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Water and Waste Management



# **Development Document for Effluent Limitations Guidelines and Standards for the**

Proposed

## **Nonferrous Metals Point Source Category Volume III**

Supplemental Development  
Documents For:

Primary Tungsten  
Primary Columbium - Tantalum  
Secondary Silver  
Secondary Lead  
Secondary Aluminum  
Secondary Copper



DEVELOPMENT DOCUMENT  
for  
EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS  
for the  
NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY

Primary Tungsten Subcategory  
Primary Columbium-Tantalum Subcategory  
Secondary Silver Subcategory  
Secondary Copper Subcategory  
Secondary Lead Subcategory  
Secondary Aluminum Subcategory

Frederick A. Eidsness, Jr.  
Assistant Administrator for Water

Steven Schatzow  
Director  
Office of Water Regulations and Standards



Jeffery D. Denit, Director  
Effluent Guidelines Division

Ernst P. Hall, P.E., Chief  
Metals and Machinery Branch

James R. Berlow, P.E.  
Technical Project Officer

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U.S. Environmental Protection Agency  
Office of Water  
Office of Water Regulations and Standards  
Effluent Guidelines Division  
Washington, D.C. 20460



This development document for nonferrous metals manufacturing (phase I) consists of three volumes, a general development document and two volumes of subcategory-specific supplements. The Agency intends to modify the General Development Document, as necessary, and produce additional volumes of subcategory-specific supplements in order to support limitations and standards for additional nonferrous metals manufacturing (phase II) subcategories as they are proposed and promulgated.

# PRIMARY TUNGSTEN SUBCATEGORY

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## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION I

#### SUMMARY AND CONCLUSIONS

Pursuant to Sections 301, 304, 306, 307, and 501 of the Clean Water Act and the provisions of the Settlement Agreement in Natural Resources Defense Council v. Train, 8 ERC 2120 (D.D.C. 1976) modified, 12 ERC 1833 (D.D.C. 1979), EPA has collected and analyzed data for plants in the primary tungsten subcategory. EPA has never proposed or promulgated effluent limitations or standards for this subcategory. This document and the administrative record provide the technical basis for proposing 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 primary tungsten subcategory is comprised of eight plants. Of the eight plants, two discharge directly to rivers, lakes, or streams; three discharge to publicly owned treatment works (POTW); and three achieve zero discharge of process wastewater.

EPA first studied the primary tungsten subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including (1) the sources and volume of water used, the processes used, and the sources of pollutants and wastewaters in the plant; and (2) the constituents of wastewaters, including toxic pollutants.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the primary tungsten 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, the number of potential closures, number of employees affected, and impact on price were estimated. These results are reported in a separate document entitled "The Economic Impact Analysis of Proposed Effluent Standards and Limitations Guidelines and Standards for the Nonferrous Smelting and Refining Industry."

Based on consideration of the above factors, EPA identified various control and treatment technologies which formed the basis for BPT and selected control and treatment appropriate for each set of standards and limitations. The mass limitations and standards for BPT, BAT, NSPS, PSES, PSNS, and BCT are presented in Section II.

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on lime 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 tungsten subcategory is not expected to incur any costs.

For BAT, the Agency has built upon the BPT technology basis by adding in-process control technologies which include recycle of process water from air pollution control waste streams. Filtration is added as an effluent polishing step to the end-of-pipe treatment scheme. To meet the BAT effluent limitations based on this technology, the primary tungsten subcategory is estimated to incur a capital cost of \$0.447 million and an annual cost of \$0.193 million.

BDT, which is the technical basis of NSPS, is equivalent to BAT. In selecting BDT, 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 technology basis for PSES is equivalent to BAT. To meet the pretreatment standards for existing sources, the primary tungsten subcategory is estimated to incur a capital cost of \$0.396 million and an annual cost of \$0.329 million. 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. The technology basis of BCT is the BPT treatment of lime precipitation and sedimentation.

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION II

#### RECOMMENDATIONS

1. EPA has divided the primary tungsten subcategory into nine subdivisions for the purpose of effluent limitations and standards. These subdivisions are:
  - (a) Tungstic acid rinse water,
  - (b) Acid leach wet air pollution control,
  - (c) Alkali leach wash,
  - (d) Ion-exchange raffinate,
  - (e) Calcium tungstate precipitate wash,
  - (f) Crystallization and drying of ammonium paratungstate,
  - (g) Ammonium paratungstate conversion to oxides wet air pollution control,
  - (h) Reduction to tungsten wet air pollution control, and
  - (i) Reduction to tungsten water of formation.
2. BPT is proposed 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 proposed:

(a) Tungstic Acid Rinse  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	7,140.0	6,188.0
Selenium	58,548.0	26,180.0
Zinc	63,308.0	26,656.0
Ammonia (as N)	6,330,800.0	2,789,360.0
TSS	1,951,600.0	952,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Acid Leach Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	5,655.0	4,901.0
Selenium	46,371.0	20,735.0
Zinc	50,141.0	21,112.0
Ammonia (as N)	5,014,100.0	2,209,220.0
TSS	1,545,700.0	754,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Alkali Leach Wash  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	7,005.0	6,071.0
Selenium	57,441.0	25,685.0
Zinc	62,111.0	26,152.0
Ammonia (as N)	6,211,100.0	2,736,620.0
TSS	1,914,700.0	934,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Ion-Exchange Raffinate  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
Lead	7,680.0	6,656.0
Selenium	62,976.0	28,160.0
Zinc	68,096.0	28,672.0
Ammonia (as N)	6,809,600.0	3,000,320.0
TSS	2,099,200.0	1,024,000.0
pH	Within the range of 7.5 to 10.0 at all times	



(e) Calcium Tungstate Precipitate Wash  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of calcium tungstate produced		
English Units - lbs/billion lbs of calcium tungstate produced		
Lead	5,580.0	4,836.0
Selenium	45,756.0	20,460.0
Zinc	49,476.0	20,832.0
Ammonia (as N)	4,947,600.0	2,179,920.0
TSS	1,525,200.0	744,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Crystallization and Drying of Ammonium Paratungstate  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium paratungstate produced		
English Units - lbs/billion lbs of ammonium paratungstate produced		
Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Ammonium Paratungstate Conversion to Oxides Wet Air  
Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	3,135.0	2,717.0
Selenium	25,707.0	11,495.0
Zinc	27,797.0	11,704.0
Ammonia (as N)	2,779,700.0	1,224,740.0
TSS	856,900.0	418,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Reduction to Tungsten Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	10,980.0	9,516.0
Selenium	90,036.0	40,260.0
Zinc	97,356.0	40,992.0
Ammonia (as N)	9,735,600.0	4,289,520.0
TSS	3,001,200.0	1,464,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(i) Reduction to Tungsten Water of Formation  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	2,910.0	2,522.0
Selenium	23,862.0	10,670.0
Zinc	25,802.0	10,864.0
Ammonia (as N)	2,580,200.0	1,136,840.0
TSS	795,400.0	388,000.0
pH	Within the range of 7.5 to 10.0 at all times	

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

(a) Tungstic Acid Rinse  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0

(b) Acid Leach Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,091.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0

(c) Alkali Leach Wash  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0

(d) Ion-Exchange Raffinate  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of ammonium tungstate produced  
English Units - lbs/billion lbs of ammonium tungstate produced

Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0

(e) Calcium Tungstate Precipitate Wash  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of calcium tungstate produced  
English Units - lbs/billion lbs of calcium tungstate produced

Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0

(f) Crystallization and Drying of Ammonium Paratungstate  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of ammonium paratungstate produced  
English Units - lbs/billion lbs of ammonium paratungstate  
produced

Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0

(g) Ammonium Paratungstate Conversion to Oxides Wet Air  
Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0

(h) Reduction to Tungsten Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	550,840.0

(i) Reduction to Tungsten Water of Formation  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0

4. NSPS are proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following effluent standards are proposed for new sources:

(a) Tungstic Acid Rinse NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0
TSS	714,000.0	571,200.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Acid Leach Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,091.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0
TSS	56,550.0	45,240.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Alkali Leach Wash NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0
TSS	700,500.0	560,400.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Ion-Exchange Raffinate NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0
TSS	768,000.0	614,400.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Calcium Tungstate Precipitate Wash NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of calcium tungstate produced		
English Units - lbs/billion lbs of calcium tungstate produced		
Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0
TSS	558,000.0	446,400.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Crystallization and Drying of Ammonium Paratungstate  
NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of ammonium paratungstate produced		
English Units - lbs/billion lbs of ammonium paratungstate produced		
Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Ammonium Paratungstate Conversion to Oxides Wet Air  
Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0
TSS	313,500.0	250,800.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Reduction to Tungsten Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	550,840.0
TSS	141,000.0	112,800.0
pH	Within the range of 7.5 to 10.0 at all times	



(i) Reduction to Tungsten Water of Formation NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0
TSS	291,000.0	232,800.0
pH	Within the range of 7.5 to 10.0 at all times	

5. PSES are proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following pretreatment standards are proposed for existing sources:

(a) Tungstic Acid Rinse PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0

(b) Acid Leach Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,901.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0

(c) Alkali Leach Wash PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of sodium tungstate produced  
English Units - lbs/billion lbs of sodium tungstate produced

Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0

(d) Ion-Exchange Raffinate PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of ammonium tungstate produced  
English Units - lbs/billion lbs of ammonium tungstate produced

Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0

(e) Calcium Tungstate Precipitate Wash PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of calcium tungstate produced  
English Units - lbs/billion lbs of calcium tungstate produced

Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0

(f) Crystallization and Drying of Ammonium Paratungstate PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of ammonium paratungstate produced  
English Units - lbs/billion lbs of ammonium paratungstate  
produced

Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0

(g) Ammonium Paratungstate Conversion to Oxides Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0

(h) Reduction to Tungsten Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	112,800.0

(i) Reduction to Tungsten Water of Formation PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0

6. PSNS are proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology, and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following pretreatment standard are proposed for new sources:

(a) Tungstic Acid Rinse PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0

(b) Acid Leach Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,091.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0

(c) Alkali Leach Wash PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0

(d) Ion-Exchange Raffinate PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0

(e) Calcium Tungstate Precipitate Wash PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of calcium tungstate produced  
English Units - lbs/billion lbs of calcium tungstate produced

Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0

(f) Crystallization and Drying of Ammonium Paratungstate PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of ammonium paratungstate produced  
English Units - lbs/billion lbs of ammonium paratungstate produced

Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0

(g) Ammonium Paratungstate Conversion to Oxides Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of "blue" oxide (WO<sub>3</sub>) produced  
English Units - lbs/billion lbs of "blue" oxide (WO<sub>3</sub>) produced

Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0

(h) Reduction to Tungsten Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	550,840.0

(i) Reduction to Tungsten Water of Formation PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0

7. BCT is proposed 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 BCT effluent limitations are proposed for existing direct dischargers:

(a) Tungstic Acid Rinse  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
TSS	1,951,600.0	952,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Acid Leach Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
TSS	1,545,700.0	754,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Alkali Leach Wash  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
TSS	1,914,700.0	934,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Ion-Exchange Raffinate  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
TSS	2,099,200.0	1,024,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Calcium Tungstate Precipitate Wash  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of calcium tungstate produced		
English Units - lbs/billion lbs of calcium tungstate produced		
TSS	1,525,200.0	744,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Crystallization and Drying of Ammonium Paratungstate  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium paratungstate produced		
English Units - lbs/billion lbs of ammonium paratungstate produced		
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Ammonium Paratungstate Conversion to Oxides  
Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
TSS	856,900.0	418,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Reduction to Tungsten Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
TSS	3,001,200.0	1,464,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(i) Reduction to Tungsten Water of Formation  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
TSS	795,400.0	388,000.0
pH	Within the range of 7.5 to 10.0 at all times	



## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION III

#### INDUSTRY PROFILE

This section of the primary tungsten supplement describes the raw materials and processes used in producing primary tungsten and presents a profile of the primary tungsten plants identified in this study. For discussion of the purpose, authority, and methodology for this study, and a general description of the nonferrous metals manufacturing category, refer to Section III of the General Development Document.

In the early 1780's, tungstic acid was first isolated from scheelite and wolframite and, shortly thereafter, tungsten was obtained by both carbon and hydrogen reduction of wolframite  $[(Fe,Mn)WO_4]$ . Hydrogen reduction is still a key step in the production of tungsten powder from which other finished products are derived. From the mid-nineteenth century through the first third of this century, tungsten was used chiefly as an alloying agent in steel. During the last 30 years, however, tungsten uses have increased to include production of carbides and alloys. The 1974 production use breakdown was 68 percent carbide, 15 percent pure metal, and 15 percent alloy. Another two percent was used to manufacture various metal compounds (2).

#### DESCRIPTION OF PRIMARY TUNGSTEN PRODUCTION

The production of tungsten metal can be divided into three distinct stages - leaching of ore concentrates, purification to ammonium paratungstate (APT), and the reduction of APT to metal. The actual processes used in each stage vary with the type and purity of the raw material used. The primary tungsten production process is presented schematically in Figure III-1 and described below.

#### RAW MATERIALS

The principal domestic ores used to produce ammonium paratungstate and tungsten metal powder are ferberite ( $FeWO_4$ ) and scheelite ( $CaWO_4$ ). Both of these ores are mined principally in California and Colorado.

#### LEACHING OF ORE CONCENTRATES

Scheelite ores of high quality (i.e., low concentrations of molybdenum and complexing elements such as phosphorus, arsenic, and silicon) are usually leached with hot hydrochloric acid (HCl). An insoluble tungstic acid intermediate ( $H_2WO_4$ ) is

formed. The acidic tungstic acid rinse water and HCl fume control scrubber water are wastewater sources.

Lower quality scheelite ores and some wolframite ores,  $(\text{Fe,Mn})\text{WO}_4$ , may be digested using a soda-autoclave leach process that uses high temperatures and soda ash in quantities greater than stoichiometric amounts to produce a sodium tungstate intermediate ( $\text{Na}_2\text{WO}_4$ ). If molybdenum impurities are present, the ore concentrates are reacted with sodium hydrosulfide ( $\text{NaHS}$ ) to precipitate molybdenum trisulfide ( $\text{MoS}_3$ ).

Higher quality wolframite ores are processed using an alkaline leaching method. This method, which also produces a sodium tungstate intermediate, involves digestion with a strong caustic solution, usually sodium hydroxide ( $\text{NaOH}$ ). The sodium tungstate solution is filtered to remove soluble impurities. Sodium tungstate is crystallized from the filtrate, and the remaining caustic solution is recycled or wasted.

#### PURIFICATION TO AMMONIUM PARATUNGSTATE

Purification of the tungstic acid intermediate ( $\text{H}_2\text{WO}_4$ ) is more direct than that for sodium tungstate. After filtering and washing to remove soluble calcium chloride ( $\text{CaCl}_2$ ), the tungstic acid is dissolved in ammonium hydroxide ( $\text{NH}_4\text{OH}$ ). APT is obtained from the crystallization of the resulting ammonia tungstate (AT) solution. Wet air pollution control wastewater associated with the drying of the APT crystals generally has treatable concentrations of ammonia.

The purification of the sodium tungstate intermediate can follow two basic routes. The classical approach is to precipitate calcium tungstate (synthetic scheelite) from the sodium tungstate solution by adding calcium chloride; a waste supernatant solution which is high in sodium chloride results. The calcium tungstate ( $\text{CaWO}_4$ ) can then be digested with hydrochloric acid ( $\text{HCl}$ ). From this point, the purification is the same as described above for the purification of tungstic acid intermediate - dissolution with ammonia followed by crystallization.

The second approach for purifying the sodium tungstate intermediate is a newer extraction method. The sodium tungstate solution is converted to ammonia tungstate solution in a liquid ion-exchange system. After equilibration with ammonium hydroxide, APT is recovered by filtration and crystallization. The raffinate from the ion exchange process is a wastewater source.

#### REDUCTION TO METAL

Dried APT is calcined in indirectly heated rotary furnaces to drive off ammonia and produce tungsten oxides ( $\text{WO}_x$ ). The type

of oxide produced is a function of furnace atmosphere ( $N_2$ ,  $H_2$ , etc.) and temperature. The calciners are often equipped with wet scrubbers whose wastewaters contain treatable concentrations of ammonia.

Tungsten oxides are reduced to metal powder in high temperature ( $>700^\circ C$ ) furnaces. The reducing agent is typically hydrogen ( $H_2$ ). Powders of various particle sizes are produced by varying furnace reaction time, temperature gradient, hydrogen flow, and layer thickness. Water of formation and scrubber wastewater may be associated with this step.

#### PROCESS WASTEWATER SOURCES

Although a variety of processes are involved in primary tungsten production, the process wastewater sources can be subdivided as follows:

1. Tungstic acid rinses,
2. Acid leaching wet air pollution control,
3. Alkali leach wash,
4. Ion-exchange raffinate,
5. Calcium tungstate precipitate wash,
6. Crystallization and drying of ammonium paratungstate,
7. Ammonium paratungstate conversion to oxides wet air pollution control,
8. Reduction to tungsten wet air pollution control, and
9. Reduction to tungsten water of formation.

#### OTHER WASTEWATER SOURCES

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

1. Stormwater runoff, and
2. Maintenance and cleanup water.

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

#### AGE, PRODUCTION, AND PROCESS PROFILE

Figure III-2 shows the location of the eight primary tungsten plants operating in the United States. Six of the eight plants are located in states around the Great Lakes while one is located in California and the other in Alabama. All but the one in California are in net precipitation areas.

Table III-1 shows the relative age and discharge status of the tungsten plants and illustrates that many plants were built around the time of World War II. The average plant age is between 25 and 35 years. From Table III-2, it can be seen that four plants produce over 1,000 tons/yr of metal, while three others produce less than 250 tons/yr. Mean production is about 1,000 tons/yr.

Table III-3 provides a summary of the number of plants generating wastewater for the waste streams associated with various processes and the number of plants with the process.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS  
IN THE PRIMARY TUNGSTEN SUBCATEGORY BY DISCHARGE TYPE

<u>Type of Plant</u>	Initial Operating Year (Range) (Plant Age in Years)							<u>Total</u>
	1982- 1973	1972- 1968	1967- 1958	1957- 1948	1947- 1938	1937- 1928	1927- 1918	
	<u>(0-10)</u>	<u>(11-15)</u>	<u>(16-25)</u>	<u>(26-35)</u>	<u>(36-45)</u>	<u>(46-55)</u>	<u>(56-65)</u>	
Direct	0	0	0	1	1	0	0	2
Indirect	0	0	1	0	1	1	0	3
Zero	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>3</u>
Total	0	1	2	1	3	1	0	8

Table III-2

## PRODUCTION RANGES FOR THE PRIMARY TUNGSTEN SUBCATEGORY

<u>Type of Plant</u>	<u>Tungsten Production Range for 1976</u>			<u>Total Number of Plants</u>
	<u>0-250 tons/yr</u>	<u>251-1,000 tons/yr</u>	<u>1,001-5,000 tons/yr</u>	
Direct	0	1	1	2
Indirect	2	0	1	3
Zero	1	0	2*	<u>3</u>
				8

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\*One plant here produces APT, not tungsten metal.

Table III-3

## SUMMARY OF SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

<u>Waste Stream</u>	<u>Number of Tungsten Plants With Process</u>	<u>Number of Plants Reporting Generation of Wastewater*</u>
Tungstic Acid Rinse	2	2
Acid Leaching Air Pollution Control	2	1
Alkali Leach Wash	4	2
Ion-Exchange Raffinate	2	2
Calcium Tungstate Precipitate Wash	4	4
Crystallization and Drying of Ammonium Paratungstate	4	1
Ammonium Paratungstate Conversion to Oxides Air Pollution Control	6	4
Reduction to Tungsten Air Pollution Control	5	3
Reduction to Tungsten Water of Formation	6	5

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

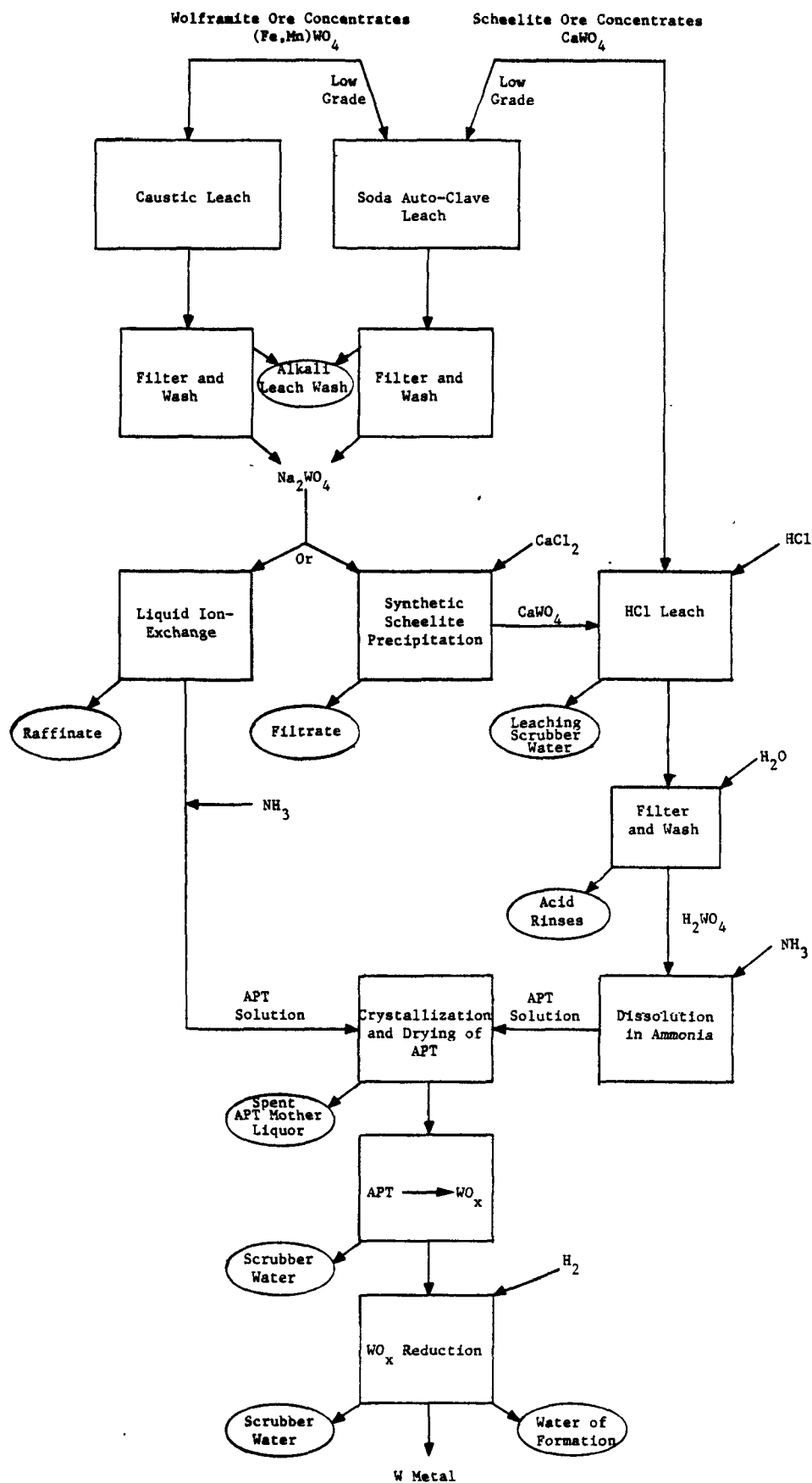


Figure III-1

PRIMARY TUNGSTEN PRODUCTION PROCESS



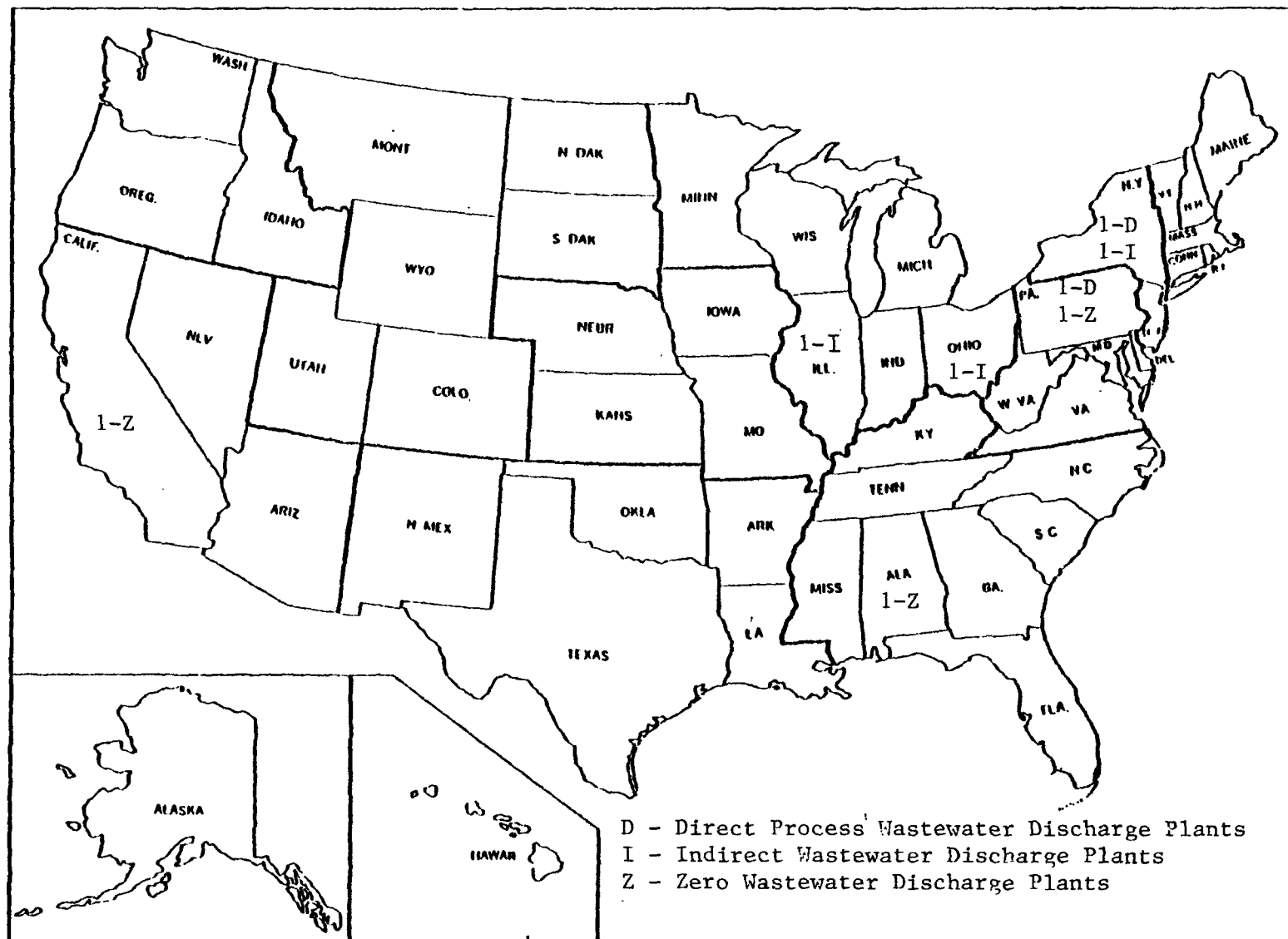


Figure III-2

GEOGRAPHIC LOCATIONS OF THE PRIMARY TUNGSTEN  
SUBCATEGORY PLANTS

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION IV

#### SUBCATEGORIZATION

As discussed in Section IV of the General Development Document, the nonferrous metals manufacturing category has been subcategorized to take into account pertinent industry characteristics, manufacturing process variations, and a number of other factors which affect the ability of the facilities to achieve effluent limitations. This section summarizes the factors considered during the designation of the primary tungsten subcategory and its related subdivisions. Production normalizing parameters for each subdivision will also be discussed.

#### FACTORS CONSIDERED IN SUBCATEGORIZATION

The following factors were evaluated for use in subcategorizing the nonferrous metals manufacturing category:

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

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

In Section IV of the General Development Document, each of these factors is described, and the rationale for selecting metal product, manufacturing process, and raw materials as the principal factors used for subcategorization is discussed. On this basis, the nonferrous metals manufacturing category (phase I) was divided into 12 subcategories, one of them being primary tungsten.

## FACTORS CONSIDERED IN SUBDIVIDING THE PRIMARY TUNGSTEN SUBCATEGORY

The factors listed previously were each evaluated when considering subdivision of the primary tungsten 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 tungsten 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 tungsten 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:

1. Tungstic acid rinse,
2. Acid leach wet air pollution control,
3. Alkali leach wash,
4. Ion-exchange raffinate,
5. Calcium tungstate precipitate wash,
6. Crystallization and drying of ammonium paratungstate,
7. Ammonium paratungstate conversion to oxides wet air pollution control,
8. Reduction to tungsten wet air pollution control, and
9. Reduction to tungsten water of formation.

These subdivisions follow directly from differences within the three distinct production stages of primary tungsten; leaching of ore concentrates, purification to APT, and reduction to metal. Generally, a specific plant will either process ore to APT, reduce APT to metal, or utilize all three stages of production and process ore concentrate all the way to tungsten metal.

Leaching of ore concentrates gives rise to the first three subdivisions. The acidic rinses of insoluble tungstic acid are a major source of wastewater directly attributable to leaching with HCl. Wastewaters from scrubbers which are used to control HCl fumes may also be significant sources of pollutants. If the alkali leaching process is used, the decantation of sodium tungstate may produce a waste stream unless it is recycled in some way.

Differences in methods of purifying the two intermediates--sodium tungstate and tungstic acid--into APT resulted in the fourth, fifth, and sixth subdivisions. If sodium tungstate is the intermediate from leaching, calcium tungstate (synthetic scheelite) may be precipitated by adding calcium chloride,  $\text{CaCl}_2$ . The filtrate from this process is a wastewater which contains sodium chloride,  $\text{NaCl}$ . If the liquid ion-exchange route is chosen to convert sodium tungstate to APT, a raffinate stream is a potential discharge.

Plants which produce APT crystallize it from solution. Consequently the spent mother liquor may create another discharge situation. Some plants use a combination of recycle or evaporation if it is feasible for this process. An ammonia recovery system is commonly economically viable for this waste stream.

The final production stage, reduction of APT to metal, also has three subdivisions associated with it. The decomposition of APT to tungsten oxides drives off ammonia which is usually contained with some type of wet scrubbing system. The reduction of oxides to tungsten metal in reduction furnaces will also require a wet scrubber to clean the reduction furnace offgases. The reduction of  $\text{WO}_3$  to tungsten metal in a hydrogen atmosphere will produce a "water of formation." This water may pass in a vapor phase through the scrubber system or may be condensed separately; consequently, a separate subdivision has been included to account for this potential discharge.

#### OTHER FACTORS

The other factors considered in this evaluation either support the establishment of the nine subdivisions or 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. 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 metal 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 tungsten product or intermediate produced will be used as the PNP. Thus, the PNPs for the nine subdivisions are as follows:

<u>Subdivision</u>	<u>PNP</u>
1. Tungstic acid rinse	kkg of tungstic acid produced
2. Acid leach wet air pollution control	kkg of tungstic acid produced
3. Alkali wash leach	kkg of sodium tungstate produced
4. Ion-exchange raffinate	kkg of ammonium tungstate produced
5. Calcium tungstate precipitate wash	kkg of calcium tungstate produced
6. Crystallization and drying of ammonium paratungstate	kkg of ammonium paratungstate produced
7. Ammonium paratungstate conversion to oxides wet air pollution control	kkg of "blue" oxide ( $WO_3$ ) produced
8. Reduction to tungsten wet air pollution control	kkg of tungsten produced
9. Reduction to tungsten water of formation	kkg of tungsten produced

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. The use of some common intermediate (i.e., ammonium paratungstate or tungsten metal) as a basis for PNPs for all processes was rejected since not all plants follow the same production path to get to the specific end-product. Additionally, some plants divert part of their intermediate products (e.g., sodium tungstate and tungsten acid) and sell them as by-products instead of processing all input raw materials to one final product. If an "end-product" were chosen as the PNP, plants that had these upstream diversions would be allowed to discharge more per mass of product than their competitors who did not.

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION V

#### WATER USE AND WASTEWATER CHARACTERISTICS

This section describes the characteristics of the wastewaters associated with the primary tungsten 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.

Section V of the General Development Document contains a detailed description of the data sources and methods of analysis used to characterize wastewater from the nonferrous metals manufacturing category. To summarize this information briefly, two principal data sources were used; 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 tungsten 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. Wastewater samples were collected in two phases: screening and verification. The first phase, screen sampling, was to identify which toxic pollutants were present in the wastewaters from production of the various metals. Screening samples were analyzed for 128 of the 129 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. There is no reason to expect that TCDD would be present in nonferrous metals manufacturing wastewater.) A total of four plants were selected for sampling in the primary tungsten subcategory; one for screening, three for verification. 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).

As described in Section IV of this supplement, the primary tungsten subcategory has been split into nine subdivisions or wastewater sources, so that the proposed regulation contains mass discharge limitations and standards for nine 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. Tungstic acid rinse water,
2. Acid leach wet air pollution control,
3. Alkali leach wash,
4. Ion-exchange raffinate,
5. Calcium tungstate precipitate wash,
6. Crystallization and drying of ammonium paratungstate,
7. Ammonium paratungstate conversion to oxides  
wet air pollution control,
8. Reduction to tungsten wet air pollution control, and
9. Reduction to tungsten water of formation.

#### 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 tungsten 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 tungsten 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 leaching scrubber water flow is related to the production of the tungstic acid intermediate. As such, the discharge rate is expressed in liters of scrubber water per metric ton of tungstic acid produced (gallons of scrubber water per ton of tungstic acid).

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 at the end of this section. 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, BPT, 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 primary tungsten production come from two sources--data collection portfolios and analytical data from field sampling trips.

### DATA COLLECTION PORTFOLIOS

In the data collection portfolios, the tungsten 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 toxic organic pollutants were believed to be absent. However, nearly all of the plants stated that they either knew the metals to be present or they believed the metals to be absent. The responses for the metals are summarized below:\*

<u>Pollutant</u>	<u>Known Present</u>	<u>Believed Present</u>	<u>Believed Absent</u>	<u>Known Absent</u>
Antimony	1	1	4	1
Arsenic	3	0	3	1
Asbestos	0	0	6	1
Beryllium	0	0	6	1
Cadmium	2	0	4	1
Chromium	3	1	2	1
Copper	4	1	2	0
Cyanide	1	0	5	1
Lead	3	0	3	1
Mercury	2	1	3	1
Nickel	1	2	3	1
Selenium	0	0	6	1
Silver	3	1	3	0
Thallium	0	0	7	0
Zinc	4	1	2	0

### FIELD SAMPLING DATA

In order to quantify the concentrations of pollutants present in wastewater from primary tungsten plants, wastewater samples were collected at four plants, which represents half of the primary tungsten plants in the United States. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 through V-4 (at the end of this section).

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\*Two plants which produce tungsten metal have been omitted due to lack of data.



Raw wastewater data are summarized in Tables V-10 through V-15 (at the end of this section). Analytical results for tungstic acid rinse water, ion-exchange raffinate, and oxides reduction furnace scrubber water are given in Tables V-10, V-11, and V-12, respectively. Table V-13 presents data on tungstic acid rinse water after lime and settle treatment. Analytical results at various points in the treatment scheme of plant C are summarized in Table V-15. Note that the stream numbers listed in the tables correspond to those given in individual plant sampling site diagrams, Figures V-1 through V-5. Where no data is listed for a specific day of sampling, the wastewater samples for the stream were not collected. If the analyses did not detect a pollutant in a wastestream, the pollutant was omitted from the table.

The field sampling data for raw wastewater and source water indicate that the concentrations of bis(2-ethylhexyl) phthalate, chloroform, di-n-octyl phthalate, and zinc in the source water were, in some cases, equal to or greater than their concentrations in the raw wastewater. This may imply that the presence of these materials in the raw wastewater is the result of source water composition rather than the processes used.

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).

These 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. Data reported as an asterisk are considered as detected but below quantifiable concentrations, and a value of zero is used for averaging. Toxic 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 excluded in calculating the average. Finally, toxic metal values reported as less than a certain value were considered as not detected, and consequently were not used in the calculation of the average. For example, three samples reported as ND, \*, and 0.021 mg/l have an average value of 0.010 mg/l.

Appropriate tubing or background blank and 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 | 24-hour manual composite    |
| 3 | 24-hour automatic composite |
| 4 | 48-hour manual composite    |
| 5 | 48-hour automatic composite |
| 6 | 72-hour manual composite    |
| 7 | 72-hour automatic composite |

#### WASTEWATER CHARACTERISTICS AND FLOWS BY SUBDIVISION

Since primary tungsten production involves nine 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.

#### TUNGSTIC ACID RINSE WATER

Both plants that leach scheelite ores or calcium tungstate (synthetic scheelite) with hydrochloric acid to produce tungstic acid ( $\text{H}_2\text{WO}_4$ ) also use water to rinse the insoluble  $\text{H}_2\text{WO}_4$ . The spent rinse water is discharged. The production normalized water use and discharge rates for tungsten acid rinses are given in Table V-1 in liters per metric ton of tungstic acid produced.

Table V-10 summarizes the field sampling data on spent tungsten acid rinse water from two plants. From this data, it can be seen that tungsten acid rinses can be characterized by acidic pH; treatable concentrations of many metals including lead and zinc; and treatable concentrations of suspended solids.

#### ACID LEACH WET AIR POLLUTION CONTROL

Plants that acid leach use wet scrubbing systems for the control of HCl fumes. One plant recycled this water and the other discharged all of it. Table V-2 presents the production normalized water use and discharge flows for acid leach scrubber water in liters per metric ton of tungstic acid produced.

The Agency did not specifically sample this wastestream, but the stream's major characteristics should be very similar to the raw wastewater data from tungstic acid rinse water, Table V-10. That is, the scrubber water is expected to be acidic (pH of approximately 2).

#### ALKALI LEACH WASH

Four plants reported using water for an alkali leaching step in which wolframite type ores,  $(\text{Fe,Mn})\text{WO}_4$ , are digested in a caustic environment to produce sodium tungstate,  $\text{Na}_2\text{WO}_4$ .  $\text{Na}_2\text{WO}_4$  is filtered from the digestion-wash liquor and the filtrate may be evaporated, recycled, or discharged. Table V-3 presents the production normalized water use and discharge flows for alkali leach wash water in liters per metric ton of sodium tungstate produced.

Although this waste stream was not sampled, it is assumed that many of the impurities that were leached away in the acid leaching process will also be present in the alkali leach wash since both start from ore concentrates. Consequently, treatable concentrations of metals and suspended solids are expected. Wastewater characteristics for acid leaching are shown in Table V-10.

#### ION-EXCHANGE RAFFINATE

Two plants use a liquid ion-exchange method for producing ammonium tungstate (AT) from sodium tungstate. A raffinate stream will be discharged. Table V-4 presents the production normalized water use and discharge flows for this waste stream. These flows are given in liters per metric ton of AT produced. Differences between the normalized flows can be attributed to slight differences in the processes themselves.

Table V-11 presents field sampling data for an ion-exchange raffinate stream at one of the plants. This stream has measurable concentrations of organics such as acenaphthene, naphthalene, acenaphthylene and fluorene, since an organic resin may be used in the ion-exchange process. The sampling data also indicate that the stream is acidic (pH of approximately 2.5) and contains metals, suspended solids, and ammonia.

#### CALCIUM TUNGSTATE PRECIPITATION WASH

Four plants report a flow associated with calcium tungstate (synthetic scheelite) precipitation. In this intermediate step, sodium tungstate is converted to calcium tungstate by mixing with a calcium chloride solution. No plants reported recycling this wastewater. The production normalized water use and discharge flows are reported in Table V-5 as liters per metric ton of calcium tungstate produced.

The Agency did not collect any raw wastewater samples from this operation during the field sampling program. It is expected that the waste filtrate will contain the same metals resulting from ore concentrate impurities which were found in other primary tungsten process waste streams. The sampling data for tungstic acid rinse water, Table V-10, is assumed to be fairly representative of the metals and conventional pollutants found in the calcium tungstate wash water. Calcium tungstate wash water is not expected to be as acidic, however.

#### CRYSTALLIZATION AND DRYING OF AMMONIUM PARATUNGSTATE

All four plants which produce ammonium paratungstate (APT) report that wastewater is associated with the crystallization and drying step. APT crystals are precipitated and filtered from an aqueous mother liquor. This mother liquor is usually recycled or evaporated after ammonia recovery. The drying of crystals may require a wet scrubber to control the ammonia which is driven off in the drying process. This scrubber water is usually stripped of ammonia and then recycled or discharged. Table V-6 presents the production normalized water use and discharge flows for this subdivision in liters per metric ton of APT produced.

The most significant pollutant characteristic associated with this stream is the concentration of ammonia. Although the Agency did not specifically sample APT drying scrubber water or mother liquor, the metal constituents present should be similar to those given in the sampling data in Table V-12. This table gives data for scrubber water from a reduction furnace. The major difference between this data and APT drying scrubber water would be the concentrations of ammonia associated with APT drying.

#### AMMONIUM PARATUNGSTATE CONVERSION TO OXIDES WET AIR POLLUTION CONTROL

Six plants report using water in converting APT to tungsten oxides ( $WO_x$ ). In all cases a wet scrubbing system is used to control the ammonia which is driven off when APT is calcined to oxides in rotary furnaces. Two of the six plants evaporate or recycle this scrubber water. To calculate production normalization factors, all oxides were assumed to be the common "blue" oxide,  $WO_3$ . Thus, production normalized water use and discharge flows are presented as liters of water per metric ton of "blue" oxide ( $WO_3$ ) in Table V-7.

Table V-12 summarizes the field sampling data for the pollutants detected in a stream which should be representative of APT reduction scrubber water with regard to toxic pollutants. Additionally, treatable concentrations of ammonia and suspended solids, and an alkaline pH are expected. The ammonia will be present in

the wastewater from this scrubber because it evolves as the APT is converted to an oxide. The presence of ammonia causes the pH to be elevated.

#### REDUCTION TO TUNGSTEN WET AIR POLLUTION CONTROL

Five plants that reduce tungsten oxides to tungsten metal report using water in a wet scrubbing system. The scrubbing system is used to control particulates from the furnace operation, although some plants use a hydrogen recovery system, too. Table V-8 gives production normalized water use and discharge flows in liters per metric ton of tungsten metal for the five plants which use water. As shown in Table V-8, two plants use a total recycle of this stream.

Particulates and soluble salts from fluxes used in the reduction furnaces will characterize this waste stream. Treatable concentrations of ammonia and an alkaline pH may also be found. Table V-12 presents field sampling data for samples taken from two different reduction furnace scrubber waters.

#### REDUCTION TO TUNGSTEN METAL WATER OF FORMATION

Plants that reduce oxides to tungsten metal in a hydrogen atmosphere may generate a water of formation as generalized by the following reaction:



In some plants this water may be recondensed in the reduction furnace scrubber system. Production normalized water use and discharge flows for this subdivision are presented in Table V-9 in liters per metric ton of tungsten metal. It should be noted that since this is a water of formation, no water will actually be used in this process.

The wastewater characteristics of this stream should be very similar to those for the scrubber waters from reduction to metal furnaces as described above. Table V-12 is the field sampling data that is associated with this stream.

Table V-1

WATER USE AND DISCHARGE RATES FOR TUNGSTIC ACID  
RINSE WATER  
( $10^3$  l/kg of Tungstic Acid Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9011	0	57.6	57.6
9014	0	37.6	37.6

Table V-2

WATER USE AND DISCHARGE RATES FOR ACID LEACH  
WET AIR POLLUTION CONTROL  
(10<sup>3</sup> l/kg of Tungstic Acid Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9011	0	37.7	37.7
9014	100	15.0	0

Table V-3

WATER USE AND DISCHARGE RATES FOR ALKALI LEACH WASH  
 (10<sup>3</sup> l/kg of Sodium Tungstate Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9011	(100% Evapora- tion)	24.4	0
9012	0	10.7	10.7
9014	NR	NR	0
9017	0	82.6	82.6

NR - Present but data not reported in dcp.



Table V-4  
WATER USE AND DISCHARGE RATES FOR ION-EXCHANGE  
RAFFINATE  
( $10^3$  l/kg of Ammonium Tungstate Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9012	NR	NR	72.5
9017	0	29.8	29.8

NR - Present but data not reported in dcp.

Table V-5

WATER USE AND DISCHARGE RATES FOR CALCIUM TUNGSTATE  
PRECIPITATE WASH  
( $10^3$  l/kg of Calcium Tungstate Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9011	0	21.0	21.0
9012	NR	NR	NR
9014	0	65.8	65.8
9017	0	24.7	24.7

NR - Present but data not reported in dcp.

Table V-6

WATER USE AND DISCHARGE RATES FOR AMMONIUM PARATUNGSTATE  
CRYSTALLIZATION AND DRYING  
(10<sup>3</sup> l/kg of Ammonium Paratungstate Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9011	(100% Evapora- tion)	.098	0
9012	NR	NR	0
9014	100	NR	0
9017	NR	NR	68.6

NR - Present but data not reported in dcp.

Table V-7

WATER USE AND DISCHARGE RATES FOR APT CONVERSION  
 TO OXIDES WET AIR POLLUTION CONTROL  
 ( $10^3$  l/kg of "blue" Oxide ( $\text{WO}_3$ ) Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9010	0	11.0	11.0
9011	(100% Evapora- tion)	.05	0
9012	0	36.8	36.8
9014	0	7.43	7.43
9015	100	NR	0
9018	0	28.4	28.4

NR - Present but data not reported in dcp.

Table V-8

WATER USE AND DISCHARGE RATES FOR REDUCTION TO  
TUNGSTEN WET AIR POLLUTION CONTROL  
(10<sup>3</sup> l/kg of Tungsten Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9012	0	426.0	426.0
9014	33	120.6	80.5
9015	100	NR	0
9016	100	NR	0
9018	0	65.9	65.9

NR - Present but data not reported in dcp.

Table V-9

WATER USE AND DISCHARGE RATES FOR REDUCTION TO  
TUNGSTEN WATER OF FORMATION  
(10<sup>3</sup> l/kg of Tungsten Produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9010	NR	0	19.4
9011	NR	0	0
9012	NR	0	NR
9014	NR	0	NR
9018	NR	0	NR

NR - Present but data not reported in dcp.

Table V-10

PRIMARY TUNGSTEN SAMPLING DATA  
TUNGSTIC ACID RINSE  
RAW WASTEWATER

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type †</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants (a)</u>							
1. acenaphthene	220	1	*	ND			
4. benzene	64	2	*	*	*	*	*
	220	2	ND	*	*		*
6. carbon tetrachloride	64	2	ND	ND	ND	ND	
8. 1,2,4-trichlorobenzene	64	7	ND	ND			
10. 1,2-dichloroethane	64	2	ND	ND	ND	ND	
	220	2	ND	ND	ND		
14. 1,1,2-trichloroethane	220	2	ND	ND	ND		
15. 1,1,2,3-tetrachloroethane	220	2	*	*	*		*
23. chloroform	64	2	.075	.025	.017	.043	.028
	220	2	*	ND	ND		
25. 1,2-dichlorobenzene	64	7	ND	ND			
29. 1,1-dichloroethylene	64	2	ND	ND	ND	.019	.019
	220	2	ND	ND	ND		
38. ethylbenzene	220	2	ND	ND	ND		

Table V-10 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TUNGSTIC ACID RINSE  
RAW WASTEWATER

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u> †	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
44. methylene chloride	220	2	ND	ND	ND		
47. bromoform	220	2	ND	ND	ND		
48. dichlorobromomethane	64	2	ND	ND	ND	ND	
	220	2	ND	ND	ND		
51. chlorodibromomethane	220	2	ND	ND	ND		
55. naphthalene	64	7	ND	*			*
	220	1	*	ND			
56. nitrobenzene	64	2	ND	ND			
66. bis(2-ethylhexyl) phthalate	64	1	0.06	0.94			0.94
	220	1	0.058	*			*
68. di-n-butyl phthalate	64	7	0.011	0.035			0.035
69. di-n-octyl phthalate	64	7	0.037	0.038			0.038
70. diethyl phthalate	64	7	ND	ND			
71. dimethyl phthalate	64	7	ND	ND			
76. chrysene	64	7	ND	0.024			0.024



Table V-10 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TUNGSTIC ACID RINSE  
RAW WASTEWATER

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type †</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
77. acenaphthylene	220	1	ND	ND			
78. anthracene (b)	64	7	ND	<0.014			<0.014
81. phenanthrene (b)	220	1	<0.016	ND			
80. fluorene	220	1	*	*			*
84. pyrene	64	7	*	*			*
85. tetrachloroethylene	64	2	*	*	*	*	*
	220	2	*	0.012	*		0.006
86. toluene	220	2	ND	*	*		*
87. trichloroethylene	64	2	<0.043	*	ND	<0.02	<0.015
	220	2	ND	*	*		*
89. aldrin	220	1	ND	ND			
95. alpha-endosulfan	220	1	ND	ND			
96. beta-endosulfan	220	1	ND	ND			
106. PCB-1242 (c)	220	1	**	**			**
107. PCB-1254 (c)							
108. PCB-1221 (c)							

Table V-10 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TUNGSTIC ACID RINSE  
RAW WASTEWATER

Concentrations (mg/l, except as noted)

<u>Pollutant</u>			<u>Stream Code</u>	<u>Sample Type</u> †	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
109.	PCB-1232	(d)	220	1	**	**			**
110.	PCB-1248	(d)							
111.	PCB-1260	(d)							
112.	PCB-1016	(d)							
114.	antimony		220	1	<0.1	<0.1			<0.1
115.	arsenic		64	7	<0.01	7.2			7.2
			220	1	<0.01	0.13			0.13
117.	beryllium		64	7	<.001	0.03			0.03
118.	cadmium		64	7	0.008	0.2			0.2
			220	1	<0.002	0.03			0.03
119.	chromium		64	7	<0.005	2.0			2.0
			220	1	<0.005	0.1			0.1
120.	copper		64	7	0.01	5.0			5.0
			220	1	0.01	0.2			0.2
121.	cyanide		64	7		0.009	0.02	0.009	0.0127
			220	1		<0.001			<0.001
122.	lead		64	7	<0.02	20.0			20.0
			220	1	<0.02	<0.2			<0.2

Table V-10 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TUNGSTIC ACID RINSE WATER  
RAW WASTEWATER

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type †</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
123. mercury	64	7	<0.0001	0.0011			0.0011
	220	1	<0.0001	0.0005			0.0005
124. nickel	64	7	<0.005	1.0			1.0
	220	1	<0.005	<0.05			<0.05
125. selenium	220	1	<0.01	<0.01			<0.01
126. silver	64	7		0.29			0.29
	220	1	<0.02	<0.02			<0.02
127. thallium	64	7	<0.01	0.7			0.7
	220	1	<0.1	<0.1			<0.01
128. zinc	64	7	0.08	2.0			2.0
	220	1	0.1	0.6			0.6
<u>Nonconventionals</u>							
ammonia	64	2		3.1	3.4	3.2	3.233
chemical oxygen demand (COD)	64	2		323			323
	220	2		22			22

Table V-10 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TUNGSTIC ACID RINSE  
RAW WASTEWATER

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type †</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
chloride	64	2	25,700			25,700	
	220	2	16,600			16,600	
phenols (total; by 4-AAP method)	64	2	0.023	0.024	0.221	0.0893	
	220	2	0.029			0.029	
total organic carbon (TOC)	64	2	6			6	
	220	2	4			4	
<u>Conventionals</u>							
oil and grease	64	2	6	2	11	6.33	
	220	2	1	3		2	
total suspended solids	64	7	209			209	
(TSS)	220	2	19			19	
pH (standard units)	64	1	0.85	0.6	1.0		
	220	1	1.80	1.80			

Table V-10 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TUNGSTIC ACID RINSE  
RAW WASTEWATER

(a) One sample from each stream was analyzed for acid extractable toxic organic pollutants; none was reported above its analytical quantification concentration.

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

†Sample type. Note: These numbers also apply to subsequent sampling data tables in this section.

- 1 - one-time grab
- 2 - 24-hour manual composite
- 3 - 24-hour automatic composite
- 4 - 48-hour manual composite
- 5 - 48-hour automatic composite
- 6 - 72-hour manual composite
- 7 - 72-hour automatic composite

\*Indicates less than or equal to 0.01 mg/l.

\*\*Indicates less than or equal to 0.005 mg/l.

Table V-11

PRIMARY TUNGSTEN SAMPLING DATA  
ION-EXCHANGE RAFFINATE  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
1. acenaphthene	219	7	*	0.111			0.111
4. benzene	219	2	ND	*	ND	ND	*
10. 1,2-dichloro-ethane	219	2	ND	*	ND	*	*
14. 1,1,2-tri-chloroethane	219	2	ND	ND	ND	ND	
15. 1,1,2,3-tetra-chloroethane	219	2	*	<0.043	*	*	<0.021
23. chloroform	219	2	*	0.014	*	0.036	0.017
29. 1,1-dichloro-ethylene	219	2	ND	ND	ND	ND	
38. ethylbenzene	219	2	ND	0.011	ND	*	0.0055
44. methylene chloride	219	2	ND	ND	ND	ND	
47. bromoform	219	2	ND	ND	0.036	0.053	0.0445
48. dichlorobromo-methane	219	2	ND	ND	ND	ND	

Table V-11 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
ION-EXCHANGE RAFFINATE  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
51. chlorodibromomethane	219	2	ND	0.038	ND	ND	0.038
55. naphthalene	219	7	*	1.078			1.078
66. bis(2-ethylhexyl)phthalate	219	7	0.058	0.016			0.016
77. acenaphthylene	219	7	ND	0.112			0.112
78. anthracene (b) 81. phenanthrene (b)	219	7	<0.016	<0.325			<0.325
80. fluorene	219	7	*	0.06			0.06
85. tetrachloroethylene	219	2	*	<0.053	0.026	0.037	<0.021
86. toluene	219	2	ND	0.046	0.020	*	0.022
87. trichloroethylene	219	2	ND	*	ND	ND	*
89. aldrin	219	7	ND	ND			
95. alpha-endo-sulfan	219	7	ND	**			**

Table V-11 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
ION-EXCHANGE RAFFINATE  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
96. beta-endo- sulfan	219	7	ND	ND			
106. PCB-1242 (c)	219	7	**	**			**
108. PCB-1254 (c)							
108. PCB-1221 (c)							
109. PCB-1232 (d)	219	7	**	**			**
110. PCB-1248 (d)							
111. PCB-1260 (d)							
112. PCB-1016 (d)							
114. antimony	219	7	<0.1	<0.1			<0.1
115. arsenic	219	7	<0.01	0.22			0.22
118. cadmium	219	7	<0.002	<0.02			<0.02
119. chromium	219	7	<0.005	<0.05			<0.05
120. copper	219	7	0.01	0.1			0.1
121. cyanide	219	7		0.002	0.003	0.002	0.0023
122. lead	219	7	<0.02	<0.2			<0.2
123. mercury	219	7	<0.0001	0.0003			0.0003



Table V-11 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
ION-EXCHANGE RAFFINATE  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u> •	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
124. nickel	219	7	<0.005	<0.05			<0.05
125. selenium	219	7	<0.01	<0.01			<0.01
126. silver	219	7	<0.02	0.1			0.1
127. thallium	219	7	<0.1	<0.1			<0.1
128. zinc	219	7	0.1	<0.6			<0.6
<u>Nonconventionals</u>							
ammonia	219	2		134	162	1,790	695
chemical oxygen demand (COD)	219	2		127			127
phenols (total; by 4-AAP method)	219	2		0.002	0.065	0.051	0.03933
total organic carbon (TOC)	219	2		28			28

Table V-11 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
ION-EXCHANGE RAFFINATE  
RAW WASTEWATER

Conventionals

oil and grease	219	2	5	3	13	7
total suspended solids (TSS)	219	2	43			43
pH (standard units)	219	1	2.4	2.5	2.5	

3

(a) One sample was analyzed for the acid extractable toxic organic pollutants; none was reported above its analytical quantification concentration.

