.0004		
124. nickel	456	1	<0.001	2.1		
125. selenium	456	1	0.033	0.050		
126. silver	456	1	<0.001	0.40		
127. thallium	456	1	0.14	2.5		

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	456	1	0.08	190		
Nonconventional Pollutants						
alkalinity	456	1	60	90,000		
aluminum	456	1	1.90	30,000		
ammonia nitrogen	456	1	0.18			
calcium	456	1	11	<0.1		
chemical oxygen demand (COD)	456	1	4.0	5,700		
fluoride	456	1	1.2	0.4		
magnesium	456	1	5.5	0.12		
phenolics	456	1	0.011	0.011		
tin	456	1	1.6	240		
Conventional Pollutants						
oil and grease	456	1	<1			

Table V-15 (Continued)

MUD POND SUPERNATANT
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
total suspended solids (TSS)	456	1	1	400		
pH (standard units)	456	1	6.2	13.4		

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-16

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	849	1	ND	0.001		
2. acrolein	849	1	ND	ND		
3. acrylonitrile	849	1	ND	ND		
4. benzene	849	1	ND	ND		
5. benzidine	849	1	ND	ND		
6. carbon tetrachloride	849	1	ND	ND		
7. chlorobenzene	849	1	ND	ND		
8. 1,2,4-trichlorobenzene	849	1	ND	ND		
9. hexachlorobenzene	849	1	ND	ND		
10. 1,2-dichloroethane	849	1	ND	ND		
11. 1,1,1-trichloroethane	849	1	ND	ND		
12. hexachloroethane	849	1	ND	ND		
13. 1,1-dichloroethane	849	1	ND	ND		
14. 1,1,2-trichloroethane	849	1	ND	ND		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	849	1	ND	ND		
16. chloroethane	849	1	ND	ND		
17. bis(chloromethyl)ether	849	1	ND	ND		
18. bis(2-chloroethyl)ether	849	1	ND	ND		
19. 2-chloroethyl vinyl ether	849	1	ND	ND		
20. 2-chloronaphthalene	849	1	ND	ND		
21. 2,4,6-trichlorophenol	849	1	ND	ND		
22. p-chloro-m-cresol	849	1	ND	ND		
23. chloroform	849	1	ND	ND		
24. 2-chlorophenol	849	1	ND	ND		
25. 1,2-dichlorobenzene	849	1	ND	ND		
26. 1,3-dichlorobenzene	849	1	ND	ND		
27. 1,4-dichlorobenzene	849	1	ND	ND		
28. 3,3'-dichlorobenzidine	849	1	ND	ND		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	849	1	ND	ND		
30. 1,2-*trans*-dichloroethylene	849	1	ND	ND		
31. 2,4-dichlorophenol	849	1	ND	ND		
32. 1,2-dichloropropane	849	1	ND	ND		
33. 1,3-dichloropropene	849	1	ND	ND		
34. 2,4-dimethylphenol	849	1	ND	ND		
35. 2,4-dinitrotoluene	849	1	ND	ND		
36. 2,6-dinitrotoluene	849	1	ND	ND		
37. 1,2-diphenylhydrazine	849	1	ND	ND		
38. ethylbenzene	849	1	ND	ND		
39. fluoranthene	849	1	ND	0.003		
40. 4-chlorophenyl phenyl ether	849	1	ND	ND		
41. 4-bromophenyl phenyl ether	849	1	ND	ND		
42. bis(2-chloroisopropyl)ether	849	1	ND	ND		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	849	1	ND	ND		
44. methylene chloride	849	1	ND	0.015		
45. methyl chloride (chloromethane)	849	1	ND	ND		
46. methyl bromide (bromomethane)	849	1	ND	ND		
47. bromoform (tribromomethane)	849	1	ND	ND		
48. dichlorobromomethane	849	1	ND	ND		
49. trichlorofluoromethane	849	1	ND	ND		
50. dichlorodifluoromethane	849	1	ND	ND		
51. chlorodibromomethane	849	1	ND	ND		
52. hexachlorobutadiene	849	1	ND	ND		
53. hexachlorocyclopentadiene	849	1	ND	ND		
54. isophorone	849	1	ND	ND		
55. naphthalene	849	1	ND	0.002		
56. nitrobenzene	849	1	ND	ND		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	849	1	ND	0.020		
58. 4-nitrophenol	849	1	ND	ND		
59. 2,4-dinitrophenol	849	1	ND	ND		
60. 4,6-dinitro-o-cresol	849	1	ND	ND		
61. N-nitrosodimethylamine	849	1	ND	ND		
62. N-nitrosodiphenylamine	849	1	ND	ND		
63. N-nitrosodi-n-propylamine	849	1	ND	ND		
64. pentachlorophenol	849	1	ND	ND		
65. phenol	849	1	ND	0.08		
66. bis(2-ethylhexyl) phthalate	849	1	0.054	ND		
67. butyl benzyl phthalate	849	1	ND	ND		
68. di-n-butyl phthalate	849	1	ND	ND		
69. di-n-octyl phthalate	849	1	ND	ND		
70. diethyl phthalate	849	1	ND	ND		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	849	1	ND	ND		
72. benzo(a)anthracene	849	1	ND	ND		
73. benzo(a)pyrene	849	1	ND	ND		
74. benzo(b)fluoranthene	849	1	ND	ND		
75. benzo(k)fluoranthane	849	1	ND	ND		
76. chrysene	849	1	ND	ND		
77. acenaphthylene	849	1	ND	ND		
78. anthracene (a)	849	1	ND	ND		
79. benzo(ghi)perylene	849	1	ND	ND		
80. fluorene	849	1	ND	ND		
81. phenanthrene (a)	849	1	ND	ND		
82. dibenzo(a,h)anthracene	849	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene	849	1	ND	ND		
84. pyrene	849	1	ND	0.003		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	849	1	ND	ND		
86. toluene	849	1	0.093	0.001		
87. trichloroethylene	849	1	ND	0.016		
88. vinyl chloride (chloroethylene)	849	1	ND	ND		
89. aldrin	849	1	ND	ND		
90. dieldrin	849	1	ND	ND		
91. chlordane	849	1	ND	ND		
92. 4,4'-DDT	849	1	ND	ND		
93. 4,4'-DDE	849	1	ND	ND		
94. 4,4'-DDD	849	1	ND	ND		
95. alpha-endosulfan	849	1	ND	ND		
96. beta-endosulfan	849	1	ND	ND		
97. endosulfan sulfate	849	1	ND	ND		
98. heptachlor	849	1	ND	ND		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
99. endrin aldehyde	849	1	ND	ND		
100. heptachlor	849	1	ND	ND		
101. heptachlor epoxide	849	1	ND	ND		
102. alpha-BHC	849	1	ND	ND		
103. beta-BHC	849	1	ND	ND		
104. gamma-BHC	849	1	ND	ND		
105. delta-BHC	849	1	ND	ND		
106. PCB-1242 (b)	849	1	ND	ND		
107. PCB-1254 (b)	849	1	ND	ND		
108. PCB-1221 (b)	849	1	ND	ND		
109. PCB-1232 (c)	849	1	ND	ND		
110. PCB-1248 (c)	849	1	ND	ND		
111. PCB-1260 (c)	849	1	ND	ND		
112. PCB-1016 (c)	849	1	ND	ND		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	849	1	ND	ND		
114. antimony	849	1	<0.001	<0.001		
115. arsenic	849	1	0.008	1.8		
117. beryllium	849	1	<0.001	0.012		
118. cadmium	849	1	<0.001	0.32		
119. chromium (total)	849	1	0.003	0.31		
120. copper	849	1	0.14	0.26		
121. cyanide (total)	849	1	0.005	4.6		
122. lead	849	1	0.001	0.98		
123. mercury	849	1	<0.002	<0.002		
124. nickel	849	1	0.001	4.3		
125. selenium	849	1	3.1	39		
126. silver	849	1	0.02	0.30		
127. thallium	849	1	<0.001	1.9		

Table V-16 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	849	1	0.06	1.1		
Nonconventional Pollutants						
ammonia nitrogen	849	1	1.5	20		
phenolics	849	1	0.002	0.003		
tin	849	1	0.28	2,300		
Conventional Pollutants						
oil and grease	849	1	5.6	ND		
total suspended solids (TSS)	849	1	19	25,000		
pH (standard units)	849	1	6.5	13		

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-17

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	850	1	ND	ND		
2. acrolein	850	1	ND	ND		
3. acrylonitrile	850	1	ND	ND		
4. benzene	850	1	ND	0.001		
5. benzidine	850	1	ND	ND		
6. carbon tetrachloride	850	1	ND	ND		
7. chlorobenzene	850	1	ND	ND		
8. 1,2,4-trichlorobenzene	850	1	ND	ND		
9. hexachlorobenzene	850	1	ND	ND		
10. 1,2-dichloroethane	850	1	ND	ND		
11. 1,1,1-trichloroethane	850	1	ND	ND		
12. hexachloroethane	850	1	ND	ND		
13. 1,1-dichloroethane	850	1	ND	ND		
14. 1,1,2-trichloroethane	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	850	1	ND	ND		
16. chloroethane	850	1	ND	ND		
17. bis(chloromethyl)ether	850	1	ND	ND		
18. bis(2-chloroethyl)ether	850	1	ND	ND		
19. 2-chloroethyl vinyl ether	850	1	ND	ND		
20. 2-chloronaphthalene	850	1	ND	ND		
21. 2,4,6-trichlorophenol	850	1	ND	ND		
22. p-chloro-m-cresol	850	1	ND	ND		
23. chloroform	850	1	ND	ND		
24. 2-chlorophenol	850	1	ND	ND		
25. 1,2-dichlorobenzene	850	1	ND	ND		
26. 1,3-dichlorobenzene	850	1	ND	ND		
27. 1,4-dichlorobenzene	850	1	ND	ND		
28. 3,3'-dichlorobenzidine	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	850	1	ND	ND		
30. 1,2-trans-dichloroethylene	850	1	ND	ND		
31. 2,4-dichlorophenol	850	1	ND	ND		
32. 1,2-dichloropropane	850	1	ND	ND		
33. 1,3-dichloropropene	850	1	ND	ND		
34. 2,4-dimethylphenol	850	1	ND	ND		
35. 2,4-dinitrotoluene	850	1	ND	ND		
36. 2,6-dinitrotoluene	850	1	ND	ND		
37. 1,2-diphenylhydrazine	850	1	ND	ND		
38. ethylbenzene	850	1	ND	ND		
39. fluoranthene	850	1	ND	ND		
40. 4-chlorophenyl phenyl ether	850	1	ND	ND		
41. 4-bromophenyl phenyl ether	850	1	ND	ND		
42. bis(2-chloroisopropyl)ether	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	850	1	ND	ND		
44. methylene chloride	850	1	ND	0.045		
45. methyl chloride (chloromethane)	850	1	ND	ND		
46. methyl bromide (bromomethane)	850	1	ND	ND		
47. bromoform (tribromomethane)	850	1	ND	ND		
48. dichlorobromomethane	850	1	ND	ND		
49. trichlorofluoromethane	850	1	ND	ND		
50. dichlorodifluoromethane	850	1	ND	ND		
51. chlorodibromomethane	850	1	ND	ND		
52. hexachlorobutadiene	850	1	ND	ND		
53. hexachlorocyclopentadiene	850	1	ND	ND		
54. isophorone	850	1	ND	ND		
55. naphthalene	850	1	ND	ND		
56. nitrobenzene	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	850	1	ND	ND		
58. 4-nitrophenol	850	1	ND	ND		
59. 2,4-dinitrophenol	850	1	ND	ND		
60. 4,6-dinitro-o-cresol	850	1	ND	ND		
61. N-nitrosodimethylamine	850	1	ND	ND		
62. N-nitrosodiphenylamine	850	1	ND	ND		
63. N-nitrosodi-n-propylamine	850	1	ND	ND		
64. pentachlorophenol	850	1	ND	ND		
65. phenol	850	1	ND	0.035		
66. bis(2-ethylhexyl) phthalate	850	1	0.054	0.007		
67. butyl benzyl phthalate	850	1	ND	ND		
68. di-n-butyl phthalate	850	1	ND	ND		
69. di-n-octyl phthalate	850	1	ND	ND		
70. diethyl phthalate	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	850	1	ND	ND		
72. benzo(a)anthracene	850	1	ND	ND		
73. benzo(a)pyrene	850	1	ND	ND		
74. benzo(b)fluoranthene	850	1	ND	ND		
75. benzo(k)fluoranthane	850	1	ND	ND		
76. chrysene	850	1	ND	ND		
77. acenaphthylene	850	1	ND	ND		
78. anthracene (a)	850	1	ND	ND		
79. benzo(ghi)perylene	850	1	ND	ND		
80. fluorene	850	1	ND	ND		
81. phenanthrene (a)	850	1	ND	ND		
82. dibenzo(a,h)anthracene	850	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene	850	1	ND	ND		
84. pyrene	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	850	1	ND	ND		
86. toluene	850	1	0.093	0.01		
87. trichloroethylene	850	1	ND	0.021		
88. vinyl chloride (chloroethylene)	850	1	ND	ND		
89. aldrin	850	1	ND	ND		
90. dieldrin	850	1	ND	ND		
91. chlordane	850	1	ND	ND		
92. 4,4'-DDT	850	1	ND	ND		
93. 4,4'-DDE	850	1	ND	ND		
94. 4,4'-DDD	850	1	ND	ND		
95. alpha-endosulfan	850	1	ND	ND		
96. beta-endosulfan	850	1	ND	ND		
97. endosulfan sulfate	850	1	ND	ND		
98. heptachlor	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
99. endrin aldehyde		850	1	ND	ND		
100. heptachlor		850	1	ND	ND		
101. heptachlor epoxide		850	1	ND	ND		
102. alpha-BHC		850	1	ND	ND		
103. beta-BHC		850	1	ND	ND		
104. gamma-BHC		850	1	ND	ND		
105. delta-BHC		850	1	ND	ND		
106. PCB-1242	(b)	850	1	ND	ND		
107. PCB-1254	(b)	850	1	ND	ND		
108. PCB-1221	(b)	850	1	ND	ND		
109. PCB-1232	(c)	850	1	ND	ND		
110. PCB-1248	(c)	850	1	ND	ND		
111. PCB-1260	(c)	850	1	ND	ND		
112. PCB-1016	(c)	850	1	ND	ND		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	850	1	ND	ND		
114. antimony	850	1	<0.001	0.77		
115. arsenic	850	1	0.008	4.8		
117. beryllium	850	1	<0.001	0.007		
118. cadmium	850	1	<0.001	0.13		
119. chromium (total)	850	1	0.003	0.002		
120. copper	850	1	0.14	0.10		
121. cyanide (total)	850	1	0.005	4.70		
122. lead	850	1	0.001	0.51		
123. mercury	850	1	<0.002	<0.002		
124. nickel	850	1	0.001	2.0		
125. selenium	850	1	3.1	30		
126. silver	850	1	0.02	0.08		
127. thallium	850	1	<0.001	0.78		

Table V-17 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION AND NEUTRALIZATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	850	1	0.06	0.12		
Nonconventional Pollutants						
ammonia nitrogen	850	1	1.5	23		
phenolics	850	1	0.002	0.5		
tin	850	1	0.28	15		
Conventional Pollutants						
oil and grease	850	1	5.6	ND		
total suspended solids (TSS)	850	1	19	140,000		

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-18

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	845	1	ND	ND	ND	ND
2. acrolein	845	1	ND	ND	ND	ND
3. acrylonitrile	845	1	ND	ND	ND	ND
4. benzene	845	1	ND	ND	ND	ND
5. benzidine	845	1	ND	ND	ND	ND
6. carbon tetrachloride	845	1	ND	ND	ND	ND
7. chlorobenzene	845	1	ND	ND	ND	ND
8. 1,2,4-trichlorobenzene	845	1	ND	ND	ND	ND
9. hexachlorobenzene	845	1	ND	ND	ND	ND
10. 1,2-dichloroethane	845	1	ND	ND	ND	ND
11. 1,1,1-trichloroethane	845	1	ND	0.210	ND	ND
12. hexachloroethane	845	1	ND	ND	ND	ND
13. 1,1-dichloroethane	845	1	ND	ND	ND	ND
14. 1,1,2-trichloroethane	845	1	ND	ND	ND	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	845	1	ND	ND	ND	ND
16. chloroethane	845	1	ND	ND	ND	ND
17. bis(chloromethyl)ether	845	1	ND	ND	ND	ND
18. bis(2-chloroethyl)ether	845	1	ND	ND	ND	ND
19. 2-chloroethyl vinyl ether	845	1	ND	ND	ND	ND
20. 2-chloronaphthalene	845	1	ND	ND	ND	ND
21. 2,4,6-trichlorophenol	845	1	ND	0.004	ND	ND
22. p-chloro-m-cresol	845	1	ND	ND	ND	ND
23. chloroform	845	1	ND	ND	ND	ND
24. 2-chlorophenol	845	1	ND	ND	ND	ND
25. 1,2-dichlorobenzene	845	1	ND	ND	ND	ND
26. 1,3-dichlorobenzene	845	1	ND	ND	ND	ND
27. 1,4-dichlorobenzene	845	1	ND	ND	ND	ND
28. 3,3 -dichlorobenzidine	845	1	ND	ND	ND	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	845	1	ND	ND	ND	ND
30. 1,2-*trans*-dichloroethylene	845	1	ND	ND	ND	ND
31. 2,4-dichlorophenol	845	1	ND	ND	ND	ND
32. 1,2-dichloropropane	845	1	ND	ND	ND	ND
33. 1,3-dichloropropene	845	1	ND	ND	ND	ND
34. 2,4-dimethylphenol	845	1	ND	ND	ND	ND
35. 2,4-dinitrotoluene	845	1	ND	ND	ND	ND
36. 2,6-dinitrotoluene	845	1	ND	ND	ND	ND
37. 1,2-diphenylhydrazine	845	1	ND	ND	ND	ND
38. ethylbenzene	845	1	ND	ND	ND	ND
39. fluoranthene	845	1	ND	0.006	0.005	0.004
40. 4-chlorophenyl phenyl ether	845	1	ND	ND	ND	ND
41. 4-bromophenyl phenyl ether	845	1	ND	ND	ND	ND
42. bis(2-chloroisopropyl)ether	845	1	ND	ND	ND	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	845	1	ND	ND	ND	ND
44. methylene chloride	845	1	ND	0.038	0.024	0.041
45. methyl chloride (chloromethane)	845	1	ND	ND	ND	ND
46. methyl bromide (bromomethane)	845	1	ND	ND	ND	ND
47. bromoform (tribromomethane)	845	1	ND	ND	ND	ND
48. dichlorobromomethane	845	1	ND	ND	ND	ND
49. trichlorofluoromethane	845	1	ND	ND	ND	ND
50. dichlorodifluoromethane	845	1	ND	ND	ND	ND
51. chlorodibromomethane	845	1	ND	ND	ND	ND
52. hexachlorobutadiene	845	1	ND	ND	ND	ND
53. hexachlorocyclopentadiene	845	1	ND	ND	ND	ND
54. isophorone	845	1	ND	ND	ND	ND
55. naphthalene	845	1	ND	ND	ND	ND
56. nitrobenzene	845	1	ND	ND	ND	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	845	1	ND	ND	ND	ND
58. 4-nitrophenol	845	1	ND	ND	ND	ND
59. 2,4-dinitrophenol	845	1	ND	ND	ND	ND
60. 4,6-dinitro-o-cresol	845	1	ND	ND	ND	ND
61. N-nitrosodimethylamine	845	1	ND	ND	ND	ND
62. N-nitrosodiphenylamine	845	1	ND	ND	ND	ND
63. N-nitrosodi-n-propylamine	845	1	ND	ND	ND	ND
64. pentachlorophenol	845	1	ND	ND	ND	ND
65. phenol	845	1	ND	ND	ND	0.007
66. bis(2-ethylhexyl) phthalate	845	1	0.054	ND	ND	1.300
67. butyl benzyl phthalate	845	1	ND	ND	ND	0.710
68. di-n-butyl phthalate	845	1	ND	ND	ND	ND
69. di-n-octyl phthalate	845	1	ND	ND	ND	0.710
70. diethyl phthalate	845	1	ND	ND	ND	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
71. dimethyl phthalate	845	1	ND	ND	ND	ND
72. benzo(a)anthracene	845	1	ND	ND	ND	0.013
73. benzo(a)pyrene	845	1	ND	ND	ND	ND
74. benzo(b)fluoranthene	845	1	ND	ND	ND	ND
75. benzo(k)fluoranthane	845	1	ND	ND	ND	ND
76. chrysene	845	1	ND	ND	ND	0.013
77. acenaphthylene	845	1	ND	ND	ND	ND
78. anthracene (a)	845	1	ND	ND	ND	ND
79. benzo(ghi)perylene	845	1	ND	ND	ND	ND
80. fluorene	845	1	ND	ND	ND	ND
81. phenanthrene (a)	845	1	ND	ND	ND	ND
82. dibenzo(a,h)anthracene	845	1	ND	ND	ND	ND
83. indeno (1,2,3-c,d)pyrene	845	1	ND	ND	ND	ND
84. pyrene	845	1	ND	0.009	0.004	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	845	1	ND	ND	ND	ND
86. toluene	845	1	0.093	0.009	0.001	0.014
87. trichloroethylene	845	1	ND	0.015	ND	0.025
88. vinyl chloride (chloroethylene)	845	1	ND	ND	ND	ND
89. aldrin	845	1	ND	ND	ND	ND
90. dieldrin	845	1	ND	ND	ND	ND
91. chlordane	845	1	ND	ND	ND	ND
92. 4,4'-DDT	845	1	ND	ND	ND	ND
93. 4,4'-DDE	845	1	ND	ND	ND	ND
94. 4,4'-DDD	845	1	ND	ND	ND	ND
95. alpha-endosulfan	845	1	ND	ND	ND	ND
96. beta-endosulfan	845	1	ND	ND	ND	ND
97. endosulfan sulfate	845	1	ND	ND	ND	ND
98. heptachlor	845	1	ND	ND	ND	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
99. endrin aldehyde		845	1	ND	ND	ND	ND
100. heptachlor		845	1	ND	ND	ND	ND
101. heptachlor epoxide		845	1	ND	ND	ND	ND
102. alpha-BHC		845	1	ND	ND	ND	ND
103. beta-BHC		845	1	ND	ND	ND	ND
104. gamma-BHC		845	1	ND	ND	ND	ND
105. delta-BHC		845	1	ND	ND	ND	ND
106. PCB-1242	(b)	845	1	ND	ND	ND	ND
107. PCB-1254	(b)	845	1	ND	ND	ND	ND
108. PCB-1221	(b)	845	1	ND	ND	ND	ND
109. PCB-1232	(c)	845	1	ND	ND	ND	ND
110. PCB-1248	(c)	845	1	ND	ND	ND	ND
111. PCB-1260	(c)	845	1	ND	ND	ND	ND
112. PCB-1016	(c)	845	1	ND	ND	ND	ND