(b), (c), (d) Reported together

\*Less than or equal to 0.01 mg/l.

\*\*Less than or equal to 0.005 mg/l.

Table V-12

PRIMARY TUNGSTEN SAMPLING DATA  
OXIDES REDUCTION FURNACE SCRUBBER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
119. chromium	130	1	ND	0.04			0.04
123. mercury	130	1	0.0001	0.0002			0.0002
	221(a)	1	0.0001	0.0004			0.0004
128. zinc	130	1	<0.065	<0.06			<0.06
	221(a)	1	0.1	0.06			0.06
<u>Nonconventionals</u>							
ammonia	130	1	0.5	0.0435			0.0435
chemical oxygen demand (COD)	130	1		0.48			0.48
total organic carbon (TOC)	130	1		12			12
<u>Conventionals</u>							
oil and grease	130	1		74			74
pH (standard units)	130	1		12			

(a) This sample was analyzed only for the toxic metal pollutant.

Table V-13

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
4. benzene	65	2	*	<0.017	*	*	<0.022
10. 1,2-dichloro-ethane	65	2	ND	0.015	ND	0.029	0.022
23. chloroform	65	2	0.075	0.031	0.041	0.083	0.052
29. 1,1-dichloro-ethylene	65	2	ND	ND	0.02	ND	0.02
48. dichlorobromo-methane	65	2	ND	0.012	*	*	0.004
66. bis(2-ethyl-hexyl)phthalate	65	7	0.06	0.797			0.797
68. di-n-butyl phthalate	65	7	0.011	0.078			0.078
69. di-n-octyl phthalate	65	7	0.037	0.08			0.08
87. trichloro-ethylene	65	2	<0.043	<0.088	<0.045	<0.03	<0.054

Table V-13 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
115. arsenic	65	7	<0.01	0.08			0.08
118. cadmium	65	7	0.008	0.08			0.08
119. chromium	65	7	<0.005	<0.0543			<0.0543
120. copper	65	7	0.01	0.07			0.07
121. cyanide	65	7	0.05	0.004	0.006	0.001	0.0037
122. lead	65	7	<0.02	<0.2			<0.2
124. nickel	65	7	<0.005	0.1			0.1
126. silver	65	7	<0.02	0.03			0.03
127. thallium	65	7	<0.1	0.9			0.9
128. zinc	65	7	0.08	<0.6			<0.6
<u>Nonconventionals</u>							
ammonia	65	2		4.9	4.2	3.7	4.27
chemical oxygen demand (COD)	65	2		53			53
chloride	65	2		19,100			19,100

Table V-13 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT B

phenols (total; by 4-AAP method)	65	2	1.55	1.17	0.62	1.11
total organic carbon (TOC)	65	2	10			10
<u>Conventionals</u>						
oil and grease	65	1	2	2	10	4.7
total suspended solids (TSS)	65	2	151			151
pH (standard units)	65	1	8.5	8.1	5.8	

Table V-14

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

		Concentrations (mg/l, except as noted)					
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutant</u>							
1. acenaphthene	9	7		ND			
4. benzene	9	1		*	ND	<0.117	<0.064
	10	1		*	<0.012	<0.017	<0.013
	11	1		*	<0.020	ND	<0.01
6. carbon tetrachloride	11	1		ND	ND	0.022	0.022
8. 1,2,4-trichlorobenzene	11	7		0.011			0.011
10. 1,2-dichloroethane	9	1		*	0.15	ND	0.075
	10	1		0.017	0.097	ND	0.0570
	11	1		ND	0.065	ND	0.065
14. 1,1,2-trichloroethane	9	1		ND	ND	0.043	0.043
	10	1		ND	ND	0.011	0.011
15. 1,1,2,3-tetrachloroethane	9	1		ND	ND	ND	
	10	1		ND	*	<0.011	<0.011
23. chloroform	9	1		0.142	0.024	0.044	0.07
	10	1		0.342	0.54	0.045	0.309
	11	1		1.933	0.073	0.058	0.688
25. 1,2-dichlorobenzene	11	7		0.011			0.011

Table V-14 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

				Concentrations (mg/l, except as noted)			
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
29. 1,1-dichloroethylene	9	1		0.013	0.05	ND	0.0315
	10	1		0.051	0.04	ND	0.0455
	11	1		0.048	ND	ND	0.048
38. ethylbenzene	9	1		ND	*	ND	*
	10	1		0.011	*	*	0.00367
44. methylene chloride	9	1		0.018	ND	ND	0.018
47. bromoform	9	1		ND	ND	ND	
48. dichlorobromomethane	9	1		ND	ND	0.117	0.117
	10	1		ND	0.012	0.022	0.017
	11	1		ND	0.012	0.048	0.03
51. chlorodibromomethane	9	1		ND	ND	0.146	0.146
	10	1		ND	ND	0.034	0.034
55. naphthalene	9	7		ND			
	11	7		0.032			0.032
56. nitrobenzene	11	7		0.011			0.011
66. bis(2-ethylhexyl)phthalate	9	7		0.03			0.03
	10	7		0.014			0.014
	11	7		0.034			0.034



Table V-14 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

Concentrations (mg/l, except as noted)							
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
68. di-n-butyl phthalate	11	7		0.013			0.013
	10	7		0.025			0.025
69. di-n-octyl phthalate	11	7		ND			
70. diethyl phthalate	11	7		0.016			0.016
71. dimethyl phthalate	11	7		0.23			0.23
76. chrysene	11	7		ND			
77. acenaphthylene	9	7		ND			
78. anthracene (b)	9	7		ND			
81. phenanthrene (b)	11	7		0.016			0.016
80. fluorene	9	7		ND			
84. pyrene	11	7		0.015			0.015
85. tetrachloroethylene	9	1		0.012	ND	ND	0.012
	10	1		0.078	*	*	0.026
	11	1		0.02	*	ND	0.01

Table V-14 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

		Concentrations (mg/l, except as noted)					
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
86. toluene	9	1		*	ND	*	*
	10	1		0.011		*	0.0055
87. trichloroethylene	9	1		*	ND	<0.162	<0.086
	10	1		0.045	<0.064	<0.07	0.015
	11	1		*	<0.093	ND	<0.0515
89. aldrin	9	7		0.007			0.007
95. alpha-endosulfan	9	7		0.03			0.03
96. beta-endosulfan	9	7		0.03			0.03
106. PCB-1242 (c)	9	7		<0.012			<0.012
107. PCB-1254 (c)	10	7		<0.009			<0.009
108. PCB-1221 (c)							
109. PCB-1232 (d)	9	7		<0.015			<0.015
110. PCB-1248 (d)	10	7		<0.013			<0.013
112. PCB-1016 (d)							
114. antimony	9	7		0.8			0.8
115. arsenic	9	7		0.02			0.02
	11	7		0.018			0.018

Table V-14 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
117. beryllium	11	7		<0.002			<0.002
118. cadmium	9	7		<0.02			<0.02
	10	7		<0.02			<0.02
	11	7		<0.02			<0.02
119. chromium	9	7		0.044			0.044
	10	7		<0.024			<0.024
	11	7		0.0443			0.0443
120. copper	9	7		0.115			0.115
	10	7		0.148			0.148
	11	7		0.064			0.064
121. cyanide	9	7		0.159	0.179	0.096	0.1447
	10	7		0.6	0.001	0.516	0.3723
	11	7		0.014	0.021	0.286	0.106
122. lead	9	7		0.242			0.242
	10	7		0.219			0.219
	11	7		0.14			0.14
123. mercury	9	7		0.003			0.003
	10	7		0.0002			0.0002
	11	7		0.0006			0.0006

Table V-14 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

Concentrations (mg/l, except as noted)							
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
124. nickel	9	7		0.092			0.092
	10	7		0.108			0.108
	11	7		<0.05			<0.05
125. selenium	9	7		1			1
	10	7		0.09			0.09
126. silver	9	7		ND			
127. thallium	9	7		0.2			0.2
	10	7		0.224			0.224
	11	7		ND			
128. zinc	9	7		0.248			0.248
	10	7		0.239			0.239
	11	7		0.083			0.083
<u>Nonconventionals</u>							
ammonia	9	1	2,250	950	1,630	1,610	
	10	1	1,150	775	1,480	1,135	
	11	1	6.8	210	700	305.6	
chemical oxygen demand (COD)	9	1	881			881	
	10	7	242			242	
	11	1	100			100	

Table V-14 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
total organic carbon (TOC)	9	1		269			269
	10	7		61			61
	11	1		33			33
phenols (total; by 4-AAP method)	9	1		0.076	0.018	0.021	0.0383
	10	1		0.007	0.016	0.007	0.01
	11	1		0.011	0.01	0.013	0.0113
<u>CONVENTIONALS</u>							
oil and grease	9	1		9	23	20	17.33
	10	1		6	8	18	10.67
	11	1		9	6	16	10.33
pH (standard units)	9	1		10.4	8.6	9.5	
	10	1		3.6	8.5	8.0	
	11	1		8.2	9.2	7.3	
total suspended solids (TSS)	9	1		6,714			6,714
	10	1		374			374
	11	7		91			91

Table V-14 (Continued)

PRIMARY TUNGSTEN SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

(a) One sample from each stream was analyzed for acid extractable toxic organic pollutants; none was reported above its analytical quantification concentration.

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

\*Less than or equal to 0.01 mg/l.

\*\*Less than or equal to 0.005 mg/l.

Source water samples were not taken at this plant.

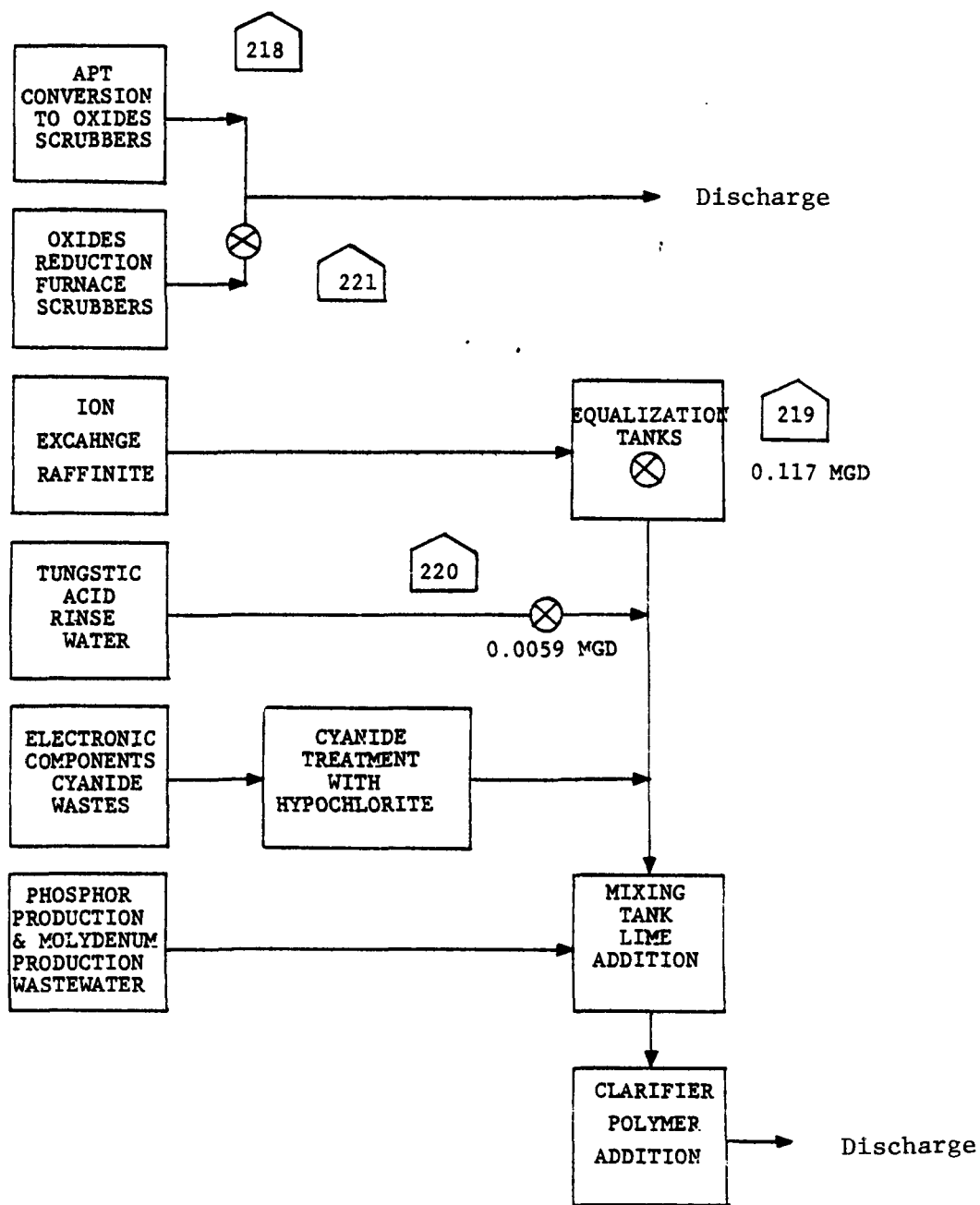


Figure V-1  
SAMPLING SITES AT PRIMARY TUNGSTEN PLANT A

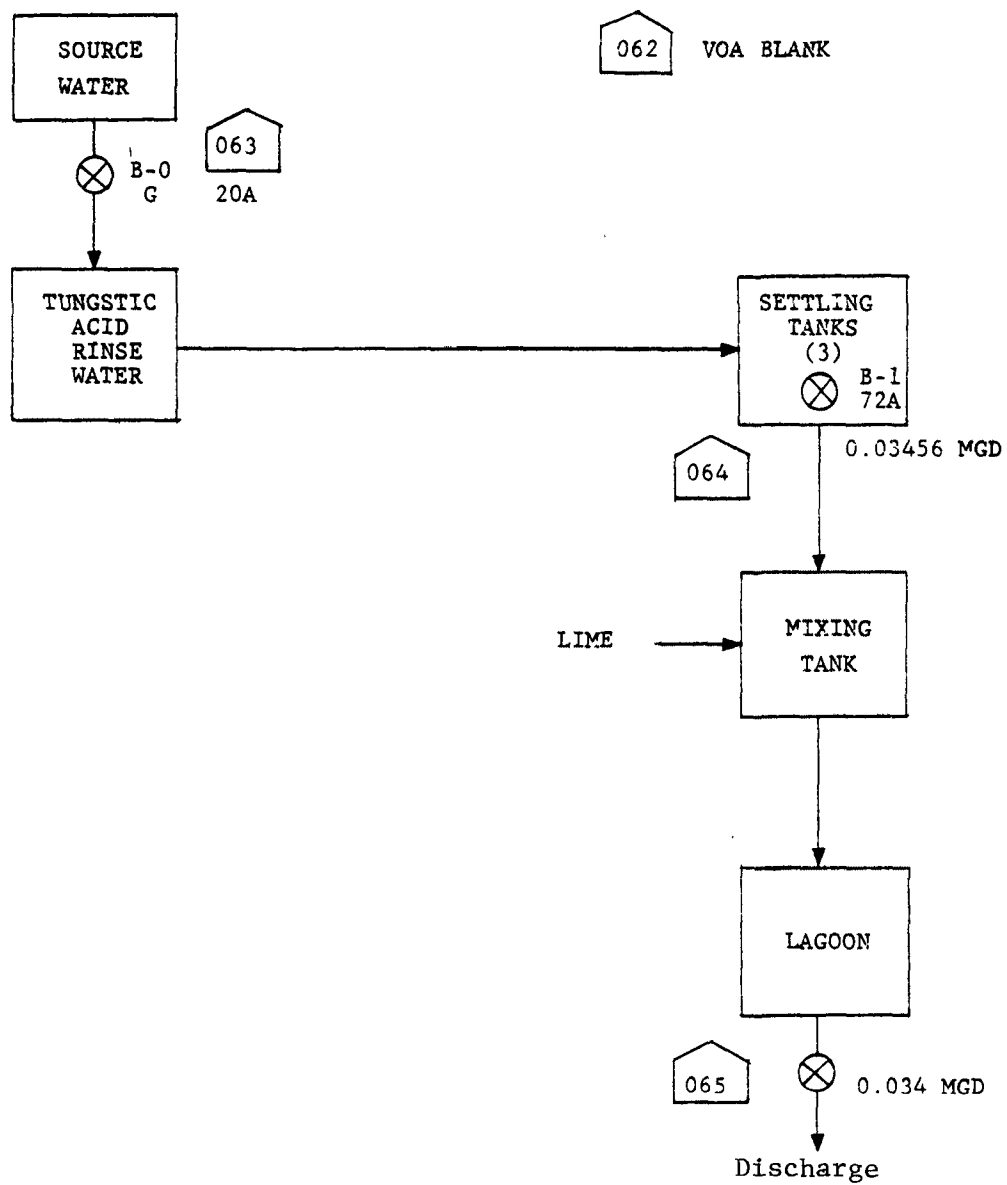


Figure V-2  
SAMPLING SITES AT PRIMARY TUNGSTEN PLANT B





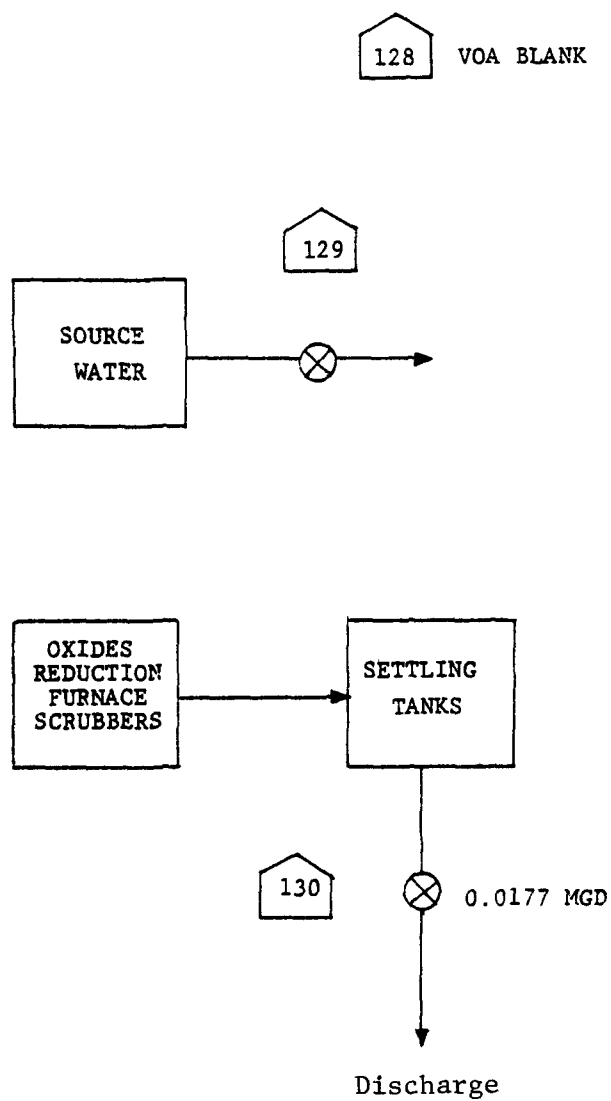


Figure V-4  
SAMPLING SITES AT PRIMARY TUNGSTEN PLANT D

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION VI

#### SELECTION OF POLLUTANT PARAMETERS

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

Each pollutant selected for potential limitation is discussed in Section VI of the General Development Document. That discussion provides information concerning the 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 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 toxic metals were the long-term performance values achievable by lime precipitation, sedimentation, and filtration. The treatable concentrations used for the toxic organics were the long-term performance values achievable by carbon adsorption (see Section VII of the General Development Document - Combined Metals Data Base).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS

This study examined samples from the primary tungsten subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and four nonconventional pollutant parameters (ammonia, chemical oxygen demand, total organic carbon, and total phenols).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

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

- ammonia
- total suspended solids (TSS)
- pH

Ammonia is the only nonconventional pollutant parameter selected for consideration in establishing limitations for this subcategory. Ammonia was found in all seven raw waste samples analyzed for this subcategory in concentrations ranging from 0.0435 to 1,790 mg/l. Three of the values recorded are well above the 32.2 mg/l concentration attainable by the available treatment technology. Additionally, ammonia concentrations above the treatable concentration (up to 2,250 mg/l) were found in three partially treated wastewaters where there was no raw waste data available. Consequently, ammonia is selected for limitation in this subcategory.

TSS concentrations ranging from 43 to 209 mg/l were observed in the three raw waste samples analyzed for this study. All three concentrations are well above the 2.6 mg/l treatable concentration. In one partially treated sample, TSS was measured at 6,714 mg/l. Furthermore, 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 nine pH values observed during this study ranged from 0.6 to 12.0. Eight of the nine values were equal to or less than 2.5, and the other was above 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 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 POLLUTANTS

The frequency of occurrence of the toxic pollutants in the raw wastewater samples taken is presented in Table VI-1. Table VI-1 is based on the raw wastewater data from streams 9, 64, 130, and 219 (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

Paragraph 8(a)(iii) of the Revised Settlement Agreement allows the Administrator to exclude from limitation those toxic pollutants not detectable by Section 304(h) analytical methods or other state-of-the-art methods. The toxic pollutants listed below were not detected in any raw wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

2. acrolein
3. acrylonitrile
5. benzidine
6. carbon tetrachloride
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
11. 1,1,1-trichloroethane
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
16. chloroethane
17. bis(chloromethyl) ether
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-dichlorobenzene
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. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl)ether
43. bis(2-chloroethoxy)methane
44. methylene chloride
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
56. nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-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
- 70. diethyl phthalate
- 71. dimethyl phthalate
- 72. benzo(a)anthracene
- 73. benzo(a)pyrene
- 74. 3,4-benzofluoranthene
- 75. benzo(k)fluoranthene
- 79. benzo(ghi)perylene
- 82. dibenzo(a,h)anthracene
- 83. indeno (1,2,3-cd)pyrene
- 88. vinyl chloride
- 89. aldrin
- 90. dieldrin
- 91. chlordane
- 92. 4,4'-DDT
- 93. 4,4'-DDE
- 94. 4,4'-DDD
- 96. beta-endosulfan
- 97. endosulfan sulfate
- 98. endrin
- 99. endrin aldehyde
- 100. heptachlor
- 101. heptachlor epoxide
- 102. alpha-BHC
- 103. beta-BHC
- 104. gamma-BHC
- 105. delta-BHC
- 113. toxaphene
- 114. antimony
- 116. asbestos
- 129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION CONCENTRATION

The provision of Paragraph 8(a)(iii) of the Revised Settlement Agreement excluding from limitation those toxic pollutants which are not detectable includes those pollutants whose concentrations fall below EPA's nominal detection limit. The toxic pollutants listed below 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.

- 4. benzene
- 10. 1,2-dichloroethane

- 15. 1,1,2,2-tetrachloroethane
- 39. fluoranthene
- 78. anthracene (a)
- 81. phenanthrene (a)
- 84. pyrene
- 87. trichloroethylene
- 95. alpha endosulfan
- 106. PCB-1242 (b)
- 107. PCB-1254 (b)
- 108. PCB-1221 (b)
- 109. PCB-1232 (c)
- 110. PCB-1248 (c)
- 111. PCB-1260 (c)
- 112. PCB-1016 (c)

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

#### TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

Paragraph 8(a)(iii) of the Revised Settlement Agreement also allows the exclusion of toxic pollutants which were detected in quantities too small to be effectively reduced by technologies known to the Administrator. 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.

- 23. chloroform
- 29. 1,1-dichloroethylene
- 38. ethylbenzene
- 51. chlorodibromomethane
- 85. tetrachloroethylene
- 86. toluene
- 117. beryllium
- 121. cyanide
- 123. mercury

Chloroform was detected in six of eight raw waste samples for which it was analyzed at concentrations ranging from 0.014 to 0.036 mg/l. Since available treatment methods specific for chloroform can reduce its concentration only to 0.1 mg/l, this pollutant should not be considered for limitations. Chloroform was found at a high concentration (1.933 mg/l) in one of the several treated wastewater samples taken. However, chloroform is a common laboratory solvent, and this elevated reading may be due to sample contamination. The presence of chloroform in the blank taken attests to this possibility.

Regardless, this result alone cannot be generalized as characteristic of the entire subcategory, since it is not used or formed during processing. Therefore, chloroform is not selected for limitation.

1,1-Dichloroethylene was detected in only one of the eight raw wastewater samples for which it was analyzed. This one concentration of 0.019 mg/l is well below the 0.10 mg/l concentration considered achievable by identified treatment technology. Therefore, 1,1-dichloroethylene is not selected for limitation.

Ethylbenzene was detected in two of the eight raw wastewater samples. Only one of these samples (0.011 mg/l) contained ethylbenzene above its analytical quantification concentration (0.01 mg/l). Because this concentration is below that attainable by identified treatment technology, (0.05 mg/l), ethylbenzene is not selected for limitation.

Chlorodibromomethane was detected in only one of the eight raw waste samples. This one concentration of 0.038 mg/l is below the 0.10 mg/l concentration considered achievable by identified treatment technology. Therefore, chlorodibromomethane is not selected for limitation.

Tetrachloroethylene was detected in all eight of the raw waste samples for which it was analyzed. Of the three detections which could be quantified, the highest concentration observed was .037 mg/l. Since this concentration is below the 0.05 mg/l concentration achievable by identified treatment technology, tetrachloroethylene is not selected for limitation.

Toluene was detected in five of the eight samples. Only two of these were above toluene's analytical quantification concentration (0.01 mg/l), and both were below this pollutant's treatable concentration (0.05 mg/l). Thus, toluene was not selected for limitation.

Beryllium was detected in only one of the five raw waste samples. This one concentration of 0.03 mg/l is below the 0.20 mg/l concentration considered achievable by available treatment. Therefore, beryllium is not selected for limitation.

Cyanide was detected in six of nine raw waste samples. Of the three detections which could be quantified, the highest concentration observed was 0.02 mg/l. Since this concentration is below the 0.047 mg/l concentration considered achievable by identified treatment technology, cyanide is not selected for limitation.

Mercury was found in all five samples analyzed, at concentrations ranging from 0.0002 mg/l to 0.004 mg/l. Since all of these are below treatability (of 0.036 mg/l), mercury is not selected for limitation.



## TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant if it is detectable in the effluent from only a small number of sources within the subcategory and it is uniquely related to only those sources. The following pollutants were not selected for limitation on this basis.

- 47. bromoform
- 66. bis(2-ethylhexyl) phthalate
- 68. di-n-butyl phthalate
- 69. di-n-octyl phthalate
- 76. chrysene
- 115. arsenic
- 120. copper
- 124. nickel
- 126. silver

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 permitter to specify effluent limitations.

Bromoform was detected in two of eight raw wastewater samples. The only concentration above the treatability of 0.05 mg/l was 0.053 mg/l. Since this is just slightly higher than could be achieved by treatment and such a small number of sources indicate that bromoform is present, bromoform is not selected for limitation.

Bis(2-ethylhexyl) phthalate was found above its treatability (0.01 mg/l) in two of three samples analyzed for it. 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. Also, in the dcp the responding primary tungsten plants indicated that this pollutant was believed to be absent. Therefore, bis(2-ethylhexyl) phthalate is not selected for limitation.

Di-n-butyl phthalate was detected above its treatability (0.025 mg/l) in only one of five samples analyzed. This compound is a plasticizer commonly used in laboratory and field sampling equipment, and is not considered a pollutant specific to this subcategory. Also, in the dcp the responding primary tungsten plants indicated that this pollutant was believed to be absent. Therefore, di-n-butyl phthalate is not selected for limitation.

Di-n-octyl phthalate occurred above its treatability (0.01 mg/l) in one of five samples. This compound is a plasticizer used in many products and is not considered a pollutant specific to this subcategory. Also, in the dcp the responding primary tungsten

plants indicated that this pollutant was believed to be absent. Therefore, di-n-octyl phthalate is not selected for limitation.

Chrysene concentrations were above treatability (0.01 mg/l) in only one of five samples analyzed. The sample measured 0.024 mg/l. This site-specific result cannot be generalized as characteristic of the entire subcategory, therefore, chrysene is not selected for limitation.

Arsenic was detected above its treatability (0.34 mg/l) in only one of the five raw waste streams for which it was sampled. The Agency has no reason to believe that treatable arsenic concentrations should be present in primary tungsten wastewaters, and it believes that this one value found at one plant is not representative of the subcategory. For these reasons arsenic is not selected for limitation.

Copper was found at 5 mg/l in one sample, but the other six samples analyzed contained copper at 0.2 mg/l or less, which is below its treatability of 0.39 mg/l. The Agency has no reason to believe that treatable copper concentrations should be present in primary tungsten wastewaters, and it believes that this one value found at one plant is not representative of the subcategory. Thus; copper is not selected for limitation.

Nickel was detected above its treatability of 0.22 mg/l in only one of the five raw waste streams for which it was sampled. The Agency has no reason to believe that treatable nickel concentrations should be present in primary tungsten wastewaters, and it believes that this one value found at one plant is not representative of the subcategory. Therefore, nickel is not selected for limitation.

Silver was detected above its treatability (0.07 mg/l) in only two of the five streams for which it was analyzed. The Agency has no reason to believe that treatable silver concentrations should be present in primary tungsten wastewaters, and it believes that these two values are not representative of the subcategory. Therefore, silver is not selected for limitation.

#### TOXIC 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 for this subcategory. The toxic pollutants selected for further consideration for limitation are each discussed following the list.

1. acenaphthene
55. naphthalene
77. acenaphthylene

- 80. fluorene
- 118. cadmium
- 119. chromium
- 122. lead
- 125. selenium
- 127. thallium
- 128. zinc

Acenaphthene was detected in one of the three raw wastewater streams for which it was analyzed. That sample, the ion-exchange raffinate, exhibited a concentration of 0.111 mg/l which is above the concentration attainable by treatment (0.01 mg/l). Since this is the only sampling data for ion exchange raffinate, and since this stream may contain toxic organic pollutants, acenaphthene is selected for further consideration for limitation.

Naphthalene was detected above its treatability (0.05 mg/l) in one of three raw wastewater streams for which it was analyzed. That sample, ion-exchange raffinate, exhibited a concentration of 1.078 mg/l. Since this is the only sampling data for ion exchange raffinate, and since this stream may contain toxic organic pollutants, naphthalene is selected for further consideration for limitation.

Acenaphthylene was detected in one of three raw wastewater streams. That sample exhibited a concentration of 0.112 mg/l which is above the concentration attainable by treatment (0.01 mg/l). Since this is the only sampling data for ion exchange raffinate, and since this stream may contain toxic organic pollutants, acenaphthylene is selected for further consideration for limitation.

Fluorene was detected in one of three raw wastewater streams. That sample exhibited a concentration of 0.06 mg/l which is above treatability (0.01 mg/l). Since this is the only sampling data for ion exchange raffinate, and since this stream may contain toxic organic pollutants, fluorene is selected for further consideration for limitation.

Cadmium was detected above treatability (0.049 mg/l) in one of seven raw wastewater streams sampled. The treatable concentration was detected in tungstic acid rinse water, which may contain cadmium from the ore concentrates. Therefore, cadmium is selected for further consideration for limitation.

Chromium was detected above its treatability of 0.07 mg/l in both tungstic acid rinse water samples before treatment. The highest concentration was 2.0 mg/l. One sample from a third stream indicated that chromium was present at a concentration quantifiable but below treatability. Therefore, chromium is selected for further consideration for limitation.

Lead was detected in one raw waste stream at a concentration of 20.0 mg/l which is well above the .08 mg/l attainable by identified treatment technology. This concentration was observed in tungstic acid rinse water which may contain toxic metals from ore concentrates. Although no raw waste data is available, sampling data at a second plant indicated that lead concentrations above the treatability concentration were present in the treated wastewater. For these reasons, lead is selected for further consideration for limitation.

Selenium was detected but could not be quantified other than as being less than 0.01 mg/l in two of five raw waste streams for which it was sampled. However, at another plant for which there was no raw wastewater data, a partially treated wastewater stream exhibited a selenium concentration of 1.0 mg/l which is above selenium's treatability of 0.20 mg/l. Since selenium impurities may be present in ore concentrates and because selenium was present at 1.0 mg/l in a partially treated sample, it is selected for further consideration for limitation.

Thallium was detected in one of the five raw wastewater samples at a concentration above its treatability of 0.34 mg/l. The treatable concentration was observed in raw tungstic acid rinse water at 0.70 mg/l. Therefore, thallium is selected for further consideration for limitation.

Zinc was detected in two of the five samples for which it was analyzed above its treatability of 0.23 mg/l. The highest concentration found was 2.0 mg/l. Treated wastewater sampling data from one plant also indicated that concentrations above treatability remained even after lime and settle treatment had been applied to a stream. Accordingly, zinc is selected for further consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY TUNGSTEN  
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
1. acenaphthene	0.010	0.010	3	3	2	0	0	1
2. acrolein	0.010	0.100	3	8	8	0	0	0
3. acrylonitrile	0.010	0.01	3	8	8	0	0	0
4. benzene	0.010	0.05 - 0.10	3	8	2	6	0	0
5. benzidine	0.010	0.01	3	3	3	0	0	0
6. carbon tetrachloride	0.010	0.05	3	8	8	0	0	0
7. chlorobenzene	0.010	0.025	3	8	8	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	3	3	3	0	0	0
9. hexachlorobenzene	0.010	0.01	3	3	3	0	0	0
10. 1,2-dichloroethane	0.010	0.1	3	8	6	2	0	0
11. 1,1,1-trichloroethane	0.010	0.01	3	8	8	0	0	0
12. hexachloroethane	0.010	0.01	3	3	3	0	0	0
13. 1,1-dichloroethane	0.010	0.01	3	8	8	0	0	0
14. 1,1,2-trichloroethane	0.010	0.1	3	8	8	0	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	3	8	3	5	0	0
16. chloroethane	0.010	0.01	3	8	8	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	3	8	8	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	3	3	3	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	3	8	8	0	0	0
20. 2-chloronaphthalene	0.010	0.01	3	3	3	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	3	3	3	0	0	0
22. parachlorometa cresol	0.010	0.05	3	3	3	0	0	0
23. chloroform	0.010	0.1	3	8	2	1	5	0
24. 2-chlorophenol	0.010	0.05	3	3	3	0	0	0
25. 1,2-dichlorobenzene	0.010	0.05	3	3	3	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	3	3	3	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	3	3	3	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	3	3	3	0	0	0
29. 1,1-dichloroethylene	0.010	0.1	3	8	7	0	1	0
30. 1,2-trans-dichloroethylene	0.010	0.1	3	8	8	0	0	0
31. 2,4-dichlorophenol	0.010	0.01	3	3	3	0	0	0
32. 1,2-dichloropropane	0.010	0.01	3	8	8	0	0	0
33. 1,3-dichloropropylene	0.010	0.01	3	8	8	0	0	0
34. 2,4-dimethylphenol	0.010	0.05	3	3	3	0	0	0
35. 2,4-dinitrotoluene	0.010	0.05	3	3	3	0	0	0
36. 2,6-dinitrotoluene	0.010	0.05	3	3	3	0	0	0
37. 1,2-diphenylhydrazine	0.010	0.05	3	3	3	0	0	0

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY TUNGSTEN  
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
38. ethylbenzene	0.010	0.05	3	8	6	1	1	0
39. fluoranthene	0.010	0.01	3	3	3	0	0	0
40. 4-chlorophenyl phenyl ether	0.010	0.01	3	3	3	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	3	3	3	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	3	3	3	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	3	3	3	0	0	0
44. methylene chloride	0.010	0.10	3	8	8	0	0	0
45. methyl chloride	0.010	0.01	3	8	8	0	0	0
46. methyl bromide	0.010	0.01	3	8	8	0	0	0
47. bromoform	0.010	0.05	3	8	6	0	1	1
48. dichlorobromomethane	0.010	0.10	3	8	8	0	0	0
49. trichlorofluoromethane	0.010	0.01	3	8	8	0	0	0
50. dichlorodifluoromethane	0.010	0.01	3	8	8	0	0	0
51. chlorodibromomethane	0.010	0.10	3	8	7	0	1	0
52. hexachlorobutadiene	0.010	0.01	3	3	3	0	1	0
53. hexachlorocyclopentadiene	0.010	0.01	3	3	3	0	0	0
54. isophorone	0.010	0.05	3	3	3	0	0	0
55. naphthalene	0.010	0.05	3	3	1	1	0	1
56. nitrobenzene	0.010	0.05	3	3	3	0	0	0
57. 2-nitrophenol	0.010	0.01	3	3	3	0	0	0
58. 4-nitrophenol	0.010	0.05	3	3	3	0	0	0
59. 2,4-dinitrophenol	0.010	0.025	3	3	3	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	3	3	3	0	0	0
61. N-nitrosodimethylamine	0.010	0.01	3	3	3	0	0	0
62. N-nitrosodiphenylamine	0.010	0.01	3	3	3	0	0	0
63. N-nitrosodi-n-propylamine	0.010	0.01	3	3	3	0	0	0
64. pentachlorophenol	0.010	0.01	3	3	3	0	0	0
65. phenol	0.010	0.05	3	3	3	0	0	0
66. bis(2-ethylhexyl) phthalate	0.010	0.01	3	3	0	1	0	2
67. butyl benzyl phthalate	0.010	0.001 - 0.01	3	3	3	0	0	0
68. di-n-butyl phthalate	0.010	0.025	3	3	2	0	0	1
69. di-n-octyl phthalate	0.010	0.01	3	3	2	0	0	1
70. diethyl phthalate	0.010	0.025	3	3	3	0	0	0
71. dimethyl phthalate	0.010	0.025	3	3	3	0	0	0
72. benzo(a)anthracene	0.010	0.01	3	3	3	0	0	0
73. benzo(a)pyrene	0.010	0.01	3	3	3	0	0	0
74. 3,4-benzofluoranthene	0.010	0.01	3	3	3	0	0	0

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY TUNGSTEN  
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
75. benzo(k)fluoranthene	0.010	0.01	3	3	3	0	0	0
76. chrysene	0.010	0.001	3	3	2	0	0	1
77. acenaphthylene	0.010	0.01	3	3	2	0	0	1
78. anthracene (c)	0.010	0.01	3	3	1	2	0	0
79. benzo(ghi)perylene	0.010	0.01	3	3	3	0	0	0
80. fluorene	0.010	0.01	3	3	1	1	0	1
81. phenanthrene (c)	0.010	0.01	3	3	1	2	0	0
82. dibenzo(a,h)anthracene	0.010	0.01	3	3	3	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	3	3	3	0	0	0
84. pyrene	0.010	0.001 - 0.01	3	3	2	1	0	0
85. tetrachloroethylene	0.010	0.05	3	8	0	5	3	0
86. toluene	0.010	0.05	3	8	3	3	2	0
87. trichloroethylene	0.010	0.01	3	8	3	5	0	0
88. vinyl chloride	0.010	0.01	3	8	8	0	0	0
89. aldrin	0.005	0.001	3	3	3	0	0	0
90. dieldrin	0.005	0.01	3	3	3	0	0	0
91. chlordane	0.005	0.01	3	3	3	0	0	0
92. 4,4'-DDT	0.005	0.01	3	3	3	0	0	0
93. 4,4'-DDE	0.005	0.01	3	3	3	0	0	0
94. 4,4'-DDD	0.005	0.01	3	3	3	0	0	0
95. alpha-endosulfan	0.005	0.001	3	3	2	1	0	0
96. beta-endosulfan	0.005	0.01	3	3	3	0	0	0
97. endosulfan sulfate	0.005	0.01	3	3	3	0	0	0
98. endrin	0.005	0.01	3	3	3	0	0	0
99. endrin aldehyde	0.005	0.01	3	3	3	0	0	0
100. heptachlor	0.005	0.01	3	3	3	0	0	0
101. heptachlor epoxide	0.005	0.01	3	3	3	0	0	0
102. alpha-BHC	0.005	0.01	3	3	3	0	0	0
103. beta-BHC	0.005	0.01	3	3	3	0	0	0
104. gamma-BHC	0.005	0.01	3	3	3	0	0	0
105. delta-BHC	0.005	0.01	3	3	3	0	0	0
106. PCB-1242 (d)	0.005	0.001	3	3	1	2	0	0
107. PCB-1254 (d)	0.005	0.001						
108. PCB-1221 (d)	0.005	0.001						
109. PCB-1232 (e)	0.005	0.001	3	3	1	2	0	0
110. PCB-1248 (e)	0.005	0.001						
111. PCB-1260 (e)	0.005	0.001						
112. PCB-1016 (e)	0.005	0.001						

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY TUNGSTEN  
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
113. toxaphene	0.005	0.01	3	3	3	0	0	0
114. antimony	0.100	0.47	5	5	5	0	0	0
115. arsenic	0.010	0.34	5	5	2	0	2	1
116. asbestos	10 MFL	10 MFL	Not Analyzed					
117. beryllium	0.010	0.20	5	5	4	0	1	0
118. cadmium	0.002	0.049	5	5	3	0	1	1
119. chromium	0.005	0.07	5	5	2	0	1	2
120. copper	0.009	0.39	5	5	2	0	2	1
121. cyanide	0.02(f)	0.047	5	9	3	3	3	0
122. lead	0.020	0.08	5	5	4	0	0	1
123. mercury	0.0001	0.036	5	5	0	0	5	0
124. nickel	0.005	0.22	5	5	4	0	0	1
125. selenium	0.01	0.20	5	5	3	2	0	0
126. silver	0.02	0.07	5	5	3	0	0	2
127. thallium	0.100	0.34	5	5	4	0	0	1
128. zinc	0.050	0.23	5	5	2	0	1	2
129. 2,3,7,8-tetrachlorodibenzo- p-dioxin (TCDD)	0.005	Not Analyzed						

(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.



## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION VII

#### CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from primary tungsten plants. This section summarizes the description of these wastewaters and indicates the treatment technologies which are currently practiced in the primary tungsten 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 tungsten subcategory.

#### CURRENT CONTROL AND TREATMENT PRACTICES

Control and treatment technologies are discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability to wastewater similar to that found in this subcategory are presented there. This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the primary tungsten 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, so these waste streams are commonly combined for treatment to reduce the concentrations of these pollutants. 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. One plant in this subcategory currently has combined wastewater treatment systems, none have lime precipitation and sedimentation, but three have lime precipitation, sedimentation and filtration. As such, five options have been selected for consideration for BPT, BAT, BDT, BCT, and pretreatment based on combined treatment of these compatible waste streams.

#### TUNGSTIC ACID RINSE WATER

Tungstic acid is prepared by leaching ore concentrates with hydrochloric acid and then rinsing the soluble tungsten acid with water. The two plants using this process practice lime and settle treatment to precipitate metals before discharging the rinse water. A third plant which produces a tungsten acid intermediate

by reacting HCl with sodium tungstate neutralizes the rinse water along with other wastes and then coagulates with polymers and practices sedimentation.

#### ACID LEACH WET AIR POLLUTION CONTROL

Plants that acid leach use wet scrubbing systems for the control of hydrochloric acid fumes. One plant discharges this acidic wastewater after lime and settle treatment while a second recycles the entire stream for use as tungsten acid rinse water.

#### ALKALI LEACH WASH

The four plants which use an alkali ore leaching process, such as caustic digestion or a soda autoclave, generate a waste from the decant washing of the sodium tungstate intermediate. Two plants have reduced this flow to zero by filtering the insoluble impurities and using a combination of evaporation and recycle. A third plant discharges this and all its other wastes to a settling pond where the water either evaporates or percolates into the ground. Only one plant discharges this wastewater, although it does pretreat this stream by chemical oxidation.

#### ION-EXCHANGE RAFFINATE

When a liquid ion-exchange process is used to convert sodium tungstate to ammonium tungstate, a raffinate stream is generated. Of the two plants which utilize this process, one is a zero discharge plant because it pumps all of its wastes, including the ion-exchange raffinate, to a settling pond where the water evaporates. The second plant, a direct discharger, treats this wastewater with a lime and settle process and then coagulates with polymers and practices sedimentation before discharge.

#### CALCIUM TUNGSTATE PRECIPITATION WASH

Calcium tungstate, synthetic scheelite, is precipitated when sodium tungstate crystals are dissolved and then reacted with calcium chloride solution. The precipitated crystals are allowed to settle, and the waste sodium chloride supernatant can be decanted. Of the four plants which precipitate calcium tungstate only one has achieved zero discharge status. This plant discharges all of its wastes to a settling pond. Two plants treat this wash water. One uses lime and settle, and the second adds coagulation with polymers to a lime and settle pretreatment. The fourth plant discharges this briny waste without treatment.

#### CRYSTALLIZATION AND DRYING OF AMMONIUM PARATUNGSTATE

Ammonium paratungstate crystals are precipitated from a mother liquor which will contain ammonia and possibly tungsten. For

this reason, three plants completely recycle and reprocess the filtrate after recovering the ammonia for reuse. If heating is used to dry the crystals, a wet scrubber system is used to contain ammonia fumes, and again, an ammonia recovery system may be used. The fourth plant recycles and reuses some of this scrubber water, but discharges the majority of it to a settling pond.

#### AMMONIUM PARATUNGSTATE CONVERSION TO OXIDES WET AIR POLLUTION CONTROL

When ammonium paratungstate (APT) is converted to tungsten oxides ( $WO_x$ ), ammonia is evolved. Most plants use a wet scrubbing system to contain the fumes, and some use an ammonia recovery system. Of the six plants which reported using this process and generating a waste stream, two have reduced the flow to zero. One of these accomplished this by recycle to a cooling tower and reuse, and the other by a combination of evaporation, ammonia recovery, and reuse. The following treatment schemes are currently in place in the rest of the subcategory:

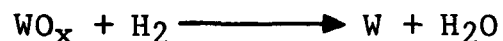
1. No treatment of scrubber water; direct discharge - one plant.
2. Lime and settle treatment of scrubber water, ammonia recovery; direct discharge - one plant.
3. Primary and secondary settling; indirect discharge - one plant.
4. Off-gases run through bubbling tank, fine particles of tungsten material settle out, overflow from settling tanks is indirectly discharged - one plant.

#### REDUCTION TO TUNGSTEN WET AIR POLLUTION CONTROL

Tungsten oxides ( $WO_x$ ) are reduced to tungsten metal in rotary reduction furnaces, usually under a hydrogen atmosphere. Of the seven plants which produce tungsten metal in this manner, five report using a wet scrubbing system to control particulate emissions. Two of these plants have achieved zero discharge for this stream through 100 percent recycle and reuse. One plant recycles one third of its scrubber water and recovers hydrogen for reuse before discharging the remaining water directly. The two remaining plants do not treat this water before discharge.

#### REDUCTION TO TUNGSTEN WATER OF FORMATION

Plants that reduce oxides to tungsten metal in a hydrogen atmosphere may generate a water of formation as generalized by the following reaction:



One plant uses primary and secondary settling on this waste stream. A second reported evaporating all of the water of formation. Many plants, however, did not quantify this waste flow because the water is recondensed in the wet scrubbing system of the reduction furnace. In these cases the treatment applied to reduction to tungsten scrubber water would also apply to the water of formation.

## CONTROL AND TREATMENT OPTIONS

The Agency examined five control and treatment technology options that are applicable to the primary tungsten subcategory. The options selected for evaluation represent a combination of in-process flow reduction, preliminary treatment technologies applicable to individual waste streams, and end-of-pipe treatment technologies.

Examination of the raw wastewater data does not show any arsenic or selenium at or above treatable concentrations. Also, these pollutants are not characteristic of the raw materials and processing agents used in this subcategory. Therefore, Option D, which includes activated aluminum adsorption, was not considered as an appropriate treatment technology.

### OPTION A

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

The Option A treatment scheme consists of chemical precipitation and sedimentation technology. Specifically, lime or some other alkaline compound is used to precipitate toxic 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.

Preliminary treatment consisting of ammonia steam stripping for waste streams containing treatable concentrations of ammonia is also included in Option A. Steam stripping is an efficient method for reducing the ammonia concentrations, as well as recovering ammonia as a by-product. Steam stripping also prevents the transfer of ammonia to the air.

### OPTION B

Option B for the primary tungsten subcategory consists of the Option A (ammonia steam stripping, lime precipitation and sedimentation) treatment scheme plus flow reduction techniques to reduce the discharge of wastewater volume. In-process changes which allow for water recycle and reuse are the principal control mechanisms for flow reduction.

#### OPTION C

Option C for the primary tungsten subcategory consists of all control and treatment requirements of Option B (in-process flow reduction, ammonia steam stripping, lime precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option B 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.

#### OPTION E

Option E for the primary tungsten subcategory consists of Option C (in-process flow reduction, ammonia steam stripping, lime precipitation and sedimentation) with the addition of granular activated carbon technology at the end of the Option C treatment scheme. The activated carbon process is utilized to control the discharge of toxic organics.

#### OPTION F

Option F for the primary tungsten subcategory consists of all of the control and treatment requirements of Option C (in-process flow reduction, ammonia steam stripping, lime precipitation and sedimentation) plus reverse osmosis and multiple-effect evaporation technology added at the end of the Option C treatment scheme. Reverse osmosis is provided for the complete recycle of the treated water by controlling the concentration of dissolved solids concentrations. Multiple-effect evaporation is used to dewater brines rejected from reverse osmosis.

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION VIII

#### COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section describes the method used to develop the costs associated with the control and treatment technologies suggested in Section VII for wastewaters from primary tungsten plants. The energy requirements of the considered options as well as solid waste, and air pollution aspects are also discussed. Section VIII of the General Development Document provides background on the capital and annual costs for each of the technologies discussed herein.

The various sources of wastewater that have been discussed throughout this document are combined into two separate groups. These groups are based on the two basic steps of primary tungsten production - the conversion of ore concentrates to ammonium paratungstate (APT) and the reduction of APT to metal. These groups are selected for the purpose of cost estimation because the combination of waste streams in each is representative of the processing that occurs in most primary tungsten plants. In addition, the waste streams associated with each group also require varying degrees of preliminary treatment with ammonia steam stripping. This will be discussed further below. Since all the plants in the subcategory can be classified as performing one or the other or both of the two basic steps in primary tungsten production, a division of the waste streams along these lines is appropriate. Accordingly, the wastewater sources in the primary tungsten subcategory have been divided, for the purpose of cost estimation, as follows:

##### Group A - Ore to APT

1. Tungstic acid rinse water;
2. Acid leach wet air pollution control;
3. Alkali leach wash;
4. Ion-exchange raffinate;
5. Calcium tungstate precipitate wash; and
6. Crystallization and drying of ammonium paratungstate.

##### Group B - APT to metal

1. Ammonium paratungstate conversion to oxides wet air pollution control;
2. Reduction to tungsten metal wet air pollution control; and
3. Reduction to tungsten metal water of formation.

The wastewater characteristics of both ore to metal and ore to APT plants are similar since it is the ore to APT step which encompasses most of the unique waste streams. Therefore, plants which do both steps (i.e., process ore concentrates all the way to tungsten metal) are included in group A, the ore to APT group.

The two wastewater groupings have been further divided into two combinations. The APT to metal group streams and ion-exchange raffinate contain treatable concentrations of ammonia, and will require ammonia steam stripping preliminary treatment. Ore to APT waste streams with the possible exception of ion-exchange raffinate will not contain treatable concentrations of ammonia. Therefore ammonia steam stripping preliminary treatment will not be costed for plants having only these streams or for plants which already have ammonia steam stripping in-place. Thus, for existing sources in the primary tungsten subcategory, the following situations are selected for cost analysis.

	<u>Ore to APT Waste Streams</u>	<u>APT to Metal Waste Streams</u>
Combination 1. (no ammonia steam stripping preliminary treatment included)	X	
Combination 2. (ammonium steam stripping preliminary treatment included)	X	X

#### TREATMENT OPTIONS COSTED FOR EXISTING SOURCES

Five treatment options have been developed for both combinations in existing primary tungsten sources. The only difference in the options for the two different combinations is that ammonia steam stripping is added to each option for combination. The options are summarized below and schematically presented in Figures X-1 through X-5.

#### OPTION A

Option A consists of preliminary ammonia steam stripping treatment and lime precipitation and sedimentation end-of-pipe technology. For combination 2, ammonia steam is added as preliminary treatment for 20 percent of the ore to APT wastewaters and 70 percent of the APT to metal wastewaters. Ammonia steam stripping is not included in the costs for combination 1.

## OPTION B

Option B consists of in-process flow reduction measures, preliminary ammonia steam stripping treatment, and lime precipitation and sedimentation end-of-pipe technology. The in-process flow reduction measure consists of the recycle of acid leach scrubber water and reduction to tungsten scrubber water through holding tanks. A separate cost curve was developed to estimate holding tank costs. This curve is based on a retention time of one day for the scrubber water which is to be recycled. To determine the cost of Option B, the holding tank cost is added to the cost of Option A.

## OPTION C

Option C requires the in-process flow reduction measures of Option B, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation, sedimentation, and multimedia filtration. As with Options A and B, only the costs for combination 2 are based on ammonia steam stripping preliminary treatment. Also, the cost curves developed for Option C do not consider in-process flow reduction. Therefore, the total cost of Option C is determined by adding the cost for holding tanks to the costs obtained from the Option C cost curves.

## OPTION E

Option E requires the in-process flow measures of Options B and C, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation, sedimentation, multimedia filtration, and activated carbon adsorption. As with Options A, B, and C, only the costs for combination 2 wastewaters are based on preliminary ammonia steam stripping treatment. Also, the cost curves developed for Option E do not consider in-process flow reduction. Therefore, the total cost of Option E is determined by adding the cost obtained from the Option E cost curves.

## OPTION F

Option F requires the in-process flow reduction measures of Options B, C, and E, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation, sedimentation, multimedia filtration, reverse osmosis, and multiple-effect evaporation. As with Options A, B, C, and E, only the costs for combination 2 are based on ammonia steam stripping preliminary treatment. In addition, the cost curves developed for Option F do not include the cost associated with in-process flow reduction. Therefore, the total cost of Option F is determined by adding the cost for holding tanks to



the cost obtained from the Option F cost curves. An Option F cost curve was not developed for the APT to metal group because this group does not have pollutant characteristics that warrant the addition of reverse osmosis technology.

The cost curves for the options summarized above are presented in the figures listed below. The respective options which the curves are based on are also shown.

<u>Combination</u>	<u>Figures VIII-</u>	<u>Options Costed</u>
1 (ore to APT)	1 - 4	A, C, E, F
2 (ore to APT)	5 - 8	A, C, E, F
3 (APT to metal)	9 - 11	A, C, E

The holding tank cost curve is presented in Figure VIII-12. This curve is used to determine the cost of flow reduction.

#### 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 primary tungsten 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. Briefly, the energy usage of the various options is determined for the primary tungsten plant with the median wastewater flow. The energy usage of the options is then compared to the energy usage of the median primary tungsten energy consumption plant. As shown in Table VIII-1, the most energy intensive option is reverse osmosis, which increases the median primary tungsten energy consumption by 2.03 percent. The remaining four options would increase the median energy consumption by less than 1 percent.

#### SOLID WASTE

Sludges associated with the primary tungsten subcategory will necessarily contain additional quantities (and concentrations) of toxic metal pollutants. 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). Consequently, sludges generated from treating primary industries' wastewater are not presently subject to regulation as hazardous wastes.