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	845	1	ND	ND		
114. antimony	845	1	<0.001	<0.001	0.51	0.28
115. arsenic	845	1	0.008	3.3	4.4	6.0
117. beryllium	845	1	<0.001	0.014	0.001	0.004
118. cadmium	845	1	<0.001	0.28	0.23	0.17
119. chromium (total)	845	1	0.003	0.004	0.003	0.014
120. copper	845	1	0.14	0.26	0.25	0.16
121. cyanide (total)	845	1	0.005	1.6	0.81	0.85
122. lead	845	1	0.001	0.93	0.91	0.70
123. mercury	845	1	<0.0002	<0.0002	<0.0002	<0.0002
124. nickel	845	1	0.001	5.6	6.0	5.2
125. selenium	845	1	3.1	39	30	30
126. silver	845	1	0.02	0.22	0.20	0.10
127. thallium	845	1	<0.001	2.2	1.4	0.96

Table V-18 (Continued)

ELECTROWINNING SOLUTION AFTER CHLORINATION, NEUTRALIZATION, AND SEDIMENTATION - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	845	1	0.06	0.56	1.0	0.8
Nonconventional Pollutants						
ammonia nitrogen	845	1	1.5	3	1.6	1.3
phenolics	845	1	0.002	0.20	0.23	0.20
tin	845	1	0.28	19	22	16
Conventional Pollutants						
oil and grease	845	1	5.6	29	21	20
total suspended solids (TSS)	845	1	19	1,600	530	1,300
pH (standard units)	845	1	6.5	8.9	8.9	

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-19

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	844	1	ND	ND	ND	ND
2. acrolein	844	1	ND	ND	ND	ND
3. acrylonitrile	844	1	ND	ND	ND	ND
4. benzene	844	1	ND	ND	0.002	0.002
5. benzidine	844	1	ND	ND	ND	ND
6. carbon tetrachloride	844	1	ND	ND	ND	ND
7. chlorobenzene	844	1	ND	ND	ND	ND
8. 1,2,4-trichlorobenzene	844	1	ND	ND	ND	ND
9. hexachlorobenzene	844	1	ND	ND	ND	ND
10. 1,2-dichloroethane	844	1	ND	ND	ND	ND
11. 1,1,1-trichloroethane	844	1	ND	ND	ND	ND
12. hexachloroethane	844	1	ND	ND	ND	ND
13. 1,1-dichloroethane	844	1	ND	ND	ND	ND
14. 1,1,2-trichloroethane	844	1	ND	ND	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	844	1	ND	ND	ND	ND
16. chloroethane	844	1	ND	ND	ND	ND
17. bis(chloromethyl)ether	844	1	ND	ND	ND	ND
18. bis(2-chloroethyl)ether	844	1	ND	ND	ND	ND
19. 2-chloroethyl vinyl ether	844	1	ND	ND	ND	ND
20. 2-chloronaphthalene	844	1	ND	ND	ND	ND
21. 2,4,6-trichlorophenol	844	1	ND	ND	ND	ND
22. p-chloro-m-cresol	844	1	ND	ND	ND	ND
23. chloroform	844	1	ND	ND	ND	ND
24. 2-chlorophenol	844	1	ND	ND	ND	ND
25. 1,2-dichlorobenzene	844	1	ND	ND	ND	ND
26. 1,3-dichlorobenzene	844	1	ND	ND	ND	ND
27. 1,4-dichlorobenzene	844	1	ND	ND	ND	ND
28. 3,3 -dichlorobenzidine	844	1	ND	ND	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	844	1	ND	ND	ND	ND
30. 1,2-trans-dichloroethylene	844	1	ND	ND	ND	ND
31. 2,4-dichlorophenol	844	1	ND	ND	ND	ND
32. 1,2-dichloropropane	844	1	ND	ND	ND	ND
33. 1,3-dichloropropene	844	1	ND	ND	ND	ND
34. 2,4-dimethylphenol	844	1	ND	ND	ND	ND
35. 2,4-dinitrotoluene	844	1	ND	ND	ND	ND
36. 2,6-dinitrotoluene	844	1	ND	ND	ND	ND
37. 1,2-diphenylhydrazine	844	1	ND	ND	ND	ND
38. ethylbenzene	844	1	ND	ND	ND	ND
39. fluoranthene	844	1	ND	ND	ND	ND
40. 4-chlorophenyl phenyl ether	844	1	ND	ND	ND	ND
41. 4-bromophenyl phenyl ether	844	1	ND	ND	ND	ND
42. bis(2-chloroisopropyl)ether	844	1	ND	ND	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	844	1	ND	ND	ND	ND
44. methylene chloride	844	1	ND	ND	ND	ND
45. methyl chloride (chloromethane)	844	1	ND	ND	ND	ND
46. methyl bromide (bromomethane)	844	1	ND	ND	ND	ND
47. bromoform (tribromomethane)	844	1	ND	ND	ND	ND
48. dichlorobromomethane	844	1	ND	ND	ND	ND
49. trichlorofluoromethane	844	1	ND	ND	ND	ND
50. dichlorodifluoromethane	844	1	ND	ND	ND	ND
51. chlorodibromomethane	844	1	ND	ND	ND	ND
52. hexachlorobutadiene	844	1	ND	ND	ND	ND
53. hexachlorocyclopentadiene	844	1	ND	ND	ND	ND
54. isophorone	844	1	ND	ND	ND	ND
55. naphthalene	844	1	ND	ND	ND	ND
56. nitrobenzene	844	1	ND	ND	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	844	1	ND	ND	ND	ND
58. 4-nitrophenol	844	1	ND	0.004	ND	ND
59. 2,4-dinitrophenol	844	1	ND	0.001	ND	ND
60. 4,6-dinitro-o-cresol	844	1	ND	ND	ND	ND
61. N-nitrosodimethylamine	844	1	ND	ND	ND	ND
62. N-nitrosodiphenylamine	844	1	ND	ND	ND	ND
63. N-nitrosodi-n-propylamine	844	1	ND	ND	ND	ND
64. pentachlorophenol	844	1	ND	ND	ND	ND
65. phenol	844	1	ND	ND	ND	ND
66. bis(2-ethylhexyl) phthalate	844	1	0.054	0.003	0.084	0.045
67. butyl benzyl phthalate	844	1	ND	ND	ND	ND
68. di-n-butyl phthalate	844	1	ND	0.002	ND	ND
69. di-n-octyl phthalate	844	1	ND	ND	ND	ND
70. diethyl phthalate	844	1	ND	0.007	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
71. dimethyl phthalate		844	1	ND	ND	ND	ND
72. benzo(a)anthracene		844	1	ND	ND	ND	ND
73. benzo(a)pyrene		844	1	ND	ND	ND	ND
74. benzo(b)fluoranthene		844	1	ND	ND	ND	ND
75. benzo(k)fluoranthane		844	1	ND	ND	ND	ND
76. chrysene		844	1	ND	ND	ND	ND
77. acenaphthylene		844	1	ND	ND	ND	ND
78. anthracene	(a)	844	1	ND	ND	ND	ND
79. benzo(ghi)perylene		844	1	ND	ND	ND	ND
80. fluorene		844	1	ND	ND	ND	ND
81. phenanthrene	(a)	844	1	ND	ND	ND	ND
82. dibenzo(a,h)anthracene		844	1	ND	ND	ND	ND
83. indeno (1,2,3-c,d)pyrene		844	1	ND	ND	ND	ND
84. pyrene		844	1	ND	ND	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	845	1	ND	ND	ND	ND
86. toluene	845	1	0.093	ND	ND	0.008
87. trichloroethylene	845	1	ND	ND	ND	ND
88. vinyl chloride (chloroethylene)	845	1	ND	ND	ND	ND
89. aldrin	845	1	ND	ND	ND	ND
90. dieldrin	845	1	ND	ND	ND	ND
91. chlordane	845	1	ND	ND	ND	ND
92. 4,4'-DDT	845	1	ND	ND	ND	ND
93. 4,4'-DDE	845	1	ND	ND	ND	ND
94. 4,4'-DDD	845	1	ND	ND	ND	ND
95. alpha-endosulfan	845	1	ND	ND	ND	ND
96. beta-endosulfan	845	1	ND	ND	ND	ND
97. endosulfan sulfate	845	1	ND	ND	ND	ND
98. heptachlor	845	1	ND	ND	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
99. endrin aldehyde		844	1	ND	ND	ND	ND
100. heptachlor		844	1	ND	ND	ND	ND
101. heptachlor epoxide		844	1	ND	ND	ND	ND
102. alpha-BHC		844	1	ND	ND	ND	ND
103. beta-BHC		844	1	ND	ND	ND	ND
104. gamma-BHC		844	1	ND	ND	ND	ND
105. delta-BHC		844	1	ND	ND	ND	ND
106. PCB-1242	(b)	844	1	ND	ND	ND	ND
107. PCB-1254	(b)	844	1	ND	ND	ND	ND
108. PCB-1221	(b)	844	1	ND	ND	ND	ND
109. PCB-1232	(c)	844	1	ND	ND	ND	ND
110. PCB-1248	(c)	844	1	ND	ND	ND	ND
111. PCB-1260	(c)	844	1	ND	ND	ND	ND
112. PCB-1016	(c)	844	1	ND	ND	ND	ND

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	844	1	ND	ND		
114. antimony	844	1	<0.001	0.004	<0.001	<0.001
115. arsenic	844	1	0.008	0.068	0.021	0.061
117. beryllium	844	1	<0.001	<0.001	<0.001	<0.001
118. cadmium	844	1	<0.001	<0.001	<0.001	0.02
119. chromium (total)	844	1	0.003	0.002	0.002	0.003
120. copper	844	1	0.14	0.20	0.14	0.20
121. cyanide (total)	844	1	0.005	0.015	0.031	0.021
122. lead	844	1	0.001	0.015	0.010	0.015
123. mercury	844	1	<0.002	<0.002	<0.002	<0.002
124. nickel	844	1	0.001	0.10	0.04	0.023
125. selenium	844	1	3.1	1.8	2.7	3.0
126. silver	844	1	0.02	<0.001	<0.001	0.03
127. thallium	844	1	<0.001	0.008	<0.001	<0.001

Table V-19 (Continued)

FINAL EFFLUENT - PLANT C
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	844	1	0.06	0.05	0.04	<0.02
Nonconventional Pollutants						
ammonia nitrogen	844	1	1.5	0.5	0.6	0.8
phenolics	844	1	0.002	0.003	0.003	0.002
tin	844	1	0.28	0.95	0.85	1.4
Conventional Pollutants						
oil and grease	844	1	5.6	14	12	7.6
total suspended solids (TSS)	844	1	19	31	32	29
pH (standard units)	844	1	6.5	6.9	7.1	

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-20

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
1. acenaphthene	858	1	ND	ND		
2. acrolein	858	1	ND	ND		
3. acrylonitrile	858	1	ND	ND		
4. benzene	858	1	ND	ND		
5. benzidine	858	1	ND	ND		
6. carbon tetrachloride	858	1	ND	ND		
7. chlorobenzene	858	1	ND	ND		
8. 1,2,4-trichlorobenzene	858	1	ND	ND		
9. hexachlorobenzene	858	1	ND	ND		
10. 1,2-dichloroethane	858	1	ND	ND		
11. 1,1,1-trichloroethane	858	1	ND	ND		
12. hexachloroethane	858	1	ND	ND		
13. 1,1-dichloroethane	858	1	ND	ND		
14. 1,1,2-trichloroethane	858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
15. 1,1,2,2-tetrachloroethane	858	1	ND	ND		
16. chloroethane	858	1	ND	ND		
17. bis(chloromethyl)ether	858	1	ND	ND		
18. bis(2-chloroethyl)ether	858	1	ND	ND		
19. 2-chloroethyl vinyl ether	858	1	ND	ND		
20. 2-chloronaphthalene	858	1	ND	ND		
21. 2,4,6-trichlorophenol	858	1	ND	ND		
22. p-chloro-m-cresol	858	1	ND	ND		
23. chloroform	858	1	0.037	ND		
24. 2-chlorophenol	858	1	ND	ND		
25. 1,2-dichlorobenzene	858	1	ND	ND		
26. 1,3-dichlorobenzene	858	1	ND	ND		
27. 1,4-dichlorobenzene	858	1	ND	ND		
28. 3,3'-dichlorobenzidine	858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
29. 1,1-dichloroethylene	858	1	ND	ND		
30. 1,2-*trans*-dichloroethylene	858	1	ND	ND		
31. 2,4-dichlorophenol	858	1	ND	ND		
32. 1,2-dichloropropane	858	1	ND	ND		
33. 1,3-dichloropropene	858	1	ND	ND		
34. 2,4-dimethylphenol	858	1	ND	ND		
35. 2,4-dinitrotoluene	858	1	ND	ND		
36. 2,6-dinitrotoluene	858	1	ND	ND		
37. 1,2-diphenylhydrazine	858	1	ND	ND		
38. ethylbenzene	858	1	ND	ND		
39. fluoranthene	858	1	ND	ND		
40. 4-chlorophenyl phenyl ether	858	1	ND	ND		
41. 4-bromophenyl phenyl ether	858	1	ND	ND		
42. bis(2-chloroisopropyl)ether	858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
43. bis(2-choroethoxy)methane	858	1	ND	ND		
44. methylene chloride	858	1	0.021	0.045		
45. methyl chloride (chloromethane)	858	1	ND	ND		
46. methyl bromide (bromomethane)	858	1	ND	ND		
47. bromoform (tribromomethane)	858	1	ND	ND		
48. dichlorobromomethane	858	1	ND	ND		
49. trichlorofluoromethane	858	1	ND	ND		
50. dichlorodifluoromethane	858	1	ND	ND		
51. chlorodibromomethane	858	1	ND	ND		
52. hexachlorobutadiene	858	1	ND	ND		
53. hexachlorocyclopentadiene	858	1	ND	ND		
54. isophorone	858	1	ND	ND		
55. naphthalene	858	1	ND	ND		
56. nitrobenzene	858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
57. 2-nitrophenol	858	1	ND	ND		
58. 4-nitrophenol	858	1	ND	ND		
59. 2,4-dinitrophenol	858	1	ND	ND		
60. 4,6-dinitro-o-cresol	858	1	ND	ND		
61. N-nitrosodimethylamine	858	1	ND	ND		
62. N-nitrosodiphenylamine	858	1	ND	ND		
63. N-nitrosodi-n-propylamine	858	1	ND	ND		
64. pentachlorophenol	858	1	ND	ND		
65. phenol	858	1	ND	0.028		
66. bis(2-ethylhexyl) phthalate	858	1	0.004	ND		
67. butyl benzyl phthalate	858	1	ND	ND		
68. di-n-butyl phthalate	858	1	ND	ND		
69. di-n-octyl phthalate	858	1	ND	ND		
70. diethyl phthalate	858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
71. dimethyl phthalate		858	1	ND	ND		
72. benzo(a)anthracene		858	1	ND	ND		
73. benzo(a)pyrene		858	1	ND	ND		
74. benzo(b)fluoranthene		858	1	ND	ND		
75. benzo(k)fluoranthane		858	1	ND	ND		
76. chrysene		858	1	ND	ND		
77. acenaphthylene		858	1	ND	ND		
78. anthracene	(a)	858	1	ND	ND		
79. benzo(ghi)perylene		858	1	ND	ND		
80. fluorene		858	1	ND	ND		
81. phenanthrene	(a)	858	1	ND	ND		
82. dibenzo(a,h)anthracene		858	1	ND	ND		
83. indeno (1,2,3-c,d)pyrene		858	1	ND	ND		
84. pyrene		858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
85. tetrachloroethylene	858	1	ND	ND		
86. toluene	858	1	0.005	0.001		
87. trichloroethylene	858	1	0.007	0.027		
88. vinyl chloride (chloroethylene)	858	1	ND	ND		
89. aldrin	858	1	ND	ND		
90. dieldrin	858	1	ND	ND		
91. chlordane	858	1	ND	ND		
92. 4,4'-DDT	858	1	ND	ND		
93. 4,4'-DDE	858	1	ND	ND		
94. 4,4'-DDD	858	1	ND	ND		
95. alpha-endosulfan	858	1	ND	ND		
96. beta-endosulfan	858	1	ND	ND		
97. endosulfan sulfate	858	1	ND	ND		
98. heptachlor	858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant		Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)							
99. endrin aldehyde		858	1	ND	ND		
100. heptachlor		858	1	ND	ND		
101. heptachlor epoxide		858	1	ND	ND		
102. alpha-BHC		858	1	ND	ND		
103. beta-BHC		858	1	ND	ND		
104. gamma-BHC		858	1	ND	ND		
105. delta-BHC		858	1	ND	ND		
106. PCB-1242	(b)	858	1	ND	ND		
107. PCB-1254	(b)	858	1	ND	ND		
108. PCB-1221	(b)	858	1	ND	ND		
109. PCB-1232	(c)	858	1	ND	ND		
110. PCB-1248	(c)	858	1	ND	ND		
111. PCB-1260	(c)	858	1	ND	ND		
112. PCB-1016	(c)	858	1	ND	ND		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
113. toxaphene	858	1	ND	ND		
114. antimony	858	1	<0.001	0.300		
115. arsenic	858	1	0.007	2.6		
117. beryllium	858	1	<0.001	0.003		
118. cadmium	858	1	0.001	0.20		
119. chromium (total)	858	1	0.004	0.37		
120. copper	858	1	0.016	0.15		
121. cyanide (total)	858	1	0.004	31,000		
122. lead	858	1	0.011	0.50		
123. mercury	858	1	0.0007	<0.0002		
124. nickel	858	1	0.003	2.4		
125. selenium	858	1	<0.005	<0.005		
126. silver	858	1	<0.001	0.14		
127. thallium	858	1	0.005	0.88		

Table V-20 (Continued)

ELECTROWINNING SOLUTION AFTER CARBONATION - PLANT D
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants (Continued)						
128. zinc	858	1	0.24	0.14		
Nonconventional Pollutants						
ammonia nitrogen	858	1	0.3	0.6		
phenolics	858	1	0.001	0.0003		
tin	858	1	1.7	26		
Conventional Pollutants						
total suspended solids (TSS)	858	1	9	25,000		

†Sample Type Code: 1 - One-time grab

(a), (b), (c) Reported together.

Table V-21

INFLUENT TO TREATMENT - PLANT E
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	896	6	0.0013	0.0008	0.0016	0.0047
115. arsenic	896	6	0.007	1.60	0.069	0.11
117. beryllium	896	6	<0.010	<0.010	<0.010	<0.010
118. cadmium	896	6	<0.030	0.061	0.50	0.30
119. chromium	896	6	<0.030	<0.030	0.035	0.035
120. copper	896	6	<0.030	0.13	1.50	7.50
121. cyanide (total)	896	1	<0.01	<0.01	<0.01	<0.01
122. lead	896	6	0.054	0.11	0.18	1.10
123. mercury	896	6	0.0149	0.0073	0.0031	<0.0025
124. nickel	896	6	0.052	0.16	1.40	6.40
125. selenium	896	6	<0.001	0.046	0.0042	0.0011
126. silver	896	6	0.0014	0.0010	0.0015	0.0118
127. thallium	896	6	<0.001	0.0011	0.0035	0.0020
128. zinc	896	6	<0.030	0.36	1.10	3.40

Table V-21 (Continued)

INFLUENT TO TREATMENT - PLANT E
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
Acidity	896	6	10	30	61	270
Alkalinity	896	6	160	200	110	<1
Aluminum	896	6	2.80	1.20	1.80	7.60
Ammonia Nitrogen	896	6	0.04	0.50	3.2	1.2
Barium	896	6	0.12	0.13	0.75	0.040
Boron	896	6	0.17	4.30	6.40	5.40
Calcium	896	6	0.067	0.26	0.37	0.51
Chloride	896	6	155	250	770	930
Cobalt	896	6	<0.030	<0.030	0.45	1.00
Fluoride	896	6	0.40	4.7	6.4	8.8
Iron	896	6	2.80	23.00	8.80	86.00
Magnesium	896	6	0.018	0.022	0.030	0.040
Manganese	896	6	0.11	0.28	0.91	1.20
Molybdenum	896	6	<0.030	0.70	1.70	0.64

Table V-21 (Continued)

INFLUENT TO TREATMENT - PLANT E
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
Germanium	896	6	<0.50	0.50	<0.50	<0.50
Indium	896	6	<0.50	<0.50	<0.50	<0.50
Sodium	896	6	0.12	0.18	0.18	0.16
Sulfate	896	6	46	190	320	310
Tin	896	6	<0.25	<0.25	<0.25	<0.25
Titanium	896	6	<0.25	<0.25	<0.25	<0.25
Total Dissolved Solids (TDS)	896	6	510	1,300	1,900	2,600
Total Organic Carbon (TOC)	896	6	13	8	<20	97
Total Solids (TS)	896	6	640	1,300	2,100	3,100
Vanadium	896	6	<0.030	<0.030	<0.030	<0.030
Yttrium	896	6	<0.25	<0.25	<0.25	<0.25
Conventional Pollutants						
Oil and Grease	896	1	<1	<1	<1	18

Table V-21 (Continued)

INFLUENT TO TREATMENT - PLANT E
RAW WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
Total Suspended Solids (TSS)	896	6	5	19	43	91
pH (standard units)	896		7.20	7.30	5.70	3.90

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

Table V-22

TREATED EFFLUENT - PLANT E
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Toxic Pollutants						
114. antimony	899	6	0.0013	0.0050	0.0020	0.0013
115. arsenic	899	6	0.007	0.14	0.052	0.082
117. beryllium	899	6	<0.010	<0.010	<0.010	<0.010
118. cadmium	899	6	<0.030	0.12	0.12	0.11
119. chromium	899	6	<0.030	<0.030	0.032	0.030
120. copper	899	6	<0.030	0.28	0.12	0.10
121. cyanide (total)	899	1	<0.01	<0.01	<0.01	<0.01
122. lead	899	6	0.054	0.12	0.12	0.099
123. mercury	899	6	0.0149	<0.0025	<0.0025	0.0030
124. nickel	899	6	0.052	0.99	0.93	0.87
125. selenium	899	6	<0.001	0.0421	0.032	0.025
126. silver	899	6	0.0014	0.0010	0.0013	0.0039
127. thallium	899	6	<0.001	0.0036	0.0050	0.0029
128. zinc	899	6	<0.030	0.17	0.17	0.16

Table V-22 (Continued)

TREATED EFFLUENT - PLANT E
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants						
Acidity	899	6	10	4,800	20	10
Alkalinity	899	6	160	56	62	68
Aluminum	899	6	2.80	0.50	0.80	0.60
Ammonia Nitrogen	899	6	0.04	3.1	2.9	2.5
Barium	899	6	0.12	0.080	0.040	0.040
Boron	899	6	0.17	3.80	3.70	3.50
Calcium	899	6	0.067	0.60	0.63	0.60
Chloride	899	6	155	48	950	880
Cobalt	899	6	<0.030	0.099	0.094	0.083
Fluoride	899	6	0.40	13	61	7.8
Iron	899	6	2.80	0.47	0.81	0.32
Magnesium	899	6	0.018	0.036	0.036	0.035
Manganese	899	6	0.11	5.10	1.10	1.00
Molybdenum	899	6	<0.030	1.30	0.47	<0.030

Table V-22 (Continued)