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 non-ferrous 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), 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. For more details, see Section VIII of the General Development Document.

## 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, multimedia filtration, activated carbon, and reverse osmosis. These technologies transfer pollutants to solid waste and do not involve air stripping or any other physical process likely to transfer pollutants to air.

Table VIII-1

## ENERGY REQUIREMENTS

Median of Total Plant Energy Consumption Btu/yr	Median Size Plant by Flow gal/day	Energy Usage (Btu/yr) and Percent of Median Plant Energy Consumption									
		Option A		Option B		Option C		Option E		Option F	
		Usage	%	Usage	%	Usage	%	Usage	%	Usage	%
$1.244 \times 10^{11}$	172,000	$6.50 \times 10^8$	.52	$6.503 \times 10^8$	.52	$6.854 \times 10^8$	.55	$1.0 \times 10^9$	.805	$2.53 \times 10^9$	2.0

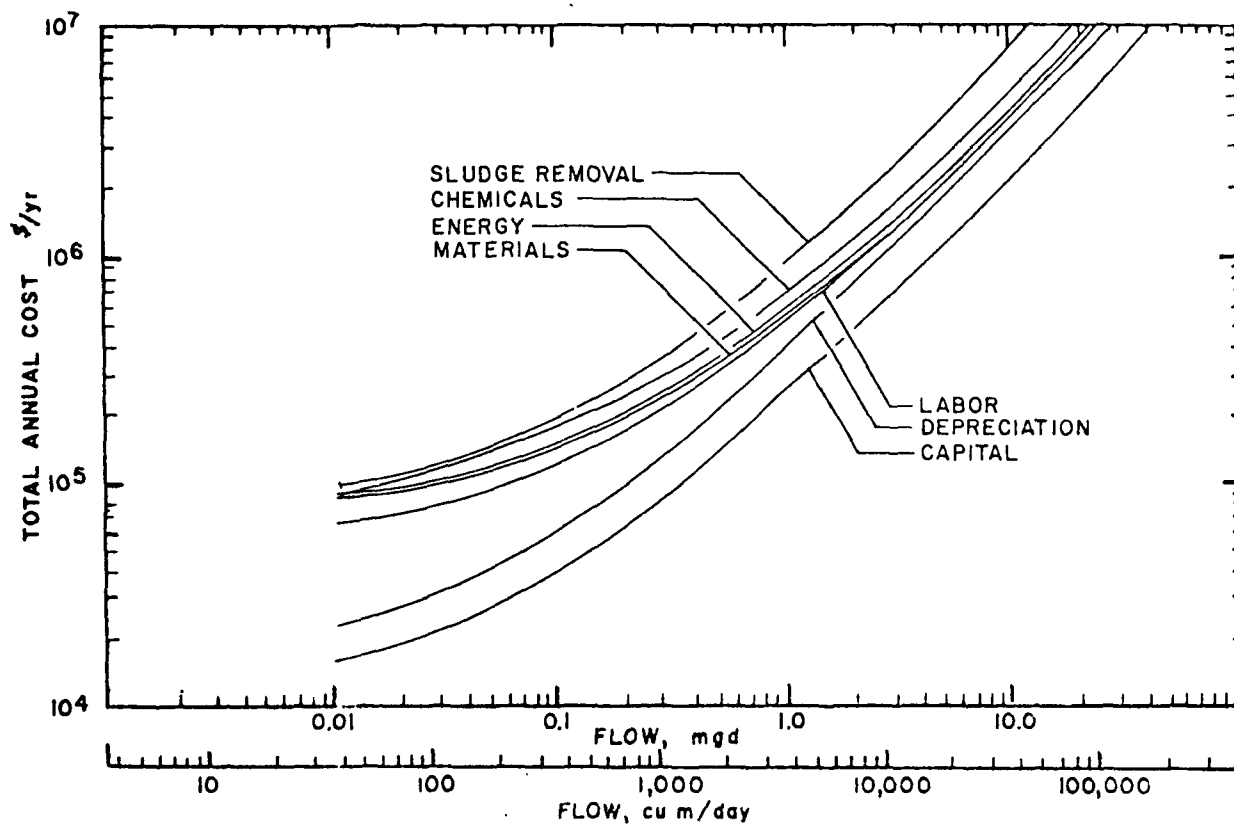


Figure VIII-1

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 1, OPTION A

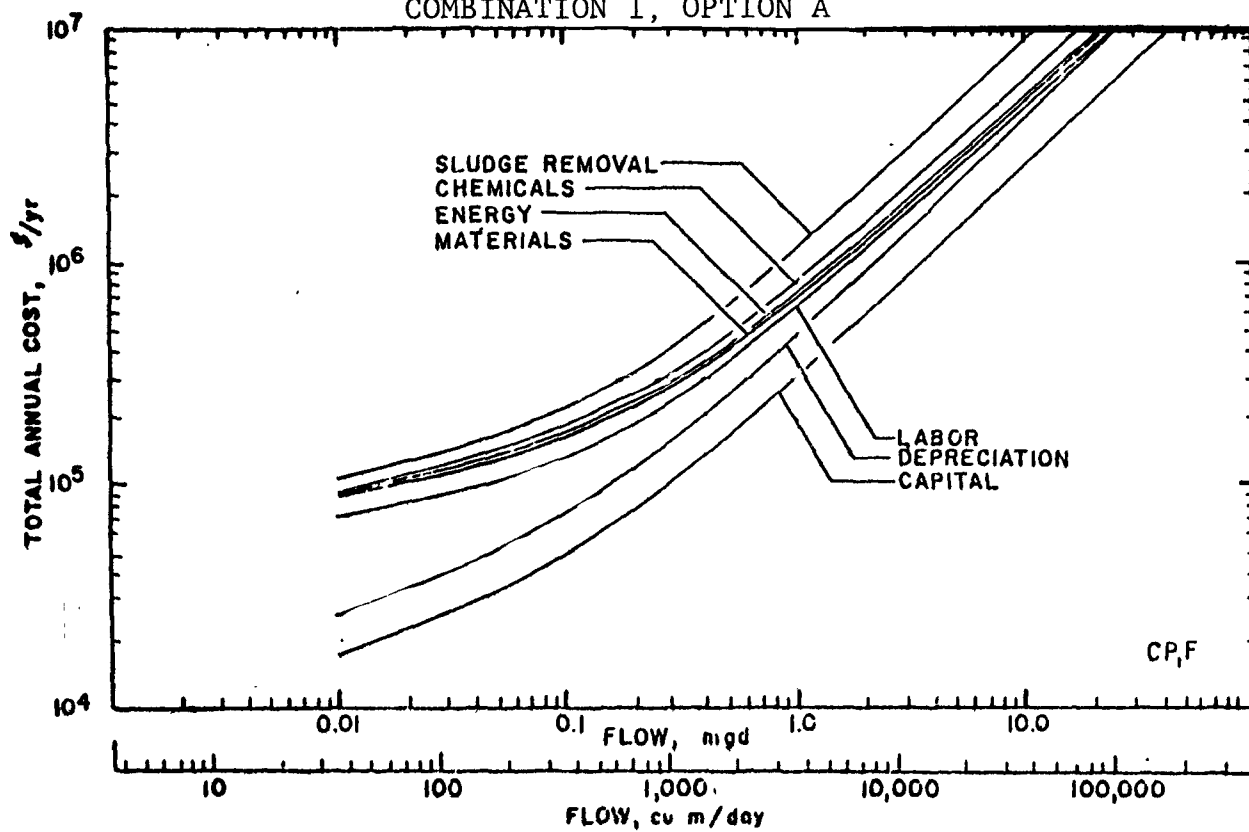


Figure VIII-2

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 1, OPTION C

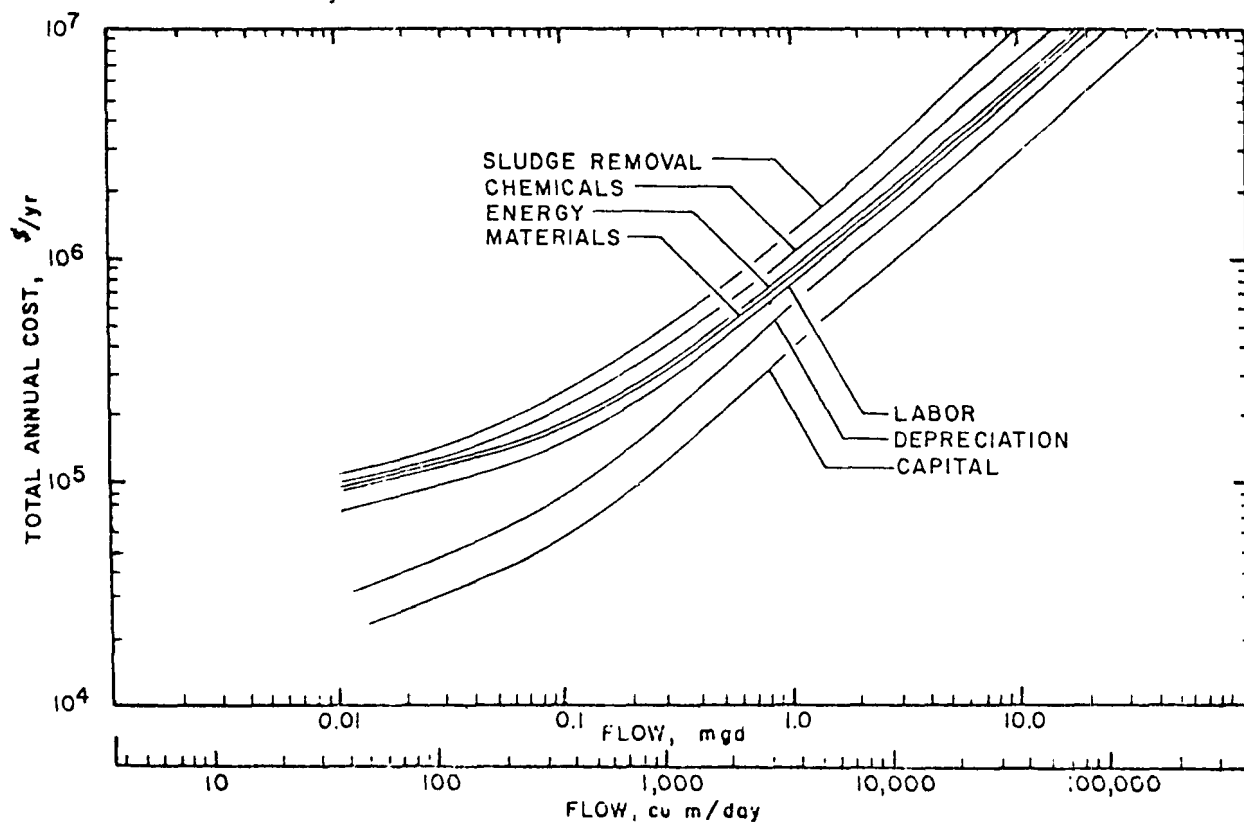


Figure VIII-3

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 1, OPTION E

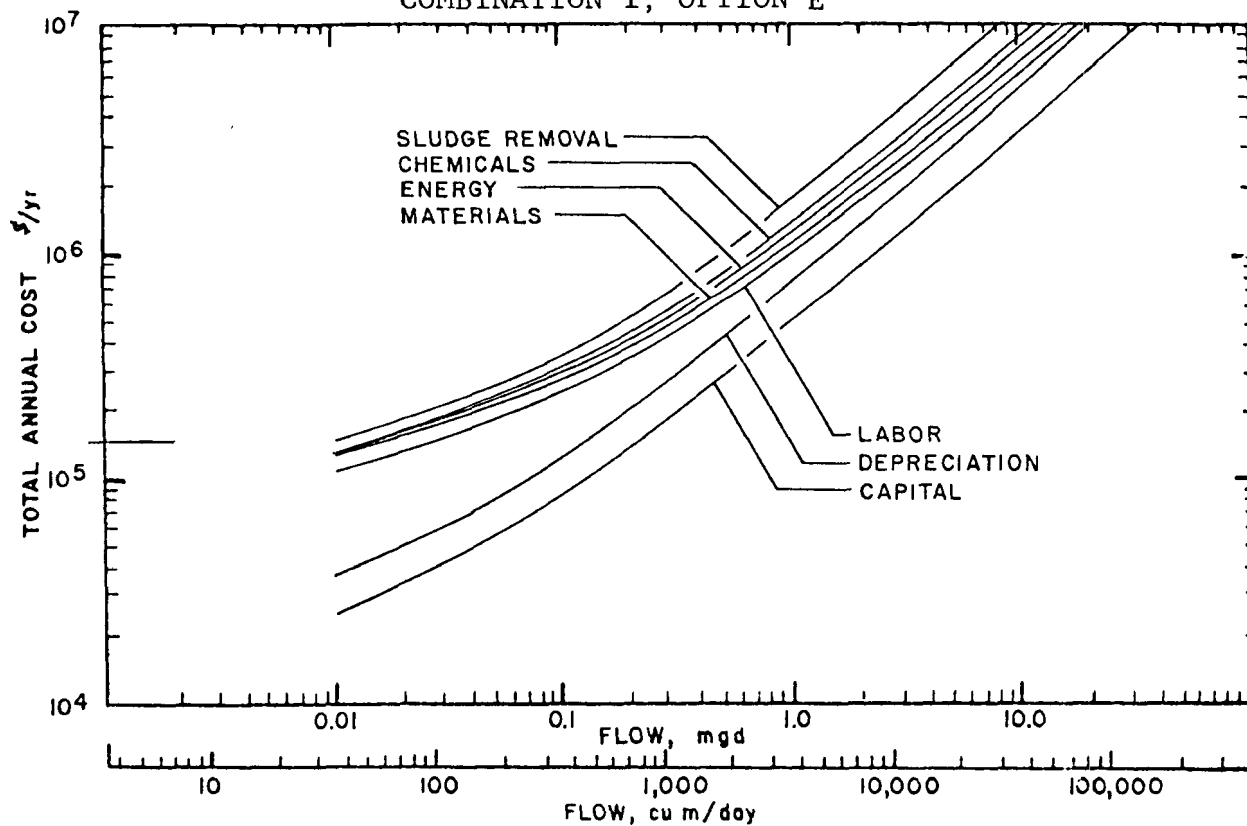


Figure VIII-4

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 1, OPTION F

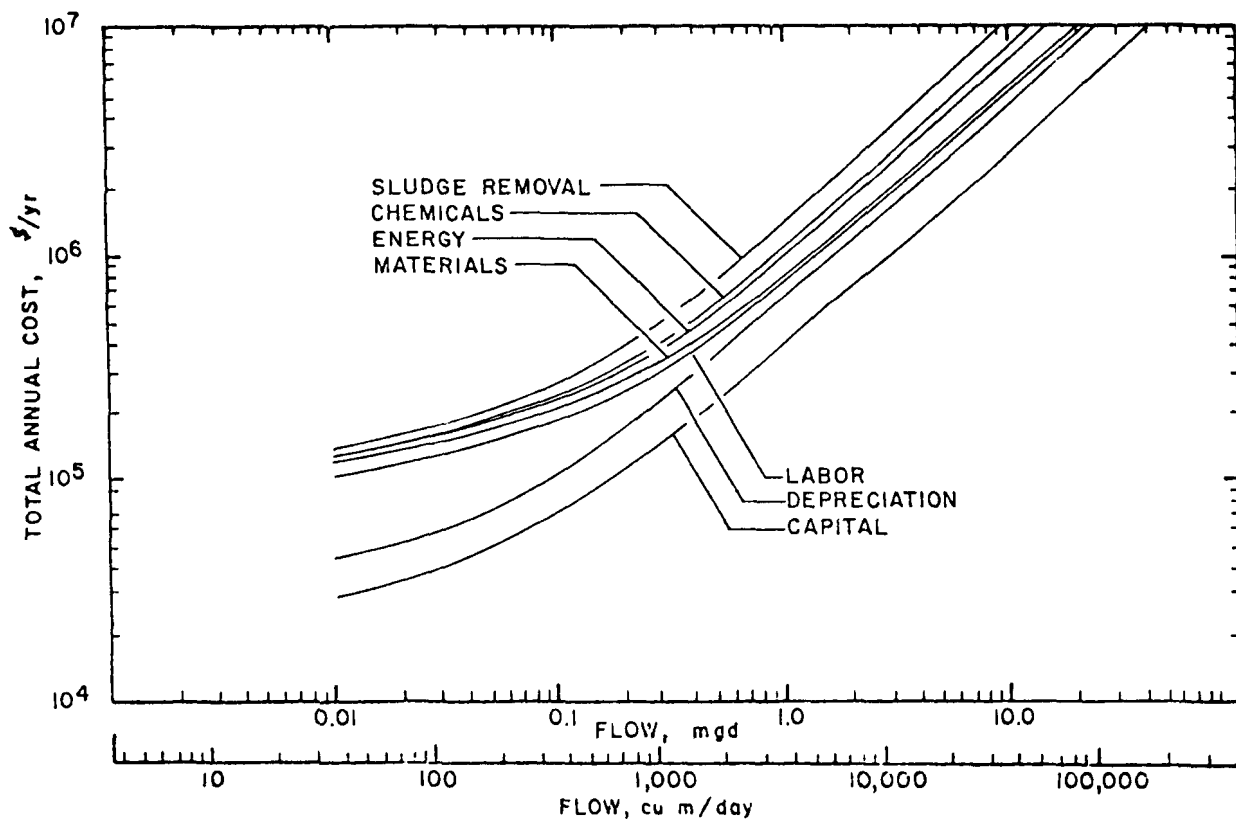


Figure VIII-5

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 2, OPTION A

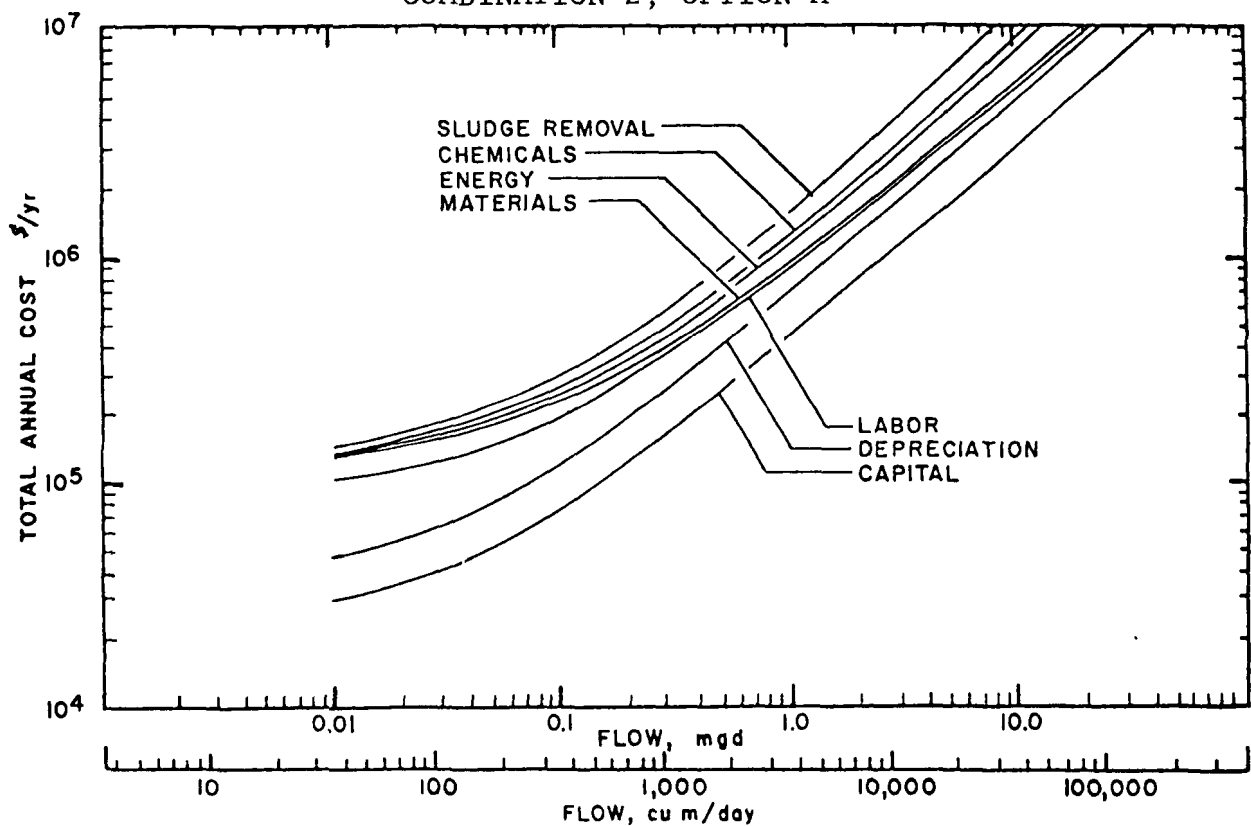


Figure VIII-6

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 2, OPTION C

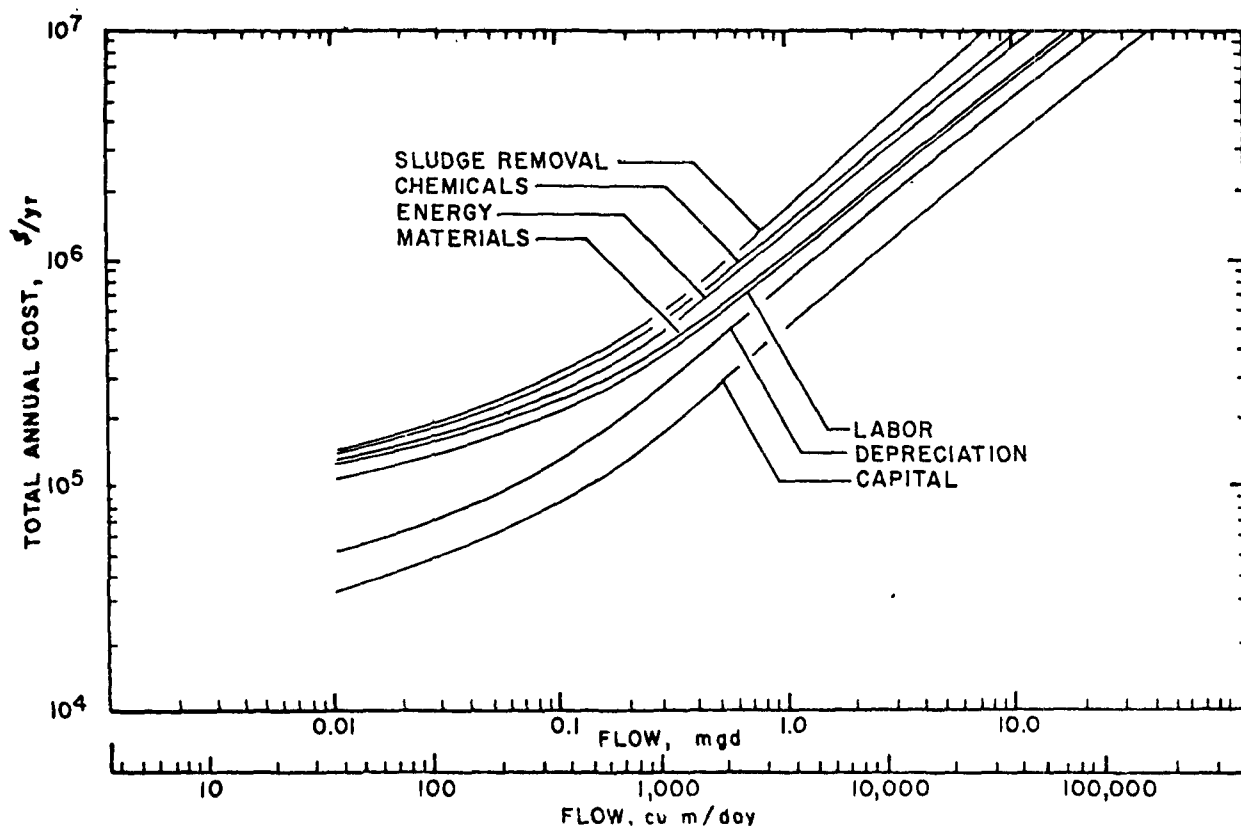


Figure VIII-7

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 2, OPTION E

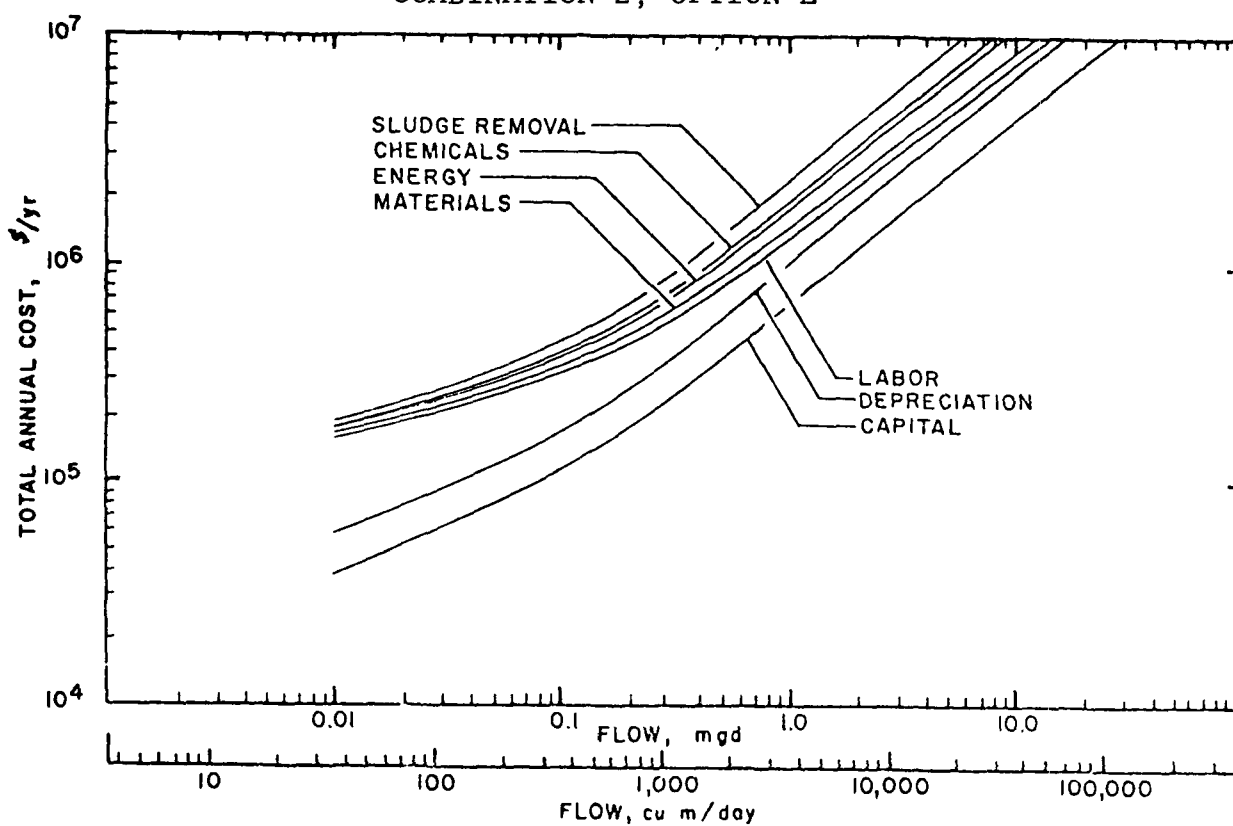


Figure VIII-8

PRIMARY TUNGSTEN (ORE TO APT)  
COMBINATION 2, OPTION F

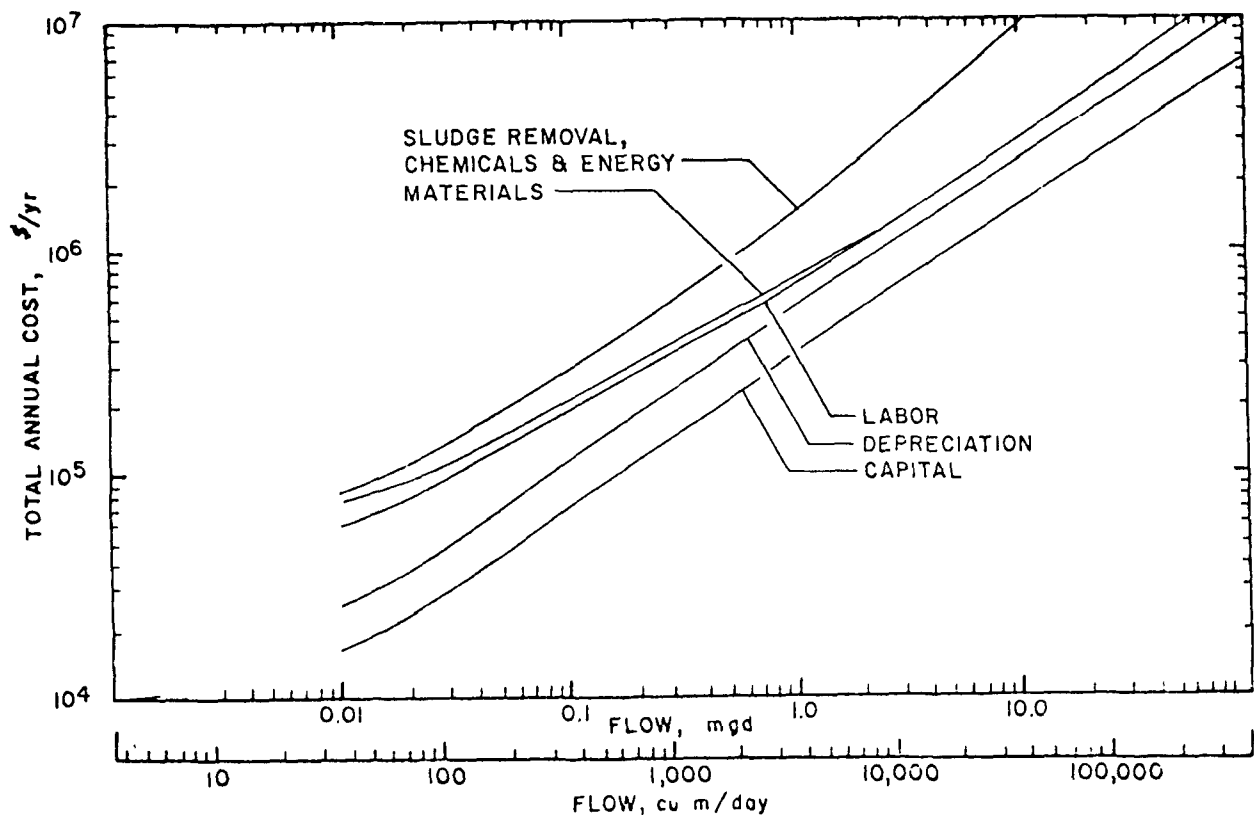


Figure VIII-9

PRIMARY TUNGSTEN (APT TO METAL)  
COMBINATION 2, OPTION A

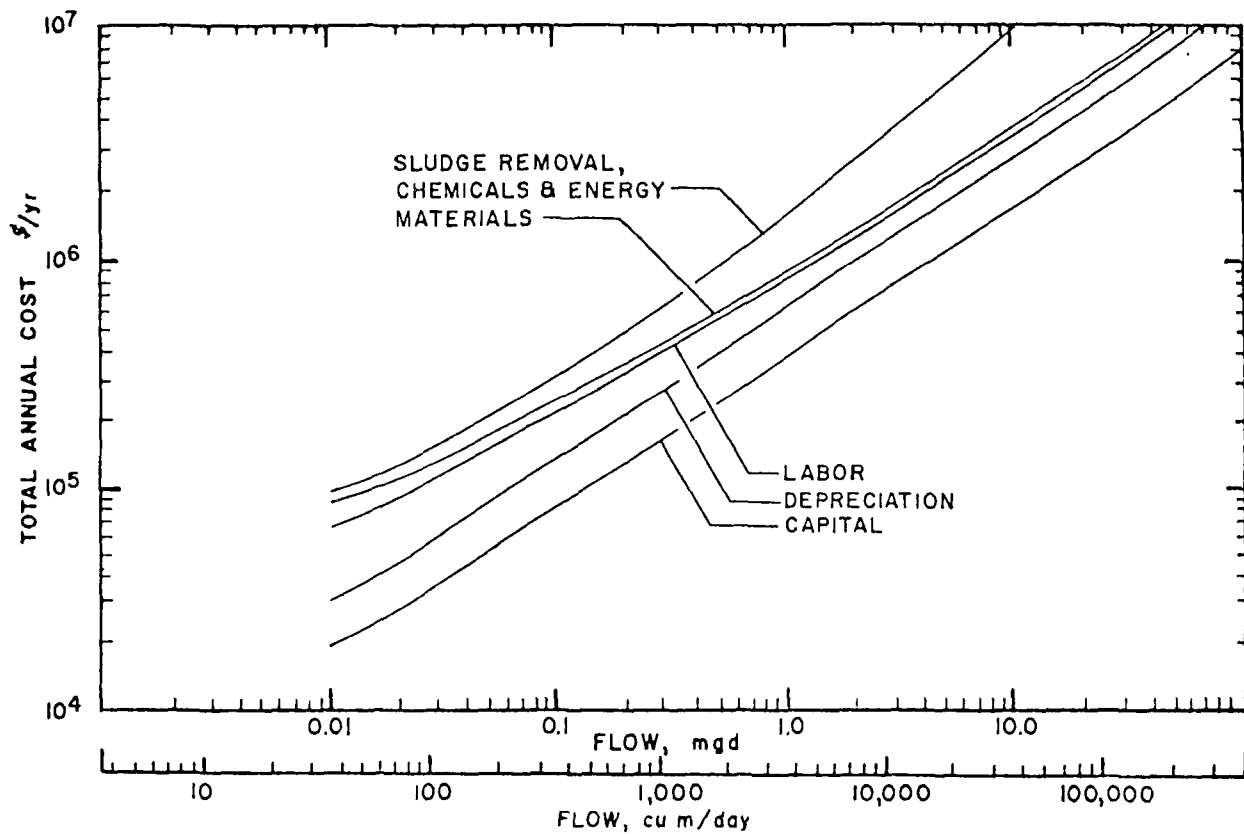


Figure VIII-10

PRIMARY TUNGSTEN (APT TO METAL)  
COMBINATION 2, OPTION C



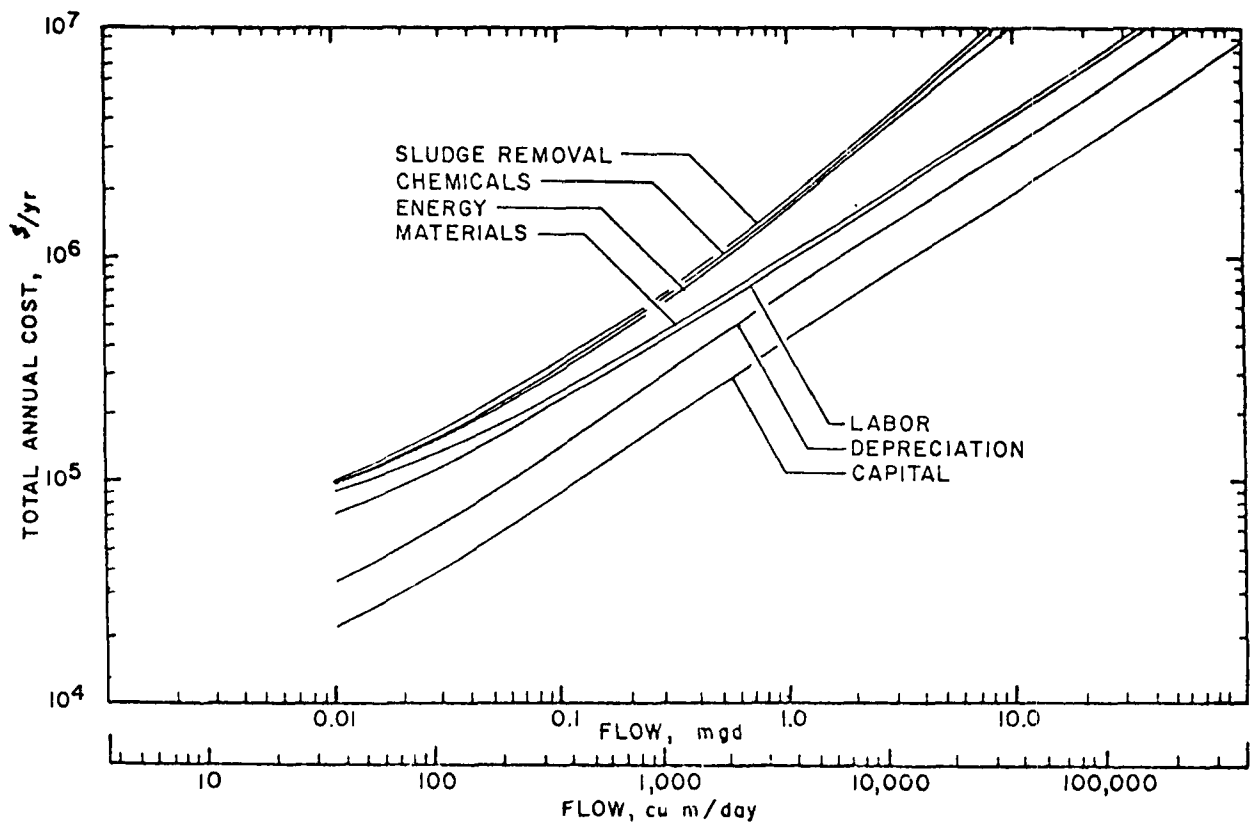


Figure VIII-11

PRIMARY TUNGSTEN (APT TO METAL)  
COMBINATION 2, OPTION E

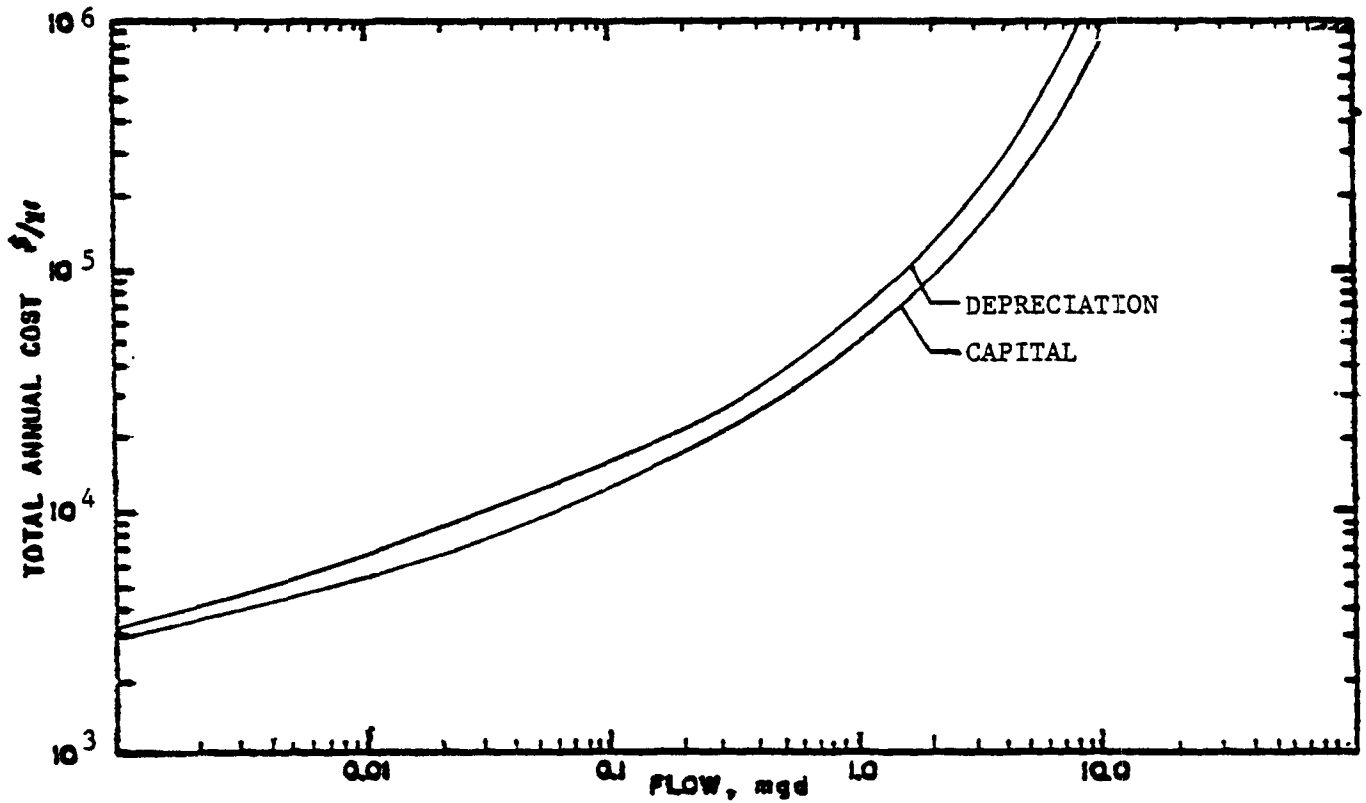


Figure VIII-12

PRIMARY TUNGSTEN HOLDING TANK COSTS

## PRIMARY TUNGSTEN SUBCATEGORY

### 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), Section 301(b)(a)(A). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the primary tungsten 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 (see Tanner's Council of America v. Train, 540 F.2d 1188 (4th Cir. 1176)). 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 industry using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. Some of the factors which must be considered in establishing effluent limitations based on BPT have already been discussed. The age of equipment and facilities, processes used, and raw materials were taken into account in subcategorization and subdivision and are discussed fully in Section IV. Nonwater quality impacts and energy requirements are considered in Section VIII.

As explained in Section IV, the primary tungsten 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. To account for production and flow variability from plant to plant, 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 (1) whether or not operations included generated wastewater, (2) specific flow rates generated, and (3) the specific production normalized flows for each process. 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.

Normalized flows were analyzed to determine which flow was 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 industry. The BPT normalized 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. In most cases, this will involve improving housekeeping practices, better maintenance to limit water leakage, or reducing excess flow by turning down a flow valve. It is not believed that these modifications would incur any costs for the plants.

For the development of effluent limitations, mass loadings were calculated for each wastewater source or subdivision. This calculation was made on a stream-by-stream basis, primarily because plants in this category may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per metric ton of production unit - mg/kkg) were calculated by multiplying the BPT normalized flow (l/kkg) by the treatability concentration using the BPT treatment system (mg/l) for each pollutant parameter to be limited under BPT.

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.

BPT effluent limitations are based on the average of the discharge flow rates for each source; consequently, the treatment technologies which are currently used by the lowest dischargers will be the treatment technologies most likely required to meet BPT guidelines. Section VII discusses the various treatment technologies which are currently in place for each wastewater source. In most cases, the current 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 added to streams containing treatable concentrations of ammonia. Consequently, the typical BPT treatment scheme will consist of ammonia steam stripping (if needed), chemical precipitation, and sedimentation. This BPT treatment scheme is presented schematically in Figure IX-1.

The overall effectiveness of end-of-pipe treatment for the removal of wastewater pollutants is improved by the application of water flow controls within the process to limit the volume of wastewater requiring treatment. The controls or in-process technologies recommended under BPT include only those measures which are commonly practiced within the subcategory and which reduce flows to meet the production normalized flow for each operation.

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.

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

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 BPT. See Weyerhaeuser Company v. Costle, 590 F.2d 1011 (D.C. Cir. 1978).

The methodology for calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Tables X-2 and X-3 show the pollutant reduction benefits for each treatment option. The current pollutant discharge and removal estimates for the primary tungsten industry are shown in Table X-4. Compliance costs are presented in Table X-5.

#### BPT OPTION SELECTION

The technology basis for the 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 preliminary treatment to remove ammonia. These technologies are demonstrated and economically achievable since they are already in place at both of the direct dischargers in this subcategory. The BPT treatment scheme is presented in Figure IX-1.

#### 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 nine 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 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 plant by subdivision in Tables V-1 through V-9.

#### TUNGSTIC ACID RINSE WATER

The BPT wastewater discharge rate for tungstic acid rinse water is 47,600 l/kg (11,400 gal/ton) of tungstic acid produced. This rate is allocated only for those plants which acid leach ore concentrates and then rinse the insoluble tungstic acid with water. Water use and wastewater discharge rates are presented in Table V-1. Two plants leach ore concentrates in this manner and generate 57,600 and 37,600 l/kg.

A third plant generates a tungstic acid rinse water from an acid leaching step, but this production normalized flow is much larger than the other flows in this subdivision and was not included in

the calculations. This stream is considered unique because an alkali leaching product, not ore concentrates, are leached, and the tungstic acid produced is more thoroughly rinsed and dried in preparation for sale as a by-product. Consequently, the BPT flows were based on data from the first two plants while streams like the third one mentioned above should be considered unique and regulated on a case-by-case basis.

#### ACID LEACH WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for acid leach scrubber water is 37,700 l/kg (9,040 gal/ton) of tungstic acid produced. This rate is allocated only for those plants which acid leach ore concentrates and use a wet scrubbing system to control the fumes. Two plants which treat ore concentrates in this manner use water for emission control. Water use and wastewater discharge rates are presented in Table V-2. One reports a once-through flow of 37,700 l/kg while the second reports no generation of wastewater due to total recycle. Extensive recycle may be possible for this stream, but zero discharge may not be technically feasible unless (1) a recycle system controls dissolved solids build-up; (2) the wastewater is evaporated; or (3) there is a production operation which can accept the quality of treated wastewater. Some of these zero discharge possibilities are site specific and, hence, may not apply to all plants. For this reason BPT flow is based on the non-zero discharger flows only, and in this case, there is only one non-zero discharger.

#### ALKALI LEACH WASH

The BPT wastewater discharge rate for alkali leach wash is 46,700 l/kg (11,200 gal/ton) of sodium tungstate produced. It is the average of two plants generating wastewater. This rate is allocated only for those plants which use an alkaline leaching step to process ore concentrates followed by a filtering or wash/decant step. Of the four plants which alkali leach, only two report generating a wastewater, at rates of 10,700 l/kg and 82,600 l/kg. Water use and wastewater discharge rates are presented in Table V-3. The plant that generates 82,600 l/kg has achieved zero discharge status by pumping all its wastes to a settling pond where the water can evaporate or percolate into the ground. Since this is feasible only because the plant is in a net evaporation area, its flow generation rate is still used in the calculation of the regulatory flow. The two plants which report zero discharge from the alkali leaching step are not considered in the regulatory flow since zero is discharge feasible in only a few site-specific applications as explained in the previous paragraph.

## ION-EXCHANGE RAFFINATE

The BPT wastewater discharge rate for ion-exchange raffinate is 51,200 l/kg (12,300 gal/ton) of ammonium tungstate produced. This rate is allocated only to those plants which use a liquid ion-exchange process. The two plants which do this generate raffinate streams at flows of 29,800 l/kg and 72,500 l/kg. Water use and wastewater discharge rates are presented in Table V-4. These values were averaged to calculate the regulatory flow. The plant which generates the 72,500 l/kg of wastewater is a zero discharge plant, but this flow is still included in the calculation since its ability to achieve zero discharge through an end-of-pipe treatment (evaporation and percolation from a settling pond) is site-specific.

## CALCIUM TUNGSTATE PRECIPITATE WASH

The BPT wastewater discharge rate for calcium tungstate precipitate washes is 37,200 l/kg (8,920 gal/ton) of calcium tungstate produced. This rate is allocated only to those plants which precipitate calcium tungstate from a sodium tungstate solution by adding calcium chloride. The filtrate or rinses of the precipitate make up this wastewater. All four plants which precipitate calcium tungstate report generating a wastewater, although the data was insufficient to quantify the flow from one plant. Water use and wastewater discharge rates are presented in Table V-5. The BPT flow rate is the average of the remaining three flows, which ranged from 21,000 l/kg to 65,800 l/kg. The plant inside this range is actually a zero discharge plant, but its flow generation rate is still used in calculation since its ability to achieve zero discharge status is site-specific.

## CRYSTALLIZATION AND DRYING OF AMMONIUM PARATUNGSTATE

No BPT wastewater discharge rate is provided for the crystallization and drying of ammonium paratungstate. Of the four plants which crystallize and then dry ammonium paratungstate, three are direct dischargers which have reduced the flow of this wastewater to zero through a combination of reuse and recycle. The fourth plant is a zero discharge plant which pumps its wastes to a settling pond. Water use and wastewater discharge rates are presented in Table V-6. Since the plants in this category have demonstrated the ability to reduce the flow of this stream to zero, it is appropriate that the BPT regulatory flow should be zero.

## AMMONIUM PARATUNGSTATE CONVERSION TO OXIDES WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for the APT conversion to oxides step is 20,900 l/kg (5,010 gal/ton) of "blue" oxide ( $WO_3$ ) produced. This rate is allocated only to those plants

which calcine APT to drive off ammonia and produce tungsten oxides (assumed to be  $WO_3$ .) Most plants use a wet scrubbing system to contain the fumes, and some use an ammonia recovery system. Of the six plants which reported using this process and generating a waste stream, two have reduced this flow to zero through combinations of recycle, reuse, and evaporation. These two plants are not figured into BPT flow calculations since zero discharge is feasible in only a few site specific applications. Water use and wastewater discharge rates are presented in Table V-7. The flow rates from the four direct and indirect dischargers which were averaged to develop the production normalized BPT flow allowance range from 7,430 l/kg to 36,800 l/kg.

#### REDUCTION TO TUNGSTEN WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for reduction to tungsten metal scrubber water is 73,200 l/kg (17,500 gal/ton) of tungsten produced. This rate is allocated only to those plants which use a wet air pollution control system to control particulate emissions from furnaces used to reduce tungsten oxides ( $WO_x$ ) to tungsten metal. Five of the seven reporting plants that produce tungsten metal in this manner use a wet scrubbing system. Water use and wastewater discharge rates are presented in Table V-8. Two of these five claim to have reduced this flow to zero through 100 percent recycle. Extensive recycle is demonstrated for this stream, but a zero discharge may not be technically feasible unless (1) a recycle system controls dissolved solids build-up; (2) the waste-water is evaporated; or (3) there is a production operation which can accept the quality of the treated wastewater. Some of these zero discharge possibilities are site-specific and, hence, are not applicable on a nationwide basis. For this reason, BPT flow is based on the non-zero discharger flows only. Of the three dischargers, one had a flow which was six times greater than the others and, since there is no technical basis for this, it was not considered when the two other flows, at 80,500 l/kg and 65,900 l/kg, were averaged.

#### REDUCTION TO TUNGSTEN WATER OF FORMATION

The BPT wastewater discharge rate for water of formation from the reduction of tungsten oxides is 19,400 l/kg (4,650 gal/ton) of tungsten produced. Of the seven plants which reduce tungsten oxides to tungsten metal, only two report wastewaters that are not associated with wet air pollution control devices or non-contact cooling. Water use and wastewater discharge rates are presented in Table V-9. Water of formation is generated when  $WO_x$  is reduced to tungsten metal in a hydrogen atmosphere. The BPT wastewater discharge rate is based on the discharge rate of one of the plants. The other plant does not discharge this wastewater and was not considered in calculating the discharge allowance.



In plants which use wet scrubbing systems, this water of formation is most likely vaporized upon formation and then recondensed in the scrubber system. Consequently, plants with wet scrubbing systems on their reduction furnaces do not report a separate water of formation waste stream. For this reason, this BPT flow rate should be allocated only to those plants which reduce oxides to metal, but do not use a wet air pollution control system.

#### 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 are selected for limitation under BPT and are listed below:

- 122. lead
- 125. selenium
- 128. zinc
- ammonia
- TSS
- pH

#### EFFLUENT LIMITATIONS

The treatable concentrations achievable by application of the proposed BPT are discussed in Section VII of the General Development Document and summarized there in Table VII-19. These treatable 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 metric ton of product represent the BPT effluent limitations and are presented in Table IX-2 for each individual waste stream.