TREATED EFFLUENT - PLANT E
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l)			
			Source	Day 1	Day 2	Day 3
Nonconventional Pollutants (Continued)						
Germanium	899	6	<0.50	<0.50	<0.50	<0.50
Indium	899	6	<0.50	<0.50	<0.50	<0.50
Sodium	899	6	0.12	0.34	0.34	0.32
Sulfate	899	6	46	630	600	480
Tin	899	6	<0.25	<0.25	<0.25	<0.25
Titanium	899	6	<0.25	<0.25	<0.25	<0.25
Total Dissolved Solids (TDS)	899	6	510	3,800	3,400	3,100
Total Organic Carbon (TOC)	899	6	13	11	35	190
Total Solids (TS)	899	6	640	3,600	3,500	3,300
Vanadium	899	6	<0.030	<0.030	<0.030	1.30
Yttrium	899	6	<0.25	2.10	<0.25	<0.25
Conventional Pollutants						
Oil and Grease	899	1	<1	78	11	3

Table V-22 (Continued)

TREATED EFFLUENT - PLANT E
TREATED WASTEWATER SAMPLING DATA

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l) Source	Day 1	Day 2	Day 3
Conventional Pollutants (Continued)						
Total Suspended Solids (TSS)	899	6	5	<1	4	4
pH (standard units)	899		7.20	6.30	6.30	6.0

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

TABLE V-23

SECONDARY TIN SAMPLING DATA
RAW WASTEWATER FROM SELF SAMPLING DATA

Pollutant	Concentration (mg/l)	
Sample Number	88176	88147
Toxic Pollutants		
117. beryllium	<0.050	
118. cadmium	0.050	
119. chromium	<0.500	
120. copper	<0.500	
121. cyanide	2.000	75.000
122. lead	<0.200	
124. nickel	0.500	
128. zinc	0.480	
Nonconventional Pollutants		
aluminum	12.000	
cobalt	<0.500	
iron	1.500	
manganese	<0.050	
molybdenum	0.520	
tin	<5.000	
titanium	<2.000	
vanadium	<1.000	

Note: 88176 = Tin Mud Acid Neutralization Filtrate
88147 = De-Aluminizing Rinse

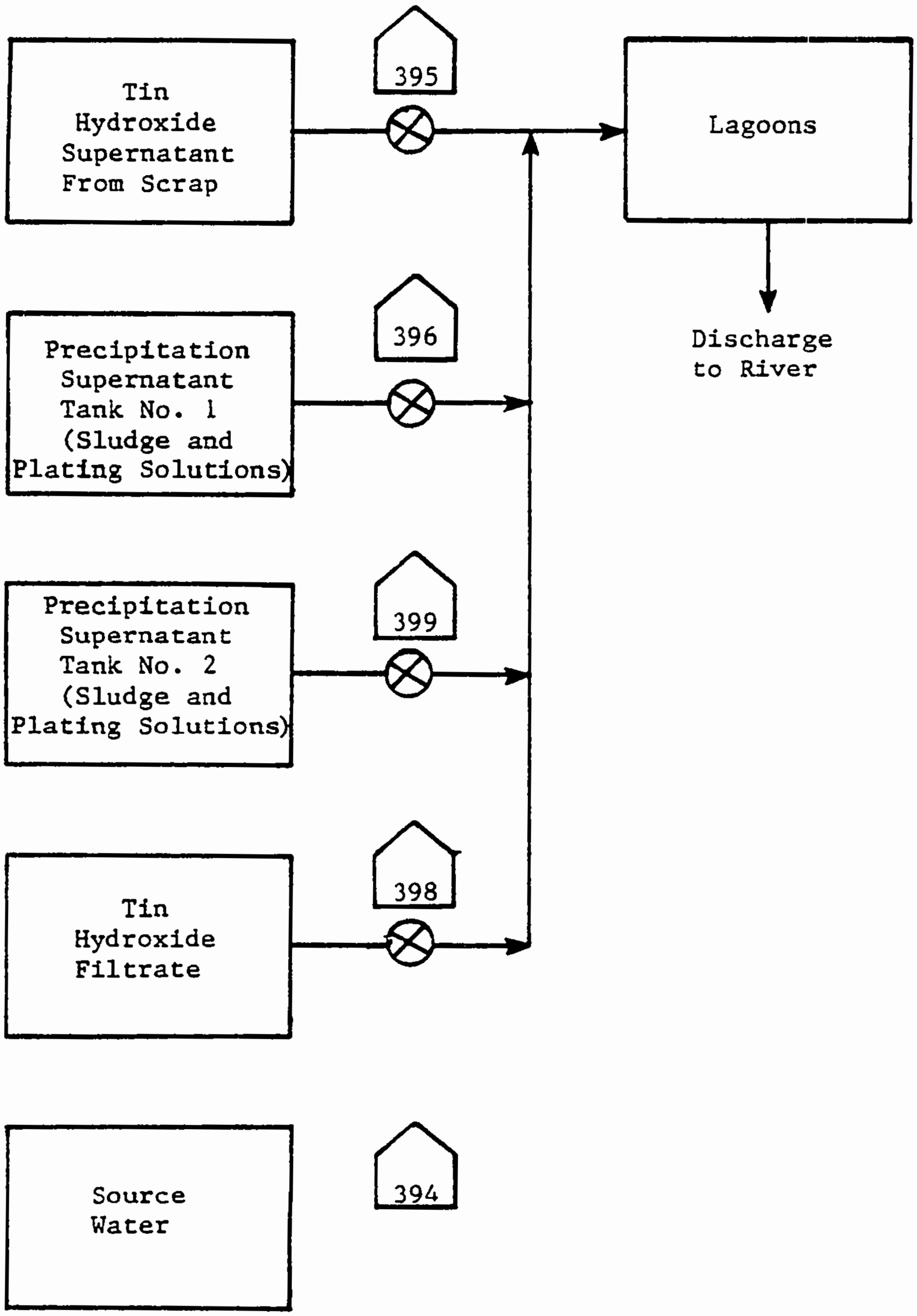

Figure V-1
SAMPLING SITES AT SECONDARY TIN PLANT A

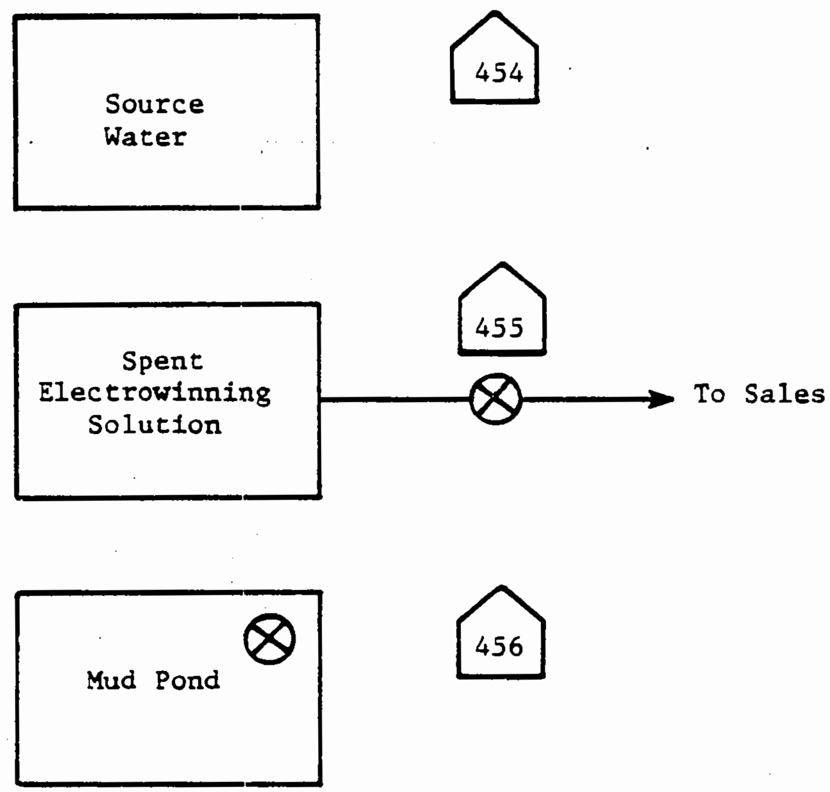

Figure V-2
SAMPLING SITES AT SECONDARY TIN PLANT B

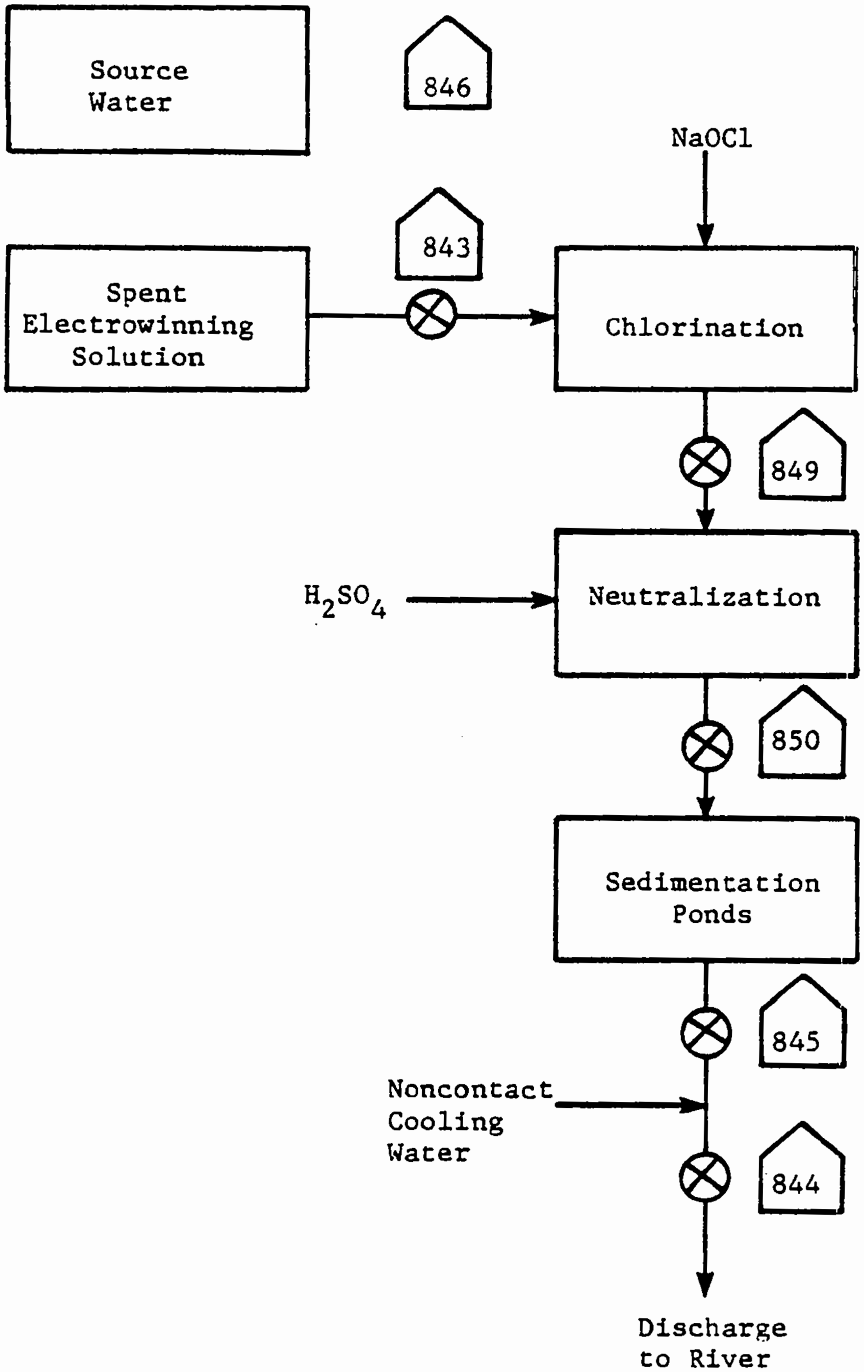

Figure V-3
SAMPLING SITES AT SECONDARY TIN PLANT C

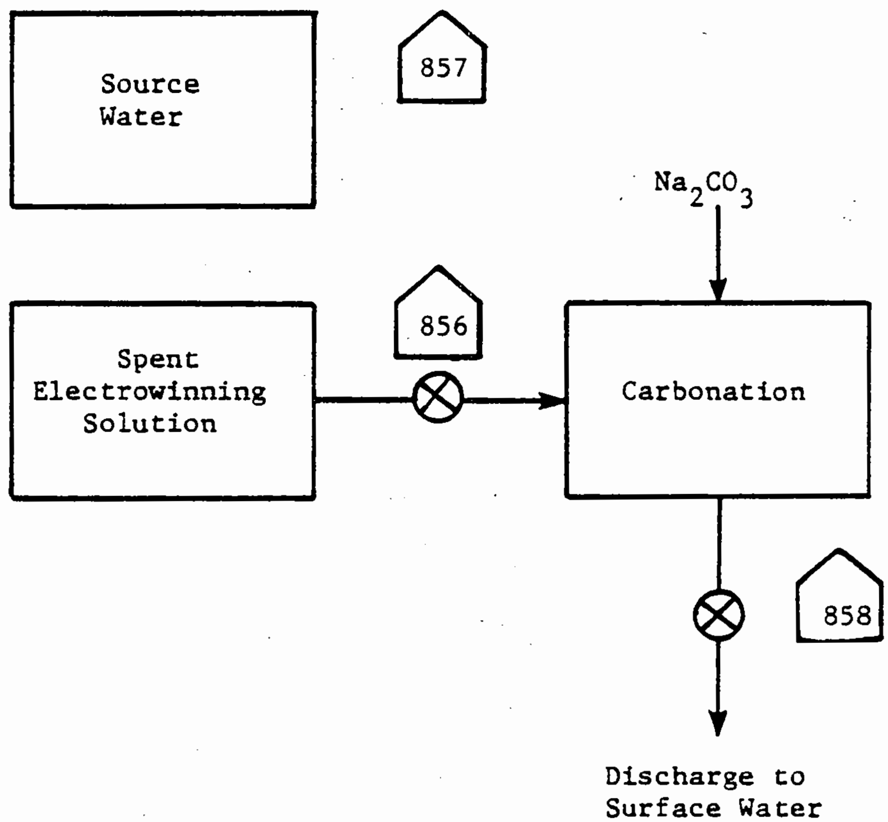

Figure V-4
SAMPLING SITES AT SECONDARY TIN PLANT D

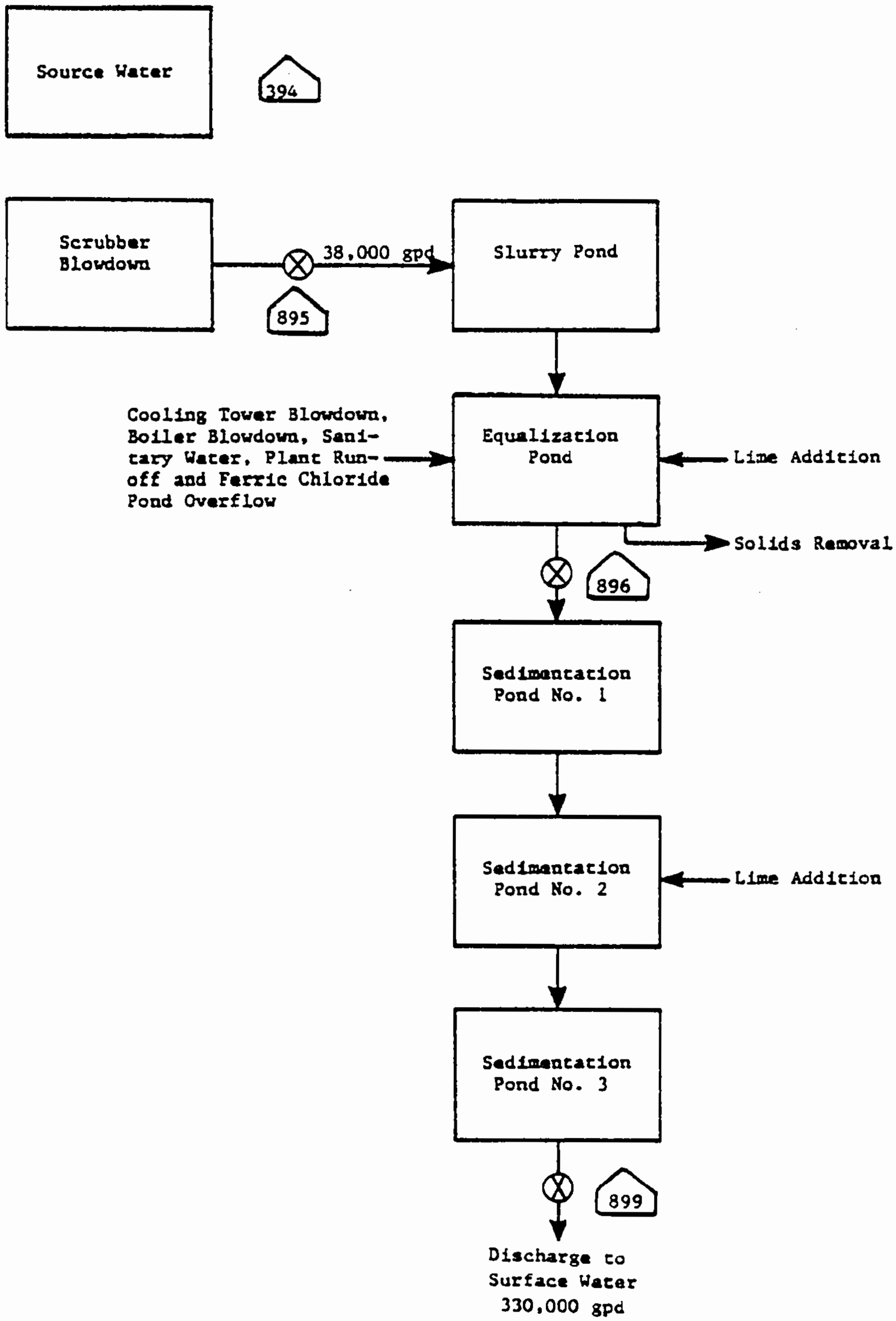

Figure V-5

SAMPLING SITES AT SECONDARY TIN PLANT E

SECTION VI

SELECTION OF POLLUTANT PARAMETERS

This section examines the chemical analysis data presented in Section V and discusses the selection or exclusion of pollutants for potential limitation. The basis for the regulation of toxic and other pollutants, along with a discussion of each pollutant selected for potential limitation is presented in Section VI of Vol. I. That discussion provides information concerning the nature 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; priority effects of the pollutant in humans and other animals; and behavior of the pollutant in POTW at the concentrations expected in industrial discharges.

The discussion that follows describes the analysis that was performed to select or exclude priority pollutants for further consideration for limitations and standards. Pollutants will be considered for limitation if they are present in concentrations treatable by the technologies considered in this analysis. The treatable concentrations used for the priority metals were the long-term performance values achievable by lime precipitation, sedimentation, and filtration. The treatable concentrations used for the priority organics are the long-term performance values achievable by carbon adsorption. Also, conventional and nonconventional pollutants and pollutant parameters are selected or excluded from limitation.

Following proposal, additional data was collected concerning raw wastewater characteristics from tin smelter scrubbing operations. This data is presented in section V of this document. Based on comments, the Agency has decided to promulgate different limitations for tin smelter scrubbing operations than for other secondary tin operations. Although secondary tin is still considered a single subcategory, the pollutants selected for tin smelter SO_2 scrubber operations are different than for other secondary tin operations. This is discussed further in Section X.

CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

As part of this study, the Agency examined samples for two conventional pollutant parameters (total suspended solids and pH) and the nonconventional pollutant parameters aluminum, barium, boron, fluoride, iron, manganese and tin. On March 18, 1985 the Agency published a notice of data availability which stated that for the tin smelter SO_2 scrubber building block, the Agency was considering regulating the nonconventional pollutants aluminum, barium, boron, iron, manganese and tin. For promulgation, the Agency has decided not to regulate aluminum, barium, boron, or manganese for the tin smelter SO_2 scrubber building block because these pollutants will be effectively controlled by the limitations developed for the regulated priority metal pollutants and the nonconventional pollutants iron and tin.

The conventional and nonconventional pollutants or pollutant parameters selected for limitation for the secondary tin subcategory are:

- fluoride
- iron
- tin
- total suspended solids (TSS)
- pH

Plants which only smelt tin concentrates and control the SO_2 off-gases with a wet scrubber will not be regulated for fluoride. All other tin facilities will be regulated for fluoride, but will not be regulated for iron.

Fluoride was detected in all 12 raw wastewater samples analyzed for this study. Five of the 12 values are equal to or greater than 12,000 mg/l. These high concentrations of fluoride are found in wastewaters associated with secondary tin production from tin plating solutions and sludges. The fluoride originates as tin fluoroborate or fluoroboric acid which are constituents of tin plating baths. For these reasons, fluoride is selected for limitation in this subcategory.

Iron was analyzed for in four raw wastewater samples. The observed concentrations were 140 mg/l, 190 mg/l, 250 mg/l, and 250 mg/l. All 4 concentrations are greater than the concentration considered achievable with lime, settle and filter treatment (0.28 mg/l). In addition, an iron compound is used as a raw material in the tin smelting operation. For these reasons, iron is selected for limitation in this subcategory.

Tin was analyzed for in all 14 raw waste samples, and was found in concentrations ranging from 0.89 mg/l to 8800 mg/l. All 14 values are greater than the 0.14 mg/l concentration considered achievable by lime, settle and filter technology. Also, tin is expected to be present in the wastewaters from this subcategory because of its prevalence in the process and its solubility. For these reasons, tin is selected for limitation in this subcategory.

TSS concentrations ranging from 25 to 50,000 mg/l were observed in the 14 raw waste samples analyzed for this study. All 14 concentrations are well above the 2.6 mg/l treatable concentration. Furthermore, most of the specific methods used to remove priority metals do so by converting these metals to precipitates, and these priority-metal-containing precipitates should not be discharged. Meeting a limitation on total suspended solids helps ensure that removal of these precipitated priority metals has been effective. For these reasons, total suspended solids is selected for limitation in this subcategory.

The 12 pH values observed during this study ranged from 6.2 to 13.3. Six of the 12 values were outside the 7.5 to 10.0 range considered desirable for discharge to receiving waters. Many deleterious effects are caused by extreme pH values or rapid changes in pH. Also, effective removal of priority metals by precipitation requires careful control of pH. Since pH control within the desirable limits is readily attainable by available treatment, pH is selected for limitation in this subcategory.

TOXIC PRIORITY POLLUTANTS - SECONDARY TIN SUBCATEGORY

The frequency of occurrence of the priority pollutants in the raw wastewater samples is presented in Table VI-1 (page 4233). Table VI-1 is based on the raw wastewater data from streams 895, 455, 456, 395, 396, 398, 399, 843, and 856 (see Section V). These data provide the basis for the categorization of specific pollutants, as discussed below. Treatment plant samples were not considered in the frequency count.

TOXIC POLLUTANTS NEVER DETECTED

The toxic pollutants listed in Table VI-2 (page 4223) were not detected in any raw wastewater samples in this subcategory; therefore, they are not selected for consideration in establishing limitations.

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

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

9. hexachlorobenzene
11. 1,1,1-trichloroethane
23. chloroform
29. 1,1-dichloroethylene
34. 2,4-dimethylphenol
37. 1,2-diphenylhydrazine
39. fluoranthene
55. naphthalene
62. n-nitrosodimethylamine
68. di-n-butyl phthalate
78. anthracene
80. fluorene
81. phenanthrene
87. trichloroethylene

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 raw wastewater samples operations in this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

117. beryllium
123. mercury

Beryllium was detected above its analytical quantification level (0.1 mg/l) in four out of 14 raw wastewater samples. The observed concentrations ranged from 0.02 mg/l to 0.20 mg/l. Three of these values are below the treatable concentration for beryllium (0.20 mg/l). One is right at the treatability concentration and would therefore not be reduced by available treatment technology. Beryllium is therefore not selected for limitation.

Mercury was detected in six out of 14 raw wastewater samples. The six observed concentrations range from 0.0004 mg/l to 0.026 mg/l, all below the concentration considered achievable by identified treatment technology (.036 mg/l). Mercury is therefore not selected for limitation.

TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

The following pollutants were not selected for limitation on the basis that they are detectable in the effluent from only a small number of sources within the subcategory and they are uniquely related to only those sources.

4. benzene
38. ethylbenzene
44. methylene chloride
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
65. phenol
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate
84. pyrene
86. toluene
88. vinyl chloride

Although these pollutants were not selected for limitation in establishing nationwide regulations, it may be appropriate, on a case-by-case basis, for the local permit issuing authority to specify effluent limitations for one or more of these pollutants.

Benzene was detected above its treatable level of 0.01 mg/l in two out of 10 raw wastewater samples. The observed treatable concentrations are .051 and .047 mg/l, just slightly higher than the treatability concentration. Because these values are only slightly higher than could be achieved by treatment and only two in 10 samples showed benzene at a treatable concentration, benzene is not selected for further consideration for limitation.

Ethylbenzene was detected above its treatable concentration of 0.01 mg/l in only one out of ten raw wastewater samples. The observed treatable concentration is 0.011 mg/l. Because it was found at a treatable concentration in only one out of ten samples and because the observed value is only slightly above the treatable concentration, ethylbenzene is not selected for further consideration for limitation.

Methylene chloride was found above its treatable concentration of 0.01 mg/l in three out of 10 raw wastewater samples. Methylene chloride is a common laboratory reagent often detected in blank and raw water samples. The treatable concentrations observed (0.031, 0.025 and 1.724 mg/l) are probably due to laboratory contamination. Methylene chloride is therefore not selected for further consideration for limitation.

2-Nitrophenol was detected above the concentration considered achievable by identified treatment technology (.01 mg/l) in three out of 12 raw wastewater samples. The treatable concentrations observed were .031 mg/l, .06 mg/l and .02 mg/l. The Agency has no reason to believe that treatable concentrations of 2-nitrophenol should be present in secondary tin wastewaters. For this reason, and because it was detected in such a small number of samples, 2-nitrophenol is not selected for further consideration for limitation.

4-Nitrophenol was detected above its treatable concentration of 0.01 mg/l in two out of 12 raw wastewater samples. The observed treatable concentrations are 0.026 and 0.025 mg/l. Because it was found at a treatable concentration in only two out of 12 samples and because the Agency has no reason to believe that treatable concentrations of 4-nitrophenol should be present in secondary tin wastewaters, 4-nitrophenol is not selected for further consideration for regulation.

2,4-Dinitrophenol was detected above its treatable concentration of 0.01 mg/l in two out of 12 raw wastewater samples. The treatable concentrations observed are .033 mg/l and .086 mg/l. Because very little removal could be expected with treatment and because it was detected at treatable concentrations in only two out of 12 samples, 2,4-dinitrophenol is not selected for further consideration for limitation.

Phenol was detected above the concentration considered achievable by available treatment technology (.01 mg/l) in three out of 12 raw wastewater samples. The observed treatable concentrations are 0.017, 0.02 and 0.13 mg/l. Because it was detected in only three of 12 samples, and because the Agency has no reason to believe that treatable concentrations of phenol should be present in secondary tin wastewaters, phenol is not selected for further consideration for limitation.

Bis(2-ethylhexyl) phthalate was detected above its treatability concentration of .01 mg/l in only one out of 12 raw wastewater samples. The observed treatable concentration is 0.268 mg/l. This compound is a plasticizer commonly used in laboratory and field sampling equipment, and is not used or formed as a by-product in this subcategory. For this reason and because it was detected at a treatable concentration in only one out of 12 raw wastewater samples, bis(2-ethylhexyl) phthalate is not selected for further consideration for limitation.

Butyl benzyl phthalate was detected above the concentration considered achievable by available treatment technology (.01 mg/l) in three out of 12 raw wastewater samples. The observed concentrations are .011 mg/l, .012 mg/l, and .025 mg/l. This compound is a plasticizer commonly used in laboratory and field equipment, and is not used or formed as a by-product in this subcategory. For this reason, and because it was detected in only three out of 12 samples, butyl benzyl phthalate is not selected for further consideration for limitation.

Pyrene was detected above its treatability concentration of .01 mg/l in only one out of 12 raw wastewater samples. The observed treatable concentration is .063 mg/l. The Agency has no reason to believe that treatable concentration of pyrene should be present in secondary tin wastewaters. For this reason, and because it was detected at a treatable concentration in only one out of 12 samples, pyrene is not selected for further consideration for limitation.

Toluene was detected above its treatable concentration of 0.01 mg/l in two out of ten raw wastewater samples. The observed treatable concentrations are 0.018 and 0.017 mg/l. Because toluene was detected in only two out of ten raw wastewater samples at concentrations only slightly above treatabilty and because it was detected in the source water sample at 0.093 mg/l, toluene is not selected for further consideration for regulation.

Vinyl chloride was detected above the concentration considered achievable by identified treatment technology (.01 mg/l) in only one out of 10 raw wastewater samples. The treatable concentration observed is .036 mg/l. Because it was detected in only one out of 10 samples, vinyl chloride is not selected for further consideration for limitation.

PRIORITY POLLUTANTS SELECTED FOR FURTHER CONSIDERATION IN ESTABLISHING LIMITATIONS AND STANDARDS

The toxic pollutants listed below are selected for further consideration in establishing limitations and standards in this subcategory. The priority pollutants selected for further consideration for limitation are each discussed following the list.

114. antimony
115. arsenic
118. cadmium
119. chromium
120. copper
121. cyanide
122. lead
124. nickel
125. selenium
126. silver
127. thallium
128. zinc

Antimony was detected above the concentration considered achievable by identified treatment technology (0.47 mg/l) in eight out of 13 raw wastewater samples. The treatable concentrations observed range from 0.9 mg/l to 12.0 mg/l. Antimony is therefore selected for further consideration for limitation.

Arsenic was detected above the concentration considered achievable by identified treatment technology (0.34 mg/l) in eight out of 14 raw wastewater samples. The treatable concentrations observed range from 1.9 mg/l to 6.6 mg/l. Arsenic is therefore selected for further consideration for limitation.

Cadmium was detected above the concentration considered achievable by identified treatment technology (0.049 mg/l) in 13 out of 14 raw wastewater samples. The treatable concentrations observed range from 0.08 mg/l to 0.42 mg/l. Cadmium is therefore selected for further consideration for limitation.

Chromium was detected above the concentration considered achievable by identified treatment technology (0.07 mg/l) in seven out of 14 raw wastewater samples. The treatable concentrations observed range from 0.084 mg/l to 0.99 mg/l. Chromium is therefore selected for further consideration for limitation.

Copper was detected above the concentration considered achievable by identified treatment technology (0.39 mg/l) in four out of 14 raw wastewater samples. The treatable concentrations observed range from 0.41 mg/l to 0.60 mg/l. Copper is therefore selected for further consideration for limitation.

Cyanide was detected above the concentration considered achievable by identified treatment technology (0.047 mg/l) in nine out of 13 raw wastewater samples analyzed for this study. The treatable concentrations observed range from 0.22 mg/l to 24 mg/l. Cyanide is therefore selected for further consideration for limitation.

Lead was detected above the concentration considered achievable by identified treatment technology (0.08 mg/l) in ten out of 14 raw wastewater samples. The treatable concentrations observed range from 1.0 mg/l to 11 mg/l. Lead is therefore selected for further consideration for limitation.

Nickel was detected above the concentration considered achievable by identified treatment technology (0.22 mg/l) in nine out of 14 raw wastewater samples. The treatable concentrations observed range from 0.35 mg/l to 4.1 mg/l. Nickel is therefore selected for further consideration for limitation.

Selenium was detected above the concentration considered achievable by identified treatment technology (0.07 mg/l) in seven out of 14 raw wastewater samples. The treatable concentrations observed range from 0.33 mg/l to 32 mg/l. Selenium is therefore selected for further consideration for limitation. Selenium was detected at 3.1 mg/l in the source water sample associated with the wastewater sample in which selenium was observed at 32 mg/l.

Silver was detected above the concentration considered achievable by identified treatment technology (0.07 mg/l) in four out of 14 raw wastewater samples. The treatable concentrations observed range from 0.30 mg/l to 0.40 mg/l. Silver is therefore selected for further consideration for limitation.

Thallium was detected above the concentration considered achievable by identified treatment technology (0.34 mg/l) in five out of 14 raw wastewater samples. The treatable concentrations observed range from 0.59 mg/l t0 3.1 mg/l. Thallium is therefore selected for further consideration for limitation.

Zinc was detected above the concentration considered achievable by identified treatment technology (0.23 mg/l) in eight out of 14 raw wastewater samples. The treatable concentrations observed range from 0.24 mg/l to 190 mg/l. Zinc is therefore selected for further consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
SECONDARY TIN SUBCATEGORY
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	9	12	12			
2.	acrolein	0.010	0.01	8	10	10			
3.	acrylonitrile	0.010	0.01	8	10	10			
4.	benzene	0.010	0.01	8	10	6	2		2
5.	benzidine	0.010	0.01	9	12	12			
6.	carbon tetrachloride	0.010	0.01	8	10	10			
7.	chlorobenzene	0.010	0.01	8	10	10			
8.	1,2,4-trichlorobenzene	0.010	0.01	9	12	12			
9.	hexachlorobenzene	0.010	0.01	9	12	10	2		
10.	1,2-dichloroethane	0.010	0.01	8	10	10			
11.	1,1,1-trichloroethane	0.010	0.01	8	10	8	2		
12.	hexachloroethane	0.010	0.01	9	12	12			
13.	1,1-dichloroethane	0.010	0.01	8	10	10			
14.	1,1,2-trichloroethane	0.010	0.01	8	10	10			
15.	1,1,2,2-tetrachloroethane	0.010	0.01	8	10	10			
16.	chloroethane	0.010	0.01	8	10	10			
17.	bis(chloromethyl) ether	0.010	0.01	8	10	10			
18.	bis(2-chloroethyl) ether	0.010	0.01	9	12	12			
19.	2-chloroethyl vinyl ether	0.010	0.01	8	10	10			
20.	2-chloronaphthalene	0.010	0.01	9	12	12			
21.	2,4,6-trichlorophenol	0.010	0.01	9	12	12			
22.	parachlorometa cresol	0.010	0.01	9	12	12			
23.	chloroform	0.010	0.01	8	10	8	2		
24.	2-chlorophenol	0.010	0.01	9	12	12			
25.	1,2-dichlorobenzene	0.010	0.01	9	12	12			
26.	1,3-dichlorobenzene	0.010	0.01	9	12	12			
27.	1,4-dichlorobenzene	0.010	0.01	9	12	12			
28.	3,3'-dichlorobenzidine	0.010	0.01	9	12	12			
29.	1,1-dichloroethylene	0.010	0.01	8	10	9	1		
30.	1,2-trans-dichloroethylene	0.010	0.01	8	10	10			
31.	2,4-dichlorophenol	0.010	0.01	9	12	12			
32.	1,2-dichloropropane	0.010	0.01	8	10	10			
33.	1,3-dichloropropylene	0.010	0.01	8	10	10			
34.	2,4-dimethylphenol	0.010	0.01	9	12	10	2		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS
SECONDARY TIN SUBCATEGORY
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	9	11	11			
36. 2,6-dinitrotoluene	0.010	0.01	9	11	11			
37. 1,2-diphenylhydrazine	0.010	0.01	9	12	10	2		
38. ethylbenzene	0.010	0.01	8	10	9			1
39. fluoranthene	0.010	0.01	9	12	11	1		
40. 4-chlorophenyl phenyl ether	0.010	0.01	9	12	12			
41. 4-bromophenyl phenyl ether	0.010	0.01	9	12	12			
42. bis(2-chloroisopropyl) ether	0.010	0.01	9	12	12			
43. bis(2-chloroethoxy) methane	0.010	0.01	9	12	12			
44. methylene chloride	0.010	0.01	8	10	4	3		3
45. methyl chloride	0.010	0.01	8	10	10			
46. methyl bromide	0.010	0.01	8	10	10			
47. bromoform	0.010	0.01	8	10	10			
48. dichlorobromomethane	0.010	0.01	8	10	10			
49. trichlorofluoromethane	0.010	0.01	8	10	10			
50. dichlorodifluoromethane	0.010	0.01	8	10	10			
51. chlorodibromomethane	0.010	0.01	8	10	10			
52. hexachlorobutadiene	0.010	0.01	9	12	12			
53. hexachlorocyclopentadiene	0.010	0.01	9	12	12			
54. isophorone	0.010	0.01	9	12	12			
55. naphthalene	0.010	0.01	9	12	8	4		
56. nitrobenzene	0.010	0.01	9	12	12			
57. 2-nitrophenol	0.010	0.01	9	12	7	1	1	3
58. 4-nitrophenol	0.010	0.01	9	12	9	1		2
59. 2,4-dinitrophenol	0.010	0.01	9	12	10			2
60. 4,6-dinitro-o-cresol	0.010	0.01	9	12	12			
61. N-nitrosodimethylamine	0.010	0.01	9	12	12			
62. N-nitrosodiphenylamine	0.010	0.01	9	12	9	3		
63. N-nitrosodi-n-propylamine	0.010	0.01	9	12	12			
64. pentachlorophenol	0.010	0.01	9	12	12			
65. phenol	0.010	0.01	9	12	6	3		3
66. bis(2-ethylhexyl) phthalate	0.010	0.01	9	12	5	6		1
67. butyl benzyl phthalate	0.010	0.01	9	12	7	2		3
68. di-n-butyl phthalate	0.010	0.01	9	12	7	5		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS SECONDARY TIN SUBCATEGORY 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
69.	di-n-octyl phthalate	0.010	0.01	9	12	12			
70.	diethyl phthalate	0.010	0.01	9	12	12			
71.	dimethyl phthalate	0.010	0.01	9	12	12			
72.	benzo(a)anthracene	0.010	0.01	9	12	12			
73.	benzo(a)pyrene	0.010	0.01	9	12	12			
74.	3,4-benzofluoranthene	0.010	0.01	9	12	12			
75.	benzo(k)fluoranthene	0.010	0.01	9	12	12			
76.	chrysene	0.010	0.01	9	12	12			
77.	acenaphthylene	0.010	0.01	9	12	12			
78.	anthracene (c)	0.010	0.01	9	12	11	1		
79.	benzo(ghi)perylene	0.010	0.01	9	12	12			
80.	fluorene	0.010	0.01	9	12	11	1		
81.	phenanthrene (c)	0.010	0.01	9	12	11	1		
82.	dibenzo(a,h)anthracene	0.010	0.01	9	12	12			
83.	indeno(1,2,3-c,d)pyrene	0.010	0.01	9	12	12			
84.	pyrene	0.010	0.01	9	12	10	1		1
85.	tetrachloroethylene	0.010	0.01	8	10	10			
86.	toluene	0.010	0.01	8	10	6	2		2
87.	trichloroethylene	0.010	0.01	8	10	8	2		
88.	vinyl chloride	0.010	0.01	8	10	9			1
89.	aldrin	0.005	0.01	8	10	10			
90.	dieldrin	0.005	0.01	8	10	10			
91.	chlordane	0.005	0.01	8	10	10			
92.	4,4'-DDT	0.005	0.01	8	10	10			
93.	4,4'-DDE	0.005	0.01	8	10	10			
94.	4,4'-DDD	0.005	0.01	8	10	10			
95.	alpha-endosulfan	0.005	0.01	8	10	10			
96.	beta-endosulfan	0.005	0.01	8	10	10			
97.	endosulfan sulfate	0.005	0.01	8	10	10			
98.	endrin	0.005	0.01	8	10	10			
99.	endrin aldehyde	0.005	0.01	8	10	10			
100.	heptachlor	0.005	0.01	8	10	10			
101.	heptachlor epoxide	0.005	0.01	8	10	10			
102.	alpha-BHC	0.005	0.01	8	10	10			
103.	beta-BHC	0.005	0.01	8	10	10			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF PRIORITY POLLUTANTS SECONDARY TIN SUBCATEGORY 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
104. gamma-BHC		0.005	0.01	8	10	10			
105. delta-BHC		0.005	0.01	8	10	10			
106. PCB-1242	(d)	0.005	0.01	8	10	10			
107. PCB-1254	(d)	0.005	0.01	8	10	10			
108. PCB-1221	(d)	0.005	0.01	8	10	10			
109. PCB-1232	(e)	0.005	0.01	8	10	10			
110. PCB-1248	(e)	0.005	0.01	8	10	10			
111. PCB-1260	(e)	0.005	0.01	8	10	10			
112. PCB-1016	(e)	0.005	0.01	8	10	10			
113. toxaphene		0.005	0.01	8	10	10			
114. antimony		0.100	0.47	9	13		5		8
115. arsenic		0.010	0.34	9	14		6		8
116. asbestos		10 MFL	10 MFL						
117. beryllium		0.010	0.20	9	14		10	4	
118. cadmium		0.002	0.049	9	14		1		13
119. chromium		0.005	0.07	9	14		1	6	7
120. copper		0.009	0.39	9	14			10	4
121. cyanide	(f)	0.02	0.047	9	13		4		9
122. lead		0.020	0.08	9	14			4	10
123. mercury		0.0001	0.036	9	14		8	6	
124. nickel		0.005	0.22	9	14		1	4	9
125. selenium		0.01	0.20	9	14		3	4	7
126. silver		0.02	0.07	9	14		9	1	4
127. thallium		0.100	0.34	9	14		6	3	5
128. zinc		0.050	0.23	9	14		1	5	8
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)					0				

(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.

TABLE VI-2

TOXIC POLLUTANTS NEVER DETECTED

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidene
6. carbon tetrachloride (tetrachloromethane)
7. chlorobenzene
8. 1,2,4-trichlorobenzene
10. 1,2-dichloroethane
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
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. parachlorometa cresol
24. 2-chlorophenol
25. 1,2-cichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene (1,3-dichloropropene)
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-chloroethoxy) methane
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
47. bromoform (tribromomethane)
48. dichlorobromomethane
49. trichlorofluoromethane (deleted)
50. dichlorodifluoromethane (deleted)
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
56. nitrobenzene

TABLE VI-2 (Continued)

TOXIC POLLUTANTS NEVER DETECTED

60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo(a)anthracene (1,2-benzanthracene)
73. benzo(a)pyrene (3,4-benzopyrene)
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene (11,12-benzofluoranthene)
76. chrysene
77. acenaphthylene
79. benzo(ghi)perylene (1,11-benzoperylene)
82. dibenzo(a,h)anthracene (1,2,5,6-dibenzanthracene)
83. indeno(1,2,3-cd)pyrene (w,e,-o-phenylenepyrene)
85. tetrachloroethylene
89. aldrin
90. dieldrin
91. chlordane (technical mixture and metabolites)
92. 4,4'-DDT
93. 4,4'-DDE(p,p'DDX)
94. 4,4'-DDD(p,p'TDE)
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. Gamma - BHC (lindane)
105. Delta - BHC
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)
113. toxaphene
116. asbestos
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

SECTION VII

CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters generated in the secondary tin subcategory. This section summarizes the description of these wastewaters and indicates the level of treatment which is currently practiced for each waste stream. This section also presents the control and treatment technology options which were examined by the Agency for possible application to the secondary tin subcategory.

CURRENT CONTROL AND TREATMENT PRACTICES

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 secondary tin subcategory is characterized by the presence of the priority metal pollutants, cyanide, iron, fluoride, tin and suspended solids. This analysis is supported by the raw (untreated) wastewater data presented for specific sources as well as combined waste streams in Section V. Generally, these pollutants are present in each of the waste streams at concentrations above treatability, and these waste streams are commonly combined for treatment. Construction of one wastewater treatment system for combined treatment allows plants to take advantage of economies of scale, and, in some instances, to combine streams of differing alkalinity to reduce treatment chemical requirements. Three plants in this subcategory currently have combined wastewater treatment systems. One has cyanide oxidation with chlorine, followed by acid neutralization and sedimentation. One has lime precipitation and sedimentation and one has sedimentation lagoons only. Two options have been selected for consideration for BPT, BAT, NSPS, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

TIN SMELTER SO_2 SCRUBBER

The one plant which practices tin smelting from concentrates and residues uses an alkaline scrubber to control SO_2 emissions from the smelting operations. The facility practices greater than 90 percent recycle of the scrubber liquor. The scrubber liquor contains treatable concentrations of priority metals and suspended solids. This stream is directly discharged after treatment consisting of lime addition and sedimentation.

DEALUMINIZING RINSE

The facility which reported the use of municipal solid waste as a raw material uses an alkaline leaching and rinsing process to remove aluminum from the scrap prior to detinning operations. The spent leachate and rinse water have a very alkaline pH and contain treatable concentrations of cyanide and priority metals. The one facility reporting this stream discharges it directly after treatment consisting of sulfide addition to precipitate aluminum, cyanide oxidation with sodium hypochlorite, acid neutralization, vacuum filtration and sedimentation.

TIN MUD ACID NEUTRALIZATION FILTRATE

Tin mud may be neutralized with sulfuric acid and dewatered in a filter press prior to sales to a tin smelter. The filtrate contains treatable concentrations of priority metals and cyanide. The one facility reporting this waste stream is an indirect discharger with no treatment in place.

TIN HYDROXIDE WASH

The one facility which reported the use of tin hydroxide, $Sn(OH)_4$, as a raw material, washes the tin hydroxide with water prior to dissolving it in a caustic solution. This solution is then mixed with the sodium stannate solution from alkaline detinning and tin is recovered from the combined stream by electrowinning. The spent wash water contains treatable concentrations of priority metals and suspended solids. The one facility reporting this waste stream achieves zero discharge through the use of evaporation ponds.

SPENT ELECTROWINNING SOLUTION FROM NEW SCRAP

New tin plated steel scrap is used as a raw material at 10 out of 12 secondary tin plants. After alkaline detinning, the tin is recovered by electrowinning and either all or a portion of the spent solution is discharged as a waste stream. The spent solution has a very alkaline pH and contains treatable concentrations of cyanide, priority metals, and suspended solids. Of the eight plants which practice electrowinning, six achieve zero discharge by contractor disposal, sales or evaporation ponds. Of the two plants which discharge this stream, one is an indirect discharger with no treatment in place and the other is a direct discharger with treatment consisting of cyanide oxidation with chlorine, acid addition, vacuum filtration and sedimentation.

SPENT ELECTROWINNING SOLUTION FROM MUNICIPAL SOLID WASTE

The one facility which reported the use of municipal solid waste as a raw material to alkaline detinning and electrowinning discharges a spent electrowinning solution waste stream. This stream has a very alkaline pH and contains treatable concentrations of cyanide, priority metals, and suspended solids. This stream is discharged directly after treatment consisting of cyanide oxidation with chlorine, acid addition, vacuum filtration and sedimentation.