Table IX-1

BPT WASTEWATER DISCHARGE RATES FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

<u>Wastewater Stream</u>	<u>BPT Normalized Discharge Rate</u>		<u>Production Normalization Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Tungstic Acid Rinse Water	47,600	11,400	Tungstic acid produced
Acid Leach Wet Air Pollution Control	37,700	9,040	Tungstic acid produced
Alkali Leach Wash	46,700	11,200	Sodium tungstate produced
Ion-Exchange Raffinate	51,200	12,300	Ammonium tungstate produced
Calcium Tungstate Precipitate Wash	37,200	8,920	Calcium tungstate produced
Crystallization and Drying of Ammonium Para- tungstate	0	0	
Ammonium Paratung- state Conversion to Oxides Wet Air Pollution Control	20,900	5,010	"Blue" oxide produced
Reduction to Tungsten Air Pollu- tion Control	73,200	17,500	Tungsten metal produced
Reduction to Tungsten Water of Formation	19,400	4,650	Tungsten metal produced

Table IX-2

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY TUNGSTEN SUBCATEGORYTungstic Acid Rinse

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	7,140.0	6,188.0
Selenium	58,548.0	26,180.0
Zinc	63,308.0	26,656.0
Ammonia (as N)	6,330,800.0	2,789,360.0
TSS	1,951,600.0	952,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Acid Leach Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	5,655.0	4,901.0
Selenium	46,371.0	20,735.0
Zinc	50,141.0	21,112.0
Ammonia (as N)	5,014,100.0	2,209,220.0
TSS	1,545,700.0	754,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Alkali Leach Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	7,005.0	6,071.0
Selenium	57,441.0	25,685.0
Zinc	62,111.0	26,152.0
Ammonia (as N)	6,211,100.0	2,736,620.0
TSS	1,914,700.0	934,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY TUNGSTEN SUBCATEGORYIon-Exchange Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
Lead	7,680.0	6,656.0
Selenium	62,976.0	28,160.0
Zinc	68,096.0	28,672.0
Ammonia (as N)	6,809,600.0	3,000,320.0
TSS	2,099,200.0	1,024,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Calcium Tungstate Precipitate Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of calcium tungstate produced		
English Units - lbs/billion lbs of calcium tungstate produced		
Lead	5,580.0	4,836.0
Selenium	45,756.0	20,460.0
Zinc	49,476.0	20,832.0
Ammonia (as N)	4,947,600.0	2,179,920.0
TSS	1,525,200.0	744,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY TUNGSTEN SUBCATEGORYCrystallization and Drying of Ammonium Paratungstate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium paratungstate produced		
English Units - lbs/billion lbs of ammonium paratungstate produced		
Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Ammonium Paratungstate Conversion to  
Oxides Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	3,135.0	2,717.0
Selenium	25,707.0	11,495.0
Zinc	27,797.0	11,704.0
Ammonia (as N)	2,779,700.0	1,224,740.0
TSS	856,900.0	418,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY TUNGSTEN SUBCATEGORYReduction to Tungsten Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	10,980.0	9,516.0
Selenium	90,036.0	40,260.0
Zinc	97,356.0	40,992.0
Ammonia (as N)	9,735,600.0	4,289,520.0
TSS	3,001,200.0	1,464,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction to Tungsten Water of Formation

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	2,910.0	2,522.0
Selenium	23,862.0	10,670.0
Zinc	25,802.0	10,864.0
Ammonia (as N)	2,580,200.0	1,136,840.0
TSS	795,400.0	388,000.0
pH	Within the range of 7.5 to 10.0 at all times	

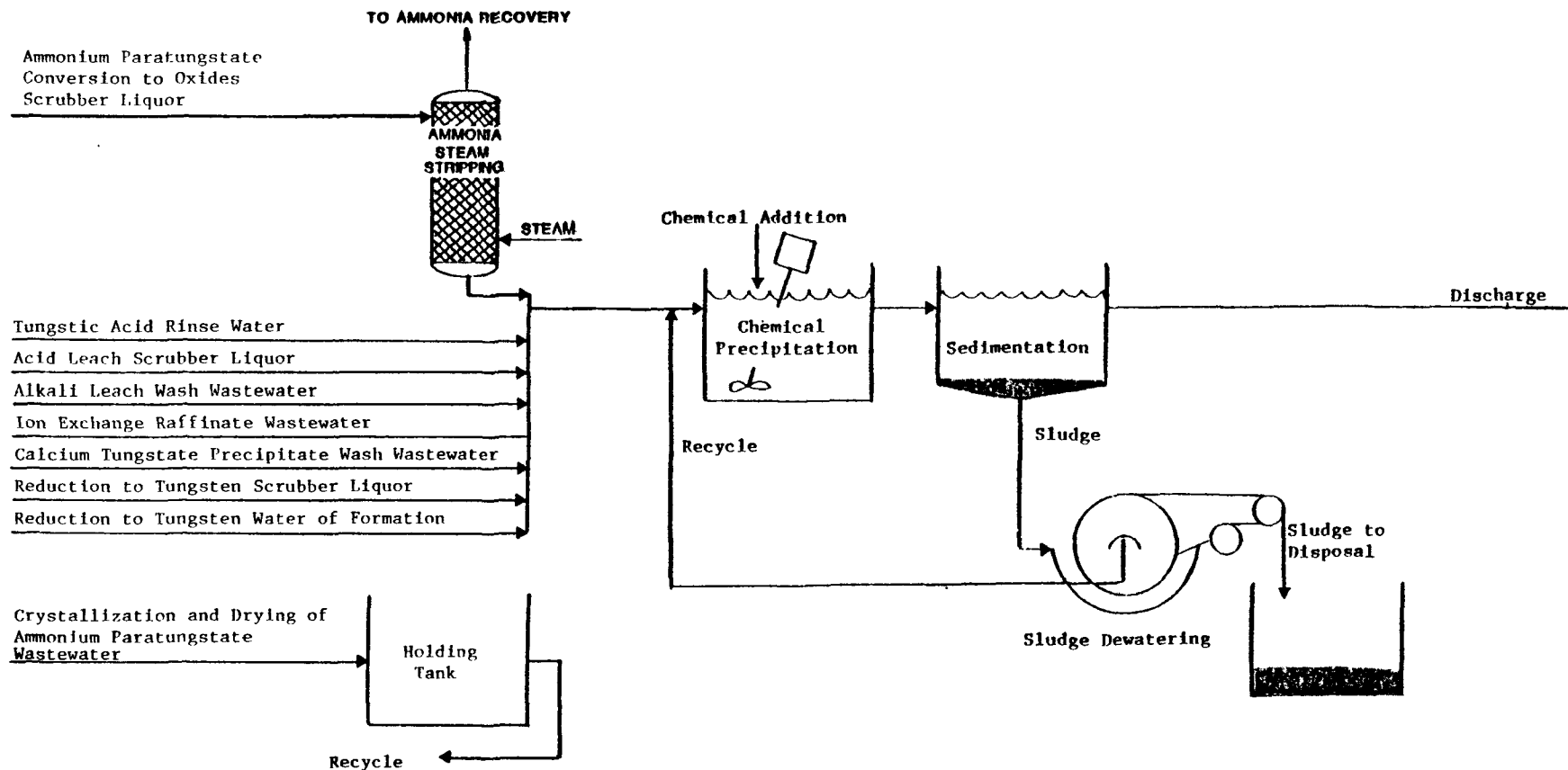


Figure IX-1

BPT TREATMENT SCHEME FOR THE PRIMARY TUNGSTEN SUBCATEGORY

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION X

#### BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

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

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

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

#### TECHNICAL APPROACH TO BAT

In pursuing this second round of effluent limitations, the Agency reviewed a wide range of technology options and evaluated the available possibilities to ensure that the most effective and beneficial technologies were used as the basis of BAT. To accomplish this, the Agency elected to examine five technology options which could be applied to the primary tungsten 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) is based on:

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation

Option B (Figure X-2) is based on:

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor

Option C (Figure X-3) is based on:

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration

Option E (Figure X-4) is based on:

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration
- o Activated carbon adsorption

Option F (Figure X-5) is based on:

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration
- o Reverse osmosis in conjunction with multiple-effect evaporation

The five 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 last four options each represent substantial progress toward the reduction of pollutant discharges above and beyond the progress achievable by BPT.

#### OPTION A

Option A for the primary tungsten 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 lime precipitation and sedimentation, with ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia (see Figure IX-1). The discharge rates for Option A are equal to the discharge rates allocated to each stream as a BPT discharge flow.

#### OPTION B

Option B for the primary tungsten subcategory achieves lower pollutant discharge by building upon the Option A end-of-pipe treatment technology. Flow reduction measures are added to the Option A treatment scheme which consists of lime precipitation and sedimentation, with ammonia steam stripping preliminary treatment of the wastewaters containing treatable concentrations of ammonia (see Figure X-2). These flow reduction measures, including in-process changes, result in the elimination of some wastewater streams and the concentration of pollutants in other effluents. As explained in Section VII of the General Development Document, treatment of a more concentrated effluent allows achievement of a greater net pollutant removal and introduces the possible economic benefits associated with treating a lower volume of wastewater.

The method used in Option B to reduce process wastewater generation and discharge rates is recycle of water used in wet air pollution control. There are two wet air pollution control wastewater sources regulated under these effluent limitations for which recycle is considered feasible:

- Acid leach wet air pollution control, and
- Reduction to metal wet air pollution control.

Table X-1 presents the number of plants reporting wastewater use with these sources, the number of plants practicing recycle of scrubber liquor, and the range of recycle values being used. Although three plants report total recycle of their scrubber water, some blowdown or periodic cleaning is likely to be needed to prevent the buildup of dissolved and suspended solids since the water picks up particulates and fumes from the air.

Reduction of flow through recycle or reuse represents the best available technology economically achievable for these streams. Acid leaching scrubber water may be reused in the scrubber with periodic blowdown or as rinse water for insoluble tungstic acid. Scrubber water from wet air pollution control systems on furnaces which reduce tungsten oxides to metal may also be recycled through the scrubber with periodic blowdown as several plants have demonstrated.

#### OPTION C

Option C for the primary tungsten subcategory consists of all control and treatment requirements of Option B (flow reduction, ammonia steam stripping, lime precipitation and sedimentation) plus multimedia filtration technology added at the end of the Option B treatment scheme (see Figure X-3). 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.

#### OPTION E

Option E for the primary tungsten subcategory consists of all the control and treatment requirements of Option C (flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration) with the addition of granular activated carbon technology at the end of the Option C treatment scheme (see Figure X-4). The activated carbon process is provided to control the discharge of toxic organics.

#### OPTION F

Option F for the primary tungsten subcategory consists of reverse osmosis and multiple-effect evaporation technology and complete recycle added at the end of the Option C (flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration) treatment scheme (see Figure X-5). Reverse osmosis controls dissolved solids to the point where total recycle, and thus zero discharge, is feasible. The multiple-effect evaporation technology is used to dewater the brines rejected from reverse osmosis.

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

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 REDUCTION BENEFITS

A complete description of the methodology used to calculate the estimated pollutant reduction, or benefit, achieved by the application of the various treatment options is presented in Section X of the General Development Document. In short, sampling data collected during the field sampling program were used to characterize the 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 tungsten subcategory. By multiplying the total subcategory production for a unit operation times the corresponding raw waste value, the mass of pollutant generated for that unit operation was estimated.

The volume of wastewater discharged after the application of each treatment option was estimated by multiplying the regulatory flow determined for each unit process by the total subcategory production. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed, referred to as the benefit, is simply 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 Agency varied this procedure slightly in computing estimated BPT discharge in a subcategory where there is an existing BPT limitation. In this case, EPA took the mass limits from the BPT limitations (for all pollutants limited at BPT) and multiplied these limits by the total subcategory production (from dcp). (The assumption is that plants are discharging a volume equal to their BPT allowance times their production.) Where pollutants are not controlled by existing BPT, EPA used the achievable concentration for the associated technology proposed today, and multiplied these concentrations by the total end-of-pipe discharge of process wastewater for the subcategory (from dcp). The total of both these calculations represents estimated mass loadings for the subcategory. The pollutant reduction benefit estimates for direct discharges in the primary tungsten subcategory are presented in Table X-2. Pollutant reduction benefit estimates for indirect dischargers are shown in Section XII.

## COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop uniformly applicable cost curves, relating the

total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied these curves on a per plant basis, a plant's costs--both capital, and operating and maintenance--being 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. The compliance costs associated with the various options are presented in Table X-3 for direct discharges in the primary tungsten subcategory. Compliance cost for indirect discharges are shown in Section XII. These costs were used in assessing economic achievability.

#### BAT OPTION SELECTION

EPA has selected Option C which includes flow reduction, lime precipitation, sedimentation, and multimedia filtration, with ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia. The estimated capital cost of proposed BAT is 447,000 dollars (1978 dollars) and the annual cost is 193,000 dollars (1978 dollars). The end-of-pipe treatment configuration for Option C is presented in Figure X-3.

EPA is proposing multimedia filtration as part of the BAT technology because this technology is demonstrated in the subcategory (three of eight plants, and both direct dischargers presently have filters) and results in additional removal 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 flow and concentrations.

Ammonia steam stripping is demonstrated in the nonferrous metals manufacturing category. Four plants in the primary tungsten subcategory have steam stripping in-place. 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 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 tungsten subcategory contained ammonia concentrations of 695 and 1,610 mg/l.

Implementation of the control and treatment technologies of Option C would remove annually an estimated 3,689 kilograms of toxic metal pollutants, which is 127 kilograms of toxic metal pollutants over the estimated BPT removal. The ammonia steam stripping technology of Option C would remove annually an estimated 741,470 kilograms of ammonia.

Activated carbon technology (Option E) was also considered, however this technology is not necessary since toxic organic pollutants are not limited in this subcategory (see discussion on Regulated Pollutant Parameters at the end of this section).

Reverse osmosis and multiple-effect evaporation (Option F) was considered for the purpose of achieving zero discharge of process wastewater; however, the Agency ultimately rejected this technology because it was determined that its performance for this specific purpose was not adequately demonstrated in this category nor was it clearly transferable from another category.

#### 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 nine wastewater sources were determined and are summarized in Table X-4. 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.

The BAT discharge rates reflect the flow reduction requirements of the selected BAT option. For this reason, the two scrubber waters which were targeted for flow reduction through recycle for BAT have lower flow rates than the corresponding BPT flows. Since several plants have demonstrated sufficient ability to achieve substantial recycle of these two wastewaters, lower flow

allowances for these streams represent the best available technology economically achievable.

The BAT discharge rate for both acid leach scrubber water and reduction to metal scrubber water is based on 90 percent recycle of the scrubber effluent (refer to Section VII of the General Development Document). Consequently, the BAT production normalized discharge flow for acid leach wet air pollution control is 3,770 l/kg (904 gal/ton) of tungstic acid produced. This rate should be allocated only to those plants which acid leach ore concentrates and use a wet air pollution control system to control fumes. Similarly, the BAT discharge flow for reduction to tungsten metal wet air pollution control is 9,400 l/kg (2,253 gal/ton) of tungsten produced. This rate is allocated only to those plants which use a wet air pollution control system to control particulate emissions from furnaces used to reduce tungsten oxides ( $WO_x$ ) to tungsten metal.

#### REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C. 1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutants and pollutant parameters for limitation. This examination and evaluation was presented in Section VI. The Agency, however, has chosen not to regulate all 10 toxic pollutants selected in this analysis.

The primary tungsten subcategory generates an estimated 8,340 kg/yr of toxic pollutants, of which only 70 kg/yr are toxic organic pollutants. The Agency believes that the toxic organic pollutants in the primary tungsten subcategory are present only in trace (de minimus quantities) and are neither causing nor likely to cause toxic effects. Therefore, the following toxic organic pollutants are excluded from regulation:

1. acenaphthene
55. naphthalene
77. acenaphthylene
80. fluorene

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 proposing effluent mass limitations only for those pollutants generated in the greatest

quantities as shown by the pollutant reduction benefit analysis. The pollutants selected for specific limitation are listed below:

- 122. lead
- 125. selenium
- 128. zinc
- ammonia (as N)

Be establishing limitations and standards for certain toxic metal pollutants, discharges will attain the same degree of control over toxic 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 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 lime 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 tungsten subcategory to control the discharges of toxic metal pollutants are lead, selenium, and zinc. Ammonia is also selected for limitation since the methods used to control lead, selenium, and zinc are not effective in the control of ammonia. The following toxic metal pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations developed for lead, selenium, and zinc:

- 118. cadmium
- 119. chromium (Total)
- 127. thallium

The conventional pollutant parameters TSS and pH will be limited by the best conventional technology (BCT) effluent limitations. These effluent limitations and a discussion of BCT are presented in Section XIII of this supplement.

#### EFFLUENT LIMITATIONS

The concentrations achievable by application of BAT are discussed in Section VII of the General Development Document and summarized there in Table VII-19. The treatable concentrations both one day maximum and monthly average values are multiplied by the BAT normalized discharge flows summarized in Table X-4 to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per metric ton of product represent the BAT effluent limitations and are presented in Table X-5 for each waste stream.



Table X-1

CURRENT RECYCLE PRACTICES WITHIN THE  
PRIMARY TUNGSTEN SUBCATEGORY

	<u>Number of Plants with Wastewater</u>	<u>Number of Plants Practicing Recycle</u>	<u>Range of Recycle Values (%)</u>
Acid Leach Wet Air Pollution Control	2	1	0 - 100
Reduction to Metal Wet Air Pollution Control	5	3	0 - 100

Table X-2

## POLLUTANT REDUCTION BENEFITS FOR DIRECT DISCHARGERS

Flow (l/yr)		592.4 x 10 <sup>6</sup>		487.0 x 10 <sup>6</sup>		487.0 x 10 <sup>6</sup>	
	Raw Waste	Option A	Option A	Option B	Option B	Option C	Option C
Pollutant	kg/yr	Removed	Discharged	Removed	Discharged	Removed	Discharged
		kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Acenaphthene	19.7	0.0	19.7	0.0	19.7	0.0	19.7
Napththalene	19.8	0.0	19.8	0.0	19.8	0.0	19.8
Acenaphthylene	19.8	0.0	19.8	0.0	19.8	0.0	19.8
Fluorene	10.6	0.0	10.6	0.0	10.6	0.0	10.6
Cadmium	29.3	0.0	29.3	0.0	29.3	5.4	23.9
Chromium	289.2	241.9	47.4	250.3	39.0	255.2	34.1
Lead	2,814.8	2,743.7	71.1	2,756.3	58.4	2,775.8	39.0
Selenium	391.7	385.8	5.9	386.8	4.9	388.3	3.4
Thallium	173.2	0.0	173.2	0.0	173.2	7.6	165.6
Zinc	369.4	191.7	177.7	223.3	146.1	257.4	112.0
TSS	2,665,714.1	2,658,605.8	7,108.3	2,659,869.9	5,844.2	2,664,447.9	1,266.2
Ammonia	754,171.5	741,469.7	12,701.8	741,469.7	12,701.8	741,469.7	12,701.8
Total Toxic Organics	69.9	0.0	69.9	0.0	69.9	0.0	69.9
Total Toxic Metals	4,067.6	3,563.1	504.6	3,616.7	450.9	3,689.7	378.0
Total Toxics	4,137.5	3,563.1	574.5	3,616.7	520.8	3,689.7	447.9
Total Conventional	2,665,714.1	2,658,605.8	7,108.3	2,659,869.9	5,844.2	2,664,447.9	1,266.2
Total Nonconventional	754,171.5	741,469.7	12,701.8	741,469.7	12,701.8	741,469.7	12,701.8
Total Pollutants	3,424,023.1	3,403,638.6	20,384.6	3,404,956.3	19,066.8	3,409,607.3	14,415.9

Table X-2 (Continued)

## POLLUTANT REDUCTION BENEFITS FOR DIRECT DISCHARGERS

Flow (l/yr)	487.0 x 10 <sup>6</sup>		0.0	
Pollutant	Option E Removed kg/yr	Option E Discharged kg/yr	Option F Removed kg/yr	Option F Discharged kg/yr
Acenaphthene	14.8	4.9	19.7	0.0
Napthhalene	14.9	4.9	19.8	0.0
Acenaphthylene	14.9	4.9	19.8	0.0
Fluorene	5.7	4.9	10.6	0.0
Cadmium	5.4	23.9	29.3	0.0
Chromium	255.2	34.1	289.2	0.0
Lead	2,775.8	39.0	2,814.8	0.0
Selenium	388.3	3.4	391.7	0.0
Thallium	7.6	165.6	173.2	0.0
Zinc	257.4	122.0	369.4	0.0
TSS	2,664,447.9	1,266.2	2,665,714.1	0.0
Ammonia	752,901.3	1,270.2	754,171.5	0.0
Total Toxic Organics	50.3	19.6	69.9	0.0
Total Toxic Metals	3,689.7	378.0	4,067.6	0.0
Total Toxics	3,740.0	397.6	4,137.5	0.0
Total Conventionals	2,664,447.9	1,266.2	2,665,714.1	0.0
Total Nonconventionals	752,901.3	1,270.2	754,171.5	0.0
Total Pollutants	3,421,089.2	2,934.0	3,424,023.1	0.0

NOTE: Total Toxic Metals = Cadmium + Chromium + Lead + Selenium + Thallium + Zinc

Total Toxics = Total Toxic Metals + Total Toxic Organics

Total Conventionals = TSS

Total Nonconventionals = Ammonia

Total Pollutants = Total Toxic Organics + Total Toxic Metals + Total Conventionals  
+ Total Nonconventionals

Option A - Chemical Precipitation, Sedimentation, and Ammonia Steam Stripping

Option B - Chemical Precipitation, Sedimentation, Ammonia Steam Stripping, and Flow Reduction

Option C - Chemical Precipitation, Sedimentation, Filtration, Ammonia Steam Stripping, and Flow Reduction

Option E - Chemical Precipitation, Sedimentation, Filtration, Activated Carbon Adsorption, Ammonia Steam Stripping, and Flow Reduction

Option F - Chemical Precipitation, Sedimentation, Filtration, Ammonia Steam Stripping, Reverse Osmosis, and Flow Reduction

Table X-3  
COST OF COMPLIANCE  
FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY  
Direct Dischargers

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	0	0
B	337,000	55,000
C	447,000	193,000
E	3,715,000	1,214,000
F	1,260,000	389,000

TABLE X-4

BAT WASTEWATER DISCHARGE RATES FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalization Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Tungstic Acid Rinse Water	47,600	11,410	Tungstic acid produced
Acid Leach Wet Air Pollution Control	3,770	904	Tungstic acid produced
Alkali Leach Wash	46,700	11,200	Sodium tungstate produced
Ion-exchange Raffinate	51,200	12,300	Ammonium tungstate produced
Calcium Tungstate Precipitate Wash	37,200	8,920	Calcium tungstate produced
Crystallization and Drying of Ammonium Paratungstate	0	0	
Ammonium Paratung- state Conversion to Oxides Wet Air	20,900	5,010	"Blue" oxide produced
Reduction to Tung- sten Wet Air Pollution Control	9,400	2,253	Tungsten metal produced
Reduction to Tungsten Water of Formation	19,400	4,650	Tungsten metal produced

Table X-5

BAT EFFLUENT LIMITATIONS FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

Tungstic Acid Rinse

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0

Acid Leach Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,019.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0

Alkali Leach Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

Ion Exchange Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0

Calcium Tungstate Precipitate Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of calcium tungstate produced		
English Units - lbs/billion lbs of calcium tungstate produced		
Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0

Crystallization and Drying of Ammonium Paratungstate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium paratungstate produced		
English Units - lbs/billion lbs of ammonium paratungstate produced		
Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

Ammonium Paratungstate Conversion to Oxides Wet Air  
Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0

Reduction to Tungsten Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	550,840.0

Reduction to Tungsten Water of Formation

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0



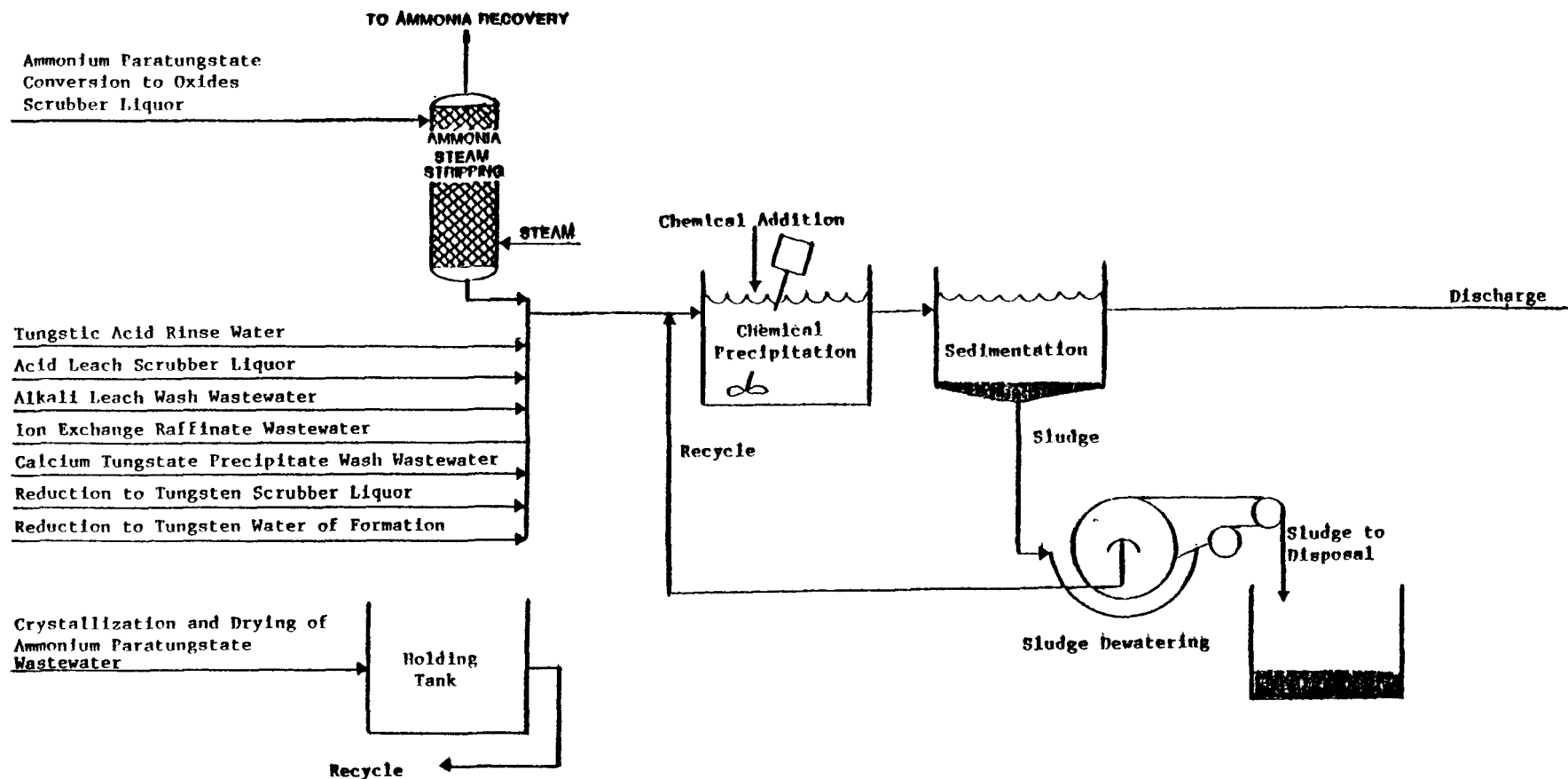


Figure X-1  
BAT TREATMENT SCHEME FOR OPTION A

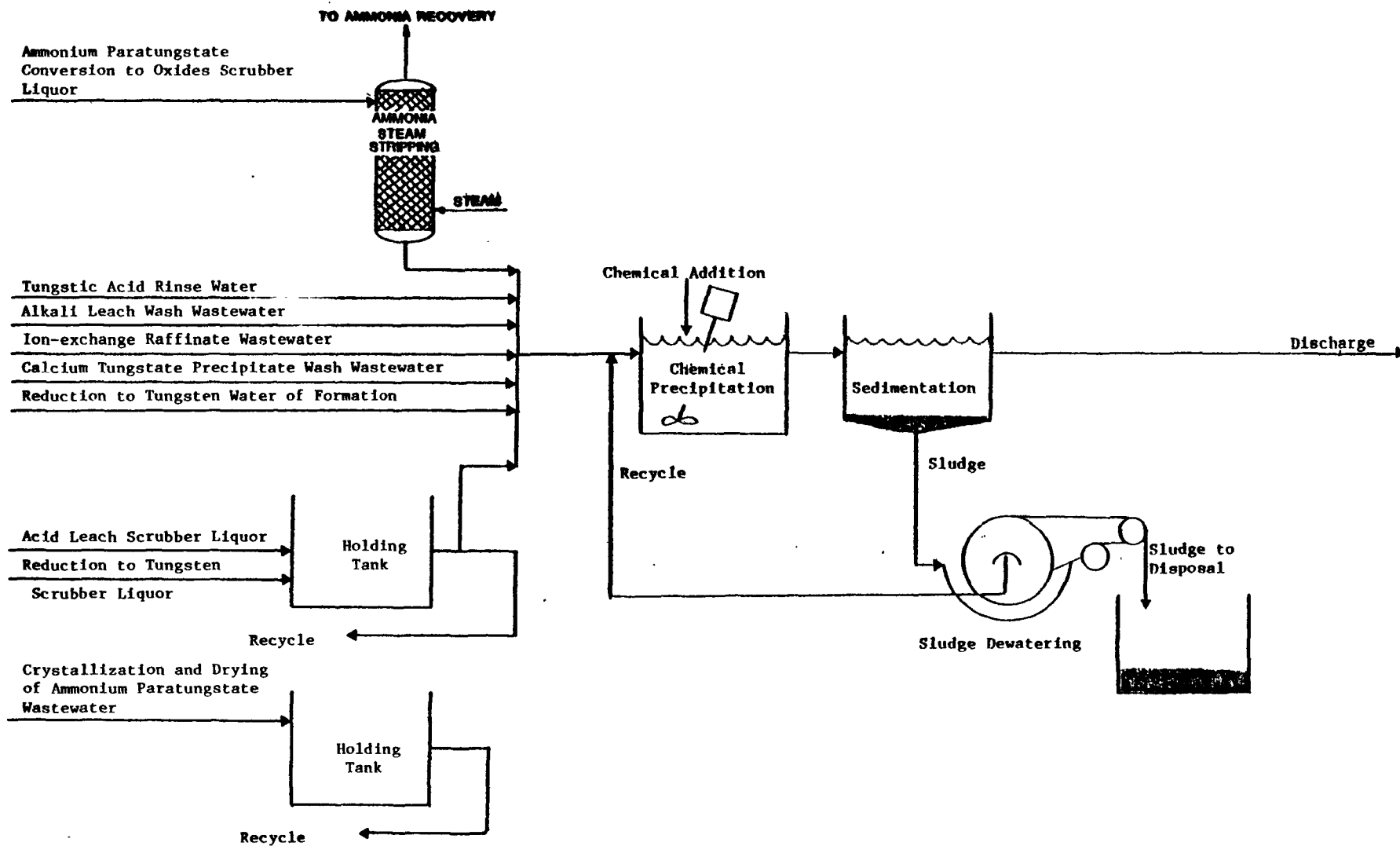


Figure X-2  
BAT TREATMENT SCHEME FOR OPTION B

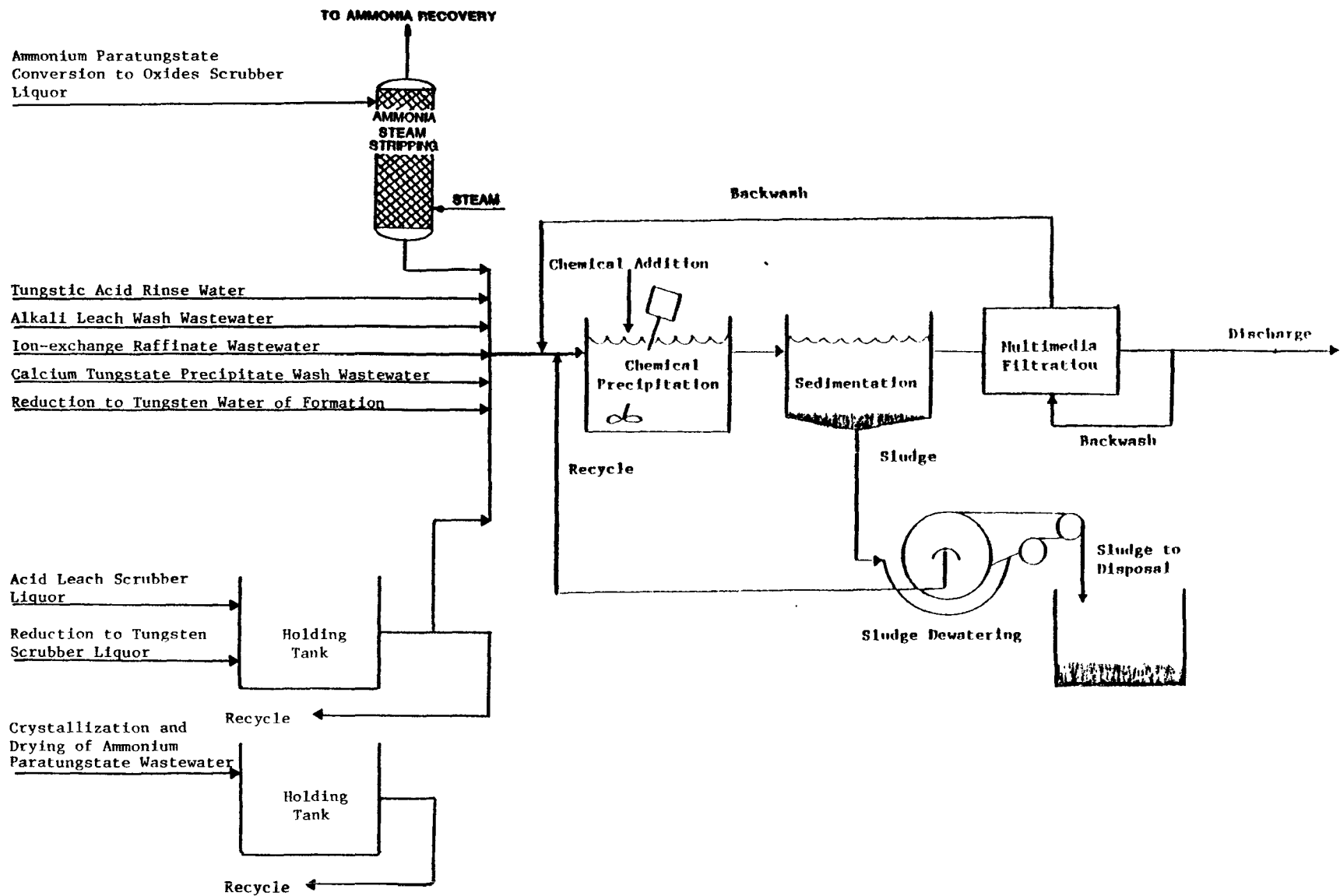


Figure X-3

BAT TREATMENT SCHEME FOR OPTION C

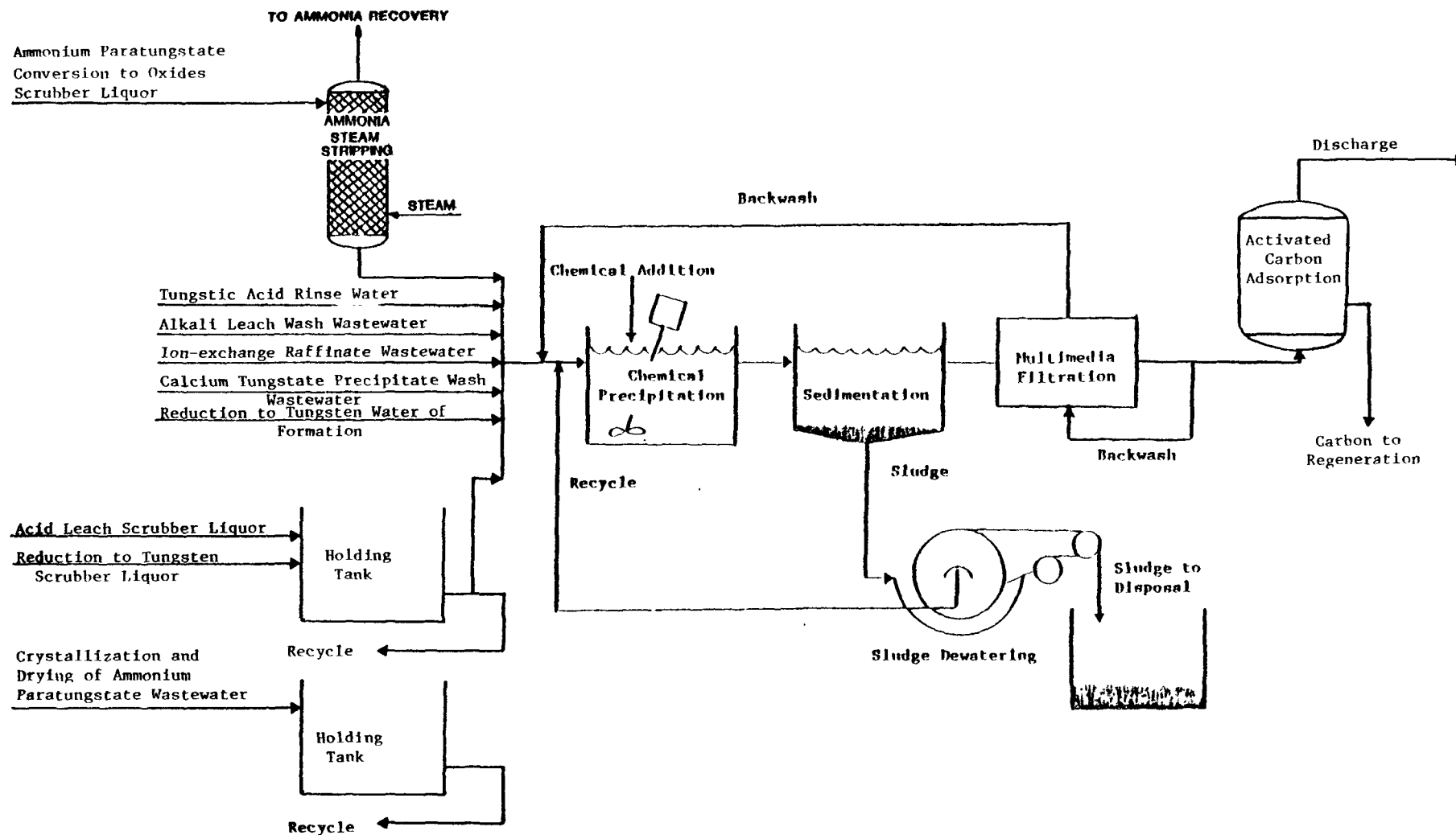


Figure X-4

BAT TREATMENT SCHEME FOR OPTION E

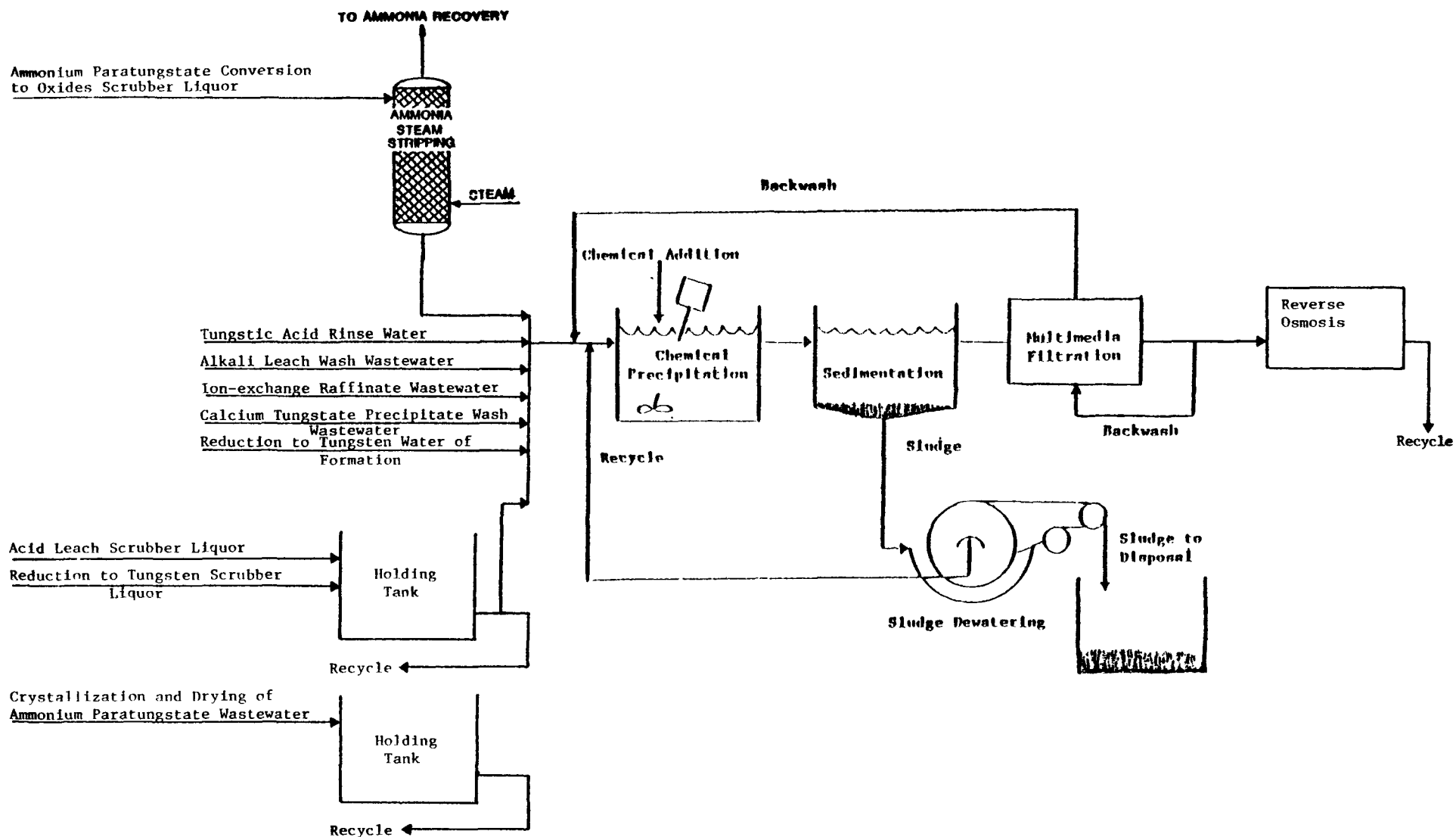


Figure X-5

BAT TREATMENT SCHEME FOR OPTION F

PRIMARY TUNGSTEN SUBCATEGORY  
SECTION XI  
NEW SOURCE PERFORMANCE STANDARDS

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

This section describes the technologies for treatment of wastewater from new sources and presents mass discharge standards for regulatory pollutants for NSPS in the primary tungsten subcategory, based on the selected treatment technology.

TECHNICAL APPROACH TO BDT

The best available demonstrated technology (BDT) for new source performance standards is equivalent to the best available technology (BAT) selected for currently existing primary tungsten 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 the General Development Document. This review of the primary tungsten 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.

Treatment technologies considered for the BDT 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 Lime precipitation and sedimentation

#### OPTION B

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor

#### OPTION C

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration

#### OPTION E

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration
- o Activated carbon adsorption

#### OPTION F

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration
- o Reverse osmosis in conjunction with multiple-effect evaporation

#### BDT OPTION SELECTION

EPA is proposing that the best available demonstrated technology for the primary tungsten subcategory be equivalent to Option C (flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration). This technology is demonstrated by three plants in the subcategory.

The wastewater flow rates for BDT are the same as the BAT flow rates. Further flow reduction measures for BDT are not feasible, because dry scrubbing is not demonstrated for controlling emissions from acid leaching, APT conversion to oxides, and tungsten

reduction furnaces. The nature of these emissions (acid fumes, hot particulate matter) technically precludes the use of dry scrubbers. Therefore, EPA is including an allowance from this source at BDT equivalent to that proposed for BAT. EPA also does not believe that new plants could achieve any additional flow reduction beyond the 90 percent scrubber effluent recycle proposed for BAT.

Activated carbon technology (Option E) was also considered, however this technology is not necessary since toxic organic pollutants are not limited in this subcategory. Reverse osmosis in conjunction with multiple-effect evaporation (Option F) was considered for the purpose of achieving zero discharge of process wastewater; however, the Agency ultimately rejected this technology because it was determined that its performance for this specific purpose was not adequately demonstrated in this category nor was it clearly transferable from another category.

#### 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 calculated by multiplying the appropriate treatable concentration (mg/l) by the production normalized wastewater discharge flows (l/kg). The treatable concentrations are listed in Table VII-19 of the General Development Document. The results of these calculations are the production-based new source performance standards. These standards are presented in Tables XI-2.



TABLE XI-1

NSPS WASTEWATER DISCHARGE RATES FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalization Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Tungstic Acid Rinse Water	47,600	11,410	Tungstic acid produced
Acid Leach Wet Air Pollution Control	3,770	904	Tungstic acid produced
Alkali Leach Wash	46,700	11,200	Sodium tungstate produced
Ion-exchange Raffinate	51,200	12,300	Ammonium tungstate produced
Calcium Tungstate Precipitate Wash	37,200	8,920	Calcium tungstate produced
Crystallization and Drying of Ammonium Paratungstate	0	0	
Ammonium Paratung- state Conversion to Oxides Wet Air	20,900	5,010	"Blue" oxide produced
Reduction to Tung- sten Wet Air Pollution Control	9,400	2,253	Tungsten metal produced
Reduction to Tungsten Water of Formation	19,400	4,650	Tungsten metal produced

Table XI-2

## NSPS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Tungstic Acid Rinse

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0
TSS	714,000.0	571,200.0
pH	Within the range of 7.5 to 10.0 at all times	

Acid Leach Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,091.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0
TSS	56,550.0	45,240.0
pH	Within the range of 7.5 to 10.0 at all times	

Alkali Leach Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0
TSS	700,500.0	560,400.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-2 (Continued)

## NSPS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ion-Exchange Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0
TSS	768,000.0	614,400.0
pH	Within the range of 7.5 to 10.0 at all times	

Calcium Tungstate Precipitate Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of calcium tungstate produced		
English Units - lbs/billion lbs of calcium tungstate produced		
Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0
TSS	558,000.0	446,400.0
pH	Within the range of 7.5 to 10.0 at all times	

Crystallization and Drying of Ammonium Paratungstate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium paratungstate produced		
English Units - lbs/billion lbs of ammonium paratungstate produced		
Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-2 (Continued)

## NSPS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ammonium Paratungstate Conversion  
to Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0
TSS	313,500.0	250,800.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction to Tungsten Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	550,840.0
TSS	141,000.0	112,800.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction to Tungsten Water of Formation

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0
TSS	291,000.0	232,800.0
pH	Within the range of 7.5 to 10.0 at all times	

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION XII

#### PRETREATMENT STANDARDS

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES), which must be achieved within three years of promulgation. 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 of 1977 requires pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives. Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time that it promulgates NSPS. 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 technology for removal of toxic pollutants.

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the primary tungsten subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology.

#### TECHNICAL APPROACH TO PRETREATMENT

Before proposing 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: (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.

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

The industry cost and pollutant reduction benefits of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Table XII-1 shows the estimated pollutant reduction benefits for indirect dischargers. Compliance costs for indirect dischargers are presented in Table XII-2.

#### 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 of the General Development Document.

Treatment technologies considered for the PSNS and PSES options are:

##### OPTION A

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation

#### OPTION B

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor

#### OPTION C

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration

#### OPTION E

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration
- o Activated carbon adsorption

#### OPTION F

- o Preliminary treatment with ammonia steam stripping (where required)
- o Lime precipitation and sedimentation
- o In-process flow reduction of acid leach and reduction to tungsten scrubber liquor
- o Multimedia filtration
- o Reverse osmosis in conjunction with multiple-effect evaporation

#### PSNS AND PSES OPTION SELECTION

Option C (flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration) has been selected as the regulatory approach for pretreatment standards for new and existing sources (PSNS and PSES) on the basis that it achieves effective removal of toxic pollutants at a reasonable cost. In addition, filtration is demonstrated in the subcategory (including one of three indirect dischargers), and will not result in adverse economic impacts. The estimated capital cost of proposed PSES is 396,000 dollars (1978 dollars) and the annual cost is 329,000 dollars (1978 dollars).

The wastewater discharge rates for both PSES and PSNS are identical to the BAT discharge rates for each waste stream. The PSES and PSNS discharge rates are shown in Table XII-3. No additional flow reduction measures for PSNS are feasible because the only other flow reduction technology, reverse osmosis in conjunction with multiple-effect evaporation, is not demonstrated, nor is it clearly transferable for this subcategory. Activated carbon technology (Option E) was also considered however, this technology is not necessary since toxic organic pollutants are not limited in this subcategory.

Implementation of the proposed PSES will result in an estimated annual removal of 4,075 kilograms of toxic pollutants. Implementation of Option C will result in an estimated annual removal of 79,500 kilograms of ammonia.

#### 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 propose PSES and PSNS to prevent the pass-through of lead, selenium, zinc, and ammonia, which are the limited pollutants.

#### 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 proposed treatment (mg/l) and the production normalized wastewater discharge rate (l/kg). The achievable treatment concentrations for BAT are identical to those for PSES and PSNS. These concentrations are listed in Tables XII-19 of the General Development Document. PSES and PSNS are presented in Tables XII-4 and XII-5.



Table XII-1

## POLLUTANT REDUCTION BENEFITS FOR INDIRECT DISCHARGERS

Flow (l/yr)		249.7 x 10 <sup>6</sup>		166.2 x 10 <sup>6</sup>		166.2 x 10 <sup>6</sup>	
		Option A	Option A	Option B	Option B	Option C	Option C
Pollutant	Raw Waste kg/yr	Removed kg/yr	Discharged kg/yr	Removed kg/yr	Discharged kg/yr	Removed kg/yr	Discharged kg/yr
Acenaphthene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Naphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acenaphthylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cadmium	33.5	13.8	19.7	20.4	13.1	25.4	8.1
Chromium	332.9	313.0	19.9	319.7	13.2	321.4	11.6
Lead	3,319.4	3,289.5	29.8	3,299.5	19.8	3,306.2	13.2
Selenium	49.6	47.2	2.5	48.0	1.7	48.5	1.2
Thallium	125.5	1.1	124.4	42.8	82.6	69.3	56.2
Zinc	343.1	268.5	74.6	293.5	49.6	305.1	38.0
TSS	367,682.2	364,703.3	2,984.9	365,705.1	1,983.1	367,258.6	429.7
Ammonia	80,456.2	79,573.8	882.9	79,573.8	882.9	79,573.8	882.9
Total Toxic Organics	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Toxic Metals	4,204.0	3,933.1	270.9	4,023.9	180.0	4,075.3	128.3
Total Toxics	4,204.0	3,933.1	270.9	4,023.9	180.0	4,075.3	128.3
Total Conventional	367,688.2	364,703.3	2,984.9	365,705.1	1,983.1	367,258.6	429.7
Total Nonconventional	80,456.2	79,573.8	882.9	79,573.8	882.9	79,573.8	882.9
Total Pollutants	452,348.4	448,210.2	4,138.7	449,302.8	3,046.0	450,907.7	1,440.9

Table XII-1 (Continued)

## POLLUTANT REDUCTION BENEFITS FOR INDIRECT DISCHARGERS

Flow (l/yr)	166.2 x 10 <sup>6</sup>		0.0	
<u>Pollutant</u>	<u>Option E Removed kg/yr</u>	<u>Option E Discharged kg/yr</u>	<u>Option F Removed kg/yr</u>	<u>Option F Discharged kg/yr</u>
Acenaphthene	0.0	0.0	0.0	0.0
Naphthalene	0.0	0.0	0.0	0.0
Acenaphthylene	0.0	0.0	0.0	0.0
Fluorene	0.0	0.0	0.0	0.0
Cadmium	25.4	8.1	33.5	0.0
Chromium	321.4	11.6	332.9	0.0
Lead	3,306.2	13.2	3,319.4	0.0
Selenium	48.5	1.2	49.6	0.0
Thallium	69.3	56.2	125.5	0.0
Zinc	305.1	38.0	343.1	0.0
TSS	367,258.6	429.7	367,688.2	0.0
Ammonia	80,368.4	88.3	804,456.6	0.0
Total Toxic Organics	0.0	0.0	0.0	0.0
Total Toxic Metals	4,075.9	128.3	4,204.0	0.0
Total Toxics	4,075.9	128.3	4,204.0	0.0
Total Conventionals	367,258.6	429.7	367,688.2	0.0
Total Nonconventionals	80,368.4	88.3	80,456.2	0.0
Total Pollutants	451,702.9	646.3	452,348.4	0.0

NOTE: Total Toxic Metals = Cadmium + Chromium + Lead + Selenium + Thallium + Zinc  
 Total Toxics = Total Toxic Metals + Total Toxic Organics  
 Total Conventionals = TSS  
 Total Nonconventionals = Ammonia  
 Total Pollutants = Total Toxic Organics + Total Toxic Metals + Total Conventionals  
 + Total Nonconventionals

Option A - Chemical Precipitation, Sedimentation, and Ammonia Steam Stripping  
 Option B - Chemical Precipitation, Sedimentation, Ammonia Steam Stripping, and Flow Reduction  
 Option C - Chemical Precipitation, Sedimentation, Filtration, Ammonia Steam Stripping, and Flow Reduction  
 Option E - Chemical Precipitation, Sedimentation, Filtration, Activated Carbon Adsorption, Ammonia Steam Stripping, and Flow Reduction  
 Option F - Chemical Precipitation, Sedimentation, Filtration, Ammonia Steam Stripping, Reverse Osmosis, and Flow Reduction

Table XII-2

COST OF COMPLIANCE  
FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

Indirect Dischargers

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	423,000	200,000
B	572,000	222,000
C	396,000	329,000
E	1,290,000	1,270,000
F	498,000	726,000

TABLE XII-3

PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE  
PRIMARY TUNGSTEN SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalization Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Tungstic Acid Rinse Water	47,600	11,410	Tungstic acid produced
Acid Leach Wet Air Pollution Control	3,770	904	Tungstic acid produced
Alkali Leach Wash	46,700	11,200	Sodium tungstate produced
Ion-exchange Raffinate	51,200	12,300	Ammonium tungstate produced
Calcium Tungstate Precipitate Wash	37,200	8,920	Calcium tungstate produced
Crystallization and Drying of Ammonium Paratungstate	0	0	
Ammonium Paratung- state Conversion to Oxides Wet Air	20,900	5,010	"Blue" oxide produced
Reduction to Tung- sten Wet Air Pollution Control	9,400	2,253	Tungsten metal produced
Reduction to Tungsten Water of Formation	19,400	4,650	Tungsten metal produced

Table XII-4

## PSES FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Tungstic Acid Rinse

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0

Acid Leach Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,901.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0

Alkali Leach Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0

Table XII-4 (Continued)

## PSES FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ion-Exchange Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of ammonium tungstate produced  
 English Units - lbs/billion lbs of ammonium tungstate produced

Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0

Calcium Tungstate Precipitate Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of calcium tungstate produced  
 English Units - lbs/billion lbs of calcium tungstate produced

Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0

Crystallization and Drying of Ammonium Paratungstate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of ammonium paratungstate produced  
 English Units - lbs/billion lbs of ammonium paratungstate  
 produced

Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-4 (Continued)

## PSES FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ammonium Paratungstate Conversion to Oxides Wet Air  
Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0

Reduction to Tungsten Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	112,800.0

Reduction to Tungsten Water of Formation

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0

Table XII-5

## PSNS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Tungstic Acid Rinse

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	4,760.0	4,284.0
Selenium	39,032.0	17,612.0
Zinc	48,552.0	19,992.0
Ammonia (as N)	6,330,800.0	2,789,360.0

Acid Leach Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
Lead	377.0	339.30
Selenium	3,091.40	1,394.90
Zinc	3,845.40	1,583.40
Ammonia (as N)	501,410.0	220,922.0

Alkali Leach Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
Lead	4,670.0	4,203.0
Selenium	38,294.0	17,279.0
Zinc	47,634.0	19,614.0
Ammonia (as N)	6,211,100.0	2,736,620.0



Table XII-5 (Continued)

## PSNS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ion-Exchange Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium tungstate produced		
English Units - lbs/billion lbs of ammonium tungstate produced		
Lead	5,120.0	4,608.0
Selenium	41,984.0	18,944.0
Zinc	52,224.0	21,504.0
Ammonia (as N)	6,809,600.0	3,000,320.0

Calcium Tungstate Precipitate Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of calcium tungstate produced		
English Units - lbs/billion lbs of calcium tungstate produced		
Lead	3,720.0	3,348.0
Selenium	30,504.0	13,764.0
Zinc	37,944.0	15,624.0
Ammonia (as N)	4,947,600.0	2,179,920.0

Crystallization and Drying of Ammonium Paratungstate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of ammonium paratungstate produced		
English Units - lbs/billion lbs of ammonium paratungstate produced		
Lead	0	0
Selenium	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-5 (Continued)

## PSNS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ammonium Paratungstate Conversion  
To Oxides Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
Lead	2,090.0	1,881.0
Selenium	17,138.0	7,733.0
Zinc	21,318.0	8,778.0
Ammonia (as N)	2,779,700.0	1,224,740.0

Reduction to Tungsten Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
Lead	940.0	846.0
Selenium	7,708.0	3,478.0
Zinc	9,588.0	3,948.0
Ammonia (as N)	1,250,200.0	550,840.0

Reduction to Tungsten Water of Formation

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
Lead	1,940.0	1,746.0
Selenium	15,908.0	7,178.0
Zinc	19,788.0	8,148.0
Ammonia (as N)	2,580,200.0	1,136,840.0

## PRIMARY TUNGSTEN SUBCATEGORY

### SECTION XIII

#### BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

The 1977 amendments to the Clean Water Act added Section 301 (b) (2)(E), establishing "best conventional pollutant control technology" (BCT) for discharge of conventional pollutants from existing industrial point sources. Biochemical oxygen-demanding pollutants (BOD<sub>5</sub>), total suspended solids (TSS), fecal coliform, oil and grease (O&G), and pH have been designated as conventional pollutants (see 44 FR 44501).

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. In addition to the other factors specified in Section 304(b)(4)(B), the Act requires that limitations for conventional pollutants be assessed in light of a two-part cost-reasonableness test. On October 29, 1982, the Agency proposed a revised methodology for carrying out BCT analyses (47 FR 49176). The purpose of the proposal was to correct errors in the BCT methodology originally established in 1977.

Part 1 of the proposed BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be compared with the cost and level of reduction to remove the same type of pollutants by publicly-owned treatment works (POTW). The POTW comparison figure has been calculated by evaluating the change in costs and removals between secondary treatment (30 mg/l BOD and 30 mg/l TSS) and advanced secondary treatment (10 mg/l BOD and 10 mg/l TSS). The difference in cost is divided by the difference in pounds of conventional pollutants removed, resulting in an estimate of the "dollars per pound" of pollutant removed, that is used as a benchmark value. The proposed POTW test benchmark is \$0.30 per pound (1978 dollars).

Part 2 of the BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be evaluated internally to the industry. In order to develop a benchmark that assesses a reasonable relationship between cost and removal, EPA has developed an industry cost ratio which compares the dollar per pound of conventional pollutant removed in going from primary to secondary treatment levels with that of going from secondary to more advanced treatment levels. The basis of costs for the calculation of this ratio are the costs incurred by a POTW. EPA used these costs because: they reflect the treatment technologies most commonly used to remove conventional pollutants from wastewater; the treatment levels associated with them compare readily to the levels considered for

industrial dischargers; and the costs are the most reliable for the treatment levels under consideration. The proposed industry subcategory benchmark is 1.42. If the industry figure for a subcategory is lower than 1.43, the subcategory passes the BCT test.

The Agency usually considers two conventional pollutants in the cost test, TSS and an oxygen-demanding pollutant. Although both oil and grease and BOD<sub>5</sub> are considered to be oxygen-demanding substances by EPA (see 44 FR 50733), only one can be selected in the cost analysis to conform to procedures used to develop POTW costs. Oil and grease is used rather than BOD<sub>5</sub> in the cost analysis performed for nonferrous metals manufacturing waste streams due to the common use of oils in casting operations in this industry.

BPT is the base for evaluating limitations on conventional pollutants (i.e., it is assumed that BPT is already in place). The test evaluates the cost and removals associated with treatment and controls in addition to that specified as BPT.

If the conventional pollutant removal cost of the candidate BCT is less than the POTW cost, Part 1 of the cost-reasonableness test is passed and Part 2 (the internal industry test) of the cost-reasonableness test must be performed. If the internal industry test is passed, then a BCT limitation is promulgated equivalent to the candidate BCT level. If all candidate BCT technologies fail both parts of the cost-reasonableness test, the BCT requirements for conventional pollutants are equal to BPT.

The BCT test was performed for the proposed BAT basis of ammonia steam stripping, lime precipitation, sedimentation, in-process flow reduction, and multimedia filtration. The primary tungsten subcategory failed Part 1 of the test with a calculated cost of \$15.04 per pound (1978 dollars) of removal of conventional pollutants using BAT technology. The intermediate flow reduction option was also examined, but it too failed with a cost of \$19.73 per pound (1978 dollars) of conventional removal.

Table XIII-1

## BCT EFFLUENT LIMITATIONS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Tungstic Acid Rinse

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
TSS	1,951,600.0	952,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Acid Leach Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungstic acid produced		
English Units - lbs/billion lbs of tungstic acid produced		
TSS	1,545,700.0	754,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Alkali Leach Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of sodium tungstate produced		
English Units - lbs/billion lbs of sodium tungstate produced		
TSS	1,914,700.0	934,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

## BCT EFFLUENT LIMITATIONS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ion-Exchange Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of ammonium tungstate produced  
 English Units - lbs/billion lbs of ammonium tungstate produced

TSS	2,099,200.0	1,024,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Calcium Tungstate Precipitate Wash

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of calcium tungstate produced  
 English Units - lbs/billion lbs of calcium tungstate produced

TSS	1,525,200.0	744,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Crystallization and Drying of Ammonium Paratungstate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of ammonium paratungstate produced  
 English Units - lbs/billion lbs of ammonium paratungstate  
 produced

TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

## BCT EFFLUENT LIMITATIONS FOR THE PRIMARY TUNGSTEN SUBCATEGORY

Ammonium Paratungstate Conversion to  
Oxides Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of "blue" oxide (WO <sub>3</sub> ) produced		
English Units - lbs/billion lbs of "blue" oxide (WO <sub>3</sub> ) produced		
TSS	856,900.0	418,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction to Tungsten Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten produced		
English Units - lbs/billion lbs of tungsten produced		
TSS	3,001,200.0	1,464,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction to Tungsten Water of Formation

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of tungsten reduced		
English Units - lbs/billion lbs of tungsten reduced		
TSS	795,400.0	388,000.0
pH	Within the range of 7.5 to 10.0 at all times	

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION I

#### SUMMARY AND CONCLUSIONS

Pursuant to Sections 301, 304, 306, 307, and 501 of the Clean Water Act and the provisions of the Settlement Agreement in Natural Resources Defense Council v. Train, 8 ERC 2120 (D.D.C. 1976) modified, 12 ERC 1833 (D.D.C. 1979), EPA has collected and analyzed data for plants in the primary columbium-tantalum subcategory. EPA has never proposed or promulgated effluent limitations or standards for this subcategory. This document and the administrative record provide the technical basis for proposing effluent limitations based on best practicable technology (BPT) and best available technology (BAT) for direct dischargers, pretreatment standards for indirect dischargers (PSES), pretreatment standards for new indirect dischargers (PSNS), and standards of performance for new source direct dischargers (NSPS).

The primary columbium-tantalum subcategory is comprised of five plants. Of the five plants, three discharge directly to rivers, lakes, or streams; two discharge to publicly owned treatment works (POTW); and none achieve zero discharge of process wastewater.

EPA first studied the primary columbium-tantalum 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 (1) the sources and volume of water used, the processes employed, and the sources of pollutants and wastewaters in the plant; and (2) the constituents of wastewaters, including toxic pollutants.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the primary columbium-tantalum subcategory. The Agency analyzed both historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts (air quality and 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 industry. 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 Smelting and Refining Industry.

Based on consideration of the above factors, EPA identified various control and treatment technologies which formed the basis for BPT and selected control and treatment appropriate for each set of standards and limitations. The mass limitations and standards for BPT, BAT, NSPS, PSES, PSNS, and BCT are presented in Section II.

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on lime precipitation and sedimentation technology is the basis for the BPT limitations. Steam stripping is selected as the technology basis for ammonia limitations. To meet the BPT effluent limitations based on this technology, the primary columbium-tantalum subcategory is not expected to incur any costs.

For BAT, the Agency has built upon the BPT basis by adding in-process control technologies which include recycle of process water from air pollution control and metal contact cooling waste streams. Filtration is added as an effluent polishing step to the end-of-pipe treatment scheme. To meet the BAT effluent limitations based on this technology, the primary columbium-tantalum subcategory is estimated to incur a capital cost of \$0.797 million and an annual cost of \$0.396 million.

The best demonstrated technology (BDT), which is the technical basis of NSPS, is equivalent to BAT. In selecting BDT, 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 selected the same technology as BAT for PSES. To meet the pretreatment standards for existing sources, the primary columbium-tantalum subcategory is estimated to incur a capital cost of \$2.47 million and an annual cost of \$1.41 million. 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. The technology basis of BCT is the BPT treatment of lime precipitation and sedimentation.

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION II

#### RECOMMENDATIONS

1. EPA has divided the primary columbium-tantalum subcategory into eight subdivisions for the purpose of effluent limitations and standards. These subdivisions are:
  - (a) Concentrate digestion wet air pollution control,
  - (b) Solvent extraction raffinate,
  - (c) Solvent extraction wet air pollution control,
  - (d) Precipitation and filtration of metal salts,
  - (e) Metal salt drying wet air pollution control,
  - (f) Reduction of salt to metal,
  - (g) Reduction of salt to metal wet air pollution control, and
  - (h) Consolidation and casting contact cooling.
2. BPT is proposed based on the effluent concentrations 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 proposed:
  - (a) Concentrate Digestion Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium-tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium-tantalum salt produced from digestion		
Lead	1,637.25	1,418.95
Zinc	14,516.95	6,112.40
Ammonia (as N)	1,451,695.0	639,619.0
Fluoride	649,442.50	288,156.0
Total Suspended Solids	447,515.0	218,300.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Solvent Extraction Raffinate  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	4,037.40	3,499.08
Zinc	35,798.28	15,072.96
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,601,502.0	710,582.40
Total Suspended Solids	1,103,556.0	538,320.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Solvent Extraction Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	645.21	559.18
Zinc	5,720.86	2,408.78
Ammonia (as N)	572,086.20	252,062.04
Fluoride	255,933.30	113,556.96
Total Suspended Solids	176,357.40	86,028.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Precipitation and Filtration of Metal Salts  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	37,083.45	32,138.99
Zinc	328,806.59	138,444.88
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	14,709,768.50	6,526,687.20
Total Suspended Solids	10,136,143.0	4,944,460.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Metal Salt Drying Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	12,546.45	10,873.59
Zinc	111,245.19	46,840.08
Ammonia (as N)	11,124,519.0	4,901,479.80
Fluoride	4,976,758.50	2,208,175.20
Total Suspended Solids	3,429,363.0	1,672,860.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Reduction of Salt to Metal  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	52,899.45	45,846.19
Zinc	469,041.79	197,491.28
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	20,983,448.50	9,310,303.20
Total Suspended Solids	14,459,183.0	7,053,260.0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Reduction of Salt to Metal Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	3,228.15	2,797.73
Zinc	28,622.93	12,051.76
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	1,280,499.50	568,154.40
Total Suspended Solids	882,361.0	430,420.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Consolidation and Casting Contact Cooling  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

3. BAT is proposed based on the treatability concentrations achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following BAT effluent limitations are proposed:

(a) Concentrate Digestion Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium or tantalum salt produced from digestion		
Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia (as N)	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88

(b) Solvent Extraction Raffinate  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60

(c) Solvent Extraction Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76

(d) Precipitation and Filtration of Metal Salts  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80

(e) Metal Salt Drying Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40

(f) Reduction of Salt to Metal  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80

(g) Reduction of Salt to Metal Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6

(h) Consolidation and Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0

4. NSPS are proposed based on the treatability concentrations achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following effluent standards are proposed for new sources:

(a) Concentrate Digestion Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium or tantalum salt produced from digestion		
Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88
Total Suspended Solids	77,344.50	61,875.60
pH	Within the range of 7.5 to 10.0 at all times	



(b) Solvent Extraction Raffinate NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60
Total Suspended Solids	403,740.0	322,992.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Solvent Extraction Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76
Total Suspended Solids	6,451.50	5,161.20
pH	Within the range of 7.5 to 10.0 at all times	

(d) Precipitation and Filtration of Metal Salts NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80
Total Suspended Solids	3,708,345.0	2,966,676.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Metal Salt Drying Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40
Total Suspended Solids	247,185.0	197,748.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Reduction of Salt to Metal NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80
Total Suspended Solids	5,289,945.0	4,231,956.0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Reduction of Salt to Metal Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6
Total Suspended Solids	322,815.0	258,252.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Consolidation and Casting Contact Cooling NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of columbium or tantalum cast or consolidated

English Units - lbs/billion lbs of columbium or tantalum cast or consolidated

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

5. PSES are proposed based on the effluent concentrations achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following effluent standards are proposed:

(a) Concentrate Digestion Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of columbium-tantalum salt produced from digestion

English Units - lbs/billion lbs of columbium-tantalum salt produced from digestion

Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia (as N)	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88

(b) Solvent Extraction Raffinate PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60

(c) Solvent Extraction Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76

(d) Precipitation and Filtration of Metal Salts PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80

(e) Metal Salt Drying Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40

(f) Reduction of Salt to Metal PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80

(g) Reduction of Salt to Metal Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6

(h) Consolidation and Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for</u> <u>Any One Day</u>	<u>Maximum for</u> <u>Monthly Average</u>
--	--	--

Metric Units - mg/kkg of columbium or tantalum cast or consolidated

English Units - lbs/billion lbs of columbium or tantalum cast or consolidated

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0

4. PSNS are proposed based on the effluent concentrations achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following effluent standards are proposed for new sources:

(a) Concentrate Digestion Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for</u> <u>Any One Day</u>	<u>Maximum for</u> <u>Monthly Average</u>
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Metric Units - mg/kkg of columbium or tantalum salt produced from digestion

English Units - lbs/billion lbs of columbium or tantalum salt produced from digestion

Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia (as N)	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88

(b) Solvent Extraction Raffinate PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for</u> <u>Any One Day</u>	<u>Maximum for</u> <u>Monthly Average</u>
--	--	--

Metric Units - mg/kkg of columbium or tantalum salt extracted

English Units - lbs/billion lbs of columbium or tantalum salt extracted

Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60

(c) Solvent Extraction Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76

(d) Precipitation and Filtration of Metal Salts PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80

(e) Metal Salt Drying Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40

(f) Reduction of Salt to Metal PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80

(g) Reduction of Salt to Metal Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6

(h) Consolidation and Casting Contact Cooling PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0



7. BCT is proposed based on the effluent concentrations achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following BPT effluent limitations are proposed:

(a) Concentrate Digestion Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium-tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium-tantalum salt produced from digestion		
Total Suspended Solids	447,515.0	218,300.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Solvent Extraction Raffinate  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Total Suspended Solids	1,103,556.0	538,320.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Solvent Extraction Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Total Suspended Solids	176,357.40	86,028.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Precipitation and Filtration of Metal Salts  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Total Suspended Solids	10,136,143.0	4,944,460.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Metal Salt Drying Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried English Units - lbs/billion lbs of columbium or tantalum salt dried		
Total Suspended Solids	3,429,363.0	1,672,860.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Reduction of Salt to Metal  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced English Units - lbs/billion lbs of columbium or tantalum reduced		
Total Suspended Solids	14,459,183.0	7,053,260.0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Reduction of Salt to Metal Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced English Units - lbs/billion lbs of columbium or tantalum reduced		
Total Suspended Solids	882,361.0	430,420.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Consolidation and Casting Contact Cooling  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION III

#### INDUSTRY PROFILE

This section of the primary columbium-tantalum supplement describes the raw materials and processes used in manufacturing primary columbium and tantalum salts and in subsequent production of the respective metals. It also presents a profile of the columbium and tantalum plants identified in this study. Refer to Section III of the General Development Document for discussion of the purpose, authority, and methodology of this study and a general description of the nonferrous metals manufacturing category.

While chemists refer to periodic table element number 41 as niobium, in American metallurgy it is known as columbium, and this name will be used in this report.

#### DESCRIPTION OF PRIMARY COLUMBIUM AND TANTALUM PRODUCTION

The processes used at a columbium and tantalum production facility depend largely upon the raw material used and the plant's final product. Four basic operations from ore or slag to metal must be performed: physical and chemical breakup of the ore or slag to form columbium and tantalum salts (digestion); separation of the columbium and tantalum salts from each other and from the various impurities present; reduction of the salt to the respective metal; and fabrication of the metals into some consistent form, e.g., ingots, bars, or plates. Some plants perform the first two operations, and some the last two; some perform all four operations. A typical plant in the first category is shown in Figure III-1.

#### RAW MATERIALS

Ore concentrates and slags are the chief raw materials for the production of columbium and tantalum. Ore concentrates are derived principally from the minerals columbite, tantalite, pyrochlore, and ferroniobium, these minerals having a relatively high concentration of the desired metals. Slags from foreign tin production have also been found to be a reliable source. Columbium and tantalum are usually found together, and are somewhat difficult to separate.

#### DIGESTION OF ORE OR SLAG

The ore or slag is first pulverized to approximately the consistency of talcum powder. Then, columbium and tantalum (along with some impurities) are leached from the powder by either hydrofluoric acid or by chlorine gas.

Treatment of the ore or slag powder with chlorine gas at 500 to 1,000°C evolves the volatile pentachlorides of columbium and tantalum, as well as the chlorides of various other substances. These are removed by selective condensation and the columbium and tantalum chlorides are separated by distillation. This process is completely anhydrous and generates no wastewater streams. The process has been used in the past, but is not now in use on a commercial scale due to the difficulty in separating the tantalum chloride and columbium chloride by distillation.

In the leaching process, aqueous hydrofluoric acid dissolves columbium, tantalum, and impurity metals from the powder forming the fluoride salts of these metals. Leaching is a more advantageous method for digesting the ore or slag because of the ease with which the columbium and tantalum fluorides can be separated by solvent extraction. Acid mist generated in the leaching process may be controlled by wet scrubbers. The scrubber liquor produced is a source of wastewater.

#### SEPARATION OF SALTS

Separation and purification of the columbium and tantalum fluorides is most economically achieved using solvent extraction. Methyl isobutyl ketone (MIBK) is the most commonly used solvent. Separation of columbium and tantalum by this method hinges on the different solubilities that the fluoride salts of the two metals exhibit in MIBK as a function of hydrofluoric acid normality in the feed. For instance, tantalum shows a great affinity for the organic (MIBK) phase at low normalities, while the normality must be substantially increased for columbium to show a similar affinity. Usually, then, a low normality feed stream is contacted with MIBK, whereupon tantalum salt of high purity is extracted. Additional hydrofluoric acid is then added to increase the normality of the aqueous phase, (the columbium-laden stream) which is then contacted with fresh MIBK, extracting the columbium salt.

The raffinate from this step is a source of wastewater. The columbium and tantalum are next extracted from MIBK by deionized water. Following extraction, the MIBK raffinate stream is recycled. Wet air pollution control used to control solvent extraction air fumes is a source of wastewater. Columbium and tantalum salts are precipitated from the deionized water, usually by the addition of ammonia (to precipitate columbium) and potassium fluoride (to precipitate tantalum). The crystal precipitates are filtered from the aqueous mother liquor, which is then discarded. The crystals are then washed with water and dried.

## REDUCTION OF SALT TO METAL

A number of methods exist for the reduction of columbium and tantalum salts to metal. They include sodium reduction, aluminothermic reduction, carbon reduction, and electrolysis.

Sodium reduction is a popular method for producing both columbium and tantalum from their salts. In this process, sodium reduces the columbium or tantalum to metal. Layers of the salt are alternated with layers of sodium in a reaction vessel, then capped with sodium chloride to prevent oxidation of the reduced metal. The reaction mixture is often ignited electrically, but once ignited, the exothermic reaction is self-sustaining. Wet scrubbers are often used to control the gaseous emissions from the reaction vessel. After cooling, the columbium or tantalum metal containing material is crushed, and any iron picked up from the reaction vessel is removed magnetically. The remaining metal powder is further purified by leaching with water, followed by nitric or hydrochloric acid.

The aluminothermic reaction also may be used on both columbium and tantalum salts. This method also may be used on certain ferrocolumbium ores which do not require digestion and separation of columbium and tantalum salts. The salt (or ore) is mixed with aluminum powder. Potassium chlorate is added to provide additional reaction heat, and magnesium is added to properly ignite the mixture. Columbium and tantalum are reduced to metal while aluminum is oxidized.

Carbon reduction takes place through a two-step route known as the Balke process and can be used on both columbium and tantalum salts. Its predominant use, however, is the reduction of the metal oxides. The metal oxide is first mixed with fine carbon and heated under vacuum to  $1,800^{\circ}\text{C}$ , where a metal carbide and carbon monoxide are formed. The carbide is then mixed with more oxide and reacts to form the pure metal and more carbon monoxide.

Electrolytic reduction of tantalum is sometimes practiced using fused salt techniques. Potassium fluotantalate ( $\text{K}_2\text{TaF}_7$ ), the crystal which was precipitated by potassium fluoride in the separation of salts step, is electrolyzed to yield the pure tantalum metal, which is then separated from the cathode by pulverizing both metal and cathode acid, leaching out the cathode material (usually carbon).

## CONSOLIDATION AND CASTING

Both columbium and tantalum show a tendency to lose their metallic characteristics, particularly malleability and ductility, when even small amounts of impurities are present in the

metal matrix. Therefore, special techniques must be used to further purify the metals and work them into their desired form. Some of the more popular processes include electron beam melting, cold-crucible arc melting, and simultaneous compacting and resistance heating.

Electron beam melting is currently the most common method of consolidation. A beam of high voltage, low current electrons is focused onto the crude metal and the top of a retractable ingot contained in a water-cooled copper cylinder. The beam melts the crude metal, and the falling molten globules form a pool on top of the ingot. The process is continuous, with the ingot being lowered as the molten metal solidifies. Most impurities boil out of the pool into the high vacuum environment required by the electron beam and are removed.

Arc melting occurs in much the same way as electron beam melting, except that a low voltage, high current arc of electricity melts the crude metal.

Simultaneous compaction and direct resistance heating is the oldest process used and is somewhat undesirable, as the metal must be processed two or three times to reach sufficient purity. The metal is typically compacted at about 6,900 atmospheres (0.7 GPa) and heated to 1,400 to 1,500°C for several hours. It is then rolled and sintered at 2,300°C. Several rolling and sintering steps may be required.

#### PROCESS WASTEWATER SOURCES

In summary, the major uses of water in primary columbium and tantalum processing are:

1. Concentrate digestion wet air pollution control,
2. Solvent extraction,
3. Solvent extraction wet air pollution control,
4. Precipitation and filtration of metal salt,
5. Metal salt drying wet air pollution control,
6. Reduction of salt to metal,
7. Reduction of salt to metal wet air pollution control, and
8. Consolidation and casting contact cooling.

#### OTHER WASTEWATER SOURCES

There are other waste streams associated with the production of primary columbium-tantalum. The principal waste stream is maintenance and cleanup water. This waste stream is not considered as part of this rulemaking. EPA believes that the flows and pollutant loadings associated with this waste stream are insignificant relative to the waste streams selected, or it is best

handled by the appropriate permit authority on a case-by-case basis under the authority of Section 403(a) of the Clean Water Act.

#### AGE, PRODUCTION, AND PROCESS PROFILE

All five of the columbium-tantalum plants identified in this study were built in the 20-year period just after World War II (Table III-1). Average plant production is approximately 450 tons per year, as shown in Table III-2.

Figure III-2 depicts the geographic locations of the plants comprising the columbium-tantalum subcategory of the nonferrous category. The plants are scattered, with half the plants located in the New England area and the rest in the Midwest or the West.

Table III-3 lists the major production processes presently used in the columbium-tantalum subcategory. Also shown is the number of plants discharging from these processes.



Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF  
PLANTS IN THE COLUMBIUM-TANTALUM SUBCATEGORY  
BY DISCHARGE TYPE

TOTAL NUMBER OF PLANTS SURVEYED = 5

<u>Type of Plant Discharge</u>	<u>1982-1968 0-15</u>	<u>1967-1958 15-25</u>	<u>1957-1948 25-35</u>	<u>Before 1948 35+</u>	<u>Total</u>
Direct	0	1	2	0	3
Indirect	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
Total	0	2	3	0	5

Table III-2

PRODUCTION RANGES FOR THE  
COLUMBIUM-TANTALUM SUBCATEGORY

<u>Production Ranges for 1976 (tons/year)</u>	<u>No. of Plants</u>
Less than 450	3
More than 450	<u>2</u>
TOTAL	5

TABLE III-3  
PRODUCTION PROCESSES UTILIZED BY THE  
COLUMBIUM-TANTALUM SUBCATEGORY

<u>Process</u>	<u>Number of Plants With Process</u>	<u>Number of Plants Reporting Generation of Wastewater</u>
Digestion	3	3
Extraction	3	3
Precipitation and Filtration	3	3
Drying Salts	3	3
Reduction	3	3
Consolidation and Casting	4	1

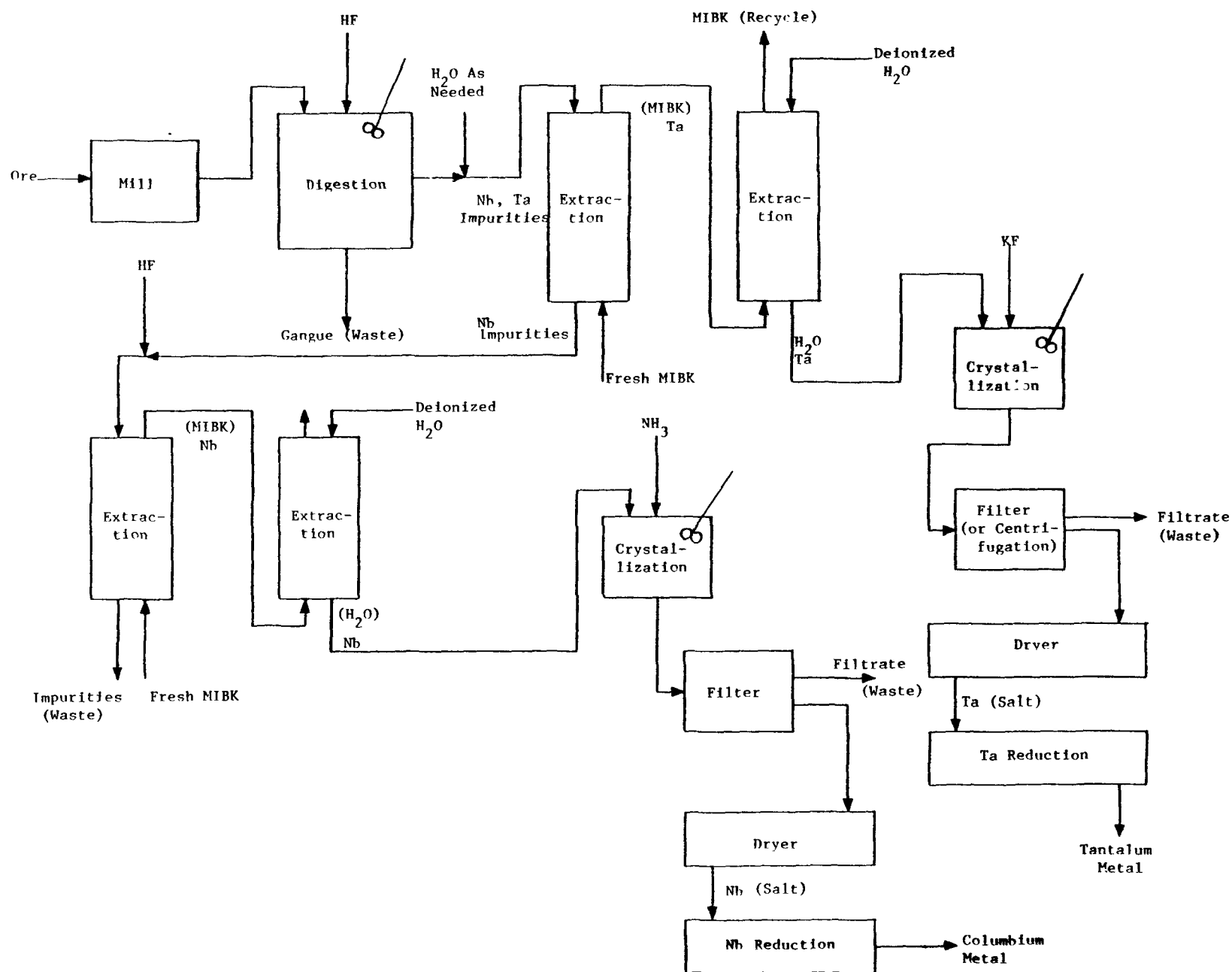


Figure III-1

## COLUMBIUM-TANTALUM MANUFACTURING PROCESS

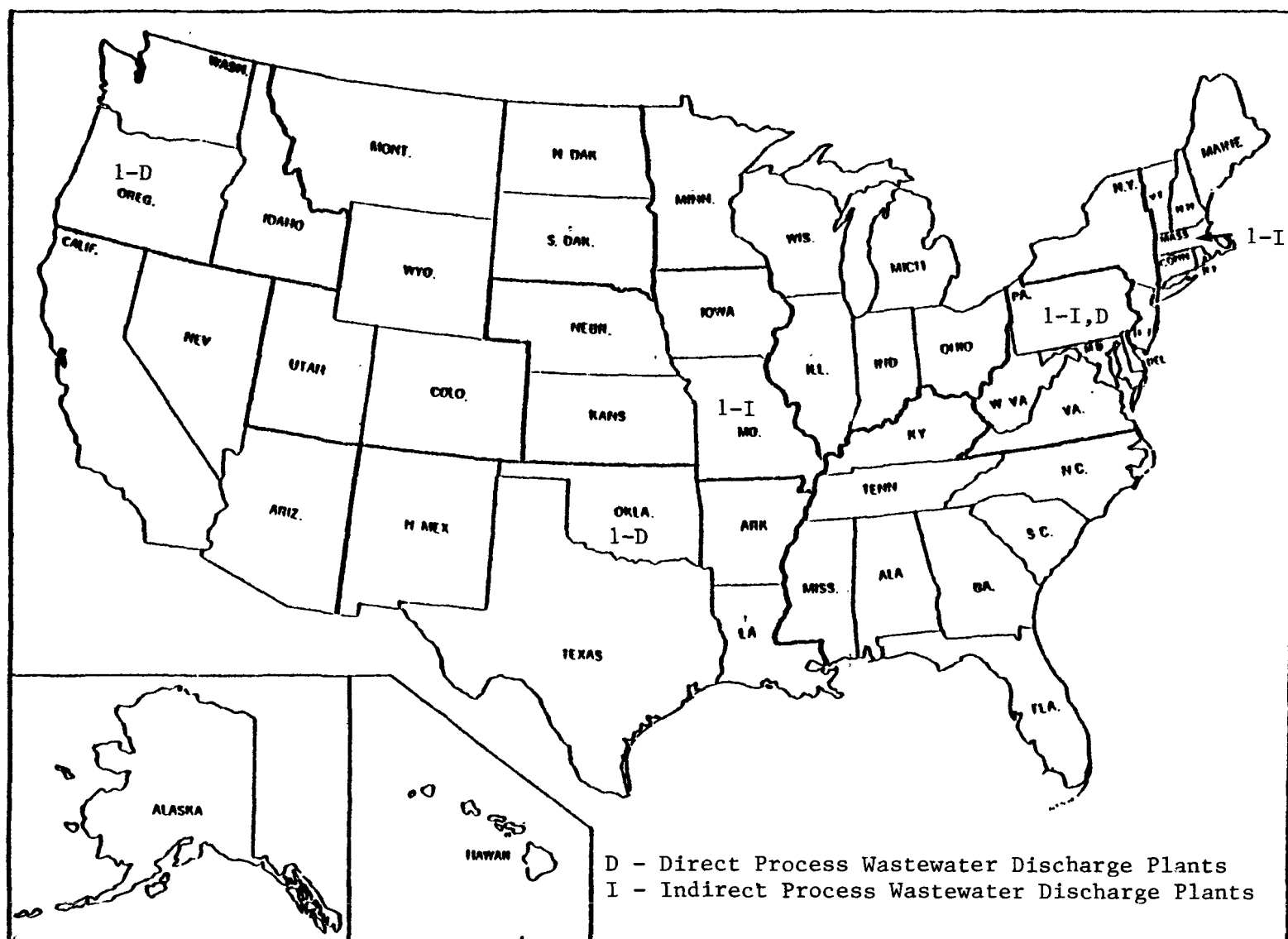


Figure III-2

GEOGRAPHIC LOCATIONS OF THE COLUMBIUM AND TANTALUM METAL PRODUCTION PLANTS

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION IV

#### SUBCATEGORIZATION

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

#### FACTORS CONSIDERED IN SUBCATEGORIZATION

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

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

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

In Section IV of the General Development Document, each of these factors is described and the rationale for selecting metal product, manufacturing processes and raw materials as the principal factors used for subcategorization is discussed. On this basis the nonferrous metals manufacturing category was divided into 12 subcategories (phase I), one of them being primary columbium-tantalum.

The primary columbium-tantalum subcategory has not been considered during previous rulemaking. The purpose of this rulemaking is to establish BPT, BAT, and BCT effluent limitations, and NSPS, PSES, and PSNS for the primary columbium-tantalum subcategory.

#### FACTORS CONSIDERED IN SUBDIVIDING THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

The factors listed previously were each evaluated when establishing the primary columbium-tantalum subcategory and its subdivisions. 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 columbium-tantalum subcategory is based primarily on the production process used. Within this subcategory, a number of different operations are performed, which may or may not have a water use or discharge, and which may require the establishment of separate effluent limitations and standards. While primary columbium-tantalum is still considered a single subcategory, a more thorough examination of the production processes, water use and discharge practices, and pollutant generation rates has illustrated the need for limitations and standards based on a specific set of waste streams. Limitations and standards will be based on specific flow allowances for the following subdivisions:

1. Concentrate digestion wet air pollution control,
2. Solvent extraction raffinate,
3. Solvent extraction wet air pollution control,
4. Precipitation and filtration of metal salt,
5. Metal salt drying wet air pollution control,
6. Reduction of salt to metal,
7. Reduction of salt to metal wet air pollution control,  
and
8. Consolidation and casting contact cooling.

These subdivisions follow directly from differences within the two distinct production stages of primary columbium and tantalum: production of salts from ore concentrates and slags, and the reduction of salts to produce the metals. Plants processing primary columbium and tantalum fall into three categories: plants which perform the ore-to-salt operation, plants which perform the salt-to-metal operation, and plants which perform both operations. A review of the sampling data shows that significantly different wastewater volumes and characteristics are produced by the two manufacturing processes. Therefore, eight subdivisions of the primary columbium-tantalum subcategory are necessary.

## Other Factors

The other factors considered in this evaluation either supported the establishment of the primary columbium-tantalum subcategory and its subdivisions, or were shown to be inappropriate bases for subcategorization. Air pollution control methods, treatment costs, nonwater quality aspects 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 will not affect the method of subcategorization. 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 were determined to be inappropriate for use as bases for subcategorization of this subcategory.

## PRODUCTION NORMALIZING PARAMETERS

The effluent limitations and standards developed in this document establish mass limitations on the discharge of pollutants. To allow these regulations to be applied to plants with various production capacities, the mass of pollutant discharge must be related to a unit of production. This factor is known as the production normalizing parameter (PNP). In general, the amount of product or intermediate produced by a particular manufacturing process is used as the PNP. This is based on the principle that the amount of water generated is proportional to the amount of product made. The PNPs for the eight primary columbium-tantalum subdivisions are shown below:

<u>Subdivision</u>	<u>PNP</u>
1. Concentrate digestion wet air pollution control	kkg of columbium or tantalum salt produced from digestion
2. Solvent extraction raffinate	kkg of columbium or tantalum salt extracted
3. Solvent extraction wet air pollution control	kkg of columbium or tantalum salt extracted
4. Precipitation and filtration of metal salt	kkg of columbium or tantalum salt precipitated
5. Metal salt drying wet air pollution control	kkg of columbium or tantalum salt dried



<u>Subdivision</u>	<u>PNP</u>
6. Reduction of salt to metal	kgg of columbium or tantalum reduced
7. Reduction of salt to metal wet air pollution control	kgg of columbium or tantalum reduced
8. Consolidation and casting contact cooling	kgg of columbium or tantalum consolidated or cast

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION V

#### WATER USE AND WASTEWATER CHARACTERISTICS

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

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

In order to quantify the pollutant discharge from primary columbium-tantalum plants, a field sampling program was conducted. Wastewater samples were collected in two phases: screening and verification. The first phase, screen sampling, was to identify which toxic pollutants were present in the wastewaters from production of the various metals. Screening samples were analyzed for 128 of the 129 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. There is no reason to expect that TCDD would be present in columbium-tantalum wastewater). A total of 10 plants were selected for screen sampling in the nonferrous metals manufacturing category with one of those plants in the primary columbium-tantalum subcategory. A complete list of the pollutants considered and a summary of the techniques used in sampling and laboratory analyses are included in Section V of the General Development Document. In general, the samples were analyzed for three classes of pollutants: toxic organic pollutants, toxic metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

As described in Section IV of this supplement, the primary columbium-tantalum subcategory has been further categorized into eight subdivisions, each representing a major source of wastewater in the subcategory. 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.

## WASTEWATER SOURCES, DISCHARGE RATES, AND CHARACTERISTICS

The wastewater data presented in this section were evaluated in light of production process information compiled during this study. As a result, it was possible to identify the principal wastewater sources in the primary columbium-tantalum subcategory. They are:

1. Concentrate digestion wet air pollution control,
2. Solvent extraction raffinate,
3. Solvent extraction wet air pollution control,
4. Precipitation and filtration of metal salt,
5. Metal salt drying wet air pollution control,
6. Reduction of salt to metal,
7. Reduction of salt to metal wet air pollution control,  
and
8. Consolidation and casting contact cooling.

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 or other fluid (e.g., spent leachate) required for a given process per mass of 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 columbium or tantalum produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carryover 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. The production normalized flows were compiled and statistically analyzed by stream type. 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 X, XI, and XII where representative BAT, BDT, and pretreatment discharge flows are selected for use in calculating the effluent limitations and standards. As an example, reduction of salt to metal air scrubbing flow is related to the reduction production. As such, the discharge rate is expressed in liters of scrubber wastewater per metric ton of metal reduced.

In order to quantify the concentrations of pollutants present in wastewater from primary columbium-tantalum plants, wastewater samples were collected at five plants, representing 100 percent

of the discharging primary columbium-tantalum plants. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 through V-5.

The raw wastewater sampling data for the primary columbium-tantalum subcategory are presented in Tables V-2, V-4, V-6, V-8, and V-10, (at the end of this section). Treated wastewater sampling data are shown in Tables V-16 through V-18 (at the end of this section). Tables V-13 through V-15 show miscellaneous

raw wastewater for plants A, B, and C. These data were not used for the wastewater characterizations discussed below. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were omitted. If the analysis did not detect a pollutant in a waste stream, the pollutant was omitted from the table.

The data tables include some wastewater samples measured at concentrations not considered quantifiable. The base neutral extractables, acid fraction extractables, and volatile organics are generally considered not quantifiable at concentrations at or below 0.010 mg/l. Below this concentration, the data is considered too susceptible to random error to be quantitatively accurate. However, these data are useful in that they indicate the presence of a particular pollutant. The pesticide fraction is considered nonquantifiable at concentrations equal to or less than 0.005 mg/l. Nonquantifiable results are designated in the tables with an asterisk (double asterisk for less than or equal to 0.005 mg/l).

These 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. Data reported as an asterisk are considered as detected but below quantifiable concentrations, and a value of zero is used for averaging. Toxic 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 excluded in calculating the average. Finally, toxic metal values reported as less than a certain value were considered as not

detected, and consequently, were not used in the calculation of the average. For example, three samples reported as ND, \*, and 0.021 mg/l have an average value of 0.010 mg/l.

The method by which each sample was collected is indicated by number, as follows.

- 1 one-time grab
- 2 24-hour manual composite
- 3 24-hour automatic composite
- 4 48-hour manual composite
- 5 48-hour automatic composite
- 6 72-hour manual composite
- 7 72-hour automatic composite

In the data collection portfolios, all of the columbium-tantalum plants indicated that the toxic organic pollutants were known or believed to be absent from their wastewater. The majority of the metals were believed to be absent as summarized below:

<u>Pollutant</u>	<u>Known Present</u>	<u>Believed Present</u>	<u>Believed Absent</u>	<u>Known Absent</u>
Antimony	1	-	2	1
Arsenic	1	-	2	1
Beryllium	-	-	3	1
Cadmium	-	-	2	2
Chromium	1	1	1	1
Copper	-	1	2	1
Lead	-	-	2	2
Mercury	-	1	1	2
Nickel	1	1	1	1
Selenium	-	-	4	1
Silver	-	-	2	2
Zinc	-	-	3	1

#### CONCENTRATE DIGESTION WET AIR POLLUTION CONTROL

The first step in the production of primary columbium and tantalum is the digestion of ore concentrates and slags with hydrofluoric acid. The process solubilizes columbium and tantalum, along with various other metals which require removal. Three of the five columbium-tantalum plants use wet scrubbers on their concentrate digestion process. Water use and discharge rates are shown in liters per metric ton of columbium-tantalum salt produced from digestion in Table V-1.

Table V-2 summarizes the raw wastewater sampling data for the toxic and selected conventional and nonconventional pollutants.

The wet scrubber liquor is strongly acidic (pH of approximately 2.0), containing suspended solids, fluorides, and some metals at treatable concentrations (see Table V-2). Insoluble gangue impurities are removed by filtration. On-site disposal of gangue impurities is required because it is radioactive. The waste gangue slurry is typically contained in a holding pond, the overflow from which is acidic and contains quantifiable concentrations of metals, fluorides, and suspended solids.

#### SOLVENT EXTRACTION RAFFINATE

The digested solution containing columbium and tantalum is contacted with an organic solvent such as methyl isobutyl ketone (MIBK) in a two step multistage extraction process, resulting in the extraction and separation of columbium and tantalum. Three plants discharge this wastewater as shown in Table V-3. The impurities from digestion remaining in the raffinate typically include treatable concentrations of organics, fluorides, metals, suspended solids, and oil and grease. The sampling data from an extraction raffinate waste stream are presented in Table V-4.

#### SOLVENT EXTRACTION WET AIR POLLUTION CONTROL

After extraction, the organic streams bearing columbium and tantalum are often contacted with deionized water to strip the columbium and tantalum from the organic phase. The organic solvent is then recycled to the first extraction process. Two plants use wet scrubbers to control air emissions from extraction operations. One of these plants uses the same scrubber for air pollution control of concentrate digestion and solvent extraction. The water use and discharge rates for the two plants are presented in Table V-5 in liters per metric ton of columbium or tantalum salt extracted. This wastewater is acidic and contains concentrations of toxic organics and metals, fluorides, and suspended solids as shown in Table V-6.

#### PRECIPITATION AND FILTRATION OF METAL SALT

Precipitation of pure metal salts from the aqueous phase may be accomplished by ammonia addition to form columbium and tantalum oxides. All three plants reporting this waste stream discharge it as shown in Table V-7. The filtrate wastewater typically contains treatable concentrations of ammonia, fluoride, metals, and suspended solids. Ammonia stripping is frequently practiced to recover ammonia from the filtrate prior to discharge of the waste stream. Tantalum may also be recovered by treatment of the solubilized tantalum salt with hydrofluoric acid and potassium fluoride to precipitate potassium fluotantalate ( $K_2TaF_7$ ). This precipitate also requires filtration and washing, leaving a filtrate effluent stream containing measurable concentrations of potassium, fluorides, and chlorides (see Table V-8).

## METAL SALT DRYING WET AIR POLLUTION CONTROL

Following filtration, the precipitates are usually dried and calcined to yield purified salts. Four of the five columbium-tantalum plants use wet scrubbers in drying operations. Water use and discharge rates are shown in Table V-9. Wet scrubber waste streams associated with this process reflect the precipitation process used. For example, treatable concentrations of ammonia are present when ammonia is used as the reagent for precipitation, as can be seen in Table V-10. Table V-10 shows data from combined wastewater from the metal salt drying scrubber, reduction of salt to metal, and reduction of salt to metal scrubber waste streams.

## REDUCTION OF SALT TO METAL WASTEWATER

Reduction processes vary somewhat in the columbium-tantalum subcategory. Of the several reduction techniques discussed in Section III, only two were reported in practice by plants in the columbium-tantalum subcategory. The first of these, sodium reduction, appears to be the dominant technique. The process requires extensive washing of the product metal with water or a combination of water and acid. The production normalized discharge rates are shown in Table V-11. This waste stream typically contains treatable concentrations of fluoride (see Table V-10), as well as toxic metals, chloride, and oil and grease. The other reduction process used, aluminothermic reduction, is reported to generate no wastewater. The waste streams are sometimes passed through a cyclone to recover valuable columbium and tantalum solids. In addition, water is used for sizing at one of the plants surveyed. However, this waste stream is combined with washing operations and is not further considered as a separate waste stream.

## REDUCTION OF SALT TO METAL WET AIR POLLUTION CONTROL

Reduction process emissions are frequently controlled with wet scrubbers. The resulting discharge is similar to the reduction washing streams. This waste stream may also be passed through a cyclone to recover columbium and tantalum solids, if present. Water use and discharge rates are presented in Table V-12 in liters per metric ton of columbium-tantalum metal reduced. Sampling data for this waste stream are contained in Table V-10. This wastewater contains many of the same pollutants found in reduction of salt to metal wastewater.

## CONSOLIDATION AND CASTING CONTACT COOLING

Only one of the plants surveyed practiced direct contact cooling of metal castings. This plant recycles 100 percent of the water used for this operation, resulting in zero discharge. No sampling data were available for this waste stream.

Table V-1

WATER USE AND DISCHARGE RATES FOR CONCENTRATE DIGESTION  
WET AIR POLLUTION CONTROL

(1/kg of columbium-tantalum salt produced from digestion)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
507	7	9,344	8,690
509	0	NR	NR
519	86	93,800	13,132

---

NR = Present, but data not reported in dcp.



Table V-2

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
CONCENTRATE DIGESTION SCRUBBER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants(a)</u>							
4. benzene	22	2		0.042	*	ND	0.021
	114	2	*	*	*	ND	*
6. carbon tetrachloride	22	2		ND	0.017	ND	0.017
	114	2	ND	0.074	*	ND	0.037
7. chlorobenzene	22	2		ND	ND	*	*
10. 1,2-dichloroethane	22	2		0.156	0.086	0.062	0.101
	114	2	ND	0.04	ND	*	0.02
14. 1,1,2-trichloroethane	22	2		ND	ND	ND	
	114	2	*	<0.032	ND	ND	<0.032
23. chloroform	22	2		0.156	0.135	0.017	0.103
	114	2	0.422	0.046	0.034	ND	0.040
30. 1,2- <u>trans</u> -dichloroethylene	22	2		ND	ND	ND	
	114	2	ND	ND	0.484	ND	0.484
38. ethylbenzene	22	2		0.057	*	*	0.019
	114	2	ND	ND	ND	ND	
44. methylene chloride	22	2		88.4	ND	ND	88.4
	114	2	ND	ND	ND	ND	

Table V-2 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
CONCENTRATE DIGESTION SCRUBBER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
48. dichlorobromomethane	22	2		ND	ND	ND	
	114	2	0.025	0.038	ND	ND	0.038
51. chlorodibromomethane	22	2		ND	ND	ND	
	114	2	*	<0.089	*	ND	
66. bis(2-ethylhexyl) phthalate	22	7		0.48			0.48
68. di-n-butyl phthalate	22	7		0.08			0.08
85. tetrachloroethylene	22	2		0.157	ND	ND	0.157
	114	2	*	ND	ND	ND	
87. trichloroethylene	22	2		0.235	*	ND	0.118
	114	2	ND	ND	ND	ND	
106. PCB-1242	22	7		<0.015			<0.015
109. PCB-1232	22	7		<0.015			<0.015
113. toxaphene	22	7		**			**
114. antimony	22	7		2.9			2.9
115. arsenic	22	7		0.003			0.003

Table V-2 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
 CONCENTRATE DIGESTION SCRUBBER  
 RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
117. beryllium	22	7		0.18			0.18
118. cadmium	22	7		40			40
119. chromium	22	7		1			1
120. copper	22	7		300			300
121. cyanide	22	7		0.003	0.004	0.002	0.003
122. lead	22	7		900			900
123. mercury	22	7		0.063			0.063
124. nickel	22	7		5			5
125. selenium	22	7		<0.002			<0.002
127. thallium	22	7		<0.05			<0.05
128. zinc	22	7		1000			1000

Table V-2 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
 CONCENTRATE DIGESTION SCRUBBER  
 RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Nonconventionals</u>							
ammonia	22	6			87.7	18.5	53.1
chemical oxygen demand (COD)	22	7		2030			2030
fluoride	22	7		24000	2800		13400
phenols (total; by 4-AAP method)	22	1		0.016	0.028	0.01	0.018
	114	2		0.01	0.024	0.011	0.015
total organic carbon (TOC)	22	7		236			236
<u>Conventionals</u>							
oil and grease	22	1		9	8	10	9
	114	1		5	8	4	5.7
total suspended solids (TSS)	22	6		823			823
pH (standard units)	22	1		3.1			
	114	1		2.4	1.9	2.0	

Table V-2 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
CONCENTRATE DIGESTION SCRUBBER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>

(a) Samples taken from stream 114 were not analyzed for toxic metals.

(b) Reported together.

†Sample type: Note: These numbers also apply to subsequent sampling data tables in this section.

- 1 - one-time grab
- 2 - 24-hour manual composite
- 3 - 24-hour automatic composite
- 4 - 48-hour manual composite
- 5 - 48-hour automatic composite
- 6 - 72-hour manual composite
- 7 - 72-hour automatic composite

\*Indicates less than or equal to 0.01 mg/l.

\*\*Indicates less than or equal to 0.005 mg/l.

Table V-3

WATER USE AND DISCHARGE RATES FOR SOLVENT EXTRACTION  
RAFFINATE

(1/kg of columbium or tantalum salt extracted)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
507	NR	19,263	19,263
509	NR	NR	NR
519	0	36,685	36,685

---

NR = Present, but data not reported in dcp.

Table V-4

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
SOLVENT EXTRACTION RAFFINATE  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants(a)</u>							
1. acenaphthene	25	1		ND	0.017	ND	0.017
4. benzene	25	2		<0.046	<0.049	<0.051	<0.049
	114	2	*	*	*	ND	*
6. carbon tetrachloride	25	2		ND	ND	ND	
	114	2	ND	0.074	*	ND	0.037
7. chlorobenzene	25	2		ND	1.001	0.034	0.522
	114	2	ND	ND	ND	ND	
8. 1,2,4-trichlorobenzene	25	1		ND	0.051	*	0.026
10. 1,2-dichloroethane	25	2		ND	0.135	ND	
	114	2	ND	0.04	ND	*	0.02
14. 1,1,2-trichloroethane	25	2		ND	ND	ND	
	114	2		<0.032	ND	ND	<0.032
15. 1,1,2,2-tetrachloroethane (b)	25	2		ND	ND	<20.39	<20.39
	114	2		ND	ND	ND	
23. chloroform	25	2		0.203	0.24	0.181	0.208
	114	2	0.422	0.046	0.034	ND	0.040

Table V-4 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
SOLVENT EXTRACTION RAFFINATE  
RAW WASTEWATER

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
30.	1,2- <u>trans</u> -dichloroethylene	25	2		ND	ND	ND	
		114	2	ND	ND	0.484	ND	0.484
38.	ethylbenzene	25	2		ND	ND	0.04	0.04
		114	2	ND	ND	ND	ND	
48.	dichlorobromomethane	25	2		ND	ND	ND	
		114	2	0.025	0.038	ND	ND	
51.	chlorodibromomethane	25	2		ND	ND	7.08	7.08
		114	2	*	<0.089	*	ND	
54.	isophorone	25	1		ND	0.029	ND	0.029
56.	nitrobenzene	25	1		ND	0.1	ND	0.1
66.	bis(2-ethylhexyl) phthalate	25	1		0.036	0.02	*	0.019
68.	di-n-butyl phthalate	25	1		0.012	0.042	*	0.018
71.	dimethyl phthalate	25	1		ND	ND	0.012	0.012
85.	tetrachloroethylene	25	2		<0.245	ND	0.138	0.138
		114	2	*	ND	ND	ND	
87.	trichloroethylene	25	2		ND	<0.259	<0.27	<0.265
		114	2	*	ND	*	ND	*



Table V-4 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
 SOLVENT EXTRACTION RAFFINATE  
 RAW WASTEWATER

				Concentrations (mg/l, Except as Noted)				
<u>Pollutant</u>		<u>Stream Code</u>	<u>Sample Type†</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
107.	PCB-1254	25	1		**	**	**	**
109.	PCB-1248	25	1		**	**	**	**
113.	toxaphene	25	1		<0.02	<0.02	<0.02	<0.02
114.	antimony	25	1		20	4	30	18
115.	arsenic	25	1		45	10	25	26.7
117.	beryllium	25	1		<0.2	<0.2	<0.2	<0.2
118.	cadmium	25	1		<0.2	<0.2	<0.2	<0.2
119.	chromium	25	1	1,000	1,000	1,000	1,000	
120.	copper	25	1	50	10	70		43.3
121.	cyanide	25	1	0.016	0.033	0.011		0.020
122.	lead	25	1	200	300	1,000		500
123.	mercury	25	1	0.01	0.0075	0.016		0.011
124.	nickel	25	1	<0.5	<0.5	<0.5		<0.5
125.	selenium	25	1	70	35	30		45

Table V-4 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
 SOLVENT EXTRACTION RAFFINATE  
 RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
127. thallium	25	1		1.14	1.18	0.83	1.05
128. zinc	25	1		500	400	400	433
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	25	1		13,000	11,000	10,000	11,330
phenols (total; by 4-AAP method)	25	1		0.02	0.008	0.014	0.014
	114	2		0.01	0.024	0.011	0.015
<u>Conventionals</u>							
oil and grease	25	1		39	20	7	22
total suspended solids (TSS)	25	1		12,600	18,300	17,500	16,130
pH (standard units)	114	1		2.4	1.9	2.0	

(a) Samples from both streams were not analyzed for the acid fraction of toxic organic pollutants.

(b) Questionable analysis.

Table V-5

WATER USE AND DISCHARGE RATES FOR SOLVENT EXTRACTION  
WET AIR POLLUTION CONTROL

(1/kkg of columbium or tantalum salt extracted)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
507	0	4,311	4,311
519*	0	93,800	13,132

---

\*Same scrubber used in concentrate digestion.

Table V-6

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
SOLVENT EXTRACTION SCRUBBER  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
4. benzene	22	2		0.042	*	ND	0.021
6. carbon tetrachloride	22	2		ND	0.017	ND	0.017
7. chlorobenzene	22	2		ND	ND	*	*
10. 1,2-dichloroethane	22	2		0.156	0.086	0.062	0.101
23. chloroform	22	2		0.156	0.135	0.017	0.103
38. ethylbenzene	22	2		0.057	*	*	0.019
44. methylene chloride	22	2		88.4	ND	ND	88.4
66. bis(2-ethylhexyl) phthalate	22	7		0.48			0.48
85. tetrachloroethylene	22	2		0.157	ND	ND	0.157
87. trichloroethylene	22	2		0.235	*	ND	0.118
106. PCB-1242	22	7		<0.015			<0.015
109. PCB-1232	22	7		<0.015			<0.015

Table V-6 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
 SOLVENT EXTRACTION SCRUBBER  
 RAW WASTEWATER

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
113.	toxaphene	22	7		**			**
114.	antimony	22	7		2.9			2.9
115.	arsenic	22	7		0.003			0.003
117.	beryllium	22	7		0.18			0.18
118.	cadmium	22	7		40			40
119.	chromium	22	7		1			1
120.	copper	22	7		300			300
121.	cyanide	22	7		0.003	0.004	0.002	0.003
122.	lead	22	7		900			900
123.	mercury	22	7		0.063			0.063
124.	nickel	22	7		5			5
125.	selenium	22	7		<0.002			<0.002
127.	thallium	22	7		<0.05			<0.05
128.	zinc	22	7		1,000			1,000

Table V-6 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
 SOLVENT EXTRACTION SCRUBBER  
 RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Nonconventionals</u>							
ammonia	22	6			87.7	18.5	53.1
chemical oxygen demand (COD)	22	7		2,030			2,030
fluoride	22	7		24,000	28,000		13,400
phenols (total; by 4-AAP method)	22	1		0.016	0.028	0.01	0.018
total organic carbon (TOC)	22	7		236			236
<u>Conventionals</u>							
oil and grease	22	1		9	8	10	9
total suspended solid (TSS)	22	6		823			823
pH (standard units)	22	1		3.1			

Table V-7

WATER USE AND DISCHARGE RATES FOR PRECIPITATION AND  
FILTRATION OF COLUMBIUM-TANTALUM SALT

(1/kg of columbium or tantalum salt precipitated)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
519	0	274,753	247,753
507	NR	NR	NR
509	NR	NR	NR

---

NR = Present, but data not reported in dcp.