TIN HYDROXIDE SUPERNATANT FROM SCRAP

Tin hydroxide may be precipitated from alkaline detinning solution as an alternative to electrowinning for tin recovery. Sulfuric acid and sodium carbonate are added to the sodium stannate solution and the tin hydroxide forms an insoluble precipitate which is separated from the liquid phase by sedimentation. The supernatant waste stream contains treatable concentrations of cyanide and priority metals. The one plant reporting this waste stream is a direct discharger after treatment in sedimentation lagoons.

TIN HYDROXIDE SUPERNATANT FROM PLATING SOLUTIONS AND SLUDGES

Tin hydroxide may be precipitated from spent plating solutions and sludges generated from tin plated steel manufacturing operations. Sulfuric acid and sodium carbonate are added to the solution and an insoluble precipitate of tin hydroxide is formed. The precipitate is separated from the liquid phase by sedimentation. The supernatant stream contains treatable concentrations of cyanide and priority metals as well as high concentrations of fluoride. The one plant reporting this waste stream is a direct discharger after treatment in sedimentation lagoons.

TIN HYDROXIDE FILTRATE

Tin hydroxide slurry which has been separated from the supernatant stream may be further dewatered in a filter press prior to drying. The resultant filtrate waste stream contains treatable concentrations of antimony, cyanide, fluoride, and suspended solids. The one facility reporting this waste stream is a direct discharger after treatment in sedimentation lagoons.

CONTROL AND TREATMENT OPTIONS

The Agency examined two control and treatment technology alternatives that are applicable to the secondary tin subcategory. The options selected for evaluation represent a combination of flow reduction, pretreatment technology applicable to individual waste streams, and end-of-pipe treatment technologies.

OPTION A

Option A for the secondary tin subcategory requires treatment technologies to reduce pollutant mass. The Option A treatment scheme consists of cyanide precipitation preliminary treatment applied to the combined stream of dealuminizing rinse, spent electrowinning solution from new scrap and municipal solid waste, tin hydroxide supernatant from scrap, tin hydroxide supernatant from plating solutions and sludges, tin hydroxide filtrate, and tin mud acid neutralization filtrate. Preliminary treatment is followed by chemical precipitation and sedimentation applied to the combined stream of cyanide precipitation effluent, tin smelter SO_2 scrubber and tin hydroxide wash. Chemical precipitation is used to remove metals and fluoride by the addition of lime or sulfuric acid followed by gravity sedimentation. Suspended solids are also removed by the process. It is necessary to use lime as the precipitation chemical in order to achieve effective tin removal.

OPTION C

Option C for the secondary tin subcategory consists of all control and treatment requirements of Option A (cyanide precipitation, chemical precipitation, and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme. Multimedia filtration is used to remove suspended solids, including precipitates of metals and fluoride, beyond the concentration attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other forms of filters such as rapid sand filters or pressure filters would perform as well. The addition of filters also provides consistent removal during periods in which there are rapid increases in flows or loadings of pollutants to the treatment system.

SECTION VIII

COST OF WASTEWATER TREATMENT AND CONTROL

This section presents a summary of compliance costs for the secondary tin subcategory and a description of the treatment options and subcategory-specific assumptions used to develop these estimates. Together with the estimated pollutant removals presented in Sections IX, X, XI, and XII of this supplement, these cost estimates provide a basis for evaluating each regulatory option. These cost estimates are also used in determining the probable economic impact of regulation on the subcategory at different pollutant discharge levels. In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution, solid wastes, and energy requirements, which are specific to the secondary tin subcategory.

TREATMENT OPTIONS FOR EXISTING SOURCES

As discussed in Section VII, two treatment options have been developed for existing secondary tin sources. The treatment schemes for each option are summarized below and schematically presented in Figures X-1 and X-2 (pages 4279 - 4280).

OPTION A

Option A consists of preliminary treatment consisting of cyanide precipitation where required and chemical precipitation and sedimentation end-of-pipe technology.

OPTION C

Option C consists of Option A preliminary treatment consisting of cyanide precipitation where required and chemical precipitation and sedimentation with the addition of multimedia filtration.

COST METHODOLOGY

A detailed discussion of the methodology used to develop the compliance costs is presented in Section VIII of Vol. I. Plant-by-plant compliance costs for the nonferrous metals manufacturing category have been revised as necessary following proposal. These revisions calculate incremental costs, above treatment already in place, necessary to comply with the promulgated effluent limitations and standards and are presented in the administrative record supporting this regulation. A comparison of the costs developed for proposal and the revised costs for the final rulemaking for the secondary tin subcategory are presented in Tables VIII-1 and VIII-2 (page 4237).

Each of the general assumptions used to develop compliance costs is presented in Section VIII of Vol. I. Each subcategory also contains a unique set of waste streams requiring certain subcategory-specific assumptions to develop compliance costs. The four major assumptions specific to the secondary tin subcategory are discussed briefly below.

(1) The generation of calcium fluoride (CaF_2) during chemical precipitation was considered in cases where significant amounts of fluoride were present. If the sludge resulting from chemical precipitation was mostly composed of CaF_2 (> 50 percent), it was assumed to be suitable for resale for use as a fluxing agent. Thus, annual costs for contract hauling of these sludges were not included in these instances.

(2) All sludges produced from wastewater treatment are considered to be nonhazardous except for those resulting from cyanide precipitation, which contain cyanide. Such cyanide bearing sludges were costed as being disposed separately based on hazardous waste contract hauling costs.

(3) The sampling values for TSS and aluminum concentration in spent electrowinning solutions were revised. It was assumed that the values reported were in error by a factor of 1000 based on conversations with personnel at one of the two sampled plants and evaluation of the reported data. The concentrations were revised as follows:

	Old	New
TSS	36,500 mg/l	36.5 mg/l
Al	28,700 mg/l	28.7 mg/l

(4) Cost estimates for cyanide precipitation for plants 1046 and 1047 do not include costs for a reaction tank and agitator. This was done because in each case the low total flow rates into the treatment system resulted in retention (or holdup) times in the chemical precipitation tank large enough to allow both cyanide precipitation and chemical precipitation to occur without significantly increasing the tank size. For example, the retention time in the chemical precipitation tank for Plant 1047 was four days or 96 hours. Since the required batch duration for cyanide precipitation was 8.5 hr. and 16 hr. for chemical precipitation, both processes could be accomplished within the time available. The above procedure resulted in a significant reduction in capital investment.

NONWATER QUALITY ASPECTS

Nonwater quality impacts specific to the secondary tin subcategory, including energy requirements, solid waste and air pollution are discussed below.

ENERGY REQUIREMENTS

Energy requirements for Option A are estimated at 576,000 kwh/yr. Option C, which includes filtration, is estimated to increase energy consumption over Option A by approximately one percent. Further, the total energy requirement for Option C is approximately one percent of the estimated total plant energy usage. It is therefore concluded that the energy requirements of the treatment options considered will have no significant impact on total plant energy consumption.

SOLID WASTE

Sludge generated in the secondary tin subcategory is due to the precipitation of metals as hydroxides and carbonates using lime. Sludges associated with the secondary tin subcategory will necessary contain quantities of priority metal pollutants. Sludges from primary operations are not subject to regulation as hazardous wastes since wastes generated by primary smelters and refiners are currently exempt from regulation by Act of Congress (Resource Conservation and Recovery Act (RCRA), Section 3001(b)), as interpreted by EPA. Wastes from secondary metal operations can be regulated as hazardous. However, the Agency examined the solid wastes that would be generated at secondary nonferrous metals manufacturing plants by the suggested treatment technologies and believes they are not hazardous wastes under the Agency's regulations implementing Section 3001 of RCRA, with one exception. This judgment is based on the results of Extraction Procedure (EP) toxicity tests performed on similar sludges (i.e. toxic-metal-bearing lime sludges) generated by other industries such as the iron and steel industry. A small amount (5-10%) excess lime was added during treatment, and the sludges subsequently generated passed the toxicity test. See CFR 8261.24. Thus, the Agency believes that the wastewater sludges from both secondary operations will not be EP toxic if the recommended technology is applied. The one exception is that sludges produced as a result of cyanide precipitation are expected to exhibit hazardous characteristics, and have been treated as such in our analysis.

Although it is the Agency's view that most of the solid wastes generated as a result of these guidelines are not expected to be hazardous, generators of these wastes must test the waste to determine if the wastes meet any of the characteristics of hazardous waste (see 40 CFR 262.11).

If these wastes should be identified or are listed as hazardous, they will come within the scope of RCRA's "cradle to grave" hazardous waste management program, requiring regulation from the point of generation to point of final disposition. EPA's generator standards would require generators of hazardous nonferrous metals manufacturing wastes to meet containerization, labeling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they would have to prepare a manifest which would track the movement of the wastes from the generator's premises to a permitted off60site treatment, storage, or disposal facility. See 40 CFR 262.20, 45 FR 33142 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). The transporter regulations require transporters of hazardous wastes to comply with the manifest system to assure that the wastes are delivered to a permitted facility. See 40 CFR 263.20, 45 FR 33151 (May 19, 1980), as amended at 45 FR 86973 (December 31, 1980). Finally, RCRA regulations establish standards for hazardous waste treatment, storage, and disposal facilities allowed to receive such wastes. See 40 CFR Part 464, 46 FR 2802 (January 12, 1981), and 47 FR 32274 (July 26, 1982).

Even if these wastes are not identified as hazardous, they still must be disposed of in compliance with the Subtitle D open dumping standards, implementing Section 4004 of RCRA. See 44 FR 53438 (September 13, 1979). The Agency has calculated as part of the costs for wastewater treatment the cost of hauling and disposing of these wastes.

It is estimated that 2,781 metric tons per year of sludge will be generated as a result of these proposed BAT and PSES regulations for the secondary tin subcategory.

AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of cyanide precipitation, chemical precipitation, sedimentation, and multimedia filtration. These technologies transfer pollutants to solid waste and are not likely to transfer pollutants to air.

TABLE VIII-1

COST OF COMPLIANCE FOR THE SECONDARY TIN SUBCATEGORY DIRECT DISCHARGERS

Compliance costs for direct dischargers in this subcategory are not presented here because the data on which they are based has been claimed to be confidential.

TABLE VIII-2

COST OF COMPLIANCE FOR THE SECONDARY TIN SUBCATEGORY INDIRECT DISCHARGERS

	Proposal Costs		Promulgation Costs	
Option	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	333400	112200	156612	46676
B	341700	119900	160187	50044

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SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

This section defines the effluent characteristics attainable through the application of best practicable control technology currently available (BPT). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the secondary tin subcategory, as well as the established performance of the recommended BPT systems. Particular consideration is given to the treatment already in place at the plants within the data base.

The factors considered in identifying BPT include the total cost of applying the technology in relation to the effluent reduction benefits from such application, the age of equipment and facilities involved, the manufacturing processes used, nonwater quality environmental impacts (including energy requirements), and other factors the Administrator considers appropriate. In general, the BPT level represents the average of the existing performances of plants of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, BPT may be transferred from a different subcategory or category. Limitations based on transfer of technology are supported by a rationale concluding that the technology is, indeed, transferable, and a reasonable prediction that it will be capable of achieving the prescribed effluent limits (see Tanner's Council of America v. Train, 540 F.2d 1188 (4th Cir. 1976). BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common industry practice.

TECHNICAL APPROACH TO BPT

The Agency studied the nonferrous metals category to identify the processes used, the wastewaters generated, and the treatment processes installed. Information was collected from the category using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. In making technical assessments of data, reviewing manufacturing processes, and assessing wastewater treatment technology options, both indirect and direct dischargers have been considered as a single group. An examination of plants and processes did not indicate any process differences based on the type of discharge, whether it be direct or indirect.

As explained in Section IV, the secondary tin subcategory has been subdivided into nine potential wastewater sources. Since the water use, discharge rates, and pollutant characteristics of each of these wastewaters is potentially unique, effluent limitations will be developed for each of the nine subdivisions.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations. The first requirement to calculate these limitations is to account for production and flow variability from plant to plant. Therefore, a unit of production or production normalizing parameter (PNP) was determined for each waste stream which could then be related to the flow from the process to determine a production normalized flow. Selection of the PNP for each process element is discussed in Section IV. Nonprocess wastewaters such as rainfall runoff and noncontact cooling water are not considered in the analysis.

Production normalized flows for each subdivision were then analyzed to determine the flow to be used as part of the basis for BPT mass limitations. The selected flow (sometimes referred to as the BPT regulatory flow or BPT discharge rate) reflects the water use controls which are common practices within the category. The BPT regulatory flow is based on the average of all applicable data. Plants with normalized flows above the average may have to implement some method of flow reduction to achieve the BPT limitations.

The second requirement to calculate mass limitations is the set of concentrations that are achievable by application of the BPT level of treatment technology. Section VII discusses the various control and treatment technologies which are currently in place for each wastewater source. In most cases, the current control and treatment technologies consist of chemical precipitation and sedimentation (lime and settle technology). Cyanide precipitation is applied to streams with treatable concentrations of cyanide.

Using these regulatory flows and the achievable concentrations, the next step is to calculate mass loadings for each wastewater source or subdivision. This calculation was made on a stream-by-stream basis, primarily because plants in this subcategory may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per metric ton of production mg/kkg) were calculated by multiplying the BPT regulatory flow (l/kkg) by the concentration achievable by the BPT level of treatment technology (mg/l) for each pollutant parameter to be limited under BPT. These mass loadings are published in the Federal Register and in CFR Part 421 as the effluent limitations and standards for the subcategory.

The mass loadings which are allowed under BPT for each plant will be the sum of the individual mass loadings for the various building blocks which are found at particular plants. Accordingly, all the wastewater generated within a plant may be combined for treatment in a single or common treatment system, but the effluent limitations for these combined wastewaters are based on the various wastewater sources which actually contribute to the combined flow. This method accounts for the variety of combinations of wastewater sources and production processes which may be found at secondary tin plants.

The Agency usually establishes wastewater limitations in terms of mass rather than concentration. This approach prevents the use of dilution as a treatment method (except for controlling pH). The production normalized wastewater flow (l/kkg) is a link between the production operations and the effluent limitations. The pollutant discharge attributable to each operation can be calculated from the normalized flow and effluent concentration achievable by the treatment technology and summed to derive an appropriate limitation for each plant.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

In balancing costs in relation to effluent reduction benefits, EPA considers the volume and nature of existing discharges, the volume and nature of discharges expected after application of BPT, the general environmental effects of the pollutants, and the cost and economic impacts of the required pollution control level. The Act does not require or permit consideration of water quality problems attributable to particular point sources or industries, or water quality improvements in particular water quality bodies. Accordingly, water quality considerations were not the basis for selecting the proposed or promulgated BPT. See Weyerhaeuser Company v. Costle, 590 F.2d 1011 (D.C. Cir. 1978).

The methodology for calculating pollutant removals and compliance costs is discussed in Section X. The pollutant removal estimates have been revised since proposal based on comments and on new data. Table X-1 (page 4266) shows the pollutant removal estimates for each treatment option for direct dischargers. Compliance costs for direct dischargers are presented in Table X-2 (page 4268).

BPT OPTION SELECTION

The technology basis for the promulgated BPT limitations is Option A, chemical precipitation and sedimentation technology to remove metals, fluoride, and solids from combined wastewaters and to control pH, with preliminary treatment consisting of cyanide precipitation. The promulgated technology is equivalent to the proposed technology. Chemical precipitation and sedimentation technology is already in-place at two of the three direct dischargers in the subcategory. The pollutants specifically selected for regulation at BPT are arsenic, cyanide, lead, iron, tin, fluoride, TSS, and pH. As discussed in Section X, plants which only smelt tin concentrates and control SO_2 off-gases with a wet scrubber will not be regulated for cyanide or fluoride. All other secondary tin plants will be regulated for cyanide and fluoride, but will not be regulated for arsenic and iron. The BPT treatment scheme is presented schematically in Figure IX-1 (page 4257).

Implementation of the promulgated BPT limitations will remove annually an estimated 544 kg of priority metals, 144 kg of cyanide, 237,220 kg of fluoride, and 506,900 kg of TSS. Capital and annual costs for achieving BPT are not presented here because the data on which they are based has been claimed to be confidential.

More stringent technology options were not selected for BPT since they require in-process changes or end-of-pipe technologies not demonstrated in the subcategory, and, therefore, are more appropriately considered under BAT.

We are transferring cyanide precipitation technology and performance to the secondary tin subcategory from coil coating plants. We believe the technology is transferable to these subcategories because the raw wastewater concentrations are of the same order of magnitude as those observed in coil coating wastewater. In that cyanide precipitation converts all cyanide species to complex cyanides and that precipitation of the complexed cyanides is solubility related, we believe that the technology will achieve identical effluent concentrations in both categories.

WASTEWATER DISCHARGE RATES

A BPT discharge rate is calculated for each building block based on the average of the flows of the existing plants, as determined from analysis of dcp. The discharge rate is used with the achievable treatment concentrations to determine BPT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the 9 wastewater sources are discussed below and summarized in Table IX-1 (page 4247). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate or product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNPs, are also listed in Table IX-1 (page 4247).

Section V of this document further describes the discharge flow rates and presents the water use and discharge flow rates for each plant by subdivision in Tables V-1 through V-9 (pages 4068 - 4070)

TIN SMELTER SO_2 SCRUBBER

The BPT wastewater discharge promulgated for tin smelter SO_2 scrubber water is 9,198 l/kkg (2,204 gal/ton) of crude tapped tin, based on greater than 90 percent recycle. This rate is allocated only to those plants which use wet air pollution control to control SO_2 emissions from tin smelting operations. Only one facility reported tin smelting operations and the use of wet scrubbing. Water use and discharge rates are presented in Table V-1 (page 4068). This facility has a recycle rate of greater than 90 percent. The BPT flow was revised following proposal based on data obtained during a field sampling episode.

DEALUMINIZING RINSE

The BPT flow allowance proposed and promulgated for dealuminizing rinse wastewater is 35 l/kkg (9 gal/ton) of dealuminized scrap produced. This rate is allocated only to those plants which practice dealuminizing of tin bearing steel scrap prior to alkaline detinning. Only one facility reported this practice, which is apparently only necessary when municipal solid waste is used as a raw material. The water use and discharge rates reported by this facility are presented in Table V-2 (page 4068). The BPT flow rate is based on the wastewater discharge rate reported by this facility.

TIN MUD ACID NEUTRALIZATION FILTRATE

The BPT wastewater discharge rate proposed and promulgated for tin mud acid neutralization filtrate is 5,047 l/kkg (1,210 gal/ton) of neutralized, dewatered tin mud produced. This rate is allocated only to those facilities which neutralize tin mud with sulfuric acid and dewater the neutralized mud. One facility reported this practice. Water use and discharge rates are presented in Table V-3 (page 4068). The BPT flow rate is based on the production normalized flow reported by this facility.

TIN HYDROXIDE WASH

The BPT wastewater discharge rate proposed and promulgated for tin hydroxide wash water is 11,953 l/kkg (2,869 gal/ton) of tin hydroxide washed. This rate is only allocated to those facilities which use tin hydroxide as a raw material in tin electrowinning operations and wash the tin hydroxide prior to dissolution in a caustic solution. One plant reported this practice. The water use and wastewater discharge rates reported by this facility are presented in Table V-4 (page 4069). The BPT flow rate is based on the wastewater discharge rate reported by this facility.

SPENT ELECTROWINNING SOLUTION FROM NEW SCRAP

The BPT wastewater discharge rate proposed and promulgated for spent electrowinning solution from new scrap is 16,800 l/kkg (4,029 gal/ton) of cathode tin produced. This rate is allocated only to those plants which produce tin metal by electrowinning. There are eight facilities which produce tin by electrowinning. Six of these eight plants reported sufficient information to calculate a discharge rate from this process. The BPT flow allowance is based on the average of the production normalized flows reported by these six facilities (see Table V-5, page 4069). These production normalized flows ranged from 10,498 l/kkg to 24,069 l/kkg.

SPENT ELECTROWINNING SOLUTION FROM MUNICIPAL SOLID WASTE

The BPT flow rate proposed and promulgated for spent electrowinning solution from municipal solid waste is 119 l/kkg (29 gal/ton) of MSW scrap used as a raw material in alkaline detinning operations. This rate is allocated only to those plants which recover secondary tin from municipal solid waste by alkaline detinning and electrowinning. One facility reported the use of municipal solid waste as a raw material in addition to new scrap. This facility discharges four to five times as much spent electrowinning solution per mass of electrolytic tin produced than the average of the other six plants which reported flows for this waste stream. The large flow is a direct result of impurities which are introduced into the electrowinning solution from the municipal solid waste.

This wastewater flow allowance for sites which process municipal solid waste was calculated by subtracting the facility's BPT flow allowance for spent electrowinning solution from new scrap from the total spent electrowinning solution flow rate reported by the facility. The difference represents the flow due to municipal solid waste processing. This flow was divided by the amount of municipal solid waste scrap which the facility uses as a raw material to alkaline detinning operations. The resultant production normalized flow rate is 119 l/kkg of municipal solid waste scrap used as a raw material, as shown in Table V-6 (page 4069).

TIN HYDROXIDE SUPERNATANT FROM SCRAP

The BPT wastewater discharge rate proposed and promulgated for tin hydroxide supernatant from scrap is 55,640 l/kkg (13,354 gal/ton) of tin metal recovered from scrap. This rate is allocated only to those facilities which precipitate tin hydroxide from tin solutions generated from alkaline detinning of tin plated steel scrap. One facility reported this practice. Water use and discharge rates are presented in Table V-7 (page 4070). The BPT flow rate is based on the production normalized flow rate at the one facility currently generating this waste stream.

TIN HYDROXIDE SUPERNATANT FROM PLATING SOLUTIONS AND SLUDGES

The promulgated BPT wastewater discharge rate for tin hydroxide supernatant from plating solutions and sludges is 115,000 l/kkg (17,600 gal/ton) of tin metal recovered from plating solutions and sludges. This rate is allocated only to those facilities which recover tin from plating solutions and sludges by precipitation of tin hydroxide.

One facility reports this practice. Water use and wastewater discharge rates are presented in Table V-8 (page 4070). The Agency decided to combine two proposed subdivisions into one subdivision for promulgation. Tin hydroxide supernatant from spent plating solutions has been combined with tin hydroxide supernatant from sludge solids to form this subdivision. This change will simplify the regulation, but will not cause the limitations with which any plant must comply to change. At proposal, a plant generating both wastewater from plating solutions and from sludges would have calculated separate mg/kg limits for each operation and summed them for a plant limitation. For plant 1036, the only facility discharging both streams, the promulgated mg/kg limitations for these operations will be identical to the proposed limitations.

TIN HYDROXIDE FILTRATE

The BPT wastewater discharge rate proposed and promulgated for tin hydroxide filtrate is 25,044 l/kkg (6,011 gal/ton) of tin metal produced. This rate is allocated only for those plants which dewater tin hydroxide slurries from tin hydroxide precipitation operations in a filter press. There is currently only one plant which reported this practice. Water use and discharge rates are presented in Table V-9 (page 4070). The BPT wastewater discharge rate for tin hydroxide filtrate is based on the value reported by the one facility which currently generates this waste stream.