Table V-8

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
PRECIPITATION AND FILTRATION  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants(a)</u>							
4. benzene	117	2	*	*	*		*
15. 1,1,2,2-tetrachloroethane	117	2	*	*	ND		ND
66. bis(2-ethylhexyl) phthalate	117	2	0.049	1.158			1.158
85. tetrachloroethylene	117	2	*	*	ND		*
87. trichloroethylene	117	2	*	*	<0.023		*
108. PCB-1221	117	2	**	**	.		**
112. PCB-1016	117	2	**	**			**
113. toxaphene	117	2	ND	**			**
114. antimony	117	2	<0.1	<0.1			<0.1
115. arsenic	117	2	<0.01	0.04			0.04
117. beryllium	117	2	<0.001	<0.1			<0.1
118. cadmium	117	2	<0.002	2			2
119. chromium	117	2	<0.005	<0.5			<0.5



Table V-8 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
PRECIPITATION AND FILTRATION  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
120. copper	117	2	<0.006	0.8			0.8
121. cyanide	117	1		0.005	0.009		0.007
122. lead	117	2	<0.02	<2			<2
123. mercury	117	2	0.0001	<0.0001			<0.0001
124. nickel	117	2	<0.005	<0.5			<0.5
125. selenium	117	2	<0.01	<0.01			<0.01
126. silver	117	2	<0.02	0.07			0.07
127. thallium	117	2	<0.1	<0.1			<0.1
128. zinc	117	2	<0.06	<6			<6
<u>Nonconventionals</u>							
ammonia	117	2	<0.1	1450	34	4.2	496.1
chemical oxygen demand (COD)	117	2		22			22
fluoride	117	2	1.6	3525			3525
phenols (total; by 4-AAP method)	117	2		0.008	0.009	0.005	0.007
total organic carbon (TOC)	117	2		1			1

Table V-8 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
 PRECIPITATION AND FILTRATION  
 RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>							
oil and grease	117	1		12	6		9
total suspended solids (TSS)	117	2		27,890			27,890
pH (standard units)	117	1		10.5	9.5	10.2	

(a) Samples from stream 117 were not analyzed for the toxic organic acid fraction.

Table V-9

WATER USE AND DISCHARGE RATES FOR METAL SALT DRYING  
WET AIR POLLUTION CONTROL

(1/kg of columbium or tantalum salt dried)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
4225	67	472,983	153,085
519	93	165,150	11,560
507	89	NR	NR
509	0	NR	NR

---

NR = Present, but data not reported in dcp.

Table V-10

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
METAL SALT DRYING SCRUBBER, REDUCTION OF SALT TO METAL, AND REDUCTION OF SALT TO METAL SCRUBBER  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants(a,b)</u>							
4. benzene	23	2		ND	ND	ND	
	113	2	*	*	*	*	*
10. 1,2-dichloroethane	23	2		0.039	0.016	ND	0.022
	113	2	ND	0.023	0.026	0.021	0.023
12. hexachloroethane	23	7		ND			
	113	7	ND	0.023			0.023
14. 1,1,2-trichloroethane	23	2		ND	ND	ND	
	113	2	*	<0.011	ND	ND	<0.011
15. 1,1,2,2-tetrachloroethane	23	2		<0.029	ND	ND	<0.029
	113	2	ND	ND	ND	ND	
23. chloroform	23	2		ND	0.018	0.012	0.015
	113	2	0.422	ND	0.032	0.089	0.061
30. 1,2- <u>trans</u> -dichloroethylene	23	2		0.015	ND	ND	0.015
	113	2	ND	ND	0.26	ND	0.26
35. 2,4-dinitrotoluene	23	7		ND			
	113	7	ND	<0.016			<0.016
36. 2,6-dinitrotoluene	23	7		ND			
	113	7	ND	<0.016			<0.016

Table V-10 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
METAL SALT DRYING SCRUBBER, REDUCTION OF SALT TO METAL, AND REDUCTION OF SALT TO METAL SCRUBBER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
38. ethylbenzene	23	2		ND	*	ND	*
	113	2	ND	ND	ND	ND	
44. methylene chloride	23	2		ND	ND	ND	
	113	2	ND	ND	ND	ND	
47. bromoform	23	2		ND	0.134	ND	0.134
	113	2	ND	*	ND	0.021	0.011
51. chlorodibromomethane	23	2		ND	0.02	ND	0.02
	113	2	*	<0.031	ND	ND	<0.031
54. isophorone	113	7	ND	*			*
66. bis(2-ethylhexyl) phthalate	23	7		0.015			0.015
	113	7	0.049	0.06			0.06
67. butyl benzyl phthalate	23	7		*			*
	113	7		ND			
68. di-n-butyl phthalate	23	7		*			*
	113	7	0.011	*			*
70. diethyl phthalate	23	7		0.017			0.017
	113	7	ND	ND			ND
71. dimethyl phthalate	23	7		0.039			0.039
	113	7	ND	*			

Table V-10 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
METAL SALT DRYING SCRUBBER, REDUCTION OF SALT TO METAL, AND REDUCTION OF SALT TO METAL SCRUBBER  
RAW WASTEWATER

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
239	81. phenanthrene	23 113	7	*	ND *			*
	85. tetrachloroethylene	23	2		<0.013	ND	ND	<0.013
	87. trichloroethylene	23 113	2 2	*	ND *	* *	ND *	* *
	108. PCB-1221	113	7	**	0.0516			0.0516
	112. PCB-1016	113	7	**	0.0336			0.0336
	114. antimony	23 113	7 7		4.5 <0.1			4.5 <0.1
	115. arsenic	23 113	7 7		0.45 <0.01			0.45 0.05
	117. beryllium	23 113	7 7		<0.02 <0.001			<0.02 0.02
	118. cadmium	23 113	7 7		<0.2 <0.002			<0.2 <0.02
	119. chromium	23 113	7 7		<0.24 <0.005			<0.24 1

Table V-10 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
METAL SALT DRYING SCRUBBER, REDUCTION OF SALT TO METAL, AND REDUCTION OF SALT TO METAL SCRUBBER  
RAW WASTEWATER

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
240	120. copper	23	7		<1			<1
		113	7	0.066	0.2			0.2
	121. cyanide	23	7		<0.001	0.004	0.003	0.0035
		113	7		0.004	0.002	0.018	0.008
	122. lead	23	7		10			10
		113	7	<0.02	1			1
	123. mercury	23	7		0.0028			0.0028
		113	7	0.0001	0.0018			0.0018
	124. nickel	23	7		1			1
		113	7	<0.005	1			1
	125. selenium	23	7		0.018			0.018
		113	7	<0.01	<0.01			<0.01
	126. silver	23	7					
		113	7	<0.02	0.06			0.06
	127. thallium	23	7		ND			ND
		113	7	<0.1	<0.1			<0.1
	128. zinc	23	7		6			6
		113	7	<0.06	<0.6			<0.6

Table V-10 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
METAL SALT DRYING SCRUBBER, REDUCTION OF SALT TO METAL, AND REDUCTION OF SALT TO METAL SCRUBBER  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Nonconventionals</u>							
ammonia	23	2		25,700	18,500	16,900	20,377
chemical oxygen demand (COD)	23	7		21	16.5	27.8	21.7
	113	7		195			195
chloride	113	7	<5	1,110			1,110
fluoride	23	7		21,000			21,000
	113	7	1.6	3,000			3,000
phenols (total; by 4-AAP method)	23	2		0.028	0.023	0.01	0.02
	113	2		0.005	0.020	0.005	0.010
total organic carbon (TOC)	23	7		12			12
	113	7		51			51
<u>Conventionals</u>							
oil and grease	23	1		6	6	4	5.3
	113	1		5	2	5	4



Table V-10 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
METAL SALT DRYING SCRUBBER, REDUCTION OF SALT TO METAL, AND REDUCTION OF SALT TO METAL SCRUBBER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
total suspended solids (TSS)	23	7		181			181
	113	7		656			656
pH (standard units)	23	1		6.8			
	113	1		6.1	8.3	8.2	

(a) Stream 113 was not analyzed for the toxic organic acid extractables.

(b) Stream 23 was not analyzed for the toxic organic acid extractable or pesticide fractions.

Table V-11

WATER USE AND DISCHARGE RATES FOR REDUCTION OF SALT  
TO METAL

(1/kg of columbium or tantalum reduced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
519	NR	NR	536,143
513	NR	NR	170,696
507	0	NR	NR

---

NR = Present, but data not reported in dcp.

Table V-12

WATER USE AND DISCHARGE RATES FOR REDUCTION OF SALT  
TO METAL WET AIR POLLUTION CONTROL

(1/kg of columbium or tantalum reduced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
513	0	40,697	40,697
519	0	2,168	2,168

---

NR = Present, but data not reported in dcp.

Table V-13

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT A

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants(a)</u>							
115. arsenic	50	2	<0.01	<0.01			<0.01
	51	2	<0.01	0.01			0.01
	52	2	<0.01	<0.01			<0.01
117. beryllium	50	2		<0.001			<0.001
	51	2		<0.01			<0.01
	52	2		0.004			0.004
118. cadmium	50	2		0.009			0.009
	51	2		<0.02			<0.02
	52	2		0.04			0.04
119. chromium	50	2		0.006			0.006
	51	2		0.15			0.15
	52	2		0.1			0.1
120. copper	50	2		1.0			1
	51	2		0.79			0.79
	52	2		0.2			0.2
122. lead	50	2		<0.02			<0.02
	51	2		0.22			0.22
	52	2		0.06			0.06
123. mercury	50	2		0.0001			0.0001
	51	2		0.004			0.004
	52	2		0.0001			0.0001

Table V-13 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT A

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
124. nickel	50	2		<0.005			<0.005
	51	2		<0.05			<0.05
	52	2		0.07			0.07
126. silver	50	2	<0.02	<0.02			<0.02
	51	2	<0.02	0.04			0.04
	52	2	<0.02	<0.02			<0.02
128. zinc	50	2		3.0			3
	51	2		<0.6			<0.6
	52	2		0.2			0.2
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	50	2	8	6			6
	51	2	8	501			501
	52	2	8	114			114
fluoride	50	2		74			74
	52	2		52			52
total organic carbon (TOC)	50	2	2	6			6
	51	2	2	216			216
	52	2	2	43			43

Table V-13 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - RAW WASTEWATER - PLANT A

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>							
oil and grease	51	1		121			121
	52	1		6			6
total suspended solids (TSS)	50	2		<1			<1
	51	2		1,012			1,012
	52	2		52			52
pH (standard units)	50	1		5.45			
	51	1		11.0			
	52	1		2.1			

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(a) No samples were analyzed for toxic organic pollutants, cyanide, or asbestos.

Table V-14

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants(a)</u>							
1. acenaphthene	116	7	ND	*			*
4. benzene	116	2	*	*	*	*	*
8. 1,2,4-trichlorobenzene	116	2	ND	0.265			0.265
10. 1,2-dichloroethane	116	2	ND	ND	0.017	ND	0.017
23. chloroform	116	2	0.422	*	ND	*	*
30. 1,2- <u>trans</u> -dichloroethylene	116	2	ND	ND	0.094	0.017	0.056
35. 2,4-dinitrotoluene	116	7	ND	*			*
36. 2,6-dinitrotoluene	116	7	ND	*			*
56. nitrobenzene	116	7	ND	0.163			0.163
66. bis(2-ethylhexyl) phthalate	116	7	0.049	1.158			1.158
71. dimethyl phthalate	116	7	ND	*			*
81. phenanthrene	116	7	*	*			*
87. trichloroethylene	116	2	*	ND	ND	*	*
108. PCB-1221	116	7	**	**			**
112. PCB-1016	116	7	**	**			**

Table V-14 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT B

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
113.	toxaphene	116	7	ND	ND			
114.	antimony	116	7	<0.1	<0.1			<0.1
115.	arsenic	116	7	<0.01	0.57			0.57
117.	beryllium	116	7	<0.001	0.5			0.5
118.	cadmium	116	7	<0.002	0.2			0.2
119.	chromium	116	7	<0.005	20			20
120.	copper	116	7	<0.006	0.7			0.7
121.	cyanide	116	7		0.002	0.002	0.002	0.002
122.	lead	116	7	<0.02	10			10
123.	mercury	116	7	0.0001	0.0003			0.0003
124.	nickel	116	7	<0.005	10			10
125.	selenium	116	7	<0.01	0.02			0.02
126.	silver	116	7	<0.02	0.05			0.05
127.	thallium	116	7	<0.1	<0.1			<0.1
128.	zinc	116	7	<0.06	1			1



Table V-14 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	116	2		497			497
total organic carbon (TOC)	116	2		119			119
<u>Conventionals</u>							
oil and grease	116	1		5	5	3	4.3
total suspended solids (TSS)	116	2		436			436
pH (standard units)	116	1		2.4	2.1	2.1	

Table V-15

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT C

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
1. acenaphthene	96	7				0.015	0.015
4. benzene	96	1	ND	<0.04	*	ND	<0.02
6. carbon tetrachloride	96	1	ND	0.109	ND	0.035	0.072
7. chlorobenzene	96	1		ND	<0.029	0.065	0.033
8. 1,2,4-trichlorobenzene	96	7				0.018	0.018
10. 1,2-dichloroethane	96	1	ND	*	0.018	ND	0.009
14. 1,1,2-trichloroethane	96	1	ND	ND	ND	*	*
15. 1,1,2,2-tetrachloroethane	96	1	ND	<0.049	ND	ND	<0.049
23. chloroform	96	1	ND	0.059	0.018	*	0.026
29. 1,1-dichloroethylene	96	1	ND	0.136	*	ND	0.068
38. ethylbenzene	96	1	ND	ND	ND	0.049	0.049
48. dichlorobromomethane	96	1	ND	0.016	ND	ND	0.016
51. chlorodibromomethane	96	1	ND	ND	*	ND	*
66. bis(2-ethylhexyl) phthalate	96	7	*			0.018	0.018

Table V-15 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT C

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
68.	di-n-butyl phthalate	96	7	*			*	*
71.	dimethyl phthalate	96	7	*			0.02	0.02
81.	phenanthrene	96	7				<0.012	<0.012
85.	tetrachloroethylene	96	1	ND	<0.046	0.189	0.137	0.109
86.	toluene	96	1	ND	0.092	*	0.012	0.035
87.	trichloroethylene	96	1	ND	<0.185	ND	0.020	0.010
108.	PCB-1221	96	7				**	**
111.	PCB-1060	96	7				**	**
113.	toxaphene	96	7		ND			
114.	antimony	96	7				<0.01	<0.01
115.	arsenic	96	7				0.18	0.18
117.	beryllium	96	7				0.02	0.02
118.	cadmium	96	7	<0.002			0.008	0.008
119.	chromium	96	7				3	3

Table V-15 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT C

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
120. copper	96	7				0.5	0.5
121. cyanide	96	7		0.001	0.002	0.003	0.002
122. lead	96	7				3	3
123. mercury	96	7				0.0017	0.0017
124. nickel	96	7				0.6	0.6
125. selenium	96	7				<0.01	<0.01
126. silver	96	7				<0.02	<0.02
127. thallium	96	7				<0.1	<0.1
128. zinc	96	7				6	6
<u>Nonconventionals</u>							
ammonia	96	1		452	3210	2180	1947
chemical oxygen demand (COD)	96	7				145	145
chloride	96	7				118	118
fluoride	96	7				2200	2200
phenols (total; by 4-AAP method)	96	1		0.092	0.005	0.004	0.337
total organic carbon (TOC)	96	7				45	45

Table V-15 (Continued)

PRIMARY COLUMBIUM-TANTALUM SAMPLING DATA  
MISCELLANEOUS - RAW WASTEWATER - PLANT C

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>							
oil and grease	96	1		10	6	6	7.3
total suspended solids (TSS)	96	1				566	566

Table V-16

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
4. benzene	48	3	*	*	*	ND	*
	49	3	*	0.047	*	ND	0.0235
6. carbon tetrachloride	48	3	ND	ND	ND	ND	
	49	3	ND	0.043	ND	ND	0.043
11. 1,1,1-trichloroethane	48	3	ND	ND	ND	ND	
	49	3	ND	0.013	0.046	ND	0.0295
23. chloroform	48	3	0.032	0.069	ND	0.027	0.048
	49	3	0.032	0.03	*	0.038	0.023
29. 1,1-dichloroethylene	48	3	ND	ND	ND	ND	
	49	3	ND	ND	0.025	ND	0.025
30. 1,2-transdichloro- ethylene	48	3	ND	ND	0.022	*	0.011
	49	3	ND	ND	*	ND	*
48. dichlorobromomethane	48	3	ND	ND	ND	ND	
	49	3	ND	0.089	ND	ND	0.089
66. bis(2-ethylhexyl) phthalate	48	3	0.173	0.404	0.221	0.198	0.274
	49	3	0.173	0.016	0.203	0.179	0.133
67. butyl benzyl phthalate	48	3	ND	ND	*	*	*
	49	3	ND	ND	0.047	0.043	0.045

Table V-16 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT A

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
256	114. antimony	48	3	<0.1	<0.01	<0.1	<0.01	<0.04
		49	3	<0.1	0.4	<0.01	<0.1	0.4
	115. arsenic	48	3	<0.01	<0.01	<0.01	<0.01	<0.01
		49	3	<0.01	<0.01	<0.01	<0.01	<0.01
	118. cadmium	48	3	ND	0.01	0.004	0.008	0.007
		49	3	ND	<0.02		<0.02	<0.02
	119. chromium	48	3	ND	0.03	0.03	0.01	0.023
		49	3	ND	0.14		<0.05	0.14
	120. copper	48	3	ND	0.009	0.03	0.007	0.015
		49	3	ND	<0.06		<0.06	<0.06
	121. cyanide	48	3		<0.001	<0.001	<0.001	<0.001
		49	3		0.001	0.002	0.001	0.0013
	122. lead	48	3	ND	0.03	0.03	<0.02	0.03
		49	3	ND	0.36		<0.2	0.36
	123. mercury	48	3	ND	0.0001	0.0001	0.0001	0.0001
		49	3	ND	0.0001		0.0002	0.00015
	124. nickel	48	3	ND	0.04	0.05	0.007	0.032
		49	3	ND	<0.05		<0.05	<0.05

Table V-16 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT A

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
126. silver	48	3	<0.02	<0.02	<0.02	<0.02	<0.02
	49	3	<0.02	0.05	<0.02	0.04	0.045
128. zinc	48	3	ND	<0.06	0.08	<0.06	0.08
	49	3	ND	<0.6		<0.6	<0.6
<u>Conventionals</u>							
oil and grease	48	1		6	6	6	6.00
	49	1		7	5	4	5.33



Table V-17

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
8. 1,2,4-trichlorobenzene	112	7	ND	0.011			0.011
	115	7	ND	ND			
23. chloroform	112	7	0.422	ND	0.022	0.02	0.02
	115	7	0.422	0.048	0.03	0.032	0.037
30. 1,2-trans-dichloro- ethylene	112	7	ND	ND			
	115	7	ND	ND	0.21	ND	0.21
51. chlorodibromomethane	112	7	*	ND			
	115	7	*	ND	0.019	ND	0.019
55. naphthalene	112	7	ND	ND			
	115	7	ND	0.084			0.084
66. bis(2-ethylhexyl) phthalate	112	7	0.049	0.05			0.05
	115	7	0.049	0.523			0.523
115. arsenic	112	7	<0.01	0.01			0.01
	115	7	<0.01	0.39			0.39
117. beryllium	112	7	<0.001	<0.001			<0.001
	115	7	<0.001	0.09			0.09
118. cadmium	112	7	<0.002	0.004			0.004
	115	7	<0.002	0.05			0.05
119. chromium	112	7	<0.005	0.008			0.008
	115	7	<0.005	3			3

Table V-17 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
120. copper	112	7	<0.006	0.01			0.01
	115	7	<0.006	0.4			0.4
121. cyanide	112	7		0.002	0.002	<0.001	0.002
	115	7		0.007	0.002	0.003	0.004
122. lead	112	7	<0.02	0.07			0.07
	115	7	<0.02	3			3
123. mercury	112	7	0.0001	<0.0001			<0.0001
	115	7	0.0001	0.0061			0.0061
124. nickel	112	7	<0.005	0.06			0.06
	115	7	<0.005	2			2
126. silver	112	7	<0.02	0.02			0.02
	115	7	<0.02	0.08			0.08
128. zinc	112	7	<0.06	<0.06			<0.06
	115	7	<0.06	<0.6			<0.6
<u>Nonconventionals</u>							
ammonia	112	7	<0.1	283	132	311	242
	115	7	<0.1	402	500	250	384
chemical oxygen demand (COD)	112	7		44			44
	115	7		408			408

Table V-17 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
fluoride	112	7	1.6	16			16
	115	7	1.6	3525			3525
phenols (total; by 4-AAP method)	112	1		0.01	0.015	0.01	0.012
	115	1		0.025	0.008	0.02	0.018
total organic carbon (TOC)	112	7		9			9
	115	7		118			118
<u>Conventionals</u>							
oil and grease	112	1		4	3		3.5
	115	1		5	6	5	5.3
total suspended solids (TSS)	112	7		36			36
	115	7		3876			3876
pH (standard units)	112	1		9	8.8	8.8	
	115	1		3.6	4	3.4	

Table V-18

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT D

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				<u>Average</u>
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Toxic Pollutants</u>								
10.	1,2-dichloroethane	24	2		0.019	0.024	ND	0.022
15.	1,1,2,2-tetrachloro-ethane	24	2		ND	ND	ND	
23.	chloroform	24	2		0.018	0.026	*	0.015
30.	1,2-trans-dichloro-ethylene	24	2		ND	ND	ND	
38.	ethylbenzene	24	2		*	*	ND	*
44.	methylene chloride	24	2		0.636	ND	ND	0.636
47.	bromoform	24	2		ND	ND	ND	
51.	chlorodibromomethane	24	2		ND	ND	ND	
66.	bis(2-ethylhexyl) phthalate	24	7		0.015			0.015
67.	butyl benzyl phthalate	24	7		0.08			0.08
68.	di-n-butyl phthalate	24	7		0.02			0.02
70.	diethyl phthalate	24	7		ND			
71.	dimethyl phthalate	24	7		ND			

Table V-18 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT D

	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				<u>Average</u>
				<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
85.	tetrachloroethylene	24	2		0.024	ND	ND	0.024
87.	trichloroethylene	24	2		0.023	<0.024	ND	0.023
114.	antimony	24	7		0.2			0.2
115.	arsenic	24	7		0.45			0.45
117.	beryllium	24	7		<0.02			<0.02
118.	cadmium	24	7		<0.2			<0.2
119.	chromium	24	7		<0.24			<0.24
120.	copper	24	7		0.11			0.11
121.	cyanide	24	7		0.003	0.009	0.009	0.007
122.	lead	24	7		5			5
123.	mercury	24	7		0.0008			0.0008
124.	nickel	24	7		<0.5			<0.5
125.	selenium	24	7		0.045			0.045
128.	zinc	24	7		6			6

Table V-18 (Continued)

PRIMARY COLUMBIUM-TANTALUM - SAMPLING DATA  
 MISCELLANEOUS - TREATMENT PLANT SAMPLES - PLANT D

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Nonconventionals</u>							
ammonia	24	2		21	16.5	27.8	21.77
chemical oxygen demand (COD)	24	7		151			151
fluoride	24	7		6			6
phenols (total; by 4-AAP method)	24	2		0.031	0.03	0.03	0.031
total organic carbon (TOC)	24	7		27			27
<u>Conventionals</u>							
oil and grease	24	1		4	4	4	4
total-suspended solids (TSS)	24	7		89			89
pH (standard units)	24	1		12			

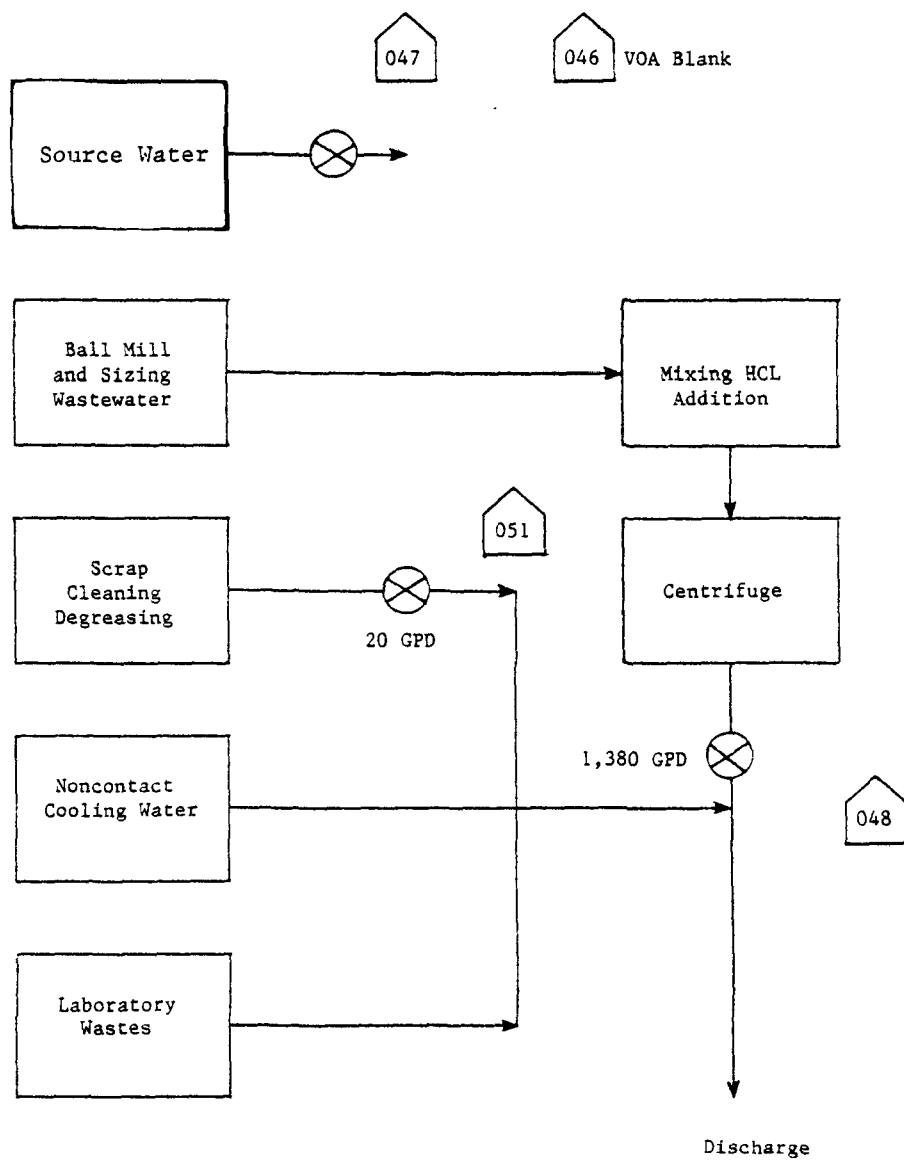


Figure V-1  
SAMPLING SITES AT COLUMBIUM-TANTALUM PLANT A

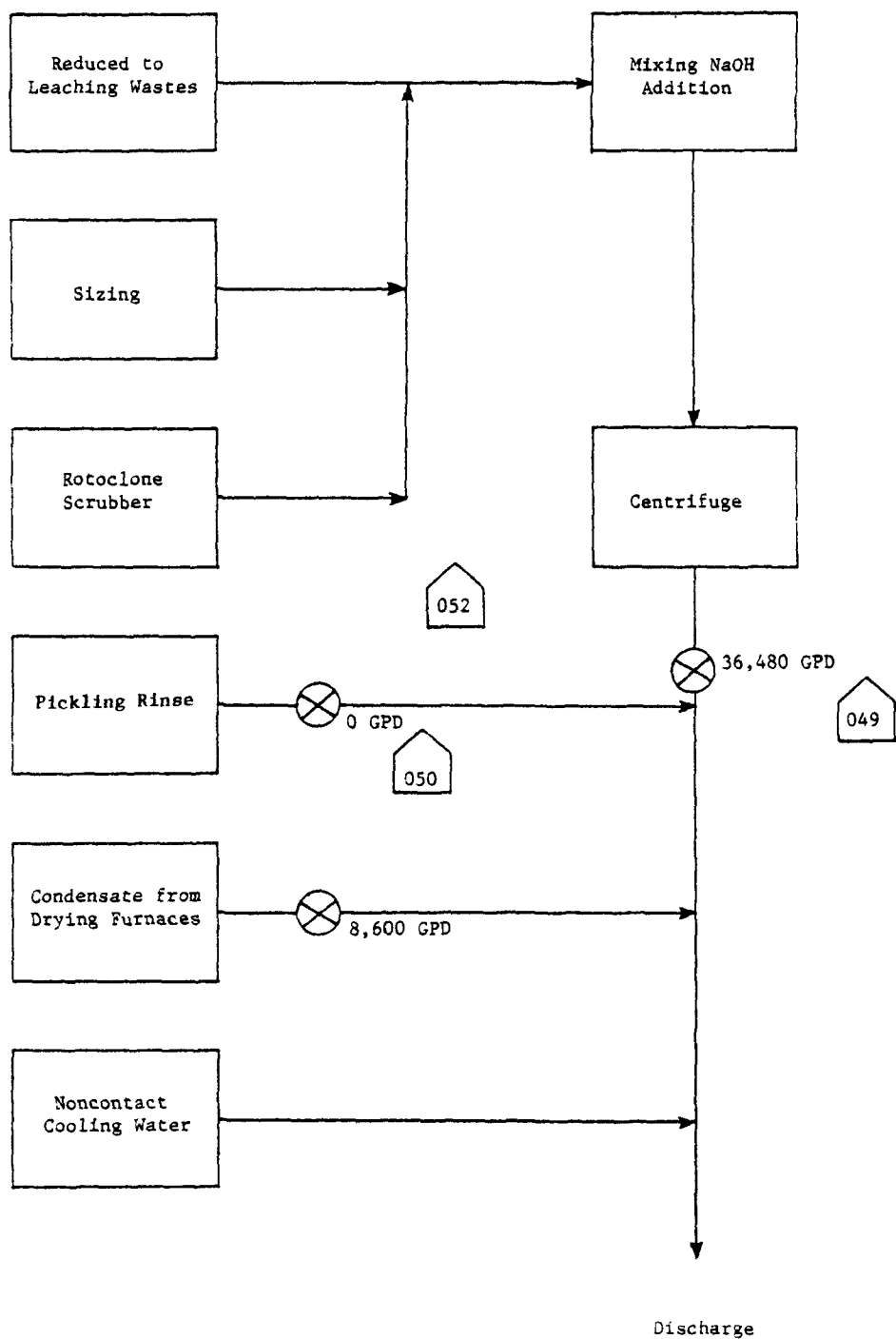


Figure V-2  
SAMPLING SITES AT COLUMBIUM-TANTALUM PLANT A



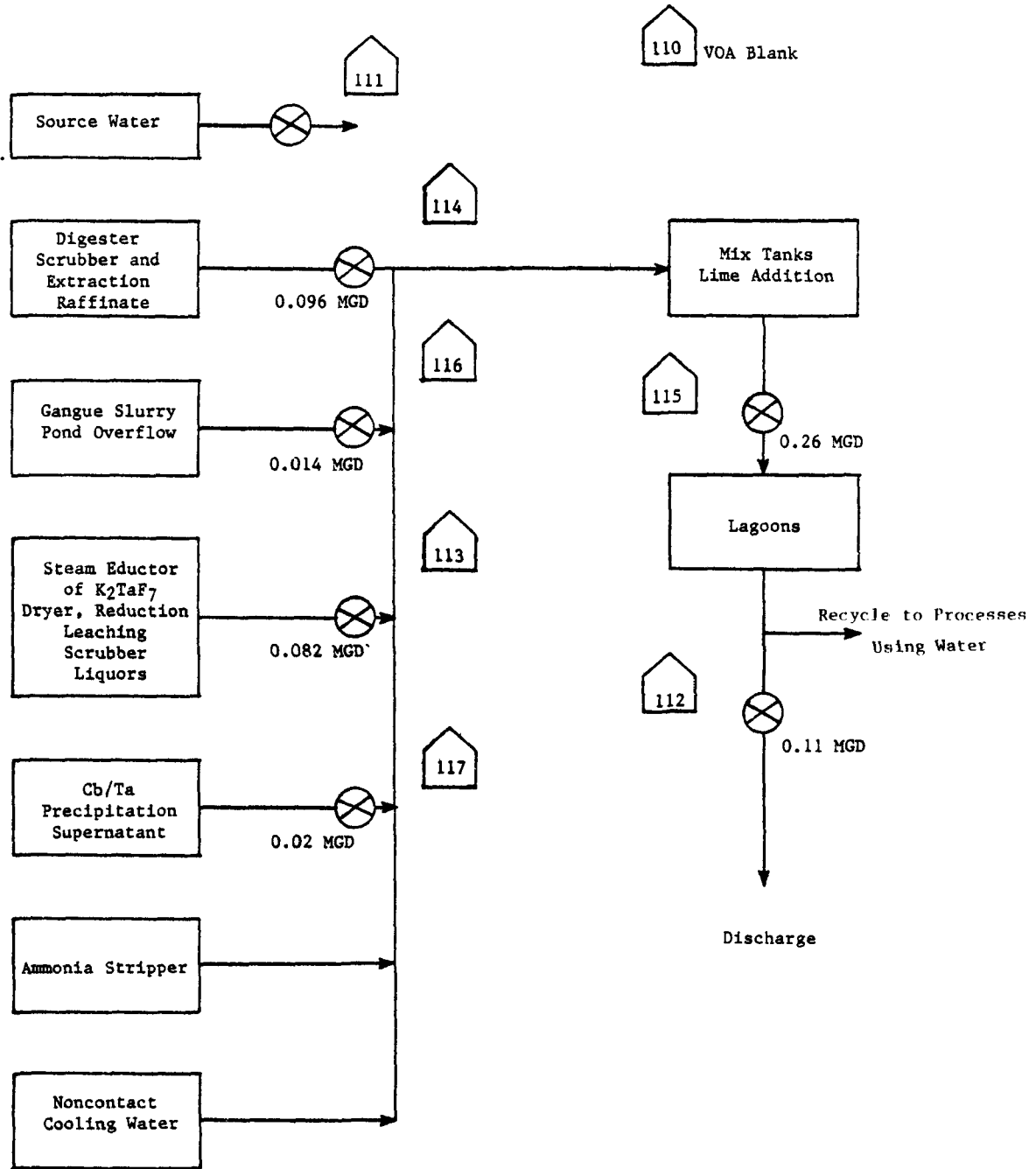


Figure V-3  
SAMPLING SITES AT COLUMBIUM-TANTALUM PLANT B

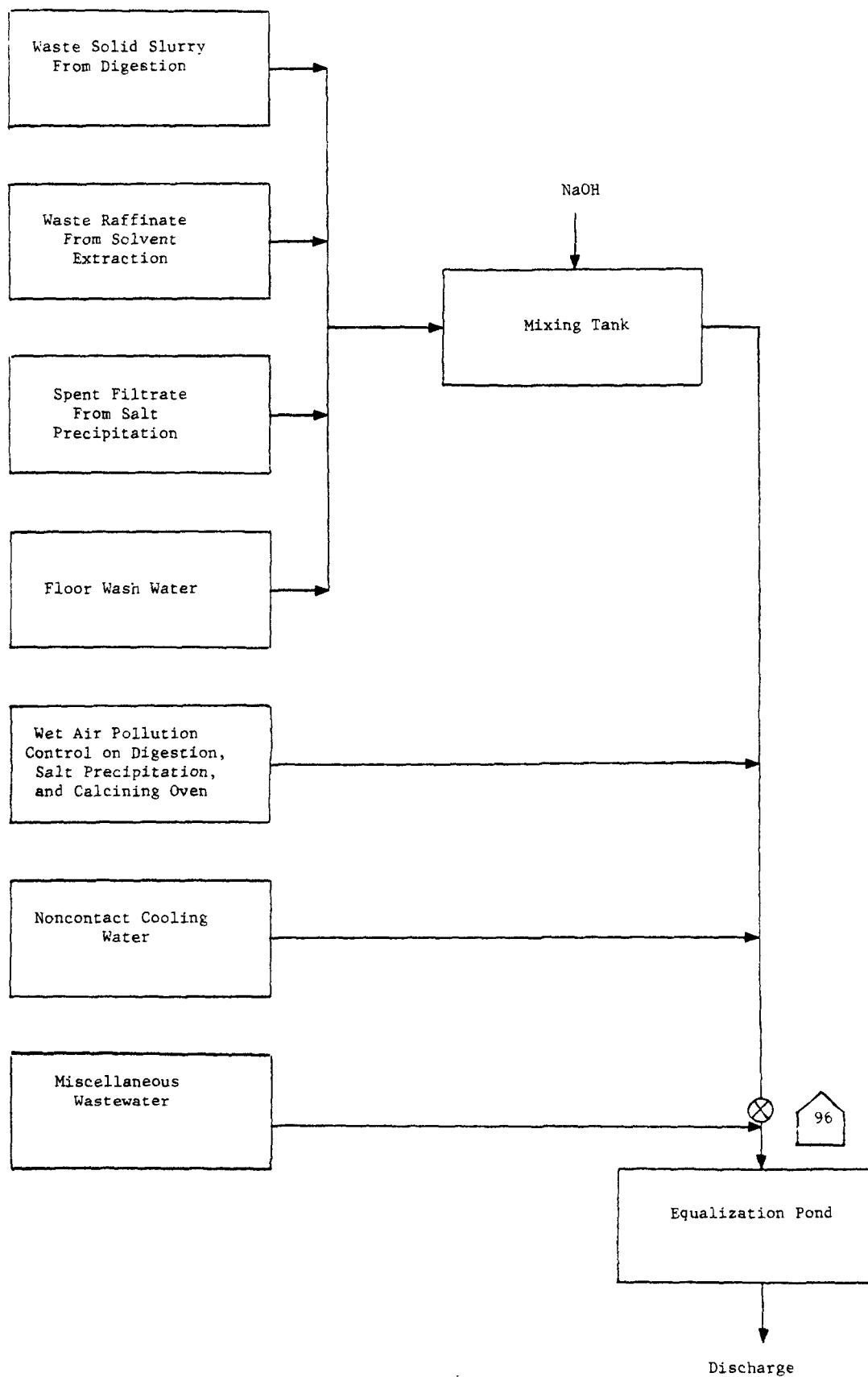


Figure V-4

SAMPLING SITES AT COLUMBIUM-TANTALUM PLANT C

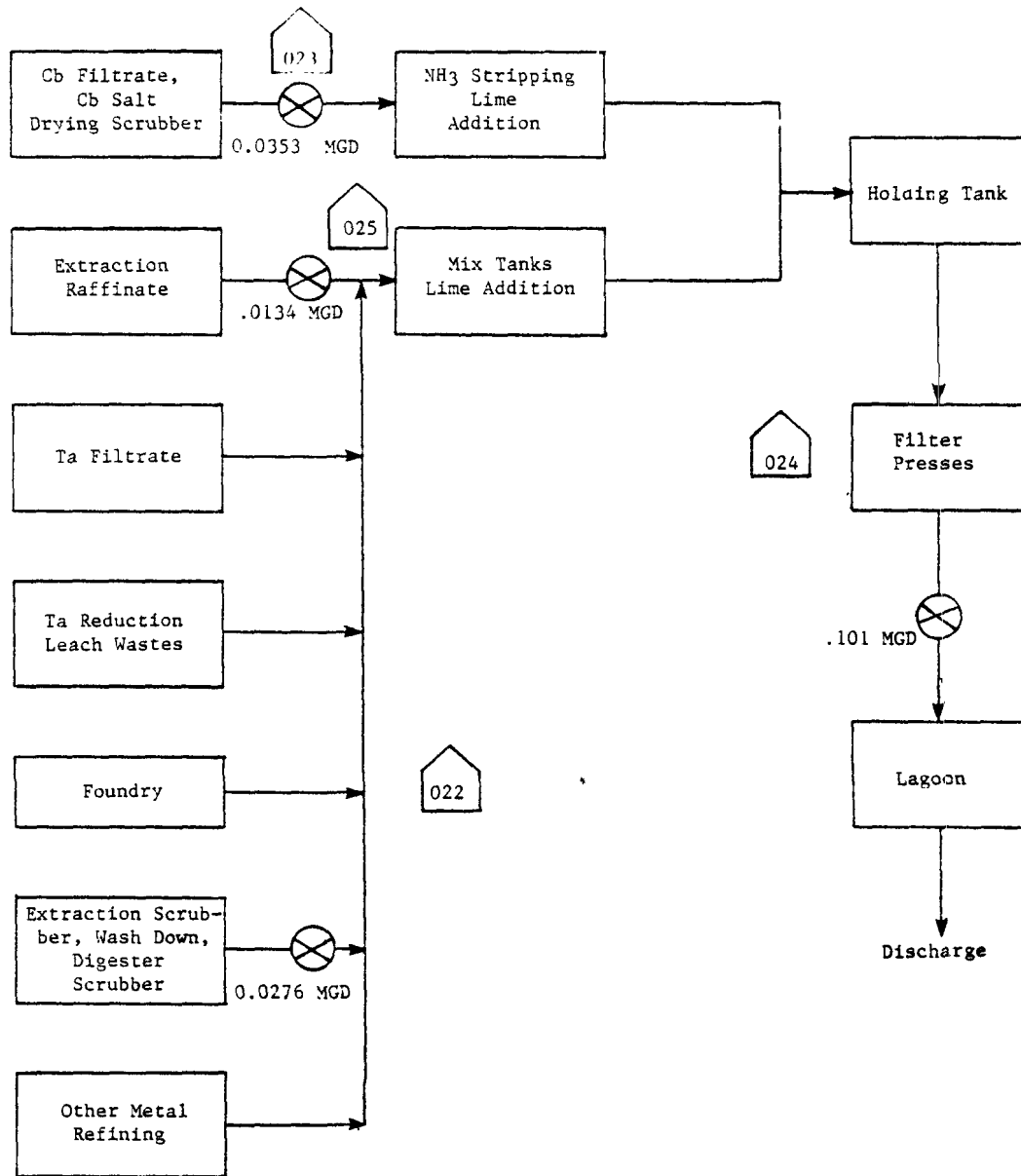


Figure V-5  
SAMPLING SITES AT COLUMBIUM-TANTALUM PLANT D

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION VI

#### SELECTION OF POLLUTANT PARAMETERS

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

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

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

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS

This study examined samples from the primary columbium-tantalum subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and six nonconventional pollutant parameters (ammonia, chemical oxygen demand, chloride, fluoride, total organic carbon, and total phenols).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

The following conventional and nonconventional pollutants or pollutant parameters are selected for consideration in establishing limitations for the columbium-tantalum subcategory:

- ammonia
- total suspended solids (TSS)
- fluoride
- pH

Five of eight samples analyzed for ammonia exhibited concentrations in excess of 40 mg/l (above the treatability concentration) with values reported as high as 3,210 mg/l. Since five of eight samples are above the 32 mg/l concentration attainable with steam stripping, ammonia is selected for further consideration.

The concentration of suspended solids in the 11 samples for which it was analyzed ranged from 1 mg/l to 27,890 mg/l. Furthermore, most of the treatment used to remove toxic metals does so by precipitating the metals or their salts, and these toxic metal precipitates should not be discharged. A limitation on total suspended solids then, would help ensure that the toxic metals are removed. Thus, total suspended solids is selected for consideration for limitation.

Fluoride ions in low concentration (approximately 1.0 mg/l) are beneficial in drinking water supplies. However, higher concentrations (above 10 mg/l) can be harmful and even fatal to humans and animals. All six samples analyzed for fluoride contained very high concentrations of this pollutant (ranging from 2,800 to 24,000 mg/l). Consequently, fluoride is selected for consideration for limitation.

The pH range measured was 1.87 to 11.0. Many deleterious effects are caused by either extreme pH values, or rapid changes in pH. Effective removal of toxic metals requires careful control of pH. Therefore, pH is considered for specific regulation in this subcategory.

#### TOXIC POLLUTANTS

The frequency of occurrence of toxic pollutants in the wastewater samples taken is presented in Table VI-1. These data provide the basis for the categorization of specific pollutants as discussed below. Table VI-1 is based on raw wastewater data from streams 22, 23, 25, 113, 114, and 117 shown in Figures V-1 through V-5 and presented in Tables V-2, V-4, V-6, V-8, and V-10. Treatment plant samples were not considered in the frequency count. Streams 48, 49, 50, 51, 52, 115, and 116 were not used because they contain either treated wastewater or wastewater from processes not considered for regulation in this rulemaking.

#### TOXIC POLLUTANTS NEVER DETECTED

Paragraph 8(a)(iii) of the Revised Settlement Agreement allows the Administrator to exclude from regulation those toxic pollutants not detectable by Section 304(h) analytical methods or other state-of-the-art methods. The toxic pollutants listed below were not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

2. acrolein
3. acrylonitrile
5. benzidine
9. hexachlorobenzene
11. 1,1,1-trichloroethane
13. 1,1-dichloroethane
16. chloroethane
17. DELETED
18. bis(2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
21. 2,4,6-trichlorophenol
22. parachlorometa cresol
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
29. 1,1-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
37. 1,2-diphenylhydrazine
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-chloroethoxy) methane
45. methyl chloride
46. methyl bromide
49. DELETED
50. DELETED
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
55. naphthalene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol
69. di-n-octyl phthalate
72. benzo(a)anthracene
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene
76. chrysene
77. acenaphthylene
79. benzo(ghi)perylene

- 82. dibenzo(a,h)anthracene
- 83. indeno(1,2,3-cd)pyrene
- 84. pyrene
- 86. toluene
- 88. vinyl chloride
- 89. aldrin
- 90. dieldrin
- 91. chlordane
- 92. 4,4'-DDT
- 93. 4,4'-DDE
- 94. 4,4'-DDD
- 95. alpha-endosulfan
- 96. beta-endosulfan
- 97. endosulfan sulfate
- 98. endrin
- 99. endrin aldehyde
- 100. heptachlor
- 101. heptachlor epoxide
- 102. alpha-BHC
- 103. beta-BHC
- 104. gamma-BHC
- 105. delta-BHC
- 129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LIMIT

The provision of Paragraph 8(a)(iii) of the Revised Settlement Agreement excluding from regulation those toxic pollutants which are not detectable includes those pollutants whose concentrations fall below EPA's nominal detection limit. The toxic pollutants listed below were never found above their analytical quantification concentration in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

- 14. 1,1,2-trichloroethane
- 15. 1,1,2,2-tetrachloroethylene
- 20. 2-chloronaphthalene
- 35. 2,4-dinitrotoluene
- 36. 2,6-dinitrotoluene
- 39. fluoranthene
- 67. butyl benzyl phthalate
- 73. benzo(a)pyrene
- 78. anthracene (a)
- 80. fluorene
- 81. phenanthrene (a)
- 113. toxaphene
- 121. cyanide

(a) Reported together.

## TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

Paragraph 8(a)(iii) of the Revised Settlement Agreement also allows the exclusion of toxic pollutants which were detected in quantities too small to be effectively reduced by any technologies known to the Administrator. The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

- 4. benzene
- 48. dichlorobromomethane
- 54. isophorone
- 70. diethyl phthalate
- 117. beryllium
- 126. silver

Benzene was detected above its analytical quantification limit in one of 14 samples. The detected value was less than 0.05 mg/l, the concentration achievable by available treatment. Therefore, benzene is not selected for consideration for limitation.

Dichlorobromomethane was detected above its analytical quantification limit in only one of 14 samples, at a concentration of 0.038 mg/l. Available treatment can reduce the dichlorobromomethane concentration to only 0.1 mg/l, so it is not selected for consideration for limitation.

Isophorone occurred above its analytical quantification limit in just one of seven samples; the reported value was 0.029 mg/l, which is below the concentration to which available treatment can reduce this pollutant (0.05 mg/l). Therefore, isophorone is not selected for consideration for limitation.

Diethyl phthalate was detected in four of eight samples with one value above the analytical quantification concentration of 0.010 mg/l. The concentration of diethyl phthalate in the sample was 0.017 mg/l, which is below the treatable concentration of 0.025 mg/l. Therefore, diethyl phthalate was not selected for consideration.

Beryllium was detected in five of six samples analyzed. However, it was found above its quantification limit in only two samples, both at concentrations below the treatable concentration of 0.20 mg/l for this pollutant. The concentrations of beryllium in the two samples were 0.18 and 0.02 mg/l. Therefore, beryllium is not selected for consideration for limitation.



Silver was detected in two of six samples analyzed, at values of 0.06 and 0.07 mg/l. However, treatment technology available cannot bring the silver concentration below 0.07 mg/l, so silver is not selected for consideration for limitation.

#### TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant if it is detectable in the effluent from only a small number of sources within the subcategory and it is uniquely related to only those sources. The following pollutants were not selected for regulation on this basis.

1. acenaphthene
6. carbon tetrachloride
12. hexachloroethane
23. chloroform
30. 1,2-trans-dichloroethylene
44. methylene chloride
47. bromoform
56. nitrobenzene
66. bis(2-ethylhexyl) phthalate
68. di-n-butyl phthalate
71. dimethyl phthalate
85. tetrachloroethylene
106. PCB-1242 (a)
107. PCB-1254 (a)
108. PCB-1221 (a)
109. PCB-1232 (a)
110. PCB-1248 (b)
111. PCB-1260 (b)
112. PCB-1016 (b)
123. mercury

(a), (b) Reported together

Acenaphthene was detected in one of eight samples, with the one detected value above the 0.01 mg/l concentration considered attainable with the identified treatment technology. The value detected in the sample was 0.017 mg/l. From the waste stream in which acenaphthene was detected, two other samples of this waste stream reported acenaphthene as a not detected. Therefore, acenaphthene is not considered characteristic of columbium-tantalum wastewaters and is not considered for limitation.

Carbon tetrachloride was found above its analytical quantification limit in two of 14 samples, with concentrations of 0.017 and 0.074 mg/l. It was found below the analytical quantification limit in 12 other samples, in all but one of which it was not

detected at all. Carbon tetrachloride is a common laboratory solvent. Since no carbon tetrachloride was detected in either of the source water samples taken, and since it is not used in the columbium-tantalum subcategory nor is it a likely by-product of any chemical that is used, the values recorded can be ascribed to sample contamination. Therefore, carbon tetrachloride is not selected for consideration for limitation.

Hexachloroethane was present in only one out of seven samples taken, at 0.023 mg/l. Concentrations above 0.01 mg/l are considered treatable by the identified treatment technology. Also, in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent. Therefore, hexachloroethane is not selected for consideration for limitation.

Chloroform, a common laboratory solvent, was detected in 10 of 14 samples, ranging from below the analytical quantification limit to 0.24 mg/l. Concentrations above the analytical quantification limit in two of the three blanks (0.052 mg/l and 0.015 mg/l) analyzed raise the likelihood of sample contamination. Also, in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent. Chloroform, therefore, is not selected for consideration for limitation.

1,2-trans-dichloroethylene was detected in two of 17 samples, with both of the concentrations above the 0.1 mg/l concentration considered attainable with the identified treatment technology. The values detected above treatability were 0.484 and 0.26 mg/l. These two values were taken from two different waste streams that were sampled three times each. The remaining six samples were reported as not detected; therefore, 1,2-trans-dichloroethylene is not considered to be characteristic of raw wastewaters from columbium-tantalum plants.

One very high value of methylene chloride, 88.4 mg/l, was found in one of 14 samples; methylene chloride was not detected in the remaining 13 samples. But this solvent is so pervasive in laboratories that this one case of detection (out of 14) is probably due to sample contamination. The presence of methylene chloride in one of the blanks attests to this. Also, in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent. Therefore, methylene chloride is not selected for consideration for limitation.

Nitrobenzene was detected in one of eight samples, and above the 0.05 concentration considered attainable with the identified treatment technology. The value detected was 0.1 mg/l. This value was obtained from a sample of solvent extraction raffinate in which two other samples were reported as not detected. Nitrobenzene, therefore, is not considered for limitation.

Bis(2-ethylhexyl) phthalate was reported present above its analytical quantification limit in five of seven samples; the reported concentrations ranged from 0.02 mg/l to 1.2 mg/l. This compound is a plasticizer found in many plastic materials used in manufacturing plants, thus it is not considered attributable to specific materials or processing in this subcategory. Also, in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent. Therefore, bis(2-ethylhexyl) phthalate is not selected for consideration for limitation.

Di-n-butyl phthalate was measured above its analytical quantification limit in three of 11 samples; the measured concentrations ranged from 0.012 mg/l to 0.08 mg/l. This substance is a plasticizer found in many products used in manufacturing plants; it is not considered a pollutant specific to this point source. Also, in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent. Therefore, di-n-butyl phthalate is not selected for consideration for limitation.

Dimethyl phthalate was reported present above its analytical quantification limit in two of 11 samples; the reported concentrations were 0.012 mg/l and 0.02 mg/l. This compound is a plasticizer found in many plastic materials used in manufacturing plants, and is not considered a point source specific pollutant. Also, in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent. Therefore, dimethyl phthalate is not selected for consideration for limitation.

Tetrachloroethylene was detected in three of 17 samples, with one of the values above the 0.05 mg/l concentration considered attainable with the identified treatment technology. The value detected was 0.157 mg/l. The process waste stream from which this sample was taken also produced six samples in which tetrachloroethylene was not detected. Therefore, tetrachloroethylene is not considered for further limitation.

PCB-1242, PCB-1254, and PCB-1221 were measured above their analytical quantification limit in only one of seven samples. The observed concentration was 0.0516 mg/l. Since PCBs were found in just one plant, and since in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent, they are not selected for consideration for limitation.

PCB-1232, PCB-1248, PCB-1260, and PCB-1016 were measured above their analytical quantification limit in one of seven samples. The observed concentration was 0.336 mg/l. Since PCB's were found in only one plant, and since in the dcp, all of the columbium-tantalum plants indicated that this pollutant was either known or believed to be absent, they are not selected for consideration for limitation.

Mercury was found above the concentration achievable by treatment in one of six samples. Only one sample at 0.063 mg/l was detected above the treatable concentration of 0.036 mg/l. Since the five other samples were below treatability, Mercury is not selected for consideration for limitation.

#### TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION FOR LIMITATIONS AND STANDARDS

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

- 7. chlorobenzene
- 8. 1,2,4-trichlorobenzene
- 10. 1,2-dichloroethane
- 38. ethylbenzene
- 51. chlorodibromomethane
- 87. trichloroethylene
- 114. antimony
- 115. arsenic
- 116. asbestos
- 118. cadmium
- 119. chromium
- 120. copper
- 122. lead
- 124. nickel
- 125. selenium
- 127. thallium
- 128. zinc

Chlorobenzene was detected in three of 17 samples, with two of the concentrations above the 0.025 mg/l concentration considered attainable with the identified treatment technology. The values detected above treatability were 1.00 and 0.034 mg/l. Both of these values are from the same waste stream and represent two of the six samples analyzed from solvent extraction raffinate.

1,2,4-Trichloroethylene was detected in two of eight samples, with one of the values above the 0.01 mg/l concentration considered attainable with the identified treatment technology. The

value detected above treatability was 0.051 mg/l. Both samples in which 1,2,4-trichloroethylene was detected are from solvent extraction raffinate. Since the waste stream is from a solvent extraction process using an organic solvent, and 1,2,4-trichloroethylene was found above a treatable concentration, it is selected for further consideration for limitation.

1,2-Dichloroethane was detected in 11 of 17 samples, with two of the concentrations above the 0.1 mg/l concentration considered attainable with the identified treatment technology. The values detected above the quantification concentration ranged from 0.016 mg/l to 0.156 mg/l. 1,2-Dichloroethane was detected above quantification in five different process waste streams representing two different plants. Therefore, 1,2-dichloroethane is not site-specific, and it is considered for further limitation.

Ethylbenzene was detected in six of 17 samples, with one of the concentrations above the 0.05 mg/l concentration considered attainable with the identified treatment technology. The values detected above the quantification concentration ranged from 0.04 mg/l to 0.057 mg/l. Ethylbenzene was detected in five different process waste streams representing two plants. Therefore, ethylbenzene is considered for further limitation.