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for limitation. This examination is presented in Sections VI and X.

A total of eight pollutants or pollutant parameters are selected for limitation under BPT and are listed below:

115. arsenic
121. cyanide
122. lead
     iron
     tin
     fluoride
     TSS
     pH

Because of the nature of the wastewaters in this subcategory, secondary tin plants which only smelt concentrates will not be regulated for cyanide or fluoride. Other secondary tin plants, those which do not smelt concentrates, will not be regulated for iron or arsenic.

EFFLUENT LIMITATIONS

The treatable concentrations achievable by application of the promulgated BPT are discussed in Section VII of Vol. I and summarized there in Table VII-21 (page 248). These treatable concentrations (both one day maximum and monthly average values) are multiplied by the BPT normalized discharge flows summarized in Table IX-1 (page 4247) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the BPT effluent limitations and are presented in Table IX-2 (page 4248) for each individual waste stream.

Table IX-1

BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY TIN SUBCATEGORY

Wastewater Stream	BPT Normalized Discharge Rate l/kkg	BPT Normalized Discharge Rate gal/ton	Production Normalizing Parameter
Tin smelter SO_2 scrubber	9,198	2,204	Crude tapped tin produced
Dealuminizing rinse	35	9	Dealuminized scrap produced
Tin mud acid neutralization filtrate	5,047	1,210	Neutralized, dewatered tin mud produced
Tin hydroxide wash	11,953	2,869	Tin hydroxide washed
Spent electrowinning solution from new scrap	16,800	4,029	Cathode tin produced
Spent electrowinning solution from municipal solid waste	119	29	MSW scrap used as a raw material
Tin hydroxide supernatant from scrap	55,640	13,354	Tin metal recovered from scrap
Tin hydroxide supernatant from plating solutions and sludges	115,000	27,600	Tin metal recovered from plating solutions and sludges
Tin hydroxide filtrate	25,044	6,011	Tin metal produced

TABLE IX-2

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(a) Tin Smelter SO_2 Scrubber BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of crude tapped tin produced	
Antimony	26.400	11.770
*Arsenic	19.220	8.554
Cadmium	3.127	1.380
Chromium	4.047	1.656
Copper	17.480	9.198
*Lead	3.863	1.840
Nickel	17.660	11.680
Selenium	11.310	5.059
Silver	3.771	1.564
Thallium	18.860	8.370
Zinc	13.430	5.611
Aluminum	59.140	29.430
Barium	51.050	23.360
Boron	16.920	7.726
*Iron	11.040	5.611
Manganese	6.255	2.667
*Tin	3.495	2.024
*TSS	377.100	179.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(b) Dealuminizing Rinse BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Antimony	0.100	0.045
Arsenic	0.073	0.033
Cadmium	0.012	0.005
Chromium	0.015	0.006
Copper	0.067	0.035
*Cyanide	0.010	0.004
*Lead	0.015	0.007
Nickel	0.067	0.045
Selenium	0.043	0.019
Silver	0.014	0.006
Thallium	0.072	0.032
Zinc	0.051	0.021
Aluminum	0.225	0.112
Barium	0.194	0.089
Boron	0.064	0.029
*Fluoride	1.225	0.697
Iron	0.042	0.021
Manganese	0.024	0.010
*Tin	0.013	0.008
*TSS	1.435	0.683
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(c) Tin Mud Acid Neutralization Filtrate BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of neutralized, dewatered tin mud produced	
Antimony	14.480	6.460
Arsenic	10.550	4.694
Cadmium	1.716	.757
Chromium	2.221	.908
Copper	9.589	5.047
*Cyanide	1.464	.606
*Lead	2.120	1.009
Nickel	9.690	6.410
Selenium	6.208	2.776
Silver	2.069	.858
Thallium	10.350	4.593
Zinc	7.369	3.079
Aluminum	32.450	16.150
Barium	28.010	12.820
Boron	9.286	4.239
*Fluoride	176.600	100.400
Iron	6.056	3.079
Manganese	3.432	1.464
*Tin	1.918	1.110
*TSS	206.900	98.420
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(d) Tin Hydroxide Wash BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of tin hydroxide washed		
Antimony	34.310	15.300
Arsenic	24.980	11.120
Cadmium	4.064	1.793
Chromium	5.259	2.152
Copper	22.710	11.950
*Cyanide	3.466	1.434
*Lead	5.020	2.391
Nickel	22.950	15.180
Selenium	14.700	6.574
Silver	4.901	2.032
Thallium	24.500	10.880
Zinc	17.450	7.291
Aluminum	76.860	38.250
Barium	66.340	30.360
Boron	21.990	10.040
*Fluoride	418.400	237.900
Iron	14.340	7.291
Manganese	8.128	3.466
*Tin	4.542	2.630
*TSS	490.100	233.100
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(e) Spent Electrowinning Solution from New Scrap BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of cathode tin produced	
Antimony	48.220	21.500
Arsenic	35.110	15.620
Cadmium	5.712	2.520
Chromium	7.392	3.024
Copper	31.920	16.800
*Cyanide	4.872	2.016
*Lead	7.056	3.360
Nickel	32.260	21.340
Selenium	20.660	9.240
Silver	6.888	2.856
Thallium	34.440	15.290
Zinc	24.530	10.250
Aluminum	108.000	53.760
Barium	93.240	42.670
Boron	30.910	14.110
*Fluoride	588.000	334.300
Iron	20.160	10.250
Manganese	11.420	4.872
*Tin	6.384	3.696
*TSS	688.800	327.600
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(f) Spent ELectrowinning Solutions from Municipal Solid Waste BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of MSW scrap used as a raw material	
Antimony	0.342	0.152
Arsenic	0.249	0.111
Cadmium	0.041	0.018
Chromium	0.052	0.021
Copper	0.226	0.119
*Cyanide	0.035	0.014
*Lead	0.050	0.024
Nickel	0.228	0.151
Selenium	0.146	0.066
Silver	0.049	0.020
Thallium	0.244	0.108
Zinc	0.174	0.073
Aluminum	0.765	0.381
Barium	0.660	0.302
Boron	0.219	0.100
*Fluoride	4.165	2.368
Iron	0.143	0.073
Manganese	0.081	0.035
*Tin	0.045	0.026
*TSS	4.879	2.321
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN !SUBCATEGORY

(g) Tin Hydroxide Supernatant from Scrap BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from scrap	
Antimony	159.700	71.220
Arsenic	116.300	51.750
Cadmium	18.920	8.346
Chromium	24.480	10.020
Copper	105.700	55.640
*Cyanide	16.140	6.677
*Lead	23.370	11.130
Nickel	106.800	70.660
Selenium	68.440	30.600
Silver	22.810	9.459
Thallium	114.100	50.630
Zinc	81.230	33.940
Aluminum	357.800	178.000
Barium	308.800	141.300
Boron	102.400	46.740
*Fluoride	1,947.000	1,107.000
Iron	66.770	33.940
Manganese	37.840	16.140
*Tin	21.140	12.240
*TSS	2,281.000	1,085.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges	
Antimony	330.100	147.200
Arsenic	240.400	107.000
Cadmium	39.100	17.250
Chromium	50.600	20.700
Copper	218.500	115.000
*Cyanide	33.350	13.800
*Lead	48.300	23.000
Nickel	220.800	146.100
Selenium	141.500	63.250
Silver	47.150	19.550
Thallium	235.800	104.700
Zinc	167.900	70.150
Aluminum	739.500	368.000
Barium	638.300	292.100
Boron	211.600	96.600
*Fluoride	4,025.000	2,289.000
Iron	138.000	70.150
Manganese	78.200	33.350
*Tin	43.700	25.300
*TSS	4,715.000	2,243.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE IX-2 (Continued)

BPT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(i) Tin Hydroxide Filtrate BPT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal produced	
Antimony	71.880	32.060
Arsenic	52.340	23.290
Cadmium	8.515	3.757
Chromium	11.020	4.508
Copper	47.580	25.040
*Cyanide	7.263	3.005
*Lead	10.520	5.009
Nickel	48.080	31.810
Selenium	30.800	13.770
Silver	10.270	4.257
Thallium	51.340	22.790
Zinc	36.560	15.280
Aluminum	161.000	80.140
Barium	139.000	63.610
Boron	46.080	21.040
*Fluoride	876.500	498.400
Iron	30.050	15.280
Manganese	17.030	7.263
*Tin	9.517	5.510
*TSS	1,027.000	488.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

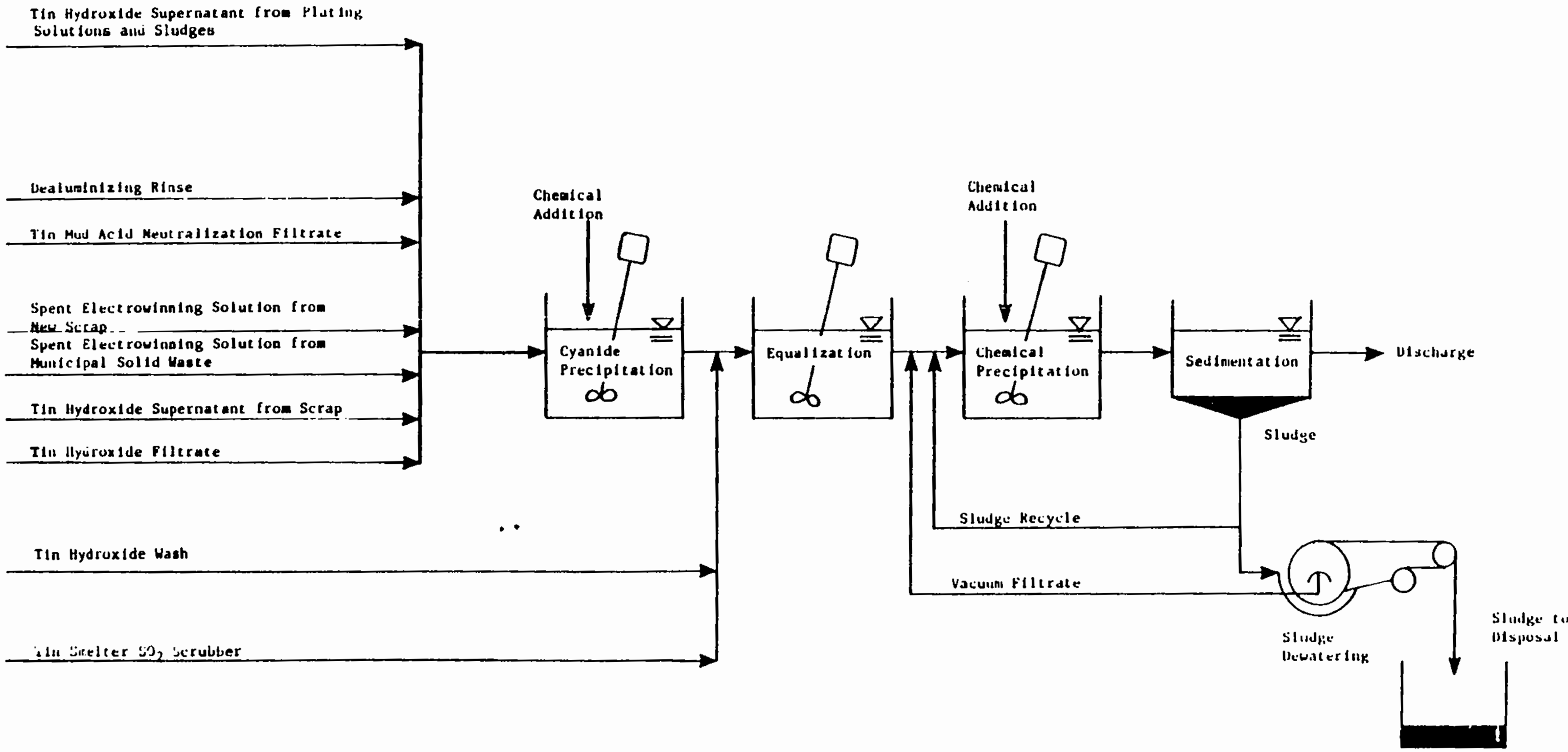

Figure IX-1

BPT TREATMENT SCHEME FOR OPTION A

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SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

These effluent limitations 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 At a minimum BAT technology represents the best available technology at plants of various ages, sizes, processes, or other characteristics. BAT may be transferred from a different subcategory or category and may include feasible process changes or internal controls, even when not in common industry practice.

The statutory assessment of BAT considers costs, but does not require a balancing of costs against effluent reduction benefits However, in assessing the proposed and promulgated BAT, the Agency has given substantial weight to the economic achievability of the selected technology.

TECHNICAL APPROACH TO BAT

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 two technology options which could be applied to the secondary tin subcategory as treatment options for the basis of BAT effluent limitations.

For the development of BAT effluent limitations, mass loadings were calculated for each wastewater source or subdivision in the subcategory using the same technical approach as described in Section IX for BPT limitations development. The differences in the mass loadings for BPT and BAT are due to increased treatment effectiveness achievable with the more sophisticated BAT treatment technology.

In summary the treatment technologies considered for BAT are presented below:

Option A (Figure X-1, page 4279) is based on

- o Preliminary treatment with cyanide precipitation
- o Chemical precipitation and sedimentation

Option C (Figure X-2, page 4280) is based on

- o Preliminary treatment with cyanide precipitation
- o Chemical precipitation and sedimentation
- o Multimedia filtration

The two options examined for BAT are discussed in greater detail below. The first option considered is the same as the BPT treatment which was presented in the previous section. The latter option represents substantial progress toward the prevention of polluting the environment above and beyond the progress achievable by BPT.

OPTION A

Option A for the secondary tin subcategory is equivalent to the control and treatment technologies which were analyzed for BPT in Section IX. The BPT end-of-pipe treatment scheme includes chemical precipitation and sedimentation, with cyanide precipitation preliminary treatment (see Figure X-1). The discharge rates for Option A are equal to the discharge rates allocated to each stream as a BPT discharge flow.

OPTION C

Option C for the secondary tin subcategory consists of all control and treatment requirements of Option A (cyanide precipitation, chemical precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option A treatment scheme (see Figure X-2). Multimedia filtration is used to remove suspended solids, including precipitates of priority metals, beyond the concentrations attainable by gravity sedimentation. The filter suggested is of the gravity, mixed media type, although other filters, such as rapid sand filters or pressure filters, would perform as well.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

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

POLLUTANT REMOVAL ESTIMATES

The pollutant removal estimates have been revised from proposal based on comments and new data; however, the methodology for calculating pollutant removals was not changed. The data used for estimating removals are the same as those used to revise the compliance costs. Sampling data collected during the field sampling program were used to characterize the major waste streams considered for regulation. At each sampled facility, the sampling data was production normalized for each unit operation (i.e., mass of pollutant generated per mass of product manufactured). This value, referred to as the raw waste, was used to estimate the mass of priority pollutants generated within the secondary tin subcategory. The pollutant removal estimates were calculated for each plant by first estimating the total mass of each pollutant in the untreated wastewater. This was calculated by first multiplying the raw waste values by the corresponding production value for that stream and then summing these values for each pollutant for every stream generated by the plant.

Next, the volume of wastewater discharged after the application of each treatment option was estimated for each operation at each plant by first comparing the actual discharge to the regulatory flow. The smaller of the two values was selected and summed with the other plant flows. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable with the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. Finally, the mass of pollutant removed is the difference between the estimated mass of pollutant generated by each plant in the subcategory and the mass of pollutant discharged after application of the treatment option.

The pollutant removal estimates for the secondary tin subcategory are presented in Table X-1, for direct dischargers.

COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop a cost model, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied the model on a per plant basis. A plant's costs - both capital, and operating and maintenance were determined by what treatment it has in place and by its individual process wastewater discharge (from dcp). The final step was to annualize the capital costs, and to sum the annualized capital costs, and the operating and maintenance costs, yielding the cost of compliance for the subcategory (see Table X-2). These costs were used in assessing economic achievability.

BAT OPTION SELECTION - PROPOSAL

BAT was proposed for the secondary tin subcategory based on Option C, consisting of ammonia steam stripping and cyanide precipitation pretreatment, chemical precipitation, sedimentation and filtration.

Implementation of the proposed BAT was estimated to remove 1,260 kg of priority metals annually. The proposed BAT was estimated to incur capital and annual costs, but those costs were not presented because they were based on confidential information.

BAT OPTION SELECTION - PROMULGATION

After proposal, EPA collected information concerning raw materials, and additional flow, production, and wastewater characteristics data for the tin smelter SO_2 scrubber subdivision. This information lead EPA to revise the name of the subcategory following proposal from primary and secondary tin to secondary tin. The same plants and operations are included in this subcategory for promulgation as at proposal. These additional data were used to recalculate a production normalized flow rate and to revise pollutant removal and compliance cost estimates. In addition, EPA learned that one plant included as an indirect discharger at proposal revised their process and no longer discharges process wastewater. This enabled EPA to revise the subdivision scheme for this subcategory by combining two subdivisions into one subdivision, and also to revise the pollutant removal estimates and compliance costs.

BAT is promulgated for the secondary tin subcategory based on Option C, consisting of cyanide precipitation preliminary treatment, chemical precipitation, sedimentation and filtration. The promulgated treatment technology is identical to the proposed treatment technology with the exception of ammonia steam stripping, which is no longer required. The one facility which generated ammonia bearing wastewater has changed its process since proposal and is now a dry facility. Except for tin, the treatment performance concentrations, upon which the mass limitations are based, are equal to values used to calculate the proposed mass limitations.

EPA is promulgating multimedia filtration as part of the BAT technology because this technology results in additional removal of priority metals. Filtration is also presently demonstrated at 25 plants throughout the nonferrous metals manufacturing category. Filtration adds reliability to the treatment system by making it less susceptible to operator error and to sudden changes in raw wastewater flow and concentrations.

Implementation of the promulgated BAT limitations would remove annually an estimated 570 kg of priority metals, which is 26 kg of priority metals more than the estimated BPT discharge. Capital and annual costs for this subcategory are not presented here because the data on which they are based has been claimed to be confidential.

WASTEWATER DISCHARGE RATES

A BAT discharge rate was calculated for each subdivision based upon the flows of the existing plants, as determined from analysis of dcp. The discharge rate is used with the achievable treatment concentrations to determine BAT effluent limitations. Since the discharge rate may be different for each wastewater source, separate production normalized discharge rates for each of the wastewater sources were determined and are summarized in Table X-3 (page 4269). The discharge rates are normalized on a production basis by relating the amount of wastewater generated to the mass of the intermediate or product which is produced by the process associated with the waste stream in question. These production normalizing parameters (PNP) are also listed in Table X-4 (page 4270).

The BAT wastewater discharge rate used at promulgation is equal to the promulgated BPT wastewater discharge rate for all of the subdivisions of the secondary tin subcategory. Based on the available data, the Agency did not find that further flow reduction would be feasible for any of these wastewater sources. The rationale for determining these regulatory flows is presented in Section IX.

REGULATED POLLUTANT PARAMETERS

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 was presented in Section VI. As discussed at proposal, the Agency has chosen not to regulate, specifically, all of the toxic pollutants selected in this analysis.

The high cost associated with analysis for priority metal pollutants has prompted EPA to develop an alternative method for regulating and monitoring priority pollutant discharges from the nonferrous metals manufacturing category. Rather than developing specific effluent mass limitations and standards for each of the priority metals found in treatable concentrations in the raw wastewater from a given subcategory, the Agency is promulgating effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant removal estimate analysis.

The pollutants selected for specific limitation in this subcategory are listed below:

115. arsenic
121. cyanide
122. lead
     iron
     fluoride
     tin

Because of the nature of the wastewaters in this subcategory, secondary tin plants which only smelt concentrates will not be regulated for cyanide or fluoride. Other secondary tin plants, those which do not smelt concentrates, will not be regulated for iron or arsenic.

By establishing limitations and standards for certain priority metal pollutants, dischargers will attain the same degree of control over priority metal pollutants as they would have been required to achieve, had all the priority metal pollutants been directly limited.

This approach is technically justified since the treatable concentrations used for lime precipitation and sedimentation technology are based on optimized treatment for concomitant multiple metals removal. Thus, even though metals have somewhat different theoretical solubilities, they will be removed at very nearly the same rate in a chemical precipitation and sedimentation treatment system operated for multiple metals removal. Filtration as part of the technology basis is likewise justified because this technology removes metals non-preferentially.

The priority metal pollutants selected for specific limitation in this subcategory are arsenic and lead. Tin is selected for limitation because it is useful as an indicator pollutant to insure proper performance in a chemical precipitation and sedimentation treatment system. The following toxic pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations developed for arsenic, and lead:

114. antimony
118. cadmium
119. chromium
120. copper
124. nickel
125. selenium
126. silver
127. thallium
128. zinc

Cyanide is selected for limitation because the methods used to control arsenic and lead are not effective in the control of cyanide.

EFFLUENT LIMITATIONS

The concentrations achievable by application of BAT are discussed in Section VII of Vol. I and summarized there in Table VII-21 (page 248). The treatment effectiveness concentrations (both one day maximum and monthly average values) are multiplied by the BAT normalized discharge flows summarized in Table X-3 (page 4269) to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per kilogram of product represent the promulgated BAT effluent limitations and are presented in Table X-4 (page 4270) for each wastewater stream.

Table X-1

SECONDARY TIN SUBCATEGORY POLLUTANT REMOVAL ESTIMATES
DIRECT DISCHARGERS

Pollutant	Raw Discharge (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)
Antimony	50.79	20.54	30.25	14.06	36.73
Arsenic	152.62	21.51	131.11	15.22	137.40
Cadmium	13.24	4.50	8.74	2.96	10.28
Chromium (Total)	2.98	0.60	2.37	0.56	2.41
Copper	18.75	17.20	1.54	16.13	2.61
Cyanide (Total)	144.87	1.03	143.83	0.98	143.88
Lead	123.01	5.64	117.37	4.14	118.87
Mercury	0.34	0.34	0.00	0.34	0.00
Nickel	24.45	6.22	18.22	5.23	19.22
Selenium	129.01	13.73	115.27	9.99	119.01
Silver	2.14	0.50	1.64	0.45	1.69
Thallium	15.63	4.08	11.55	3.72	11.91
Zinc	120.83	15.15	105.67	11.40	109.42
TOTAL PRIORITY POLLUTANTS	798.66	111.04	687.56	85.18	713.43
Aluminum	36,396.37	81.57	36,314.79	54.26	36,342.10
Ammonia	215.02	177.48	37.53	177.28	37.73
Barium	9.12	9.12	0.00	7.69	1.42
Boron	869.57	9.40	860.17	6.30	863.27
Cobalt	6.96	1.74	5.22	1.18	5.78
Fluoride	237,848.06	626.23	237,221.82	498.12	237,349.93
Iron	7,731.14	14.27	7,716.86	9.75	7,721.39
Magnesium	338.84	3.48	335.36	2.33	336.51
Manganese	15.32	5.57	9.75	4.87	10.44
Tin	10,431.98	41.13	10,390.84	27.81	10,404.17
TOTAL NONCONVENTIONALS	293,862.38	969.99	292,892.34	789.59	293,072.74

Table X-1 (Continued)

SECONDARY TIN SUBCATEGORY POLLUTANT REMOVAL ESTIMATES
DIRECT DISCHARGERS

Pollutant	Raw Discharge (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)
TSS	507,638.47	735.39	506,903.08	157.18	507,481.29
Oil and Grease	678.27	193.89	484.38	189.36	488.90
TOTAL CONVENTIONALS	508,316.74	929.28	507,387.46	346.54	507,970.19
TOTAL POLLUTANTS	802,977.78	2,010.31	800,967.36	1,221.31	801,756.36

Table X-2

COST OF COMPLIANCE FOR THE
SECONDARY TIN SUBCATEGORY DIRECT DISCHARGERS

Compliance costs for direct dischargers in this subcategory are not presented here because the data on which they are based have been claimed to be confidential.

Table X-3

BAT WASTEWATER DISCHARGE RATES FOR THE
SECONDARY TIN SUBCATEGORY

Wastewater Stream	BAT Normalized Discharge Rate 1/kkg	gal/ton	Production Normalizing Parameter
Tin smelter SO_2 scrubber	9,198	2,204	Crude tapped tin produced
Dealuminizing rinse	35	9	Dealuminized scrap produced
Tin mud acid neutralization filtrate	5,047	1,210	Neutralized, dewatered tin mud produced
Tin hydroxide wash	11,953	2,869	Tin hydroxide washed
Spent electrowinning solution from new scrap	16,800	4,029	Cathode tin produced
Spent electrowinning solution from municipal solid waste	119	29	MSW scrap used as a raw material
Tin hydroxide supernatant from scrap	55,640	13,354	Tin metal recovered from scrap
Tin hydroxide supernatant from plating solutions and sludges	115,000	27,600	Tin metal recovered from plating solutions and sludges
Tin hydroxide filtrate	25,044	6,011	Tin metal produced

TABLE X-4

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(a) Tin Smelter SO_2 Scrubber BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of crude tapped tin produced		
Antimony	17.750	7.910
*Arsenic	12.790	5.703
Cadmium	1.840	0.736
Chromium	3.403	1.380
Copper	11.770	5.611
*Lead	2.575	1.196
Nickel	5.059	3.403
Selenium	7.542	3.403
Silver	2.667	1.104
Thallium	12.880	5.611
Zinc	9.382	3.863
Aluminum	56.200	24.930
Barium	10.580	4.691
Boron	16.920	7.726
*Iron	11.040	5.611
Manganese	2.759	2.116
*Tin	3.495	2.024

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(b) Dealuminizing Rinse BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Antimony	0.068	0.030
Arsenic	0.049	0.022
Cadmium	0.007	0.003
Chromium	0.013	0.005
Copper	0.045	0.021
*Cyanide	0.007	0.003
*Lead	0.010	0.005
Nickel	0.019	0.013
Selenium	0.029	0.013
Silver	0.010	0.004
Thallium	0.049	0.021
Zinc	0.036	0.015
Aluminum	0.214	0.095
Barium	0.040	0.018
Boron	0.064	0.029
*Fluoride	1.225	0.697
Iron	0.042	0.021
Manganese	0.011	0.008
*Tin	0.013	0.008

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(c) Tin Mud Acid Neutralization Filtrate BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of neutralized, dewatered tin mud produced	
Antimony	9.741	4.340
Arsenic	7.015	3.129
Cadmium	1.009	0.404
Chromium	1.867	0.757
Copper	6.460	3.079
*Cyanide	1.009	0.404
*Lead	1.413	0.656
Nickel	2.776	1.867
Selenium	4.139	1.867
Silver	1.464	0.606
Thallium	7.066	3.079
Zinc	5.148	2.120
Aluminum	30.840	13.680
Barium	5.804	2.574
Boron	9.286	4.239
*Fluoride	176.600	100.400
Iron	6.056	3.079
Manganese	1.514	1.161
*Tin	1.918	1.110

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(d) Tin Hydroxide Wash BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of tin hydroxide washed		
Antimony	23.070	10.280
Arsenic	16.610	7.411
Cadmium	2.391	0.956
Chromium	4.423	1.793
Copper	15.300	7.291
*Cyanide	2.391	0.956
*Lead	3.347	1.554
Nickel	6.574	4.423
Selenium	9.801	4.423
Silver	3.466	1.434
Thallium	16.730	7.291
Zinc	12.190	5.020
Aluminum	73.030	32.390
Barium	13.750	6.096
Boron	21.990	10.040
*Fluoride	418.400	237.900
Iron	14.340	7.291
Manganese	3.586	2.749
*Tin	4.542	2.630

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(e) Spent Electrowinning Solution from New Scrap BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of cathode tin produced		
Antimony	32.420	14.450
Arsenic	23.350	10.420
Cadmium	3.360	1.344
Chromium	6.216	2.520
Copper	21.500	10.250
*Cyanide	3.360	1.344
*Lead	4.704	2.184
Nickel	9.240	6.216
Selenium	13.780	6.216
Silver	4.872	2.016
Thallium	23.520	10.250
Zinc	17.140	7.056
Aluminum	102.600	45.530
Barium	19.320	8.568
Boron	30.910	14.110
*Fluoride	588.000	334.300
Iron	20.160	10.250
Manganese	5.040	3.864
*Tin	6.384	3.696

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(f) Spent Electrowinning Solution from Municipal Solid Waste BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of MSW scrap used as a raw material	
Antimony	0.230	0.102
Arsenic	0.165	0.074
Cadmium	0.024	0.010
Chromium	0.044	0.018
Copper	0.152	0.073
*Cyanide	0.024	0.010
*Lead	0.033	0.016
Nickel	0.066	0.044
Selenium	0.098	0.044
Silver	0.035	0.014
Thallium	0.167	0.073
Zinc	0.121	0.050
Aluminum	0.727	0.322
Barium	0.137	0.061
Boron	0.219	0.100
*Fluoride	4.165	2.368
Iron	0.143	0.073
Manganese	0.036	0.027
*Tin	0.045	0.026

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(g) Tin Hydroxide Supernatant from Scrap BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from scrap	
Antimony	107.400	47.850
Arsenic	77.340	34.500
Cadmium	11.130	4.451
Chromium	20.590	8.346
Copper	71.220	33.940
*Cyanide	11.130	4.451
*Lead	15.580	7.233
Nickel	30.600	20.590
Selenium	45.620	20.590
Silver	16.140	6.677
Thallium	77.900	33.940
Zinc	56.750	23.370
Aluminum	340.000	150.800
Barium	63.990	28.380
Boron	102.400	46.740
*Fluoride	1,947.000	1,107.000
Iron	66.770	33.940
Manganese	16.690	12.800
*Tin	21.140	12.240

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges		
Antimony	222.000	98.900
Arsenic	159.900	71.300
Cadmium	23.000	9.200
Chromium	42.550	17.250
Copper	147.200	70.150
*Cyanide	23.000	9.200
*Lead	32.200	14.950
Nickel	63.250	42.550
Selenium	94.300	42.550
Silver	33.350	13.800
Thallium	161.000	70.150
Zinc	117.300	48.300
Aluminum	702.700	311.700
Barium	132.300	58.650
Boron	211.600	96.600
*Fluoride	4,025.000	2,289.000
Iron	138.000	70.150
Manganese	34.500	26.450
*Tin	43.700	25.300

*Regulated Pollutant

TABLE X-4 (Continued)

BAT MASS LIMITATIONS FOR THE SECONDARY TIN SUBCATEGORY

(i) Tin Hydroxide Filtrate BAT

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal produced	
Antimony	48.330	21.540
Arsenic	34.810	15.530
Cadmium	5.009	2.004
Chromium	9.266	3.757
Copper	32.060	15.280
*Cyanide	5.009	2.004
*Lead	7.012	3.256
Nickel	13.770	9.266
Selenium	20.540	9.266
Silver	7.263	3.005
Thallium	35.060	15.280
Zinc	25.540	10.520
Aluminum	153.000	67.870
Barium	28.800	12.770
Boron	46.080	21.040
*Fluoride	876.500	498.400
Iron	30.050	15.280
Manganese	7.513	5.760
*Tin	9.517	5.510

*Regulated Pollutant

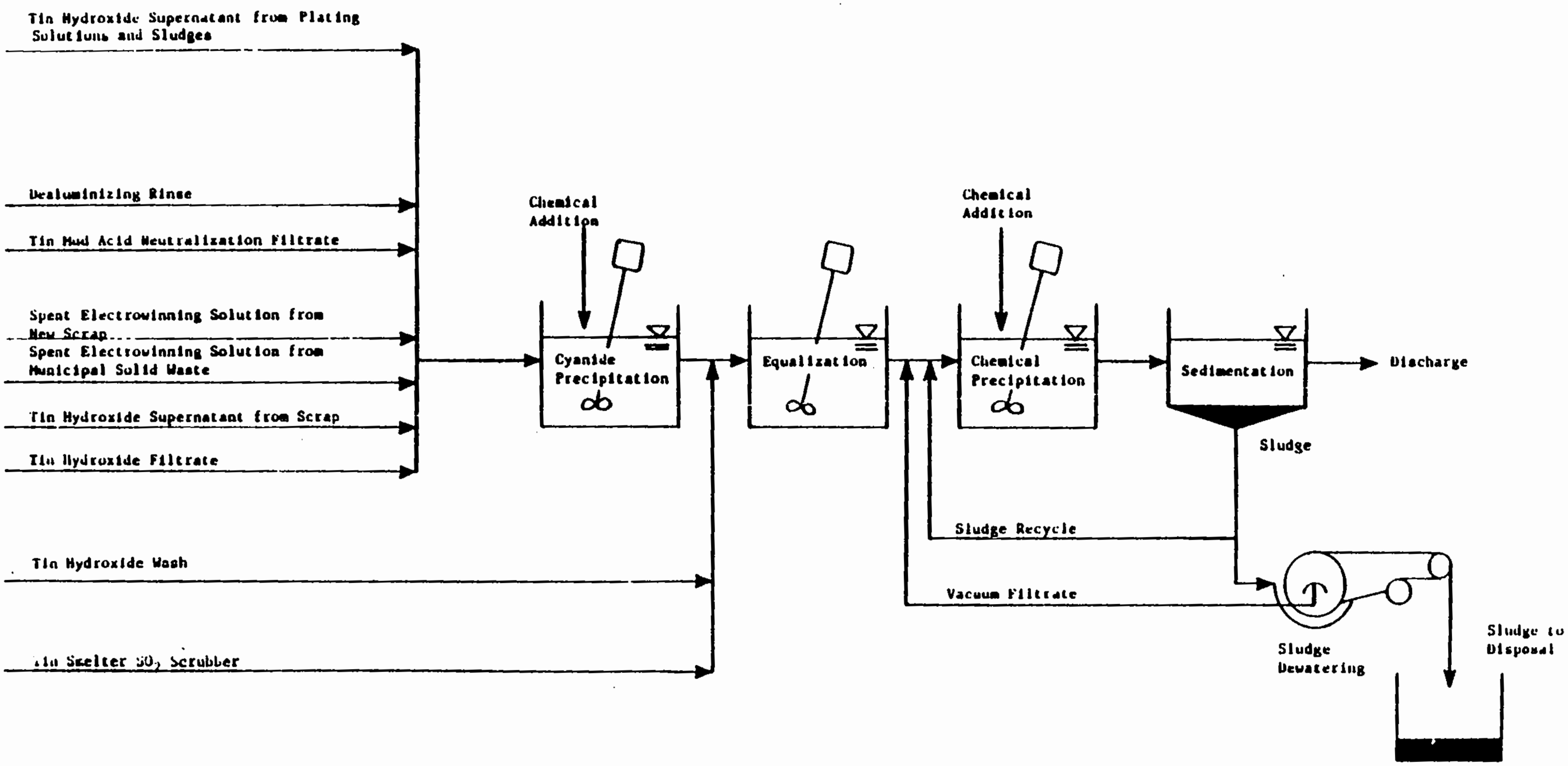

Figure X-1

BAT TREATMENT SCHEME FOR OPTION A

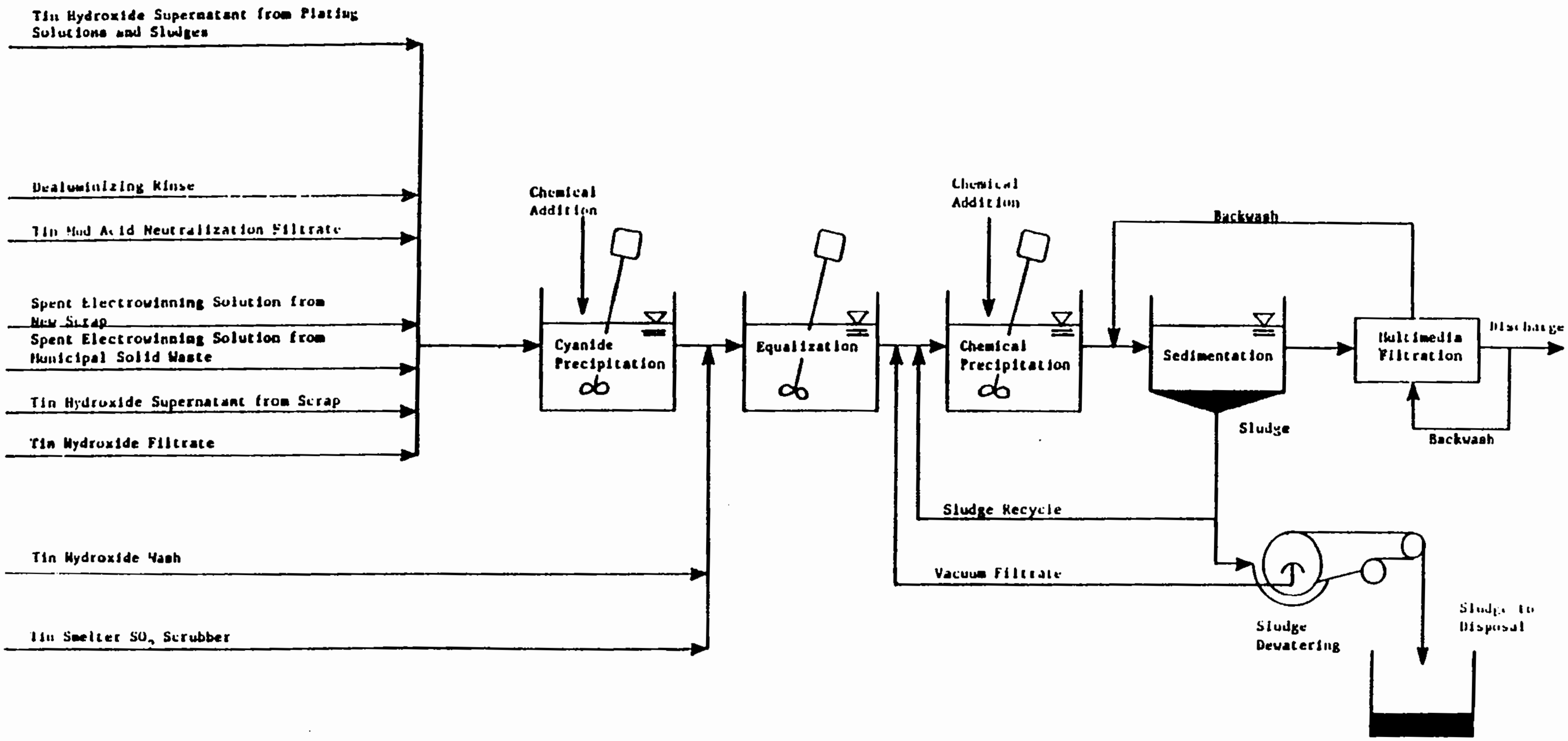

Figure X-2

BAT TREATMENT SCHEME FOR OPTION C

SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

This section describes the technologies for treatment of wastewater from new sources and presents mass discharge standards for regulatory pollutants for NSPS in the secondary tin subcategory, based on the selected treatment technology. 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, EPA has considered the best demonstrated process changes, in-plant controls, and end-of-pipe treatment technologies which reduce pollution to the maximum extent feasible.

TECHNICAL APPROACH TO NSPS

New source performance standards are equivalent to the best available technology (BAT) selected for currently existing secondary tin plants. This result is a consequence of careful review by the Agency of a wide range of technology options for new source treatment systems. This review of the secondary tin 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. Consequently, BAT production normalized discharge rates, which are based on the best existing practices of the subcategory, can also be applied to new sources. These rates are presented in Table XI-1 (page 4283).

Treatment technologies considered for the NSPS options are identical to the treatment technologies considered for the BAT options. These options are:

OPTION A

- o Preliminary treatment consisting of cyanide precipitation (where required)
- o Chemical precipitation and sedimentation

OPTION C

- o Preliminary treatment consisting of cyanide precipitation (where required)
- o Chemical precipitation and sedimentation
- o Multimedia filtration

NSPS OPTION SELECTION - PROPOSAL

EPA proposed that the best available demonstrated technology for the primary and secondary tin subcategory be equivalent to Option C (ammonia steam stripping, cyanide precipitation, chemical precipitation, sedimentation, and filtration).

The wastewater flow rates for NSPS were the same as the proposed BAT flow rates. Flow reduction measures for NSPS and BAT were not considered feasible because no new demonstrated technologies existed within the subcategory that improved on present water use practices in the subcategory. Therefore, EPA concluded that flow reduction beyond the allowances proposed for BPT or BAT was unachievable, and NSPS flow rates should be equal to those for BPT and BAT.

NSPS OPTION SELECTION - PROMULGATION

EPA is promulgating best available technology for the secondary tin subcategory equivalent to Option C (cyanide precipitation, chemical precipitation, sedimentation, and filtration).

The wastewater flow rates promulgated for NSPS are the same as the promulgated BAT flow rates. The NSPS flow rates are presented in Table XI-1 (page 4283). Additional flow reduction and more stringent treatment technologies are not demonstrated or readily transferable to the secondary tin subcategory.

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 selected for limitation under NSPS in accordance with the rationale of Sections VI and X, are identical to those selected for BAT. The conventional pollutant parameters TSS and pH are also selected for limitation.

NEW SOURCE PERFORMANCE STANDARDS

The NSPS discharge flows for each wastewater source are the same as the discharge rates for BAT and are shown in Table XI-1 (page 4283). The mass of pollutant allowed to be discharged per mass of product is based upon the product of the appropriate treatment effectiveness concentration (mg/l) and the production normalized wastewater discharge flows. The results of these calculations are the production-based new source performance standards. These standards are presented in Table XI-2 (page 4284)

Table XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY TIN SUBCATEGORY

Wastewater Stream	NSPS Normalized Discharge Rate l/kkg	NSPS Normalized Discharge Rate gal/ton	Production Normalizing Parameter
Tin smelter SO_2 scrubber	9,198	2,204	Crude tapped tin produced
Dealuminizing rinse	35	9	Dealuminized scrap produced
Tin mud acid neutralization filtrate	5,047	1,210	Neutralized, dewatered tin mud produced
Tin hydroxide wash	11,953	2,869	Tin hydroxide washed
Spent electrowinning solution from new scrap	16,800	4,029	Cathode tin produced
Spent electrowinning solution from municipal solid waste	119	29	MSW scrap used as a raw material
Tin hydroxide supernatant from scrap	55,640	13,354	Tin metal recovered from scrap
Tin hydroxide supernatant from plating solutions and sludges	115,000	27,600	Tin metal recovered from plating solutions and sludges
Tin hydroxide filtrate	25,044	6,011	Tin metal produced

TABLE XI-2

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(a) Tin Smelter SO_2 Scrubber NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of crude tapped tin produced		
Antimony	17.750	7.910
*Arsenic	12.790	5.703
Cadmium	1.840	.736
Chromium	3.403	1.380
Copper	11.770	5.611
*Lead	2.575	1.196
Nickel	5.059	3.403
Selenium	7.542	3.403
Silver	2.667	1.104
Thallium	12.880	5.611
Zinc	9.382	3.863
Aluminum	56.200	24.930
Barium	10.580	4.691
Boron	16.920	7.726
*Iron	11.040	5.611
Manganese	2.759	2.116
*Tin	3.495	2.024
*TSS	138.000	110.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(b) Dealuminizing Rinse NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Antimony	0.068	0.030
Arsenic	0.049	0.022
Cadmium	0.007	0.003
Chromium	0.013	0.005
Copper	0.045	0.021
*Cyanide	0.007	0.003
*Lead	0.010	0.005
Nickel	0.019	0.013
Selenium	0.029	0.013
Silver	0.010	0.004
Thallium	0.049	0.021
Zinc	0.036	0.015
Aluminum	0.214	0.095
Barium	0.040	0.018
Boron	0.064	0.029
*Fluoride	1.225	0.697
Iron	0.042	0.021
Manganese	0.011	0.008
*Tin	0.013	0.008
*TSS	0.525	0.420
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(c) Tin Mud Acid Neutralization Filtrate NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of neutralized, dewatered tin mud produced	
Antimony	9.741	4.340
Arsenic	7.015	3.129
Cadmium	1.009	0.404
Chromium	1.867	0.757
Copper	6.460	3.079
*Cyanide	1.009	0.404
*Lead	1.413	0.656
Nickel	2.776	1.867
Selenium	4.139	1.867
Silver	1.464	0.606
Thallium	7.066	3.079
Zinc	5.148	2.120
Aluminum	30.840	13.680
Barium	5.804	2.574
Boron	9.286	4.239
*Fluoride	176.600	100.400
Iron	6.056	3.079
Manganese	1.514	1.161
*Tin	1.918	1.110
*TSS	75.710	60.560
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(d) Tin Hydroxide Wash NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of tin hydroxide washed		
Antimony	23.070	10.280
Arsenic	16.610	7.411
Cadmium	2.391	0.956
Chromium	4.423	1.793
Copper	15.300	7.291
*Cyanide	2.391	0.956
*Lead	3.347	1.554
Nickel	6.574	4.423
Selenium	9.801	4.423
Silver	3.466	1.434
Thallium	16.730	7.291
Zinc	12.190	5.020
Aluminum	73.030	32.390
Barium	13.750	6.096
Boron	21.990	10.040
*Fluoride	418.400	237.900
Iron	14.340	7.291
Manganese	3.586	2.749
*Tin	4.542	2.630
*TSS	179.300	143.400
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(e) Spent Electrowinning Solution from New Scrap NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of cathode tin produced		
Antimony	32.420	14.450
Arsenic	23.350	10.420
Cadmium	3.360	1.344
Chromium	6.216	2.520
Copper	21.500	10.250
*Cyanide	3.360	1.344
*Lead	4.704	2.184
Nickel	9.240	6.216
Selenium	13.780	6.216
Silver	4.872	2.016
Thallium	23.520	10.250
Zinc	17.140	7.056
Aluminum	102.600	45.530
Barium	19.320	8.568
Boron	30.910	14.110
*Fluoride	588.000	334.300
Iron	20.160	10.250
Manganese	5.040	3.864
*Tin	6.384	3.696
*TSS	252.000	201.600
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(f) Spent Electrowinning Solution from Municipal Solid Waste NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of MSW scrap used as a raw material	
Antimony	0.230	0.102
Arsenic	0.165	0.074
Cadmium	0.024	0.010
Chromium	0.044	0.018
Copper	0.152	0.073
*Cyanide	0.024	0.010
*Lead	0.033	0.016
Nickel	0.066	0.044
Selenium	0.098	0.044
Silver	0.035	0.014
Thallium	0.167	0.073
Zinc	0.121	0.050
Aluminum	0.727	0.322
Barium	0.137	0.061
Boron	0.219	0.100
*Fluoride	4.165	2.368
Iron	0.143	0.073
Manganese	0.036	0.027
*Tin	0.045	0.026
*TSS	1.785	1.428
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(g) Tin Hydroxide Supernatant from Scrap NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from scrap	
Antimony	107.400	47.850
Arsenic	77.340	34.500
Cadmium	11.130	4.451
Chromium	20.590	8.346
Copper	71.220	33.940
*Cyanide	11.130	4.451
*Lead	15.580	7.233
Nickel	30.600	20.590
Selenium	45.620	20.590
Silver	16.140	6.677
Thallium	77.900	33.940
Zinc	56.750	23.370
Aluminum	340.000	150.800
Barium	63.990	28.380
Boron	102.400	46.740
*Fluoride	1,947.000	1,107.000
Iron	66.770	33.940
Manganese	16.690	12.800
*Tin	21.140	12.240
*TSS	834.600	667.700
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges	
Antimony	222.000	98.900
Arsenic	159.900	71.300
Cadmium	23.000	9.200
Chromium	42.550	17.250
Copper	147.200	70.150
*Cyanide	23.000	9.200
*Lead	32.200	14.950
Nickel	63.250	42.550
Selenium	94.300	42.550
Silver	33.350	13.800
Thallium	161.000	70.150
Zinc	117.300	48.300
Aluminum	702.700	311.700
Barium	132.300	58.650
Boron	211.600	96.600
*Fluoride	4,025.000	2,289.000
Iron	138.000	70.150
Manganese	34.500	26.450
*Tin	43.700	25.300
*TSS	1,725.000	1,380.000
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

TABLE XI-2 (Continued)

NSPS FOR THE SECONDARY TIN SUBCATEGORY

(i) Tin Hydroxide Filtrate NSPS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal produced	
Antimony	48.330	21.540
Arsenic	34.810	15.530
Cadmium	5.009	2.004
Chromium	9.266	3.757
Copper	32.060	15.280
*Cyanide	5.009	2.004
*Lead	7.012	3.256
Nickel	13.770	9.266
Selenium	20.540	9.266
Silver	7.263	3.005
Thallium	35.060	15.280
Zinc	25.540	10.520
Aluminum	153.000	67.870
Barium	28.800	12.770
Boron	46.080	21.040
*Fluoride	876.500	498.400
Iron	30.050	15.280
Manganese	7.513	5.760
*Tin	9.517	5.510
*TSS	375.700	300.500
*pH	Within the range of 7.5 to 10.0 at all times	

*Regulated Pollutant

SECTION XII

PRETREATMENT STANDARDS

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the secondary tin subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology.