Chlorodibromomethane was detected in five of 17 samples, with one of the concentrations above the 0.10 mg/l concentration considered attainable with the identified treatment technology. The values detected above the quantification concentration ranged from 0.02 to 7.08 mg/l. The detection of chlorodibromomethane was not site-specific as it was detected in three different process wastewater streams representing two plants. Therefore, chlorodibromomethane is considered for further limitation.

Trichloroethylene was detected in 13 of 17 samples, with one of the concentrations above the 0.01 mg/l concentration considered attainable with the identified treatment technology. Twelve of these samples were below the quantification concentration. The value detected above the treatable concentration was 0.235 mg/l. Trichloroethylene was detected in four different process waste streams representing two plants. Trichloroethylene cannot be considered site-specific and is therefore considered for further limitation.

Antimony was found in four of six samples analyzed; in all four of these, it was measured above its treatable concentration (0.047 mg/l) at concentrations ranging up to 30 mg/l. Therefore, antimony is selected for further consideration.

Arsenic was found in all six samples analyzed; three samples contained concentrations above its treatable concentration of 0.34 mg/l. Values were as high as 45 mg/l. Therefore, arsenic is selected for further consideration.

Analyses were made for asbestos at only one plant. The raw wastewater sample contained 980 million fibers per liter (MFL), while the plant influent contained less than 9 MFL. Since asbestos was detected and is above the treatable concentration of 10 MFL in the only sample analyzed, it is considered for further limitation.

Cadmium was detected in four of six samples, and was found above its treatable concentration of 0.049 mg/l. The concentration of cadmium in the sample was 40 mg/l. Cadmium, therefore, is selected for further consideration.

Five of six samples analyzed for chromium showed concentrations in excess of its treatable concentration (0.07 mg/l). Wastewater at one sampling site was found to contain 1,000 mg/l on each of three days sampled. Therefore, chromium is selected for further consideration.

Copper was found in all six samples analyzed, and occurred at concentrations above its treatable concentration of 0.39 mg/l in five of these. Values ranged from 0.8 to 300 mg/l. Therefore, copper is selected for further consideration.

Lead occurred far above its treatable concentration of 0.08 mg/l in five of six samples. Concentrations ranged from 1.0 to 1,000 mg/l. Lead, therefore, is selected for further consideration.

Eight out of 10 samples analyzed for nickel yielded values above the treatable concentration of 0.22 mg/l. The reported concentrations were generally around 0.5 mg/l, but ran as high as 10 mg/l. Therefore, nickel is selected for further consideration.

Selenium was found in three of six samples analyzed, all three above its treatable concentration (0.20 mg/l). Values were as high as 70 mg/l. Therefore, selenium is selected for further consideration.

Thallium was found above its treatable concentration of 0.34 mg/l in three of six samples, with concentrations of 0.83, 1.14, and 1.18 mg/l. Therefore, thallium is selected for further consideration.

Four of six samples analyzed contained zinc at concentrations above the treatability concentration of 0.23 mg/l. Values ranged from less than 400 mg/l to 1,000 mg/l. Zinc is thus selected for further consideration.

Table VI-1

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY COLUMBIUM-TANTALUM 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 Treat- able Concen- tration	Detected Above Treat- able Concen- tration
1. acenaphthene	0.010	0.010	6	8	7			1
2. acrolein	0.010	0.100	6	17	17			
3. acrylonitrile	0.010	0.01	6	17	17			
4. benzene	0.010	0.05 - 0.10	6	17	8	8	1	
5. benzidine	0.010	0.01	6	8	8			
6. carbon tetrachloride	0.010	0.05	6	17	14	1	1	1
7. chlorobenzene	0.010	0.025	6	17	14	1		2
8. 1,2,4-trichlorobenzene	0.010	0.01	6	8	6	1		1
9. hexachlorobenzene	0.010	0.01	6	8	8			
10. 1,2-dichloroethane	0.010	0.1	6	17	6	1	8	2
11. 1,1,1-trichloroethane	0.010	0.01	6	17	13	2		2
12. hexachloroethane	0.010	0.01	6	8	7			1
13. 1,1-dichloroethane	0.010	0.01	6	17	17			
14. 1,1,2-trichloroethane	0.010	0.1	6	17	15	2		
15. 1,1,2,2-tetrachloroethane	0.010	0.05	6	17	15	2		
16. chloroethane	0.010	0.01	6	17	17			
17. bis(chloromethyl) ether	0.010	0.01	6	17	17			
18. bis(2-chloroethyl) ether	0.010	0.01	6	8	8			
19. 2-chloroethyl vinyl ether	0.010	0.01	6	17	17			
20. 2-chloronaphthalene	0.010	0.01	6	8	7	1		
21. 2,4,6-trichlorophenol	0.010	0.025	2	4	4			
22. parachlorometa cresol	0.010	0.05	2	4	4			
23. chloroform	0.010	0.1	6	17	5	2	5	5
24. 2-chlorophenol	0.010	0.05	2	4	4			
25. 1,2-dichlorobenzene	0.010	0.05	6	8	8			
26. 1,3-dichlorobenzene	0.010	0.01	6	8	8			
27. 1,4-dichlorobenzene	0.010	0.01	6	8	8			
28. 3,3'-dichlorobenzidine	0.010	0.01	6	8	8			
29. 1,1-dichloroethylene	0.010	0.1	6	17	17			
30. 1,2-trans-dichloroethylene	0.010	0.1	6	17	14		1	2
31. 2,4-dichlorophenol	0.010	0.01	2	4	4			
32. 1,2-dichloropropane	0.010	0.01	6	17	17			
33. 1,3-dichloropropylene	0.010	0.01	6	17	17			
34. 2,4-dimethylphenol	0.010	0.05	2	4	4			
35. 2,4-dinitrotoluene	0.010	0.05	6	8	7	1		
36. 2,6-dinitrotoluene	0.010	0.05	6	8	7	1		
37. 1,2-diphenylhydrazine	0.010	0.05	6	8	8			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
38. ethylbenzene	0.010	0.05	6	17	11	1	4	1
39. fluoranthene	0.010	0.01	6	8	8	1		
40. 4-chlorophenyl phenyl ether	0.010	0.01	6	8	8			
41. 4-bromophenyl phenyl ether	0.010	0.01	6	8	8			
42. bis(2-chloroisopropyl) ether	0.010	0.01	6	8	8			
43. bis(2-chloroethoxy) methane	0.010	0.01	6	8	8			
44. methylene chloride	0.010	0.10	6	17	16			1
45. methyl chloride	0.010	0.01	6	17	17			
46. methyl bromide	0.010	0.01	6	17	17			
47. bromoform	0.010	0.05	6	17	14	1	1	1
48. dichlorobromomethane	0.010	0.10	6	17	14		1	
49. trichlorofluoromethane	0.010	0.01	6	17	17			
50. dichlorodifluoromethane	0.010	0.01	6	17	17			
51. chlorodibromomethane	0.010	0.10	6	17	12	3	1	1
52. hexachlorobutadiene	0.010	0.01	6	8	8			
53. hexachlorocyclopentadiene	0.010	0.01	6	8	8			
54. isophorone	0.010	0.05	6	8	6	1	1	
55. naphthalene	0.010	0.05	6	8	8			
56. nitrobenzene	0.010	0.05	6	8	7			1
57. 2-nitrophenol	0.010	0.01	2	4	4			
58. 4-nitrophenol	0.010	0.05	2	4	4			
59. 2,4-dinitrophenol	0.010	0.025	2	4	4			
60. 4,6-dinitro-o-cresol	0.010	0.025	2	4	4			
61. N-nitrosodimethylamine	0.010	0.01	6	8	8			
62. N-nitrosodiphenylamine	0.010	0.01	6	8	8			
63. N-nitrosodi-n-propylamine	0.010	0.01	6	8	8			
64. pentachlorophenol	0.010	0.01	2	4	4			
65. phenol	0.010	0.05	2	4	4			
66. bis(2-ethylhexyl) phthalate	0.010	0.01	6	8	1	1		6
67. butyl benzyl phthalate	0.010	0.001 - 0.01	6	8	7	1		
68. di-n-butyl phthalate	0.010	0.025	6	8	3	2	1	2
69. di-n-octyl phthalate	0.010	0.01	6	8	8			
70. diethyl phthalate	0.010	0.025	6	8	4	3	1	
71. dimethyl phthalate	0.010	0.025	6	8	5	1	1	1
72. benzo(a)anthracene	0.010	0.01	6	8	8			
73. benzo(a)pyrene	0.010	0.01	6	8	8	1		
74. 3,4-benzofluoranthene	0.010	0.01	6	8	8			



Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY COLUMBIUM-TANTALUM 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 Treat- able Concen- tration	Detected Above Treat- able Concen- tration
75. benzo(k)fluoranthene	0.010	0.01	6	8	8			
76. chrysene	0.010	0.001	6	8	8			
77. acenaphthylene	0.010	0.01	6	8	8			
78. anthracene (c)	0.010	0.01	6	8	7	1		
79. benzo(ghi)perylene	0.010	0.01	6	8	8			
80. fluorene	0.010	0.01	6	8	8			
81. phenanthrene (c)	0.010							
82. dibenzo(a,h)anthracene	0.010	0.01	6	8	8			
83. indeno(1,2,3-cd)pyrene	0.010	0.01	6	8	8			
84. pyrene	0.010	0.001 - 0.01	6	8	8			
85. tetrachloroethylene	0.010	0.05	6	17	14	2		1
86. toluene	0.010	0.05	6	17	17			
87. trichloroethylene	0.010	0.01	6	17	4	12		1
88. vinyl chloride	0.010	0.01	6	17	17			
89. aldrin	0.005	0.001	5	7	7			
90. dieldrin	0.005	0.01	5	7	7			
91. chlordane	0.005	0.01	5	7	7			
92. 4,4'-DDT	0.005	0.01	5	7	7			
93. 4,4'-DDE	0.005	0.01	5	7	7			
94. 4,4'-DDD	0.005	0.01	5	7	7			
95. alpha-endosulfan	0.005	0.001	5	7	7			
96. beta-endosulfan	0.005	0.01	5	7	7			
97. endosulfan sulfate	0.005	0.01	5	7	7			
98. endrin	0.005	0.01	5	7	7			
99. endrin aldehyde	0.005	0.01	5	7	7			
100. heptachlor	0.005	0.01	5	7	7			
101. heptachlor epoxide	0.005	0.01	5	7	7			
102. alpha-BHC	0.005	0.01	5	7	7			
103. beta-BHC	0.005	0.01	5	7	7			
104. gamma-BHC	0.005	0.01	5	7	7			
105. delta-BHC	0.005	0.01	5	7	7			
106. PCB-1242 (d)	0.005	0.001	5	7	1	5		1
107. PCB-1254 (d)	0.005							
108. PCB-1221 (d)	0.005							
109. PCB-1232 (e)	0.005	0.001	5	7	1	5		1
110. PCB-1248 (e)	0.005							
111. PCB-1260 (e)	0.005							
112. PCB-1016 (e)	0.005							

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
PRIMARY COLUMBIUM-TANTALUM 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 Treat- able Concen- tration	Detected Above Treat- able Concen- tration
113. toxaphene	0.005	0.01	5	7	2	5		
114. antimony	0.100	0.47	5	7	2			5
115. arsenic	0.010	0.34	4	7			4	3
116. asbestos	10 MFL	10 MFL	1	1				1
117. beryllium	0.010	0.20	4	7	2	3	2	
118. cadmium	0.002	0.049	4	7	3	3		1
119. chromium	0.005	0.07	4	7	2			5
120. copper	0.009	0.39	4	7	1		1	5
121. cyanide (f)	0.02	0.047	4	14		14		
122. lead	0.020	0.08	4	7	1			6
123. mercury	0.0001	0.036	4	7	1		5	1
124. nickel	0.005	0.22	4	7	4			3
125. selenium	0.01	0.20	4	7	3		1	3
126. silver	0.02	0.07	4	7	5		2	
127. thallium	0.100	0.34	4	7	4			3
128. zinc	0.050	0.23	4	7	2			5
129. 2,3,7,8-tetrachlorodibenzo- p-dioxin (TCDD)	Not Analyzed							

(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.

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION VII

#### CONTROL AND TREATMENT TECHNOLOGIES

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

#### CURRENT CONTROL AND TREATMENT PRACTICES

Control and treatment technologies are discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability to wastewater similar to that found in this subcategory are presented there. This section presents a summary of the control and treatment technologies that are currently applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the primary columbium-tantalum subcategory is characterized by the presence of the toxic metal pollutants, ammonia, 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, so these waste streams are commonly combined for treatment to reduce the concentrations of these pollutants. 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, three have lime precipitation and sedimentation, and one has lime precipitation, sedimentation and filtration. As such, six options have been selected for consideration for BPT, BAT, BDT, BCT, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

#### CONCENTRATE DIGESTION WET AIR POLLUTION CONTROL

All three plants which practice digestion use hydrofluoric acid to leach the columbium and tantalum ore concentrates. The leachate goes to solvent extraction. Wet scrubbers are used at all three plants, two with recycle (7 and 86 percent) and a bleed stream, and one with once-through water usage. Wet scrubbers are necessary due to the acidic nature of the emissions and the presence of gaseous fluoride. The scrubber liquor has treatable concentrations of suspended solids, fluoride and metals. One

plant also reports a gangue slurry of unreacted ore which has similar concentrations. The addition of alkali is used in all cases to reduce these high concentrations. Existing wastewater treatment schemes for this waste stream are as follows:

1. Lime addition and sedimentation (partial recycle);
2. Lime addition, sedimentation, and filtration (no recycle); and
3. Equalization pond (no recycle).

#### SOLVENT EXTRACTION RAFFINATE

After methyl isobutyl ketone extraction the barren raffinate must be treated. One plant of the three plants with this wastewater recycles a portion of the raffinate to the leaching process to utilize the acidic nature of this waste stream. The raffinate has characteristics similar to the concentrate digestion scrubber liquor. This stream is treated as follows:

1. Lime addition and sedimentation (partial recycle);
2. Lime addition, sedimentation, and filtration (no recycle); and
3. Neutralization and equalization pond (no recycle).

#### SOLVENT EXTRACTION WET AIR POLLUTION CONTROL

This waste stream is generated by wet air pollution control equipment located over the solvent extraction process. Two plants use wet scrubbers to control solvent extraction air emissions. One plant does not recycle the scrubber effluent; the other plant uses the same scrubber for solvent extraction and concentrate digestion, practicing 86 percent recycle. Waste characteristics are very similar to those found in the solvent extraction raffinate and concentrate digester scrubber waste streams; treatment similar to these two waste streams is indicated. Indeed, the established treatment techniques are identical:

1. Lime addition and sedimentation (partial recycle); and
2. Lime addition, sedimentation, and filtration (no recycle).

#### PRECIPITATION AND FILTRATION OF METAL SALT

The metal salts in the pregnant extraction solutions are precipitated either by oxide precipitation with ammonia or by potassium fluoride precipitation of potassium fluotantalate ( $K_2TaF_7$ ). The barren solutions must subsequently be treated. Three plants produce this wastewater; one is a once-through discharger. Two plants did not report their discharge practices. The wastewater

contains treatable concentrations of ammonia, fluoride, metals, and suspended solids. The following wastewater treatment schemes are practiced for this stream:

1. Ammonia stripping, lime addition, and sedimentation (partial recycle);
2. Ammonia stripping, lime addition, sedimentation, and filtration (no recycle); and
3. Neutralization and equalization pond (no recycle).

#### METAL SALT DRYING WET AIR POLLUTION CONTROL

Four of the five plants surveyed practice salt drying or calcining prior to further processing. Wet scrubbers are necessary to control fluoride emissions during this process. Three plants practice partial recycle, ranging from 67 to 93 percent. The fourth plant discharges without recycle. This wastewater contains treatable concentrations of ammonia when ammonia is used in precipitation. Precipitation with hydrofluoric acid results in wastewater containing treatable concentrations of fluoride. Suspended solids, metals are also present. The treatment schemes used to treat salt drying scrubber liquor by the four plants which practice salt drying are as follows:

1. Lime addition and sedimentation (partial recycle);
2. Ammonia stripping, lime addition, sedimentation, and filtration (no recycle);
3. Lime addition, caustic addition, polymer addition, and sedimentation (partial recycle); and
4. Neutralization and equalization pond (no recycle).

#### REDUCTION OF SALT TO METAL WASTEWATER

Four plants reduce columbium or tantalum salts to the metal. One plant practices aluminothermic reduction, which produces no wastewater. The other three plants practice sodium reduction. Leaching after sodium reduction, a common practice for tantalum production, is a major source of wastewater. After completion of the reduction reaction and subsequent cooling, the tantalum exists as small particles of metal in a matrix of potassium and sodium salts. The salts are removed by successive leaches in water and acid to produce a pure metal powder. The resulting wastewater contains fluoride at treatable concentrations, as well as toxic metals and oil and grease. The wastewater treatment schemes used for this waste stream are as follows:

1. Lime addition and sedimentation (partial recycle);
2. Lime addition, sedimentation, and filtration (no recycle); and
3. Caustic addition and centrifugation (no recycle).

## REDUCTION OF SALT TO METAL SCRUBBER

Wet scrubbers are used to control emissions during the reduction reaction. Two plants use wet scrubbers, neither practicing recycle of the scrubber liquor. This wastewater is similar in characteristic to the reduction wastewater. It contains toxic metals and fluoride and chloride in treatable concentrations. Treatment for the waste stream consists of:

1. Lime addition and sedimentation (partial recycle); and
2. Lime addition, sedimentation, and filtration (no recycle)

## CONSOLIDATION AND CASTING CONTACT COOLING

Four plants reported consolidation and casting operations. One plant generates no wastewater. Two plants use noncontact cooling water. The fourth plant generates contact cooling water but recycles 100 percent through a cooling tower. Therefore no wastewater is discharged for this waste stream.

## CONTROL AND TREATMENT OPTIONS

The Agency examined six control and treatment technology alternatives that are applicable to the primary columbium-tantalum subcategory. The options selected for evaluation represent a combination of in-process flow reduction, pretreatment technology applicable to individual waste streams, and end-of-pipe treatment technologies.

### OPTION A

Option A for the primary columbium-tantalum subcategory requires treatment technologies to reduce pollutant mass. The Option A treatment schemes consists of ammonia steam stripping preliminary treatment applied to the combined streams of precipitation and filtration of metal salts wastewater, solvent extraction air pollution scrubber wastewater, and concentrate digestion scrubber wastewater. Preliminary treatment is followed by lime precipitation and sedimentation applied to the combined stream of steam stripper effluent, solvent extraction raffinate wastewater, reduction of salt to metal wastewater and reduction of salt to metal air pollution scrubbing wastewater. Chemical precipitation is used to remove metals and fluoride by the addition of lime followed by gravity sedimentation. Suspended solids are also removed from the process.

#### OPTION B

Option B for the primary columbium-tantalum subcategory consists of all treatment requirements of Option A (ammonia steam stripping, lime precipitation, and sedimentation) plus control technologies to reduce the discharge of wastewater volume. Water recycle and reuse are the principal control mechanisms for flow reduction.

#### OPTION C

Option C for the primary columbium-tantalum subcategory consists of all control and treatment requirements of Option B (ammonia steam stripping, in-process flow reduction, lime precipitation, and sedimentation) plus multimedia filtration technology added at the end of the Option B 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.

#### OPTION D

Option D for the primary columbium-tantalum subcategory consists of Option C (ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration) with the addition of activated alumina technology at the end of the Option C treatment scheme. The activated alumina process is used to remove dissolved arsenic which remains after lime precipitation.

#### OPTION E

Option E for the primary columbium-tantalum subcategory consists of Option C (ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration) with the addition of granular activated carbon technology at the end of the Option C treatment scheme. The activated carbon process is utilized to control the discharge of toxic organics.

#### OPTION F

Option F for the primary columbium-tantalum subcategory consists of Option C (ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration)

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION VIII

#### COSTS, ENERGY AND NONWATER QUALITY ASPECTS

This section describes the method used to develop the costs associated with the control and treatment technologies suggested in Section VII for wastewaters from primary columbium-tantalum plants. Cost curves are presented showing the total annual cost of each treatment and control technology as a function of wastewater flow rate. The energy consumption of each technology as well as solid waste and air pollution aspects are also discussed. A discussion concerning the costing methodology is contained in Section VIII of the General Development Document.

For costing purposes, the primary columbium-tantalum subcategory has been divided into two groups: ore to salt or metal and salt to metal. Costs are determined for each of the two types of plants currently in existence by using the annual cost curves developed for each of these two groups.

The ore to salt or metal group contains plants which have preliminary ammonia steam stripping followed by lime precipitation and sedimentation technology in place, and plants which do not have these technologies in place. Therefore, costs have been developed for each of those two combinations of wastewater treatment. Combination 1 represents the plants which practice preliminary ammonia steam stripping followed by lime precipitation and sedimentation technology. Combination 2 represents the plants which do not have preliminary ammonia steam stripping followed by lime precipitation and sedimentation technology in place. Each combination consists of the following wastewaters:

1. Concentrate digestion wet air pollution control wastewater,
2. Solvent extraction raffinate,
3. Solvent extraction wet air pollution control wastewater,
4. Precipitation and filtration of metal salt wastewater,
5. Metal salt drying wet air pollution control wastewater,
6. Reduction of salt to metal wastewater, and
7. Reduction of salt to metal wet air pollution control wastewater.

The salt to metal group contains the following wastewaters:

1. Metal salt drying wet air pollution control wastewater,
2. Reduction of salt to metal wastewater, and
3. Reduction of salt to metal wet air pollution control wastewater.



Ammonia steam stripping is not considered in the costs developed for the combined salt to metal group wastewaters since ammonia is not present in those waste streams.

#### TREATMENT OPTIONS COSTED FOR EXISTING SOURCES

Six control and treatment options are considered for treating wastewater from the primary columbium-tantalum subcategory. Cost estimates in the form of annual cost curves have been developed for each of the control and treatment options. The options are summarized below and presented schematically in Figures X-1 through X-6.

##### OPTION A

Option A for the primary columbium-tantalum subcategory consists of lime precipitation and sedimentation end-of-pipe technology, with ammonia steam stripping preliminary treatment for waste streams containing treatable concentrations of ammonia. Streams with treatable concentrations of ammonia include precipitation and filtration of metal salts wastewater, concentration digestion scrubber water, and solvent extraction scrubber water. Cost curves for Option A are not presented for the ore to salt or metal group combination 1 plants, since these plants already have Option A technology in place. Also, as mentioned previously, the cost curves for the salt to metal group do not consider ammonia steam stripping since ammonia is not present in this group's wastewaters. The curves for the ore to salt or metal group combination 2 plants assume that 11 percent of the wastewaters receive ammonia steam stripping preliminary treatment.

##### OPTION B

Option B for the primary columbium-tantalum subcategory requires control and treatment technologies to reduce the discharge of wastewater volume and pollutant mass. The recycle of metal salt drying scrubber water, concentrate digestion scrubber, and solvent extraction scrubber water through holding tanks is the control mechanism for flow reduction. The Option B treatment scheme consists of ammonia steam stripping preliminary treatment for streams containing treatable concentrations of ammonia, and end-of-pipe treatment technology consists of lime precipitation and sedimentation. The cost of Option B is the cost of holding tanks for the ore to salt or metal combination 1 plants. For the ore to salt or metal combination 2 plants and the salt to metal plants, holding tank costs are added to the Option A cost to determine the cost of Option B.

## OPTION C

Option C consists of all the control and treatment technologies of Option B (flow reduction, ammonia steam stripping, lime precipitation, and sedimentation) with the addition of multimedia filtration to the end-of-pipe treatment scheme. The holding tanks used for flow reduction are not included in the cost curves developed for Option C. Therefore, the total cost of Option C is determined by adding holding tank costs to the costs obtained from the Option C cost curves. For the ore to salt or metal combination 1 group plants, the cost curves for Option C and the options which follow represent the incremental cost associated with adding the various end-of-pipe technologies to existing treatment.

## OPTION D

Option D consists of all the control and treatment technologies of Option C (flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration) with the addition of activated alumina adsorption to the end-of-pipe treatment scheme. As with Option C, the total cost of Option D is determined by adding holding tank costs to the costs obtained from the Option D cost curves.

## OPTION E

Option E consists of all the control and treatment technologies of Option C (flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration) with the addition of activated carbon adsorption to the end-of-pipe treatment scheme. Holding tank costs must also be added to the costs obtained from the Option E cost curves to determine the total cost of Option E.

## OPTION F

Option F consists of all the control and treatment technologies of Option C (flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration) with the addition of reverse osmosis and multiple-effect evaporation followed by complete recycle to the end-of-pipe treatment scheme. The total cost of Option F is determined by adding holding tank costs to the costs obtained from the Option F cost curves.

The cost curves for the options summarized above are presented in the figures listed below. The respective options which the curves are based on are also shown.

<u>Group</u>	<u>Combination</u>	<u>Figure VIII-</u>	<u>Option Costed</u>
Ore to Salt or Metal	1	1 - 4	C, D, E, F
Ore to Salt or Metal	2	5 - 9	A, C, D, E, F
Salt to Metal	1	10 - 14	A, C, D, E, F

The holding tank cost curves are presented in Figure VIII-15.

#### 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 primary columbium-tantalum 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. Briefly, the energy usage of the various options is determined for the primary columbium-tantalum plant with the median wastewater flow. The energy usage of the options is then compared to the energy usage of the median primary columbium-tantalum energy consumption plant. As shown in Table VIII-1, the most energy intensive option is reverse osmosis, which increases the usage of the median primary columbium-tantalum energy consumption by 0.42 percent.

#### SOLID WASTE

Sludges associated with the primary columbium-tantalum subcategory will necessarily contain additional quantities (and concentrations) of toxic metal pollutants. 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). Consequently, sludges generated from treating primary industries' wastewater are not presently subject to regulation as hazardous wastes.

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), 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. For more details, see Section VIII of the General Development Document.

#### AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of chemical precipitation, sedimentation, multimedia filtration and reverse osmosis. These technologies transfer pollutants to solid waste and do not involve air stripping or any other physical process likely to transfer pollutants to air.

Table VIII-1

## ENERGY REQUIREMENTS

Median of Total Plant Energy Consumption (Btu/year)	Median Size Plant by Flow (gal/day)	ENERGY USAGE (Btu/year) AND PERCENT OF MEDIAN PLANT ENERGY CONSUMPTION					
		Option A		Option B		Option C	
		Usage	%	Usage	%	Usage	%
$2.115 \times 10^{11}$	59,000	$2.24 \times 10^8$	0.11	$2.24 \times 10^8$	0.11	$2.30 \times 10^8$	0.11
		Option D		Option E		Option F	
		Usage	%	Usage	%	Usage	%
		$2.37 \times 10^8$	0.11	$3.29 \times 10^8$	0.16	$8.96 \times 10^8$	0.42

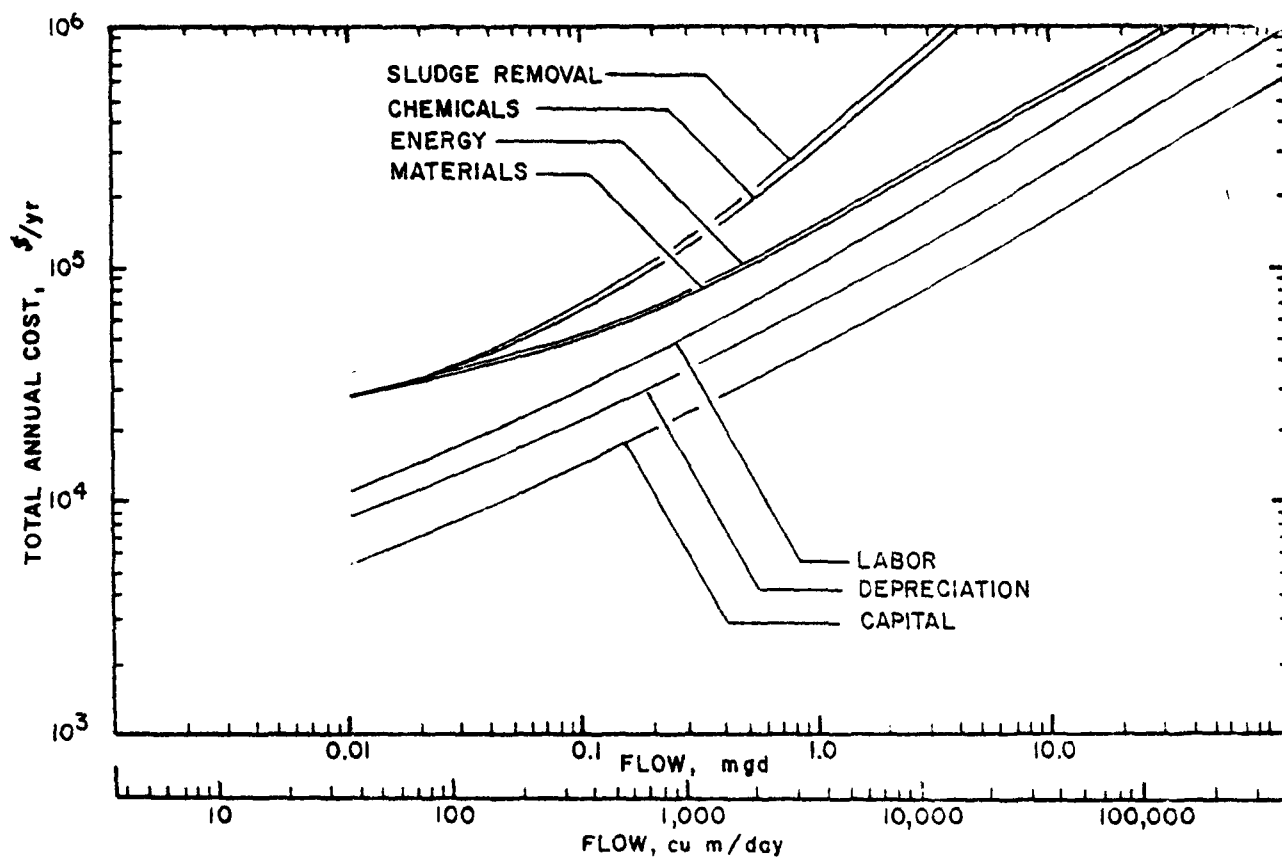


Figure VIII-1  
COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 1, OPTION C

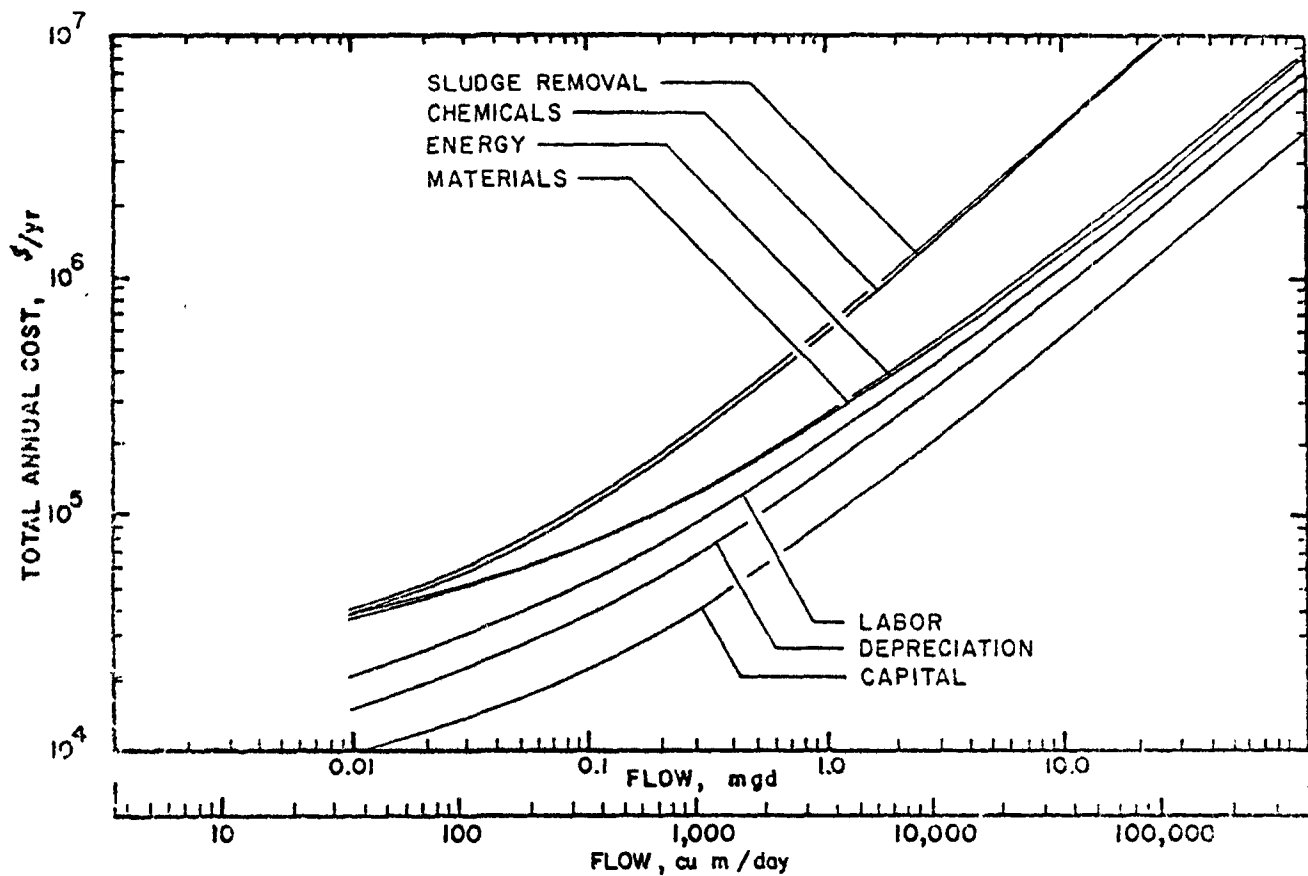


Figure VIII-2  
COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 1, OPTION D

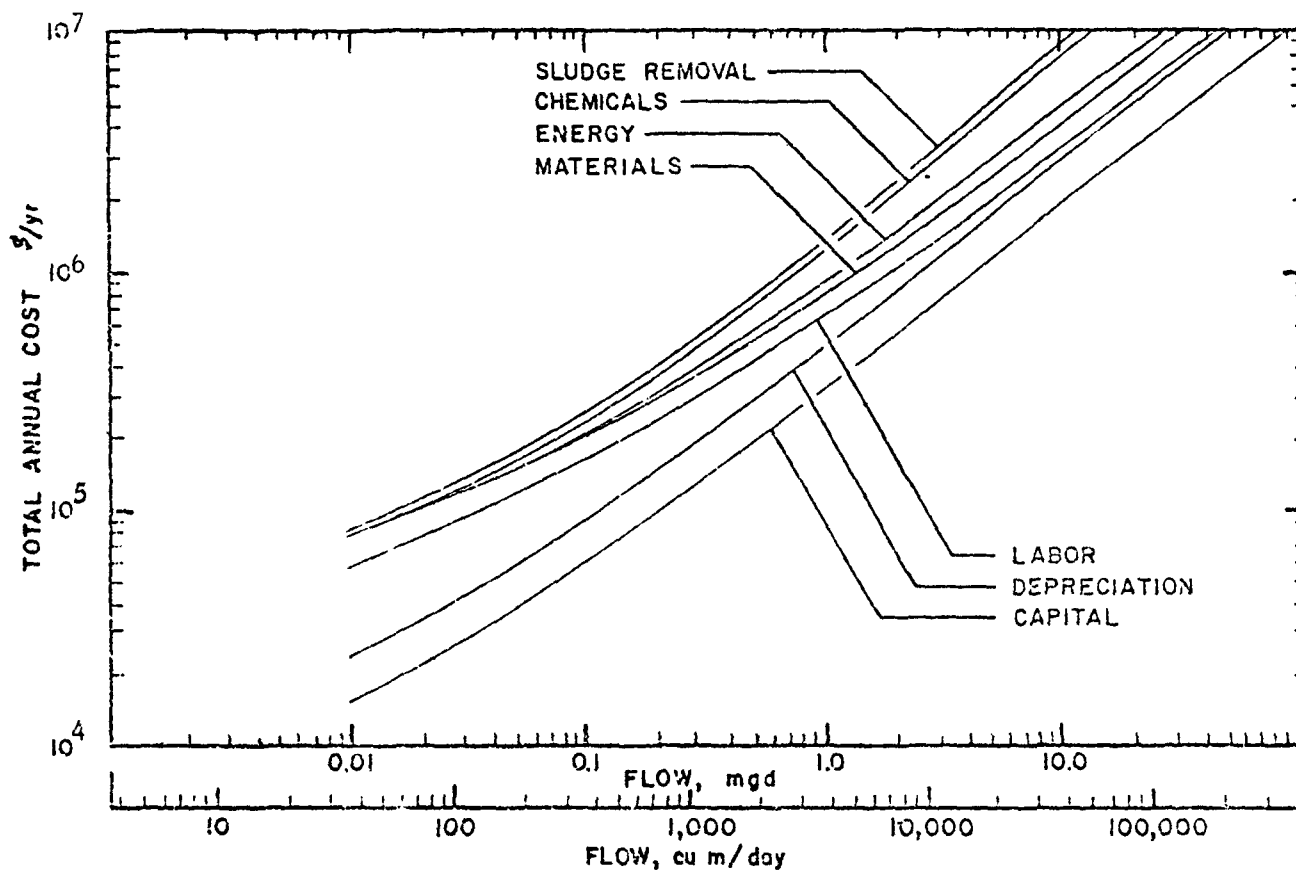


Figure VIII-3  
COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 1, OPTION E



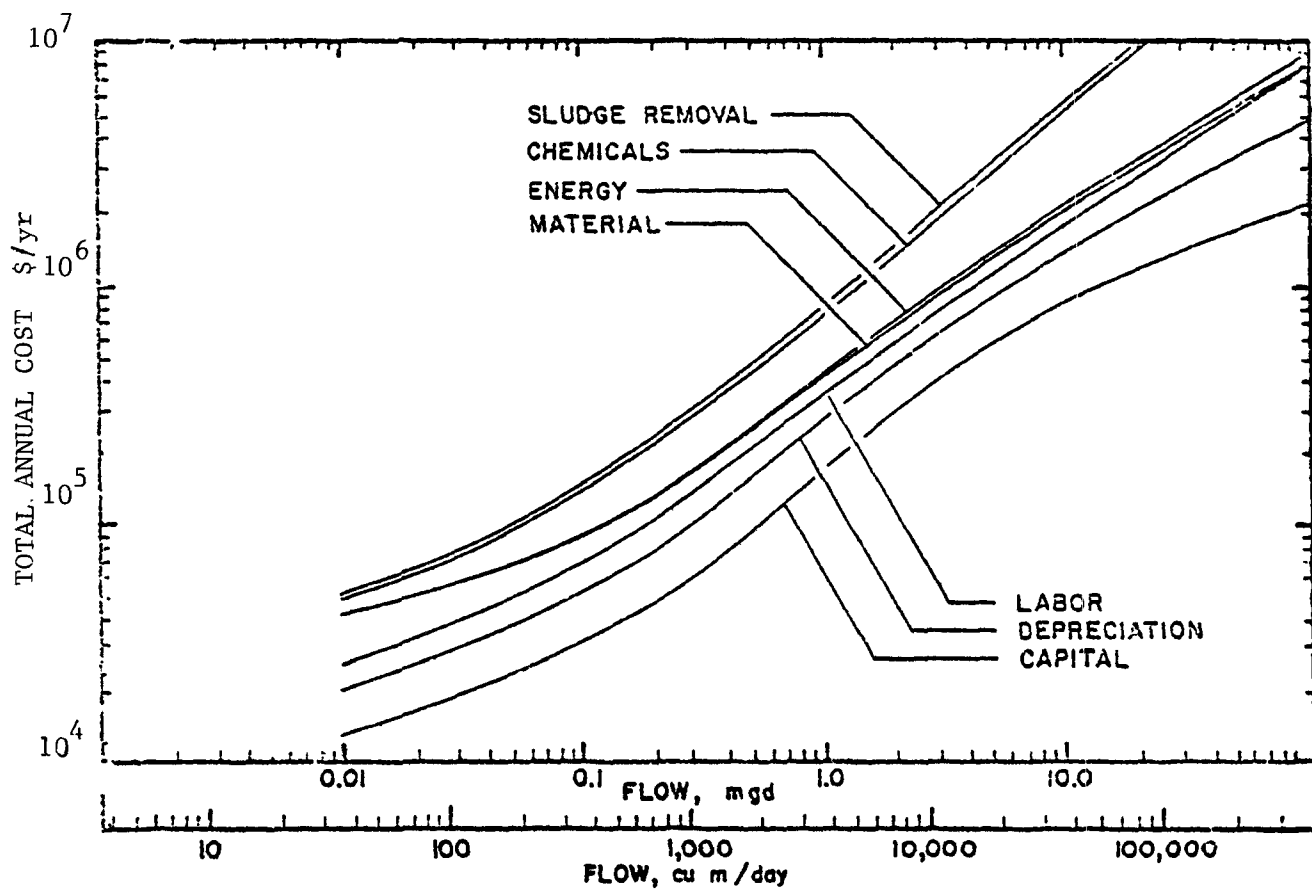


Figure VIII-4  
COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 1, OPTION F