TECHNICAL APPROACH TO PRETREATMENT

Before proposing and promulgating pretreatment standards, the Agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or its chosen sludge disposal practices. In determining whether pollutants pass through a well-operated POTW, achieving secondary treatment, the Agency compares the percentage of a pollutant removed by POTW with the percentage removed by direct dischargers applying the best available technology economically achievable. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTW meeting secondary treatment requirements, is less than the percentage removed by direct dischargers complying with BAT effluent limitations guidelines for that pollutant. (See generally, 46 FR at 9415-16 (January 28, 1981).

This definition of pass through satisfies two competing objectives set by Congress that standards for indirect dischargers be equivalent to standards for direct dischargers while at the same time the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers.

The Agency compares percentage removal rather than the mass or concentration of pollutants discharged because the latter would not take into account the mass of pollutants discharged to the POTW from non-industrial sources or the dilution of the pollutants in the POTW effluent to lower concentrations due to the addition of large amounts of non-industrial wastewater.

INDUSTRY COST AND POLLUTANT REMOVAL ESTIMATES

The industry cost and pollutant removal estimates of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant removal estimates and plant compliance costs is discussed in Section X. Table XII-1 (page 4296) shows the estimated pollutant removals for indirect dischargers. Compliance costs for indirect dischargers are presented in Table XII-2 (page 4297).

PRETREATMENT STANDARDS FOR EXISTING AND NEW SOURCES

Options for pretreatment of wastewaters from both existing and new sources are based on increasing the effectiveness of end-of-pipe treatment technologies. All in-plant changes and applicable end-of-pipe treatment processes have been discussed previously in Sections X and XI. The options for PSNS and PSES, therefore, are the same as the BAT options discussed in Section X.

A description of each option is presented in Section X, while a more detailed discussion, including pollutants controlled by each treatment process is presented in Section VII.

Treatment technologies considered for the PSNS and PSES options are:

OPTION A

- o Preliminary treatment consisting of cyanide precipitation (where required)
- o Chemical precipitation and sedimentation

OPTION C

- o Preliminary treatment consisting of cyanide precipitation (where required)
- o Chemical precipitation and sedimentation
- o Multimedia filtration

PSES AND PSNS OPTION SELECTION

Option C (cyanide precipitation, chemical precipitation, sedimentation and filtration) has been selected as the treatment technology basis for pretreatment standards for existing and new sources (PSES and PSNS). Option C prevents pass-through and is equivalent to BAT treatment for direct dischargers. In addition, Option C achieves effective removal of priority pollutants by incorporating filtration, which is demonstrated by 25 plants throughout the nonferrous metals manufacturing category.

The wastewater discharge rates for the promulgated PSES and PSNS are identical to the promulgated BAT discharge rates for each waste stream. The PSES and PSNS discharge rates are shown in Table XII-3 (page 4298). No additional flow reduction measures for PSES or PSNS are feasible; EPA does not believe that new plants could achieve flow reduction beyond the allowance promulgated for BAT.

Implementation of the promulgated PSES limitations would remove annually an estimated 167 kg of priority pollutants and 6,230 kg of tin. Capital cost for achieving promulgated PSES is $160,187, and annual cost is $50,044 (1982 dollars). The promulgated PSES will not result in adverse economic impacts. We believe that the promulgated PSNS are achievable, and that they are not a barrier to entry of new plants into this subcategory.

REGULATED POLLUTANT PARAMETERS

Pollutants selected for limitation, in accordance with the rationale of Sections VI and X, are identical to those selected for limitation for BAT. It is necessary to promulgate PSES and PSNS to prevent pass-through of arsenic, lead, fluoride, iron, and tin, which are the limited pollutants. Because of the nature of the wastewaters in this subcategory, secondary tin plants which only smelt concentrates will not be regulated for cyanide or fluoride. Other secondary tin plants, those which do not smelt concentrates, will not be regulated for iron or arsenic.

PRETREATMENT STANDARDS

Pretreatment standards are based on the treatable concentrations from the selected treatment technology, (Option C), and the discharge rates determined in Section X for BAT. A mass of pollutant per mass of product (mg/kg) allocation is given for each subdivision within the subcategory. This pollutant allocation is based on the product of the treatable concentration from the promulgated treatment (mg/l) and the production concentrations for BAT are identical to those for PSES and PSNS. PSES are presented in Table XII-4 (page 4299) and NSPS are presented in Table XII-5 (page 4308).

Table XII-1

SECONDARY TIN SUBCATEGORY POLLUTANT REMOVAL ESTIMATES
INDIRECT DISCHARGERS

Pollutant	Raw Discharge (kg/yr)	Option A Discharge (kg/yr)	Option A Removed (kg/yr)	Option C Discharge (kg/yr)	Option C Removed (kg/yr)
Antimony	6.35	0.77	5.57	0.51	5.83
Arsenic	7.25	0.56	6.68	0.37	6.87
Cadmium	1.16	0.08	1.07	0.05	1.10
Chromium (total)	1.46	0.09	1.36	0.07	1.38
Copper	1.15	0.64	0.50	0.43	0.71
Cyanide (total)	19.79	0.07	19.71	0.05	19.73
Lead	4.67	0.13	4.53	0.08	4.58
Mercury	0	0	0	0	0
Nickel	12.72	0.81	11.90	0.24	12.47
Selenium	78.98	0.33	78.64	0.22	78.75
Silver	1.15	0.11	1.03	0.07	1.07
Thallium	7.45	0.55	6.89	0.37	7.07
Zinc	27.78	0.36	27.41	0.25	27.52
TOTAL PRIORITY POLLUTANTS	169.91	4.50	165.29	2.71	167.08
Aluminum	22.60	2.47	20.12	1.64	20.95
Fluoride	0.87	0.87	0	0.87	0
Tin	6,227.62	0.23	6,227.38	0.15	6,227.46
TOTAL NONCONVENTIONALS	6,251.09	3.57	6,247.50	2.66	6,248.41
TSS	490.43	13.25	477.17	2.87	487.55
Oil and Grease	7.42	7.42	0	7.42	0
TOTAL CONVENTIONALS	497.85	20.67	477.17	10.29	487.55
TOTAL POLLUTANTS	6,918.85	28.74	6,889.96	15.66	6,903.04

TABLE XII-2

COST OF COMPLIANCE FOR THE SECONDARY TIN SUBCATEGORY
INDIRECT DISCHARGERS

	Proposal Costs		Promulgation Costs	
Option	Capital Cost	Annual Cost	Capital Cost	Annual Cost
A	333400	112200	156612	46676
B	341700	119900	160187	50044

Table XII-3

PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY TIN SUBCATEGORY

Wastewater Stream	PSES and PSNS Normalized Discharge Rate l/kkg	gal/ton	Production Normalizing Parameter
Tin smelter SO_2 scrubber	9,198	2,204	Crude tapped tin produced
Dealuminizing rinse	35	9	Dealuminized scrap produced
Tin mud acid neutralization filtrate	5,047	1,210	Neutralized, dewatered tin mud produced
Tin hydroxide wash	11,953	2,869	Tin hydroxide washed
Spent electrowinning solution from new scrap	16,800	4,029	Cathode tin produced
Spent electrowinning solution from municipal solid waste	119	29	MSW scrap used as a raw material
Tin hydroxide supernatant from scrap	55,640	13,354	Tin metal recovered from scrap
Tin hydroxide supernatant from plating solutions and sludges	115,000	27,600	Tin metal recovered from plating solutions and sludges
Tin hydroxide filtrate	25,044	6,011	Tin metal produced

TABLE XII-4

PSES FOR THE SECONDARY TIN SUBCATEGORY

(a) Tin Smelter SO_2 Scrubber PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of crude tapped tin produced		
Antimony	17.750	7.910
*Arsenic	12.790	5.703
Cadmium	1.840	0.736
Chromium	3.403	1.380
Copper	11.770	5.611
*Lead	2.575	1.196
Nickel	5.059	3.403
Selenium	7.542	3.403
Silver	2.667	1.104
Thallium	12.880	5.611
Zinc	9.382	3.863
Aluminum	56.200	24.930
Barium	10.580	4.691
Boron	16.920	7.726
*Iron	11.040	5.611
Manganese	2.759	2.116
*Tin	3.495	2.024

*Regulated Pollutant

TABLE XII-4

PSES FOR THE SECONDARY TIN SUBCATEGORY

(b) Dealuminizing Rinse PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Antimony	0.068	0.030
Arsenic	0.049	0.022
Cadmium	0.007	0.003
Chromium	0.013	0.005
Copper	0.045	0.021
*Cyanide	0.007	0.003
*Lead	0.010	0.005
Nickel	0.019	0.013
Selenium	0.029	0.013
Silver	0.010	0.004
Thallium	0.049	0.021
Zinc	0.036	0.015
Aluminum	0.214	0.095
Barium	0.040	0.018
Boron	0.064	0.029
*Fluoride	1.225	0.697
Iron	0.042	0.021
Manganese	0.011	0.008
*Tin	0.013	0.008

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY TIN SUBCATEGORY

(c) Tin Mud Acid Neutralization Filtrate PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of neutralized, dewatered tin mud produced	
Antimony	9.741	4.340
Arsenic	7.015	3.129
Cadmium	1.009	0.404
Chromium	1.867	0.757
Copper	6.460	3.079
*Cyanide	1.009	0.404
*Lead	1.413	0.656
Nickel	2.776	1.867
Selenium	4.139	1.867
Silver	1.464	0.606
Thallium	7.066	3.079
Zinc	5.148	2.120
Aluminum	30.840	13.680
Barium	5.804	2.574
Boron	9.286	4.239
*Fluoride	176.600	100.400
Iron	6.056	3.079
Manganese	1.514	1.161
*Tin	1.918	1.110

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY TIN SUBCATEGORY

(d) Tin Hydroxide Wash PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of tin hydroxide washed		
Antimony	23.070	10.280
Arsenic	16.610	7.411
Cadmium	2.391	.956
Chromium	4.423	1.793
Copper	15.300	7.291
*Cyanide	2.391	.956
*Lead	3.347	1.554
Nickel	6.574	4.423
Selenium	9.801	4.423
Silver	3.466	1.434
Thallium	16.730	7.291
Zinc	12.190	5.020
Aluminum	73.030	32.390
Barium	13.750	6.096
Boron	21.990	10.040
*Fluoride	418.400	237.900
Iron	14.340	7.291
Manganese	3.586	2.749
*Tin	4.542	2.630

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY TIN SUBCATEGORY

(e) Spent Electrowinning Solution from New Scrap PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of cathode tin produced		
Antimony	32.420	14.450
Arsenic	23.350	10.420
Cadmium	3.360	1.344
Chromium	6.216	2.520
Copper	21.500	10.250
*Cyanide	3.360	1.344
*Lead	4.704	2.184
Nickel	9.240	6.216
Selenium	13.780	6.216
Silver	4.872	2.016
Thallium	23.520	10.250
Zinc	17.140	7.056
Aluminum	102.600	45.530
Barium	19.320	8.568
Boron	30.910	14.110
*Fluoride	588.000	334.300
Iron	20.160	10.250
Manganese	5.040	3.864
*Tin	6.384	3.696

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY TIN SUBCATEGORY

(f) Spent ELectrowinning Solution from Municipal Solid Waste PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of MSW scrap used as a raw material	
Antimony	.230	.102
Arsenic	.165	.074
Cadmium	.024	.010
Chromium	.044	.018
Copper	.152	.073
*Cyanide	.024	.010
*Lead	.033	.016
Nickel	.066	.044
Selenium	.098	.044
Silver	.035	.014
Thallium	.167	.073
Zinc	.121	.050
Aluminum	.727	.322
Barium	.137	.061
Boron	.219	.100
*Fluoride	4.165	2.368
Iron	.143	.073
Manganese	.036	.027
*Tin	.045	.026

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY TIN SUBCATEGORY

(g) Tin Hydroxide Supernatant from Scrap PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from scrap	
Antimony	107.400	47.850
Arsenic	77.340	34.500
Cadmium	11.130	4.451
Chromium	20.590	8.346
Copper	71.220	33.940
*Cyanide	11.130	4.451
*Lead	15.580	7.233
Nickel	30.600	20.590
Selenium	45.620	20.590
Silver	16.140	6.677
Thallium	77.900	33.940
Zinc	56.750	23.370
Aluminum	340.000	150.800
Barium	63.990	28.380
Boron	102.400	46.740
*Fluoride	1,947.000	1,107.000
Iron	66.770	33.940
Manganese	16.690	12.800
*Tin	21.140	12.240

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY TIN SUBCATEGORY

(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges	
Antimony	222.000	98.900
Arsenic	159.900	71.300
Cadmium	23.000	9.200
Chromium	42.550	17.250
Copper	147.200	70.150
*Cyanide	23.000	9.200
*Lead	32.200	14.950
Nickel	63.250	42.550
Selenium	94.300	42.550
Silver	33.350	13.800
Thallium	161.000	70.150
Zinc	117.300	48.300
Aluminum	702.700	311.700
Barium	132.300	58.650
Boron	211.600	96.600
*Fluoride	4,025.000	2,289.000
Iron	138.000	70.150
Manganese	34.500	26.450
*Tin	43.700	25.300

*Regulated Pollutant

TABLE XII-4 (Continued)

PSES FOR THE SECONDARY TIN SUBCATEGORY

(i) Tin Hydroxide Filtrate PSES

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of tin metal produced		
Antimony	48.330	21.540
Arsenic	34.810	15.530
Cadmium	5.009	2.004
Chromium	9.266	3.757
Copper	32.060	15.280
*Cyanide	5.009	2.004
*Lead	7.012	3.256
Nickel	13.770	9.266
Selenium	20.540	9.266
Silver	7.263	3.005
Thallium	35.060	15.280
Zinc	25.540	10.520
Aluminum	153.000	67.870
Barium	28.800	12.770
Boron	46.080	21.040
*Fluoride	876.500	498.400
Iron	30.050	15.280
Manganese	7.513	5.760
*Tin	9.517	5.510

*Regulated Pollutant

TABLE XII-5

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(a) Tin Smelter SO_2 Scrubber PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of crude tapped tin produced		
Antimony	17.750	7.910
*Arsenic	12.790	5.703
Cadmium	1.840	0.736
Chromium	3.403	1.380
Copper	11.770	5.611
*Lead	2.575	1.196
Nickel	5.059	3.403
Selenium	7.542	3.403
Silver	2.667	1.104
Thallium	12.880	5.611
Zinc	9.382	3.863
Aluminum	56.200	24.930
Barium	10.580	4.691
Boron	16.920	7.726
*Iron	11.040	5.611
Manganese	2.759	2.116
*Tin	3.495	2.024

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(b) Dealuminizing Rinse PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of dealuminized scrap produced		
Antimony	0.068	0.030
Arsenic	0.049	0.022
Cadmium	0.007	0.003
Chromium	0.013	0.005
Copper	0.045	0.021
*Cyanide	0.007	0.003
*Lead	0.010	0.005
Nickel	0.019	0.013
Selenium	0.029	0.013
Silver	0.010	0.004
Thallium	0.049	0.021
Zinc	0.036	0.015
Aluminum	0.214	0.095
Barium	0.040	0.018
Boron	0.064	0.029
*Fluoride	1.225	0.697
Iron	0.042	0.021
Manganese	0.011	0.008
*Tin	0.013	0.008

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(c) Tin Mud Acid Neutralization Filtrate PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of neutralized, dewatered tin mud produced	
Antimony	9.741	4.340
Arsenic	7.015	3.129
Cadmium	1.009	0.404
Chromium	1.867	0.757
Copper	6.460	3.079
*Cyanide	1.009	0.404
*Lead	1.413	0.656
Nickel	2.776	1.867
Selenium	4.139	1.867
Silver	1.464	0.606
Thallium	7.066	3.079
Zinc	5.148	2.120
Aluminum	30.840	13.680
Barium	5.804	2.574
Boron	9.286	4.239
*Fluoride	176.600	100.400
Iron	6.056	3.079
Manganese	1.514	1.161
*Tin	1.918	1.110

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(d) Tin Hydroxide Wash PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of tin hydroxide washed		
Antimony	23.070	10.280
Arsenic	16.610	7.411
Cadmium	2.391	0.956
Chromium	4.423	1.793
Copper	15.300	7.291
*Cyanide	2.391	0.956
*Lead	3.347	1.554
Nickel	6.574	4.423
Selenium	9.801	4.423
Silver	3.466	1.434
Thallium	16.730	7.291
Zinc	12.190	5.020
Aluminum	73.030	32.390
Barium	13.750	6.096
Boron	21.990	10.040
*Fluoride	418.400	237.900
Iron	14.340	7.291
Manganese	3.586	2.749
*Tin	4.542	2.630

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(e) Spent Electrowinning Solution from New Scrap PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
mg/kg (lb/million lbs) of cathode tin produced		
Antimony	32.420	14.450
Arsenic	23.350	10.420
Cadmium	3.360	1.344
Chromium	6.216	2.520
Copper	21.500	10.250
*Cyanide	3.360	1.344
*Lead	4.704	2.184
Nickel	9.240	6.216
Selenium	13.780	6.216
Silver	4.872	2.016
Thallium	23.520	10.250
Zinc	17.140	7.056
Aluminum	102.600	45.530
Barium	19.320	8.568
Boron	30.910	14.110
*Fluoride	588.000	334.300
Iron	20.160	10.250
Manganese	5.040	3.864
*Tin	6.384	3.696

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(f) Spent ELectrowinning Solutions from Municipal Solid Waste PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of MSW scrap used as a raw material	
Antimony	0.230	0.102
Arsenic	0.165	0.074
Cadmium	0.024	0.010
Chromium	0.044	0.018
Copper	0.152	0.073
*Cyanide	0.024	0.010
*Lead	0.033	0.016
Nickel	0.066	0.044
Selenium	0.098	0.044
Silver	0.035	0.014
Thallium	0.167	0.073
Zinc	0.121	0.050
Aluminum	0.727	0.322
Barium	0.137	0.061
Boron	0.219	0.100
*Fluoride	4.165	2.368
Iron	0.143	0.073
Manganese	0.036	0.027
*Tin	0.045	0.026

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(g) Tin Hydroxide Supernatant from Scrap PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from scrap	
Antimony	107.400	47.850
Arsenic	77.340	34.500
Cadmium	11.130	4.451
Chromium	20.590	8.346
Copper	71.220	33.940
*Cyanide	11.130	4.451
*Lead	15.580	7.233
Nickel	30.600	20.590
Selenium	45.620	20.590
Silver	16.140	6.677
Thallium	77.900	33.940
Zinc	56.750	23.370
Aluminum	340.000	150.800
Barium	63.990	28.380
Boron	102.400	46.740
*Fluoride	1,947.000	1,107.000
Iron	66.770	33.940
Manganese	16.690	12.800
*Tin	21.140	12.240

*Regulated Pollutant

Table XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

PSNS
Secondary Tin
(h) Tin Hydroxide Supernatant from Plating Solutions and Sludges PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal recovered from plating solutions and sludges	
Antimony	222.000	98.900
Arsenic	159.900	71.300
Cadmium	23.000	9.200
Chromium	42.550	17.250
Copper	147.200	70.150
*Cyanide	23.000	9.200
*Lead	32.200	14.950
Nickel	63.250	42.550
Selenium	94.300	42.550
Silver	33.350	13.800
Thallium	161.000	70.150
Zinc	117.300	48.300
Aluminum	702.700	311.700
Barium	132.300	58.650
Boron	211.600	96.600
*Fluoride	4,025.000	2,289.000
Iron	138.000	70.150
Manganese	34.500	26.450
*Tin	43.700	25.300

*Regulated Pollutant

TABLE XII-5 (Continued)

PSNS FOR THE SECONDARY TIN SUBCATEGORY

(i) Tin Hydroxide Filtrate PSNS

Pollutant or pollutant property	Maximum for any one day	Maximum for monthly average
	mg/kg (lb/million lbs) of tin metal produced	
Antimony	48.330	21.540
Arsenic	34.810	15.530
Cadmium	5.009	2.004
Chromium	9.266	3.757
Copper	32.060	15.280
*Cyanide	5.009	2.004
*Lead	7.012	3.256
Nickel	13.770	9.266
Selenium	20.540	9.266
Silver	7.263	3.005
Thallium	35.060	15.280
Zinc	25.540	10.520
Aluminum	153.000	67.870
Barium	28.800	12.770
Boron	46.080	21.040
*Fluoride	876.500	498.400
Iron	30.050	15.280
Manganese	7.513	5.760
*Tin	9.517	5.510

*Regulated Pollutant

SECTION XIII

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

EPA is not promulgating best conventional pollutant control technology (BCT) limitations for the secondary tin subcategory at this time.