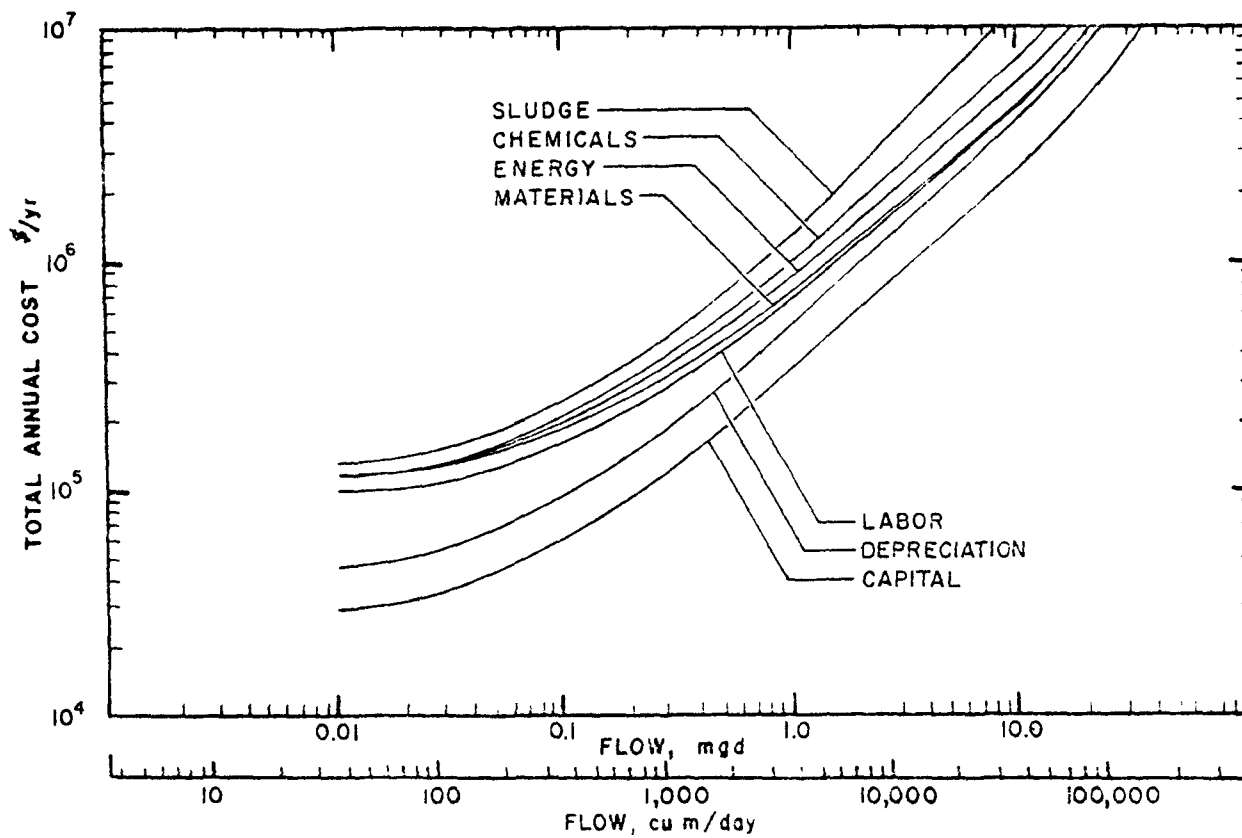


Figure VIII-5

COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 2, OPTION A

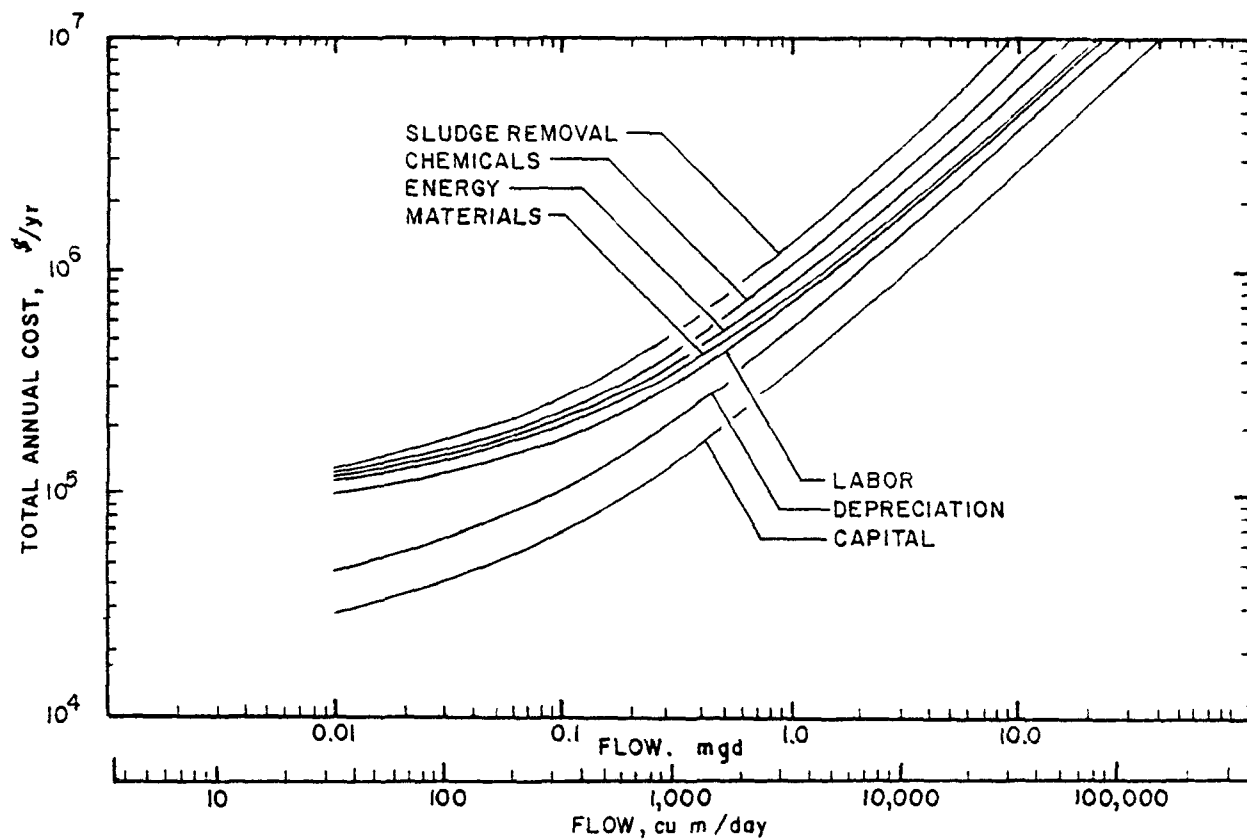


Figure VIII-6

COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 2, OPTION C

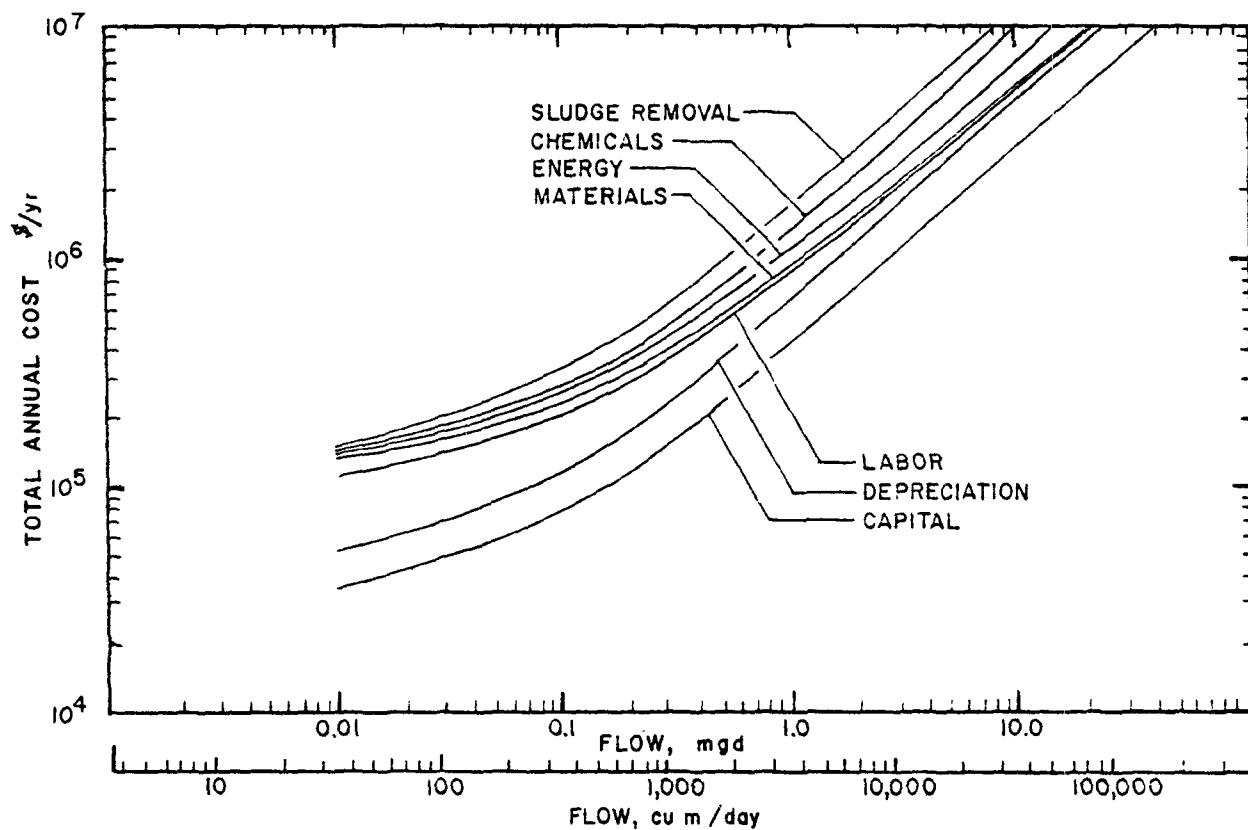


Figure VIII-7

COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 2, OPTION D

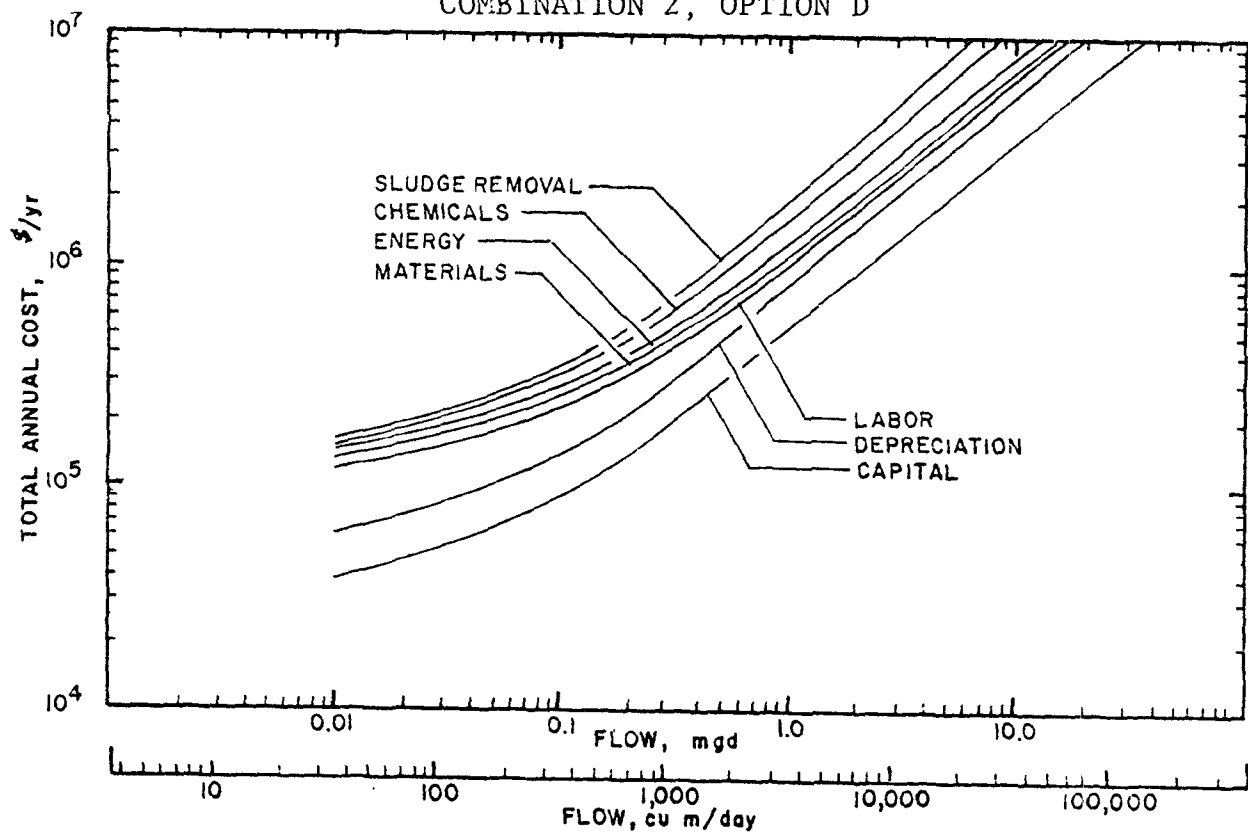


Figure VIII-8

COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 2, OPTION E

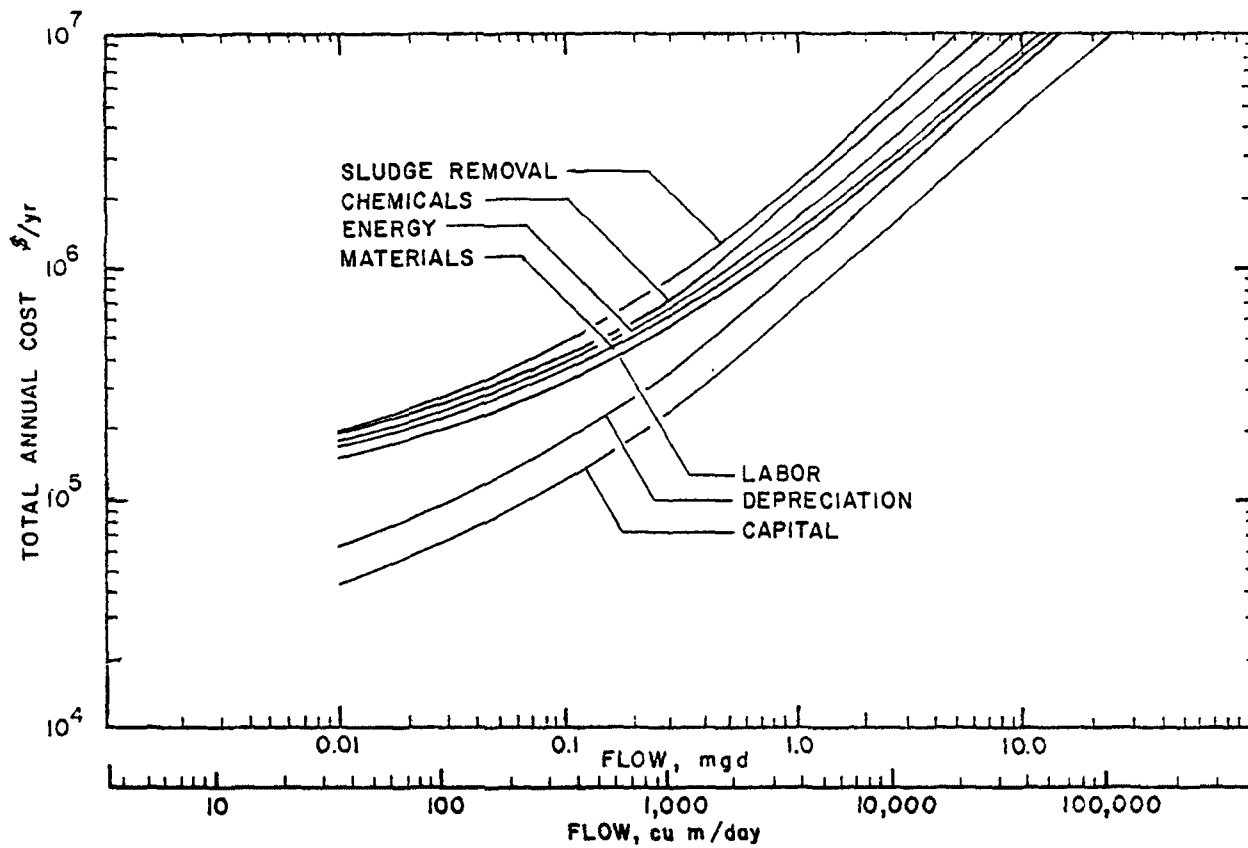


Figure VIII-9

COLUMBIUM-TANTALUM (ORE TO SALT/METAL)  
COMBINATION 2, OPTION F

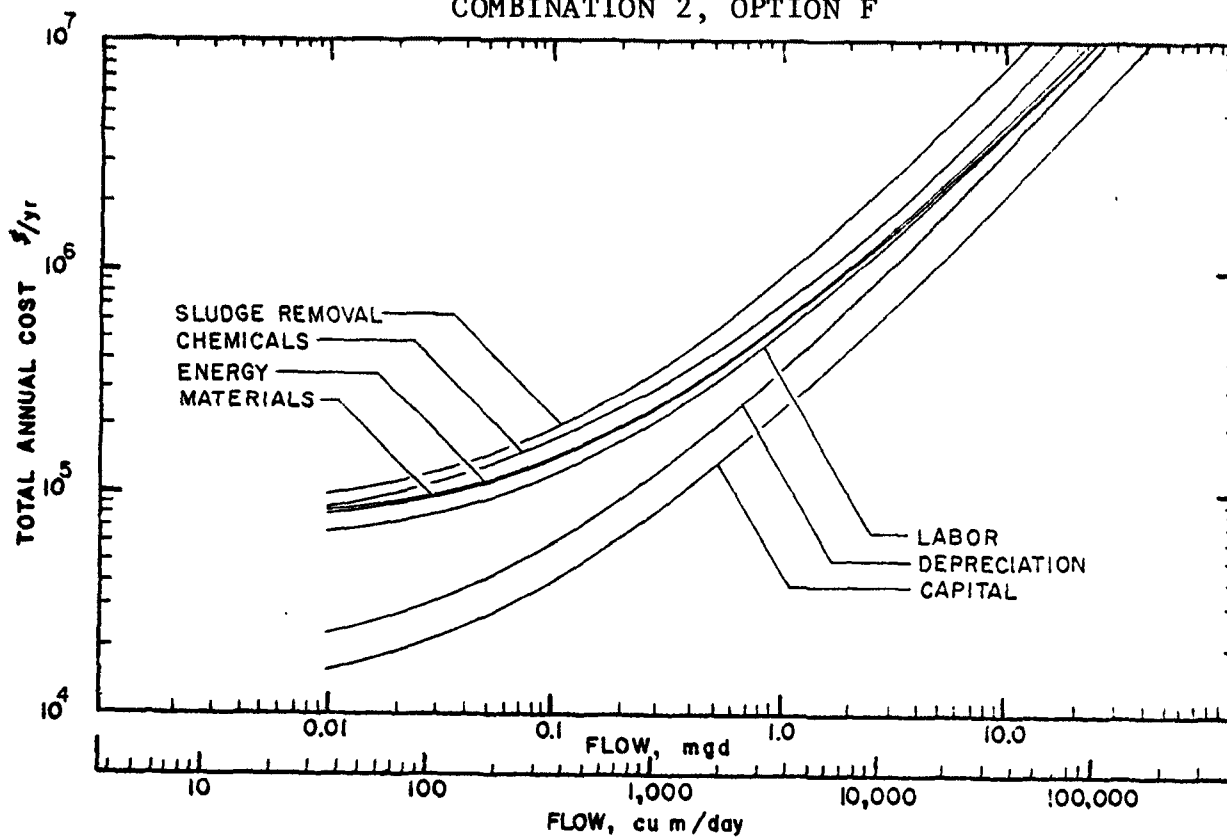


Figure VIII-10

COLUMBIUM-TANTALUM (SALT TO METAL)  
COMBINATION 1, OPTION A

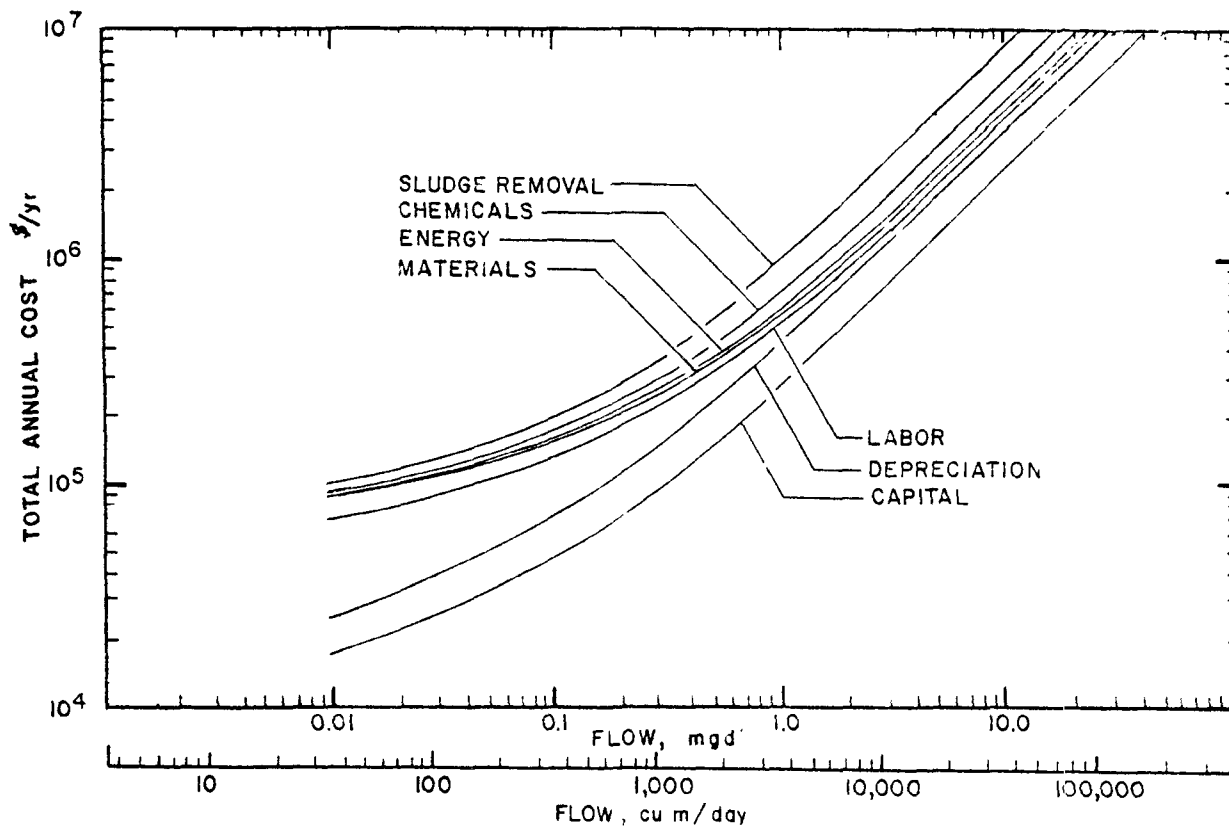


Figure VIII-11  
COLUMBIUM-TANTALUM (SALT TO METAL)  
COMBINATION 1, OPTION C

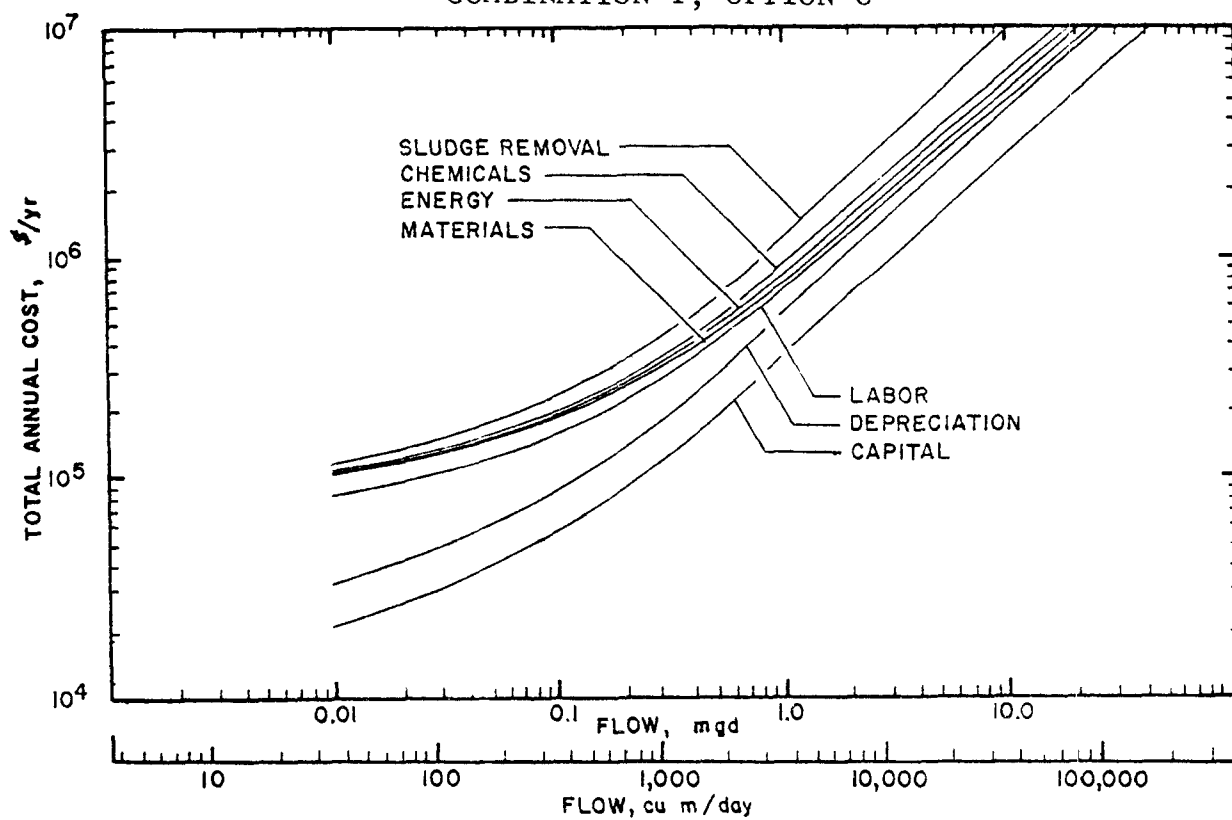


Figure VIII-12  
COLUMBIUM-TANTALUM (SALT TO METAL)  
COMBINATION 1, OPTION D

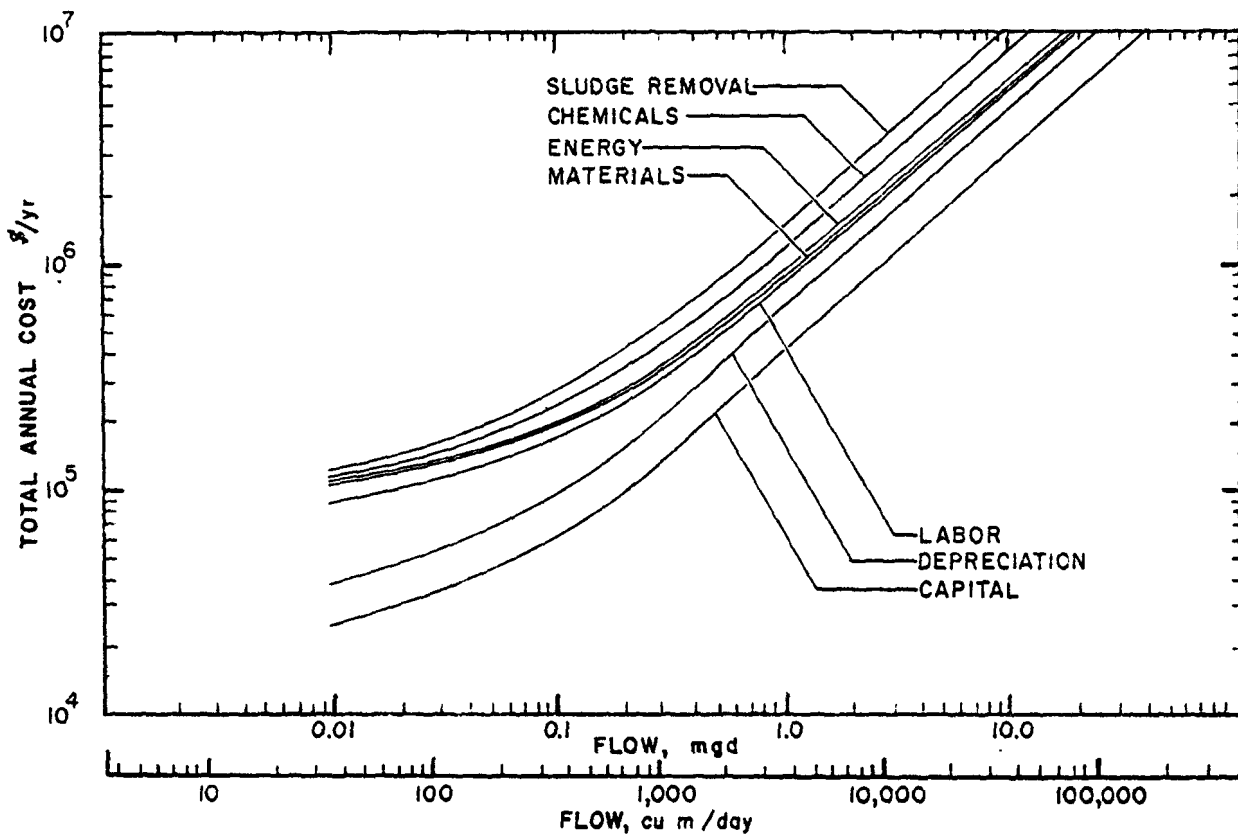


Figure VIII-13

COLUMBIUM-TANTALUM (SALT TO METAL)  
COMBINATION 1, OPTION E

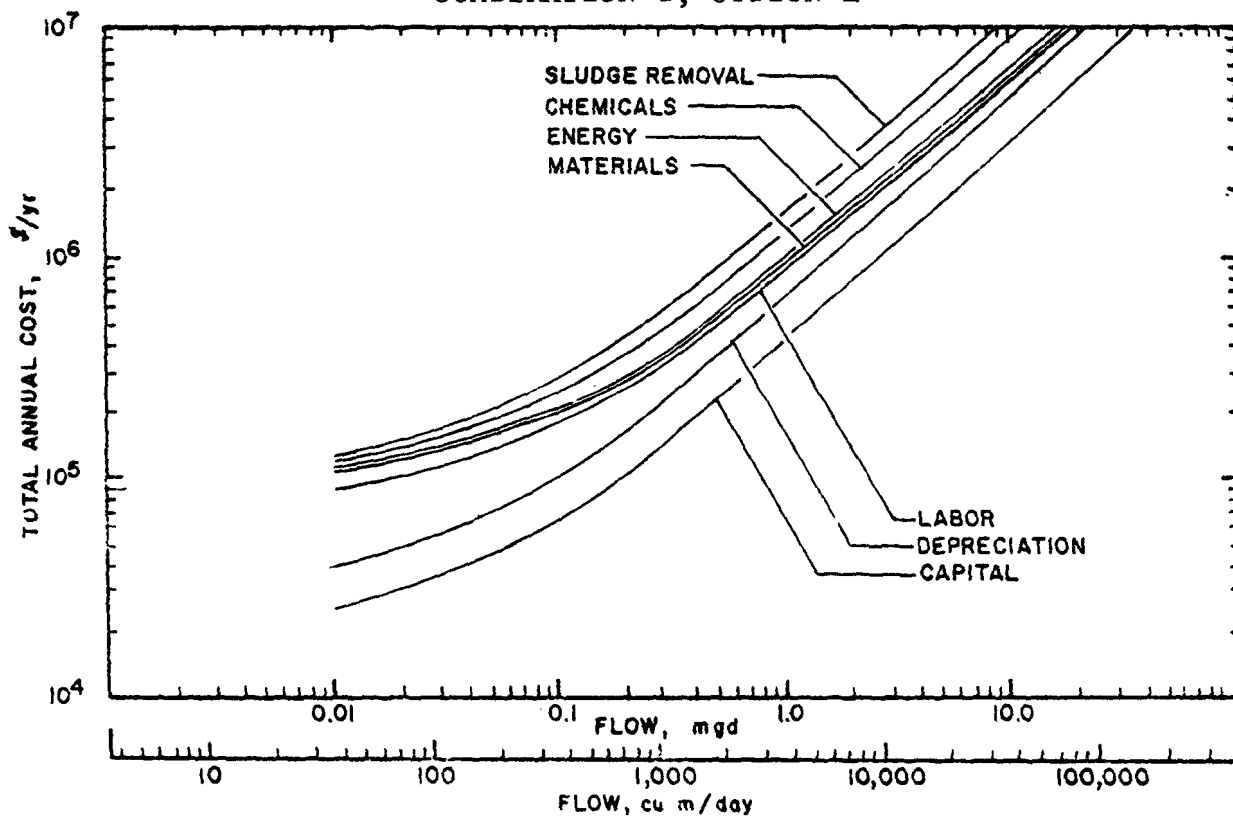


Figure VIII-14

COLUMBIUM-TANTALUM (SALT TO METAL)  
COMBINATION 1, OPTION F

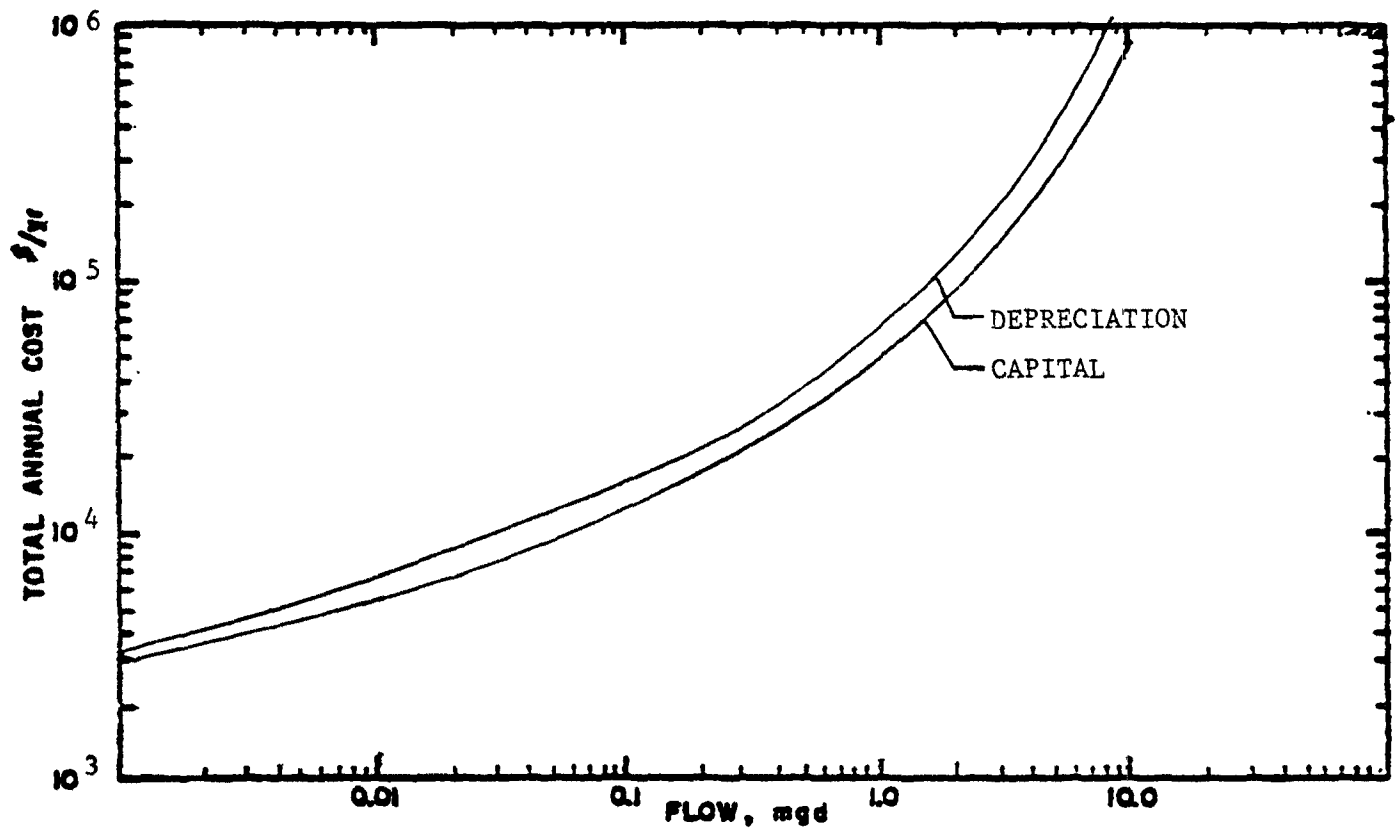


Figure VIII-15  
HOLDING TANK COSTS

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### 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), Section 301(b)(a)(A). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the primary columbium-tantalum 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 (see Tanner's Council of America v. Train, 540 F.2d 1188 (4th Cir. 1176)). 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. Some of the factors which must be considered in establishing effluent limitations based on BPT have already been discussed. The age of equipment and facilities, processes used, and raw materials were taken into account in subcategorization and subdivision and are discussed fully in Section IV. Nonwater quality impacts and energy requirements are considered in Section VIII.



As explained in Section IV, the primary columbium-tantalum subcategory has been subdivided into eight 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 eight subdivisions.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations. To account for production and flow variability from plant to plant, 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 (1) whether or not operations included generated wastewater, (2) specific flow rates generated, and (3) the specific production normalized flows for each process. 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.

Normalized flows were analyzed to determine which flow was 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 normalized 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.

For the development of effluent limitations, mass loadings were calculated 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 unit - mg/kg) were calculated by multiplying the BPT normalized flow (l/kg) by the concentration achievable using the BPT treatment system (mg/l) for each pollutant parameter to be limited under BPT.

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 columbium-tantalum 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/kg) 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.

BPT effluent limitations are based on the average of the discharge flow rates for each source; consequently, the treatment technologies which are currently used by the lowest dischargers will be the treatment technologies most likely required to meet BPT effluent limitations. Section VII discusses the various treatment technologies which are currently in place for each wastewater source. In most cases, the current 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 added to streams with treatable concentrations of ammonia.

The overall effectiveness of end-of-pipe treatment for the removal of wastewater pollutants is improved by the application of water flow controls within the process to limit the volume of wastewater requiring treatment. The controls or in-process technologies recommended under BPT include only those measures which are commonly practiced within the subcategory and which reduce flows to meet the production normalized flow for each operation.

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.

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

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 BPT. See Weyerhaeuser Company v. Costle, 590 F. 2d 1011 (D.C. Cir. 1978).

The methodology for calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Table X-2 shows the estimated pollutant reduction benefits for each treatment option for direct dischargers. Compliance costs are presented in Table X-3.

#### BPT OPTION SELECTION

The BPT selected consists of chemical precipitation and sedimentation (lime and settle technology) with ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia. The best practicable technology is presented in Figure IX-1. The BPT treatment is equivalent to Option A described in Section VII.

Ammonia steam stripping is demonstrated in the nonferrous metals manufacturing category and at two primary columbium-tantalum facilities. 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 generally 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 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 columbium-tantalum subcategory contained ammonia concentrations of 53.1, 496.1, 25,700, 18,500, and 16,900 mg/l. These latter three concentrations represent three days of sampling from a metal salt drying scrubber. Although these concentrations are much larger than the data used to develop the ammonia steam stripping performance values, the Agency believes that these performance values are still achievable.

## 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 concentration 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 eight 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 intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNP's, are 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.

### CONCENTRATE DIGESTION WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for concentrate digestion wet air pollution control is 10,915 l/kg (2,618 gal/ton) of columbium-tantalum salt produced from digestion. This rate is allocated only for plants practicing wet air pollution control for concentrate digestion. Three plants reported wastewater discharges from concentrate digestion wet air pollution control, but dcp information provided by one plant was insufficient to calculate a discharge rate. Therefore, the BPT discharge rate is based on the average of two plants which discharge 8,692.4 and 13,135.5 l/kg (2,084.5 and 3,150 gal/ton). Water use and discharge rates are presented in Table V-1.

### SOLVENT EXTRACTION RAFFINATE

The BPT wastewater discharge rate for solvent extraction raffinate is 26,916 l/kg (6,470.4 gal/ton) of columbium or tantalum salt extracted. This rate is based on the average discharge rate of two plants, which discharge 19,268 and 34,694 l/kg (4,620 and 8,320 gal/ton). A third plant reported insufficient data to calculate a discharge rate. Water use and discharge rates are presented in Table V-3.

### SOLVENT EXTRACTION WET AIR POLLUTION CONTROL

The BPT discharge rate for solvent extraction wet air pollution control is 4,301 l/kg (1,034 gal/ton) of columbium or tantalum salt extracted. This rate is allocated only for plants practicing wet air pollution control for solvent extraction. Two plants reported this wastewater, however, one plant uses the same scrubber for both solvent extraction and concentrate digestion wet air pollution control. This plant should not receive a discharge

allowance for solvent extraction wet air pollution control because the entire flow for this scrubber was allocated to concentrate digestion scrubbing and would result in double counting. The BPT discharge rate is based on the discharge rate of the single plant which will receive an allowance for solvent extraction wet air pollution control. Water use and discharge rates are presented in Table V-5.

#### PRECIPITATION AND FILTRATION OF METAL SALTS

The BPT wastewater discharge rate for precipitation and filtration waste streams is 247,223 l/kg (59,428 gal/ton) of columbium or tantalum salt precipitated. Three plants reported producing this waste stream. The BPT discharge rate is based on the discharge rate of one of the plants. The two other plants reported insufficient data to calculate a discharge rate. Water use and discharge rates are presented in Table V-7.

#### METAL SALT DRYING WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for metal salt drying wet air pollution control is 83,643 l/kg (20,106 gal/ton) of columbium or tantalum salt dried. This rate is allocated only for plants practicing wet air pollution control for metal salt drying emissions. Four plants discharge a metal salt drying wet air pollution control waste stream. Two plants discharging this waste stream reported sufficient dcp information to calculate a discharge rate. The two plants generate 11,563 and 156,125 l/kg (2,773 and 37,440 gal/ton) respectively, of metal salt drying wet air pollution wastewater. The BPT discharge is the average discharge rate of these two plants. Water use and discharge rates are presented in Table V-9.

#### REDUCTION OF SALT TO METAL

The BPT wastewater discharge rate for reduction of salt to metal is 352,663 l/kg (84,775 gal/ton) of columbium or tantalum reduced. This rate is based on the average discharge rate of two plants, which discharge 170,740 and 536,282 l/kg (40,945 and 128,605 gal/ton). A third plant reported insufficient dcp information to calculate a discharge rate. Water use and discharge rates are presented in Table V-11.

#### REDUCTION OF SALT TO METAL WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for reduction of salt to metal wet air pollution control is 21,521 l/kg (5,173 gal/ton) of columbium or tantalum reduced. This rate is allocated only for those plants practicing wet air pollution control for reduction emissions. The BPT discharge rate is based on the average discharge rate of the two plants reporting this wastewater. The two

plants generate 2,168 and 40,978 l/kg (520 and 9,827 gal/ton) respectively, of this wastewater. Water use and discharge rates are presented in Table V-12.

#### CONSOLIDATION AND CASTING CONTACT COOLING

No BPT wastewater discharge allowance is provided for consolidation and casting contact cooling. Only one plant in this subcategory reported a consolidation and casting contact cooling waste stream. This plant does not discharge this wastewater. BPT is based on this plant.

#### 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 and are listed below:

- 122. lead
- 128. zinc
- ammonia
- fluoride
- total suspended solids
- pH

#### EFFLUENT LIMITATIONS

The treatability concentrations achievable by application of the proposed BPT treatment are explained in Section VII of General Development Document and summarized there in Table VII-19. The achievable treatment 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 metric ton of product represent the BPT effluent limitations and are presented in Table IX-2 for each individual waste stream.

Table IX-1

## BPT WASTEWATER DISCHARGE RATES FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

<u>Wastewater Stream</u>	<u>BPT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kgg</u>	<u>gal/ton</u>	
Concentrate Digestion Wet Air Pollution Control	10,915	2,618	Columbium-Tantalum Salt Produced from Digestion
Solvent Extraction Raffinate	26,916	6,470	Columbium or Tantalum Salt Extracted
Solvent Extraction Wet Air Pollution Control	4,301	1,034	Columbium or Tantalum Salt Extracted
Precipitation and Filtration Wastewater	247,223	59,428	Columbium or Tantalum Salt Precipitated
Metal Salt Drying Wet Air Pollution Control	83,643	20,106	Columbium or Tantalum Salt Dried
Reduction of Salt to Metal	352,663	84,775	Columbium or Tantalum Reduced
Reduction of Salt to Metal Wet Air Pollution Control	21,521	5,173	Columbium or Tantalum Reduced
Consolidation and Casting Contact Cooling	0	0	Columbium or Tantalum Cast or Consolidated

Table IX-2

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Concentrate Digestion Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium-tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium-tantalum salt produced from digestion		
Lead	1,637.25	1,418.95
Zinc	14,516.95	6,112.40
Ammonia (as N)	1,451,695.0	639,619.0
Fluoride	649,442.50	288,156.0
Total Suspended Solids	447,515.0	218,300.0
pH	Within the range of 7.5 to 10.0 at all times	

Solvent Extraction Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	4,037.40	3,499.08
Zinc	35,798.28	15,072.96
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,601,502.0	710,582.40
Total Suspended Solids	1,103,556.0	538,320.0
pH	Within the range of 7.5 to 10.0 at all times	



Table IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Solvent Extraction Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	645.21	559.18
Zinc	5,720.86	2,408.78
Ammonia (as N)	572,086.20	252,062.04
Fluoride	255,933.30	113,556.96
Total Suspended Solids	176,357.40	86,028.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Metal Salts

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	37,083.45	32,138.99
Zinc	328,806.59	138,444.88
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	14,709,768.50	6,526,687.20
Total Suspended Solids	10,136,143.0	4,944,460.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORYMetal Salt Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	12,546.45	10,873.59
Zinc	111,245.19	46,840.08
Ammonia (as N)	11,124,519.0	4,901,479.80
Fluoride	4,976,758.50	2,208,175.20
Total Suspended Solids	3,429,363.0	1,672,860.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction of Salt to Metal

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	52,899.45	45,846.19
Zinc	469,041.79	197,491.28
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	20,983,448.50	9,310,303.20
Total Suspended Solids	14,459,183.0	7,053,260.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

BPT EFFLUENT LIMITATIONS FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Reduction of Salt to Metal Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	3,228.15	2,797.73
Zinc	28,622.93	12,051.76
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	1,280,499.50	568,154.40
Total Suspended Solids	882,361.0	430,420.0
pH	Within the range of 7.5 to 10.0 at all times	

Consolidation and Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

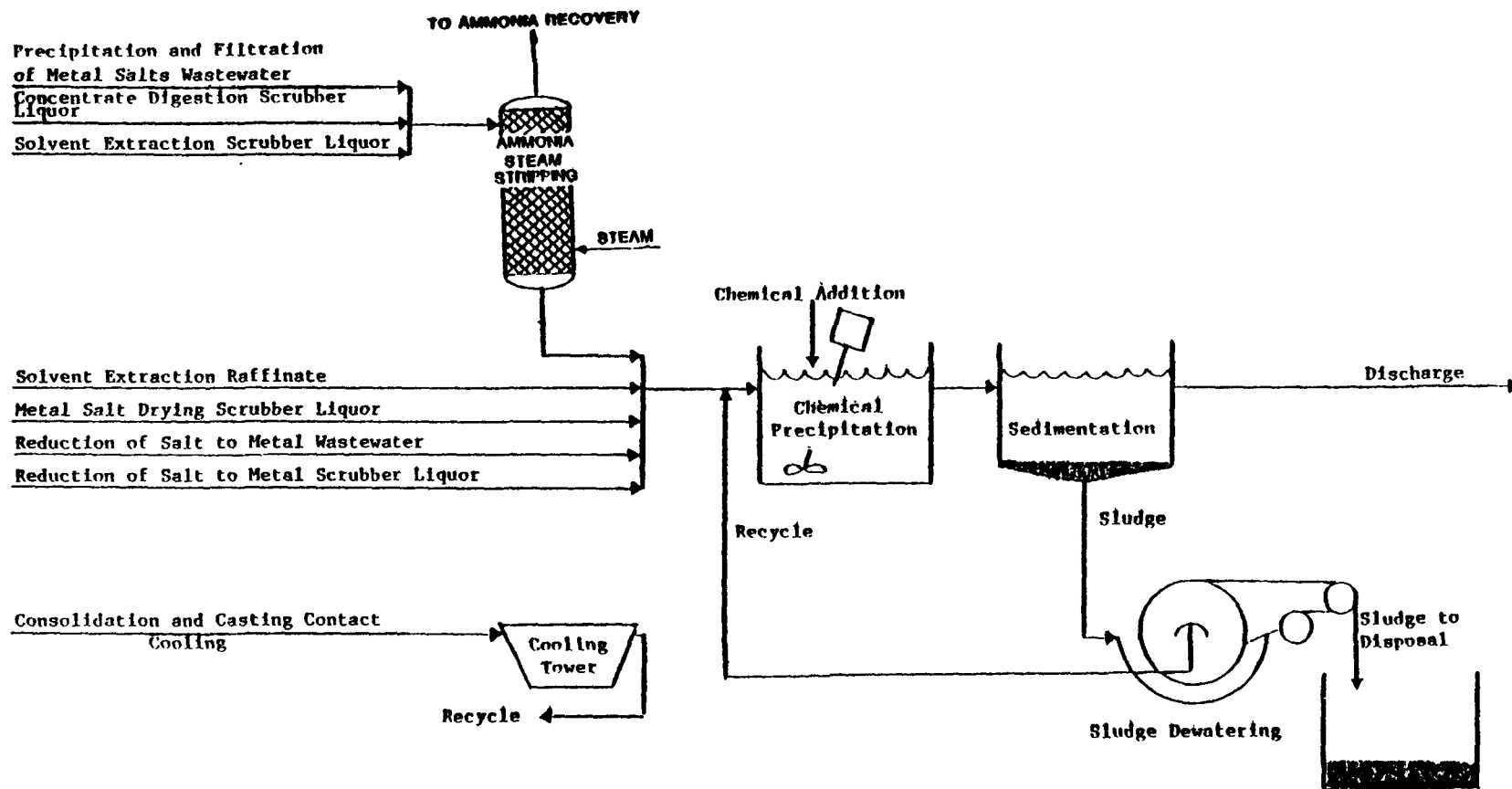


Figure IX-1

BPT TREATMENT SCHEME FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION X

#### BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

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

The factors considered in assessing best available technology economically achievable (BAT) include the age of equipment and facilities involved, the process used, process changes, nonwater quality environmental impacts (including energy requirements), and the costs of application of such technology (Section 304 (b)(2)(B) of the Clean Water Act). At a minimum BAT technology represents the best available technology at plants of various ages, sizes, processes, or other characteristics. As with BPT, 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 statutory assessment of BAT considers costs, but does not require a balancing of costs against effluent reduction benefits (see Weyerhaeuser v. Costle, 11 ERC 2149 (D.C. Cir. 1978)). However, in assessing the proposed BAT, the Agency has given substantial weight to the economic achievability of the selected technology.

#### TECHNICAL APPROACH TO BAT

In pursuing this second round of effluent limitations, the Agency reviewed a wide range of technology options and evaluated the available possibilities to ensure that the most effective and beneficial technologies were used as the basis of BAT. To accomplish this, the Agency elected to examine six technology options which could be applied to the primary columbium-tantalum 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 and reductions in the effluent flows allocated to various waste streams.

In summary, the treatment technologies considered for BAT are presented below:

Option A (Figure X-1) is based on

- o Preliminary treatment with ammonia steam stripping
- o Chemical precipitation and sedimentation

Option B (Figure X-2) is based on

- o Preliminary treatment with ammonia steam stripping
- o Chemical precipitation and sedimentation
- o In-process flow reduction

Option C (Figure X-3) is based on

- o Preliminary treatment with ammonia steam stripping
- o Chemical precipitation and sedimentation
- o In-process flow reduction
- o Multimedia filtration

Option D (Figure X-4) is based on

- o Preliminary treatment with ammonia steam stripping
- o Chemical precipitation and sedimentation
- o In-process flow reduction
- o Multimedia filtration
- o Activated alumina adsorption for fluoride removal

Option E (Figure X-5) is based on

- o Preliminary treatment with ammonia steam stripping
- o Chemical precipitation and sedimentation
- o In-process flow reduction
- o Multimedia filtration
- o Preliminary treatment with activated carbon adsorption

Option F (Figure X-6) is based on

- o Preliminary treatment with ammonia steam stripping
- o Chemical precipitation and sedimentation
- o In-process flow reduction
- o Multimedia filtration
- o Reverse osmosis in conjunction with multiple-effect evaporation

The six 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 last five options each represent substantial progress toward the prevention of polluting the environment above and beyond the progress achievable by BPT.

#### OPTION A

Option A for the primary columbium-tantalum 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 lime precipitation, sedimentation, with ammonia steam stripping 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 B

Option B for the primary columbium-tantalum subcategory achieves lower pollutant discharge by building upon the Option A end-of-pipe treatment technology, which consists of ammonia steam stripping, lime precipitation, and sedimentation. Flow reduction measures are added to Option A treatment (see Figure X-2). These flow reduction measures, including in-process changes, result in the elimination of some wastewater streams and the concentration of pollutants in other effluents. Treatment of a more concentrated effluent allows achievement of a greater net pollutant removal and introduces the possible economic benefits associated with treating a lower volume of wastewater.

Methods used in Option B to reduce process wastewater generation or discharge rates are presented below:

#### Recycle of Water Used in Wet Air Pollution Control

There are four wastewater sources associated with wet air pollution control which are regulated under these effluent limitations:

- Concentrate digestion scrubber,
- Solvent extraction scrubber,
- Metal salt drying scrubber, and
- Reduction of salt to metal scrubber.

Table X-1 presents the number of plants reporting wastewater use with these sources, the number of plants practicing recycle of scrubber liquor, and the range of recycle values being used. Although some plants report total recycle of their scrubber

water, some blowdown or periodic cleaning is likely to be needed to prevent the buildup of dissolved and suspended solids since the water picks up particulates and fumes from the air.

#### OPTION C

Option C for the primary columbium-tantalum subcategory consists of all control and treatment requirements of Option B (ammonia steam stripping, in-process flow reduction, lime precipitation, and sedimentation) plus multimedia filtration technology added at the end of the Option B treatment scheme (see Figure X-3). 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 filters, such as rapid sand filters or pressure filters, would perform as well.

#### OPTION D

Option D for the primary columbium-tantalum subcategory consists of Option C (ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration) with the addition of activated alumina technology at the end of the Option C treatment scheme (see Figure X-4). The activated alumina process will provide further improvement in the effluent quality by removing fluoride from the effluent.

#### OPTION E

Option E for the primary columbium-tantalum subcategory consists of Option C (ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration) with the addition of granular activated carbon technology at the end of the Option C treatment scheme (see Figure X-5). The activated carbon process is utilized to control the discharge of toxic organics.

#### OPTION F

Option F for the primary columbium-tantalum subcategory consists of Option C (ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration) with the addition of reverse osmosis and multiple-effect evaporation technologies at the end of the Option C treatment scheme (see Figure X-6). Option F is used for complete recycle of the treated water by controlling the concentration of dissolved solids.



## INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

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 REDUCTION BENEFITS

A complete description of the methodology used to calculate the estimated pollutant reduction, or benefit, achieved by the application of the various treatment options is presented in Section X of the General Development Document. In short, sampling data collected during the field sampling program were used to characterize the 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 columbium-tantalum subcategory. By multiplying the total subcategory production for a unit operation by the corresponding raw waste value, the mass of pollutant generated for that unit operation was estimated.

The volume of wastewater discharged after the application of each treatment option was estimated by multiplying the regulatory flow determined for each unit process by the total subcategory production. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed, referred to as the benefit, is simply 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 reduction benefit estimates for the primary columbium-tantalum subcategory are presented in Table X-2.

### COMPLIANCE COST

In estimating subcategory-wide compliance costs, the first step was to develop uniformly-applicable cost curves, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied these curves on a per plant basis, a plant's costs - both capital, and operating and maintenance - being 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-3). These costs were used in assessing economic achievability.

#### BAT OPTION SELECTION

EPA has selected Option C as the basis for BAT in this subcategory. The combination of in-process controls and end-of-pipe technologies increases the removal of toxic pollutants by an estimated 285 kg/yr and nonconventionals by 2,424 kg/yr over estimated BPT discharges. Removals from the raw waste generated are estimated at 145,735 kg/yr of toxic metals and 1,286,679 kg/yr of nonconventional pollutants. The end-of-pipe treatment configuration for Option C was presented in Figure X-3.

Activated alumina (Option D) was considered; however, this technology was rejected because it was not demonstrated in this category nor was it clearly transferable to nonferrous wastewater. Activated carbon (Option E) was also considered; however, this technology was eliminated because it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory. Reverse osmosis (Option F) was considered for the purpose of achieving zero discharge of process wastewater; however, the Agency ultimately rejected this technology because it was determined that its performance for this specific purpose was not adequately demonstrated in this category nor was it clearly transferable from another category.

#### 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 concentration 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 eight wastewater sources were determined and are summarized in Table X-4. 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 (PNP) are also listed in Table X-4.

The BAT wastewater discharge rate equals the BPT wastewater discharge rate for five of the eight waste streams in the primary columbium-tantalum subcategory. Based on the available data, the Agency did not find that further flow reduction would be feasible for these wastewater sources. The rationale for determining these regulatory flows is presented in Section IX. Wastewater streams for which BAT discharge rates differ from BPT are discussed below.

## CONCENTRATE DIGESTION WET AIR POLLUTION CONTROL

The BAT wastewater discharge rate for concentrate digestion wet air pollution control is 5,156 l/kg (1,237 gal/ton) of columbium-tantalum salt produced from digestion. This rate is allocated only to those plants with concentrate digestion wet air pollution control. The BAT discharge rate is based on 90 percent recycle of the average water use of two plants. A third plant reported insufficient dcp information to calculate a discharge rate. Water use and discharge rates are presented in Table V-1.

## SOLVENT EXTRACTION WET AIR POLLUTION CONTROL

The BAT wastewater discharge rate for solvent extraction wet air pollution control is 430 l/kg (103 gal/ton) of columbium or tantalum salt extracted. This rate is allocated only to those plants with concentrate digestion wet air pollution control. The BAT discharge rate is based on 90 percent recycle of the water use at one of the two plants which generate this waste stream. One plant uses the same scrubber for both solvent extraction and concentrate digestion wet air pollution control. This plant is regulated under concentrate digestion wet air pollution control and should not receive a discharge allowance for solvent extraction wet air pollution control in order to prevent double counting of this flow. Water use and discharge rates are presented in Table V-3.

## METAL SALT DRYING WET AIR POLLUTION CONTROL

The BAT wastewater discharge rate for metal salt drying wet air pollution control is 16,479.4 l/kg (3,961.4 gal/ton) of columbium or tantalum salt dried. This rate is allocated only to those plants with metal salt drying wet air pollution control. Four plants generate this waste stream. The BAT discharge rate is based on 90 percent recycle of the water use at one of these plants. Two plants reported insufficient dcp information to calculate water usage, and the water usage of one plant was extremely high. These plants were not considered in calculating the BAT discharge rate. Water use and discharge rates are presented in Table V-9.

## REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C. 1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutants and pollutant parameters for limitation. This examination and evaluation was presented in Section VI. The Agency, however, has chosen not to regulate all 19 toxic pollutants selected in this analysis.

The columbium-tantalum subcategory generates an estimated 211,000 kg/yr of toxic pollutants, of which only 170 kg/yr are toxic organic pollutants. The Agency believes that the toxic organic pollutants in the columbium-tantalum subcategory are present only in trace (deminimus quantities) and are neither causing nor likely to cause toxic effects. Therefore, the following toxic organic pollutants are excluded from regulation:

- 7. chlorobenzene
- 8. 1,2,4-trichlorobenzene
- 10. 1,2-dichloroethane
- 30. 1,2-trans-dichloroethylene
- 38. ethylbenzene
- 51. chlorodibromomethane
- 87. trichloroethylene

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 proposing effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant reduction benefit analysis. The pollutants selected for specific limitation are listed below:

- 122. lead
- 128. zinc
- ammonia (as N)
- fluoride

By establishing limitations and standards for certain toxic metal pollutants, dischargers will attain the same degree of control over toxic 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 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 lime 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 columbium-tantalum subcategory to control the discharges of toxic metal pollutants are lead and zinc. Ammonia is also

selected for limitation since the methods used to control lead and zinc are not effective in the control of ammonia. The following toxic pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations developed for lead and zinc:

- 114. antimony
- 115. arsenic
- 116. asbestos
- 118. cadmium
- 119. chromium (Total)
- 120. copper
- 124. nickel
- 125. selenium
- 127. thallium

The conventional pollutant parameters pH and TSS will be limited by the best conventional technology (BCT) effluent limitations. These effluent limitations and a discussion of BCT are presented in Section XIII of this supplement.

#### EFFLUENT LIMITATIONS

The concentrations achievable by application of BAT are discussed in Section VII of the General Development Document and summarized there in Table VII-19. The treatability concentrations both one day maximum and monthly average values are multiplied by the BAT normalized discharge flows summarized in Table X-4 to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per metric ton of product represent the BAT effluent limitations and are presented in Table X-5 for each waste stream.

Table X-1

CURRENT RECYCLE PRACTICES WITHIN THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

	<u>Number of Plants With Wastewater</u>	<u>Number of Plants Practicing Recycle</u>	<u>Range of Recycle Values (%)</u>
Concentrate Digestion	3	2	7 - 86
Solvent Extraction	2	1	0 - 86
Metal Salt Drying	4	3	67 - 89
Reduction of Salt to Metal	2	0	

Table X-2

POLLUTANT REDUCTION BENEFITS  
FOR  
DIRECT DISCHARGERS

Flow (l/yr)		235.20 x 10 <sup>6</sup>		178.99 x 10 <sup>6</sup>		178.99 x 10 <sup>6</sup>	
	Raw Waste	Option A	Option A	Option B	Option B	Option C	Option C
Pollutant	kg/yr	Removed	Discharged	Removed	Discharged	Removed	Discharged
		kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Acenaphthene	0.3	0.0	0.3	0.0	0.3	0.0	0.3
Chlorobenzene	9.1	0.0	9.1	0.0	9.1	0.0	9.1
1,2,4-trichloro- benzene	0.4	0.0	0.4	0.0	0.4	0.0	0.4
1,2-trans-dichloro- ethylene	83.1	0.0	83.1	0.0	83.1	0.0	83.1
Nitrobenzene	1.7	0.0	1.7	0.0	1.7	0.0	1.7
Tetrachlorethylene	11.0	0.0	11.0	0.0	11.0	0.0	11.0
Trichloroethylene	5.6	0.0	5.6	0.0	5.6	0.0	5.6
Antimony	454.4	442.7	11.8	445.5	8.9	448.3	6.1
Arsenic	472.8	352.9	120.0	381.5	91.3	411.9	60.9
Cadmium	2,043.8	2,025.2	18.6	2,029.6	14.1	2,035.0	8.8
Chromium	17,563.5	17,544.7	18.8	17,549.2	14.3	17,551.0	12.5
Copper	15,528.7	15,392.1	136.4	15,424.9	103.8	15,458.9	69.8
Lead	52,942.6	52,914.4	28.2	52,921.1	21.5	52,928.3	14.3
Nickel	411.9	277.8	134.1	309.9	102.0	372.5	39.4
Zinc	56,570.4	56,499.8	70.6	56,516.7	53.7	56,529.2	41.2
TSS	1,522,614.9	1,519,792.2	2,822.7	1,520,467.0	2,147.9	1,522,149.6	465.4
Ammonia	22,129.9	17,196.3	4,933.6	17,972.8	4,157.1	17,972.8	4,157.1
Fluoride	1,270,399.4	1,267,059.1	3,340.2	1,267,857.7	2,541.7	1,268,706.1	1,693.3
Total Toxic Organics	111.2	0.0	111.2	0.0	111.2	0.0	111.2
Total Toxic Metals	145,988.1	145,449.7	538.5	145,578.4	409.6	145,735.1	253.0
Total Toxics	146,099.3	145,449.7	649.7	145,578.4	520.8	145,735.1	364.2
Total Conventional	1,522,614.9	1,519,792.2	2,822.4	1,520,467.0	2,147.9	1,522,149.6	465.4
Total Nonconven- tionals	1,292,529.3	1,284,255.4	8,273.8	1,285,830.5	6,698.8	1,286,678.9	5,850.4
Total Pollutants	2,961,243.5	2,949,497.3	11,745.9	2,951,875.9	9,367.5	2,954,563.6	6,680.0

Table X-2 (Continued)

POLLUTANT REDUCTION BENEFITS  
FOR  
DIRECT DISCHARGERS

Flow (l/yr)	178.99 x 10 <sup>6</sup>		178.99 x 10 <sup>6</sup>		0.0	
	Option D	Option D	Option E	Option E	Option F	Option F
Pollutant	Removed	Discharged	Removed	Discharged	Removed	Discharged
	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Acenaphthene	0.0	0.3	0.0	0.3	0.3	0.0
Chlorobenzene	0.0	9.1	7.3	1.8	9.1	0.0
1,2,4-trichloro- benzene	0.0	0.4	0.0	0.4	0.4	0.0
1,2-trans-dichloro- ethylene	0.0	83.1	81.3	1.8	83.1	0.0
Nitrobenzene	0.0	1.7	0.0	1.7	1.7	0.0
Tetrachlorethylene	0.0	11.0	9.2	1.8	11.0	0.0
Trichloroethylene	0.0	5.6	3.8	1.8	5.6	0.0
Antimony	448.3	6.1	448.3	6.1	454.4	0.0
Arsenic	454.9	17.9	411.9	60.9	472.8	0.0
Cadmium	2,035.0	8.8	2,035.0	8.8	2,043.8	0.0
Chromium	17,551.0	12.5	17,551.0	12.5	17,563.5	0.0
Copper	15,458.9	69.8	15,458.9	69.8	15,528.7	0.0
Lead	52,928.3	14.3	52,928.3	14.3	52,942.6	0.0
Nickel	372.5	39.4	372.5	39.4	411.9	0.0
Zinc	56,259.2	41.2	56,529.2	41.2	56,570.4	0.0
TSS	1,522,149.6	465.4	1,522,149.6	465.4	1,522,614.9	0.0
Ammonia	17,972.8	4,157.1	21,714.2	415.7	22,129.9	0.0
Fluoride	1,270,220.4	179.0	1,270,051.3	348.1	1,270,399.4	0.0
Total Toxic Organics	0.0	111.2	101.6	9.6	111.2	0.0
Total Toxic Metals	145,778.1	210.0	145,735.1	253.0	145,988.1	0.0
Total Toxics	145,778.1	321.2	145,836.7	254.9	146,099.3	0.0
Total Conventional	1,522,149.6	465.4	1,522,149.6	465.4	1,522,614.9	0.0
Total Nonconven- tionals	1,288,193.2	4,336.1	1,291,765.5	763.8	1,292,529.3	0.0
Total Pollutants	2,956,120.9	5,122.7	2,959,751.8	1,484.1	2,961,243.5	0.0

NOTE: Total Toxic Metals = Antimony + Arsenic + Cadmium + Chromium + Copper + Lead + Nickel + Zinc

Total Toxics = Total Toxic Metals + Total Toxic Organics

Total Conventional = TSS

Total Nonconventional = Ammonia + Fluoride

Total Pollutants = Total Toxic Metals + Total Conventional + Total Nonconventional

Option A = Lime precipitation and sedimentation.

Option B = Option A plus in-process flow reduction.

Option C = Option B plus multimedia filtration.

Option D = Option C plus activated alumina.

Option E = Option C plus activated carbon adsorption.

Option F = Option C plus reverse osmosis.



Table X-3  
COST OF COMPLIANCE FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	0	0
B	86,000	13,000
C	797,000	396,000
D	872,000	439,000
E	1,270,000	571,000
F	986,000	504,000

Table X-4

## BAT WASTEWATER DISCHARGE RATES FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Concentrate Digestion Wet Air Pollution Control	5,156	1,237	Columbium-Tantalum Salt Produced from Digestion
Solvent Extraction Raffi- nate	26,916	6,470	Columbium or Tantalum Salt Extracted
Solvent Extraction Wet Air Pollution Control	430	103	Columbium or Tantalum Salt Extracted
Precipitation and Filtra- tion Wastewater	247,223	59,428	Columbium or Tantalum Salt Precipitated
Metal Salt Drying Wet Air Pollution Control	16,479	3,961	Columbium or Tantalum Salt Dried
Reduction of Salt to Metal	352,663	84,775	Columbium or Tantalum Reduced
Reduction of Salt to Metal Wet Air Pollution Control	21,521	5,173	Columbium or Tantalum Reduced
Consolidation and Casting Contact Cooling	0	0	Columbium or Tantalum Cast or Consolidated

Table X-5

BAT EFFLUENT LIMITATIONS FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Concentrate Digestion Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium or tantalum salt produced from digestion		
Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia (as N)	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88

Solvent Extraction Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60

Solvent Extraction Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Precipitation and Filtration of Metal Salts

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80

Metal Salt Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40

Reduction of Salt to Metal

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Reduction of Salt to Metal Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6

Consolidation and Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0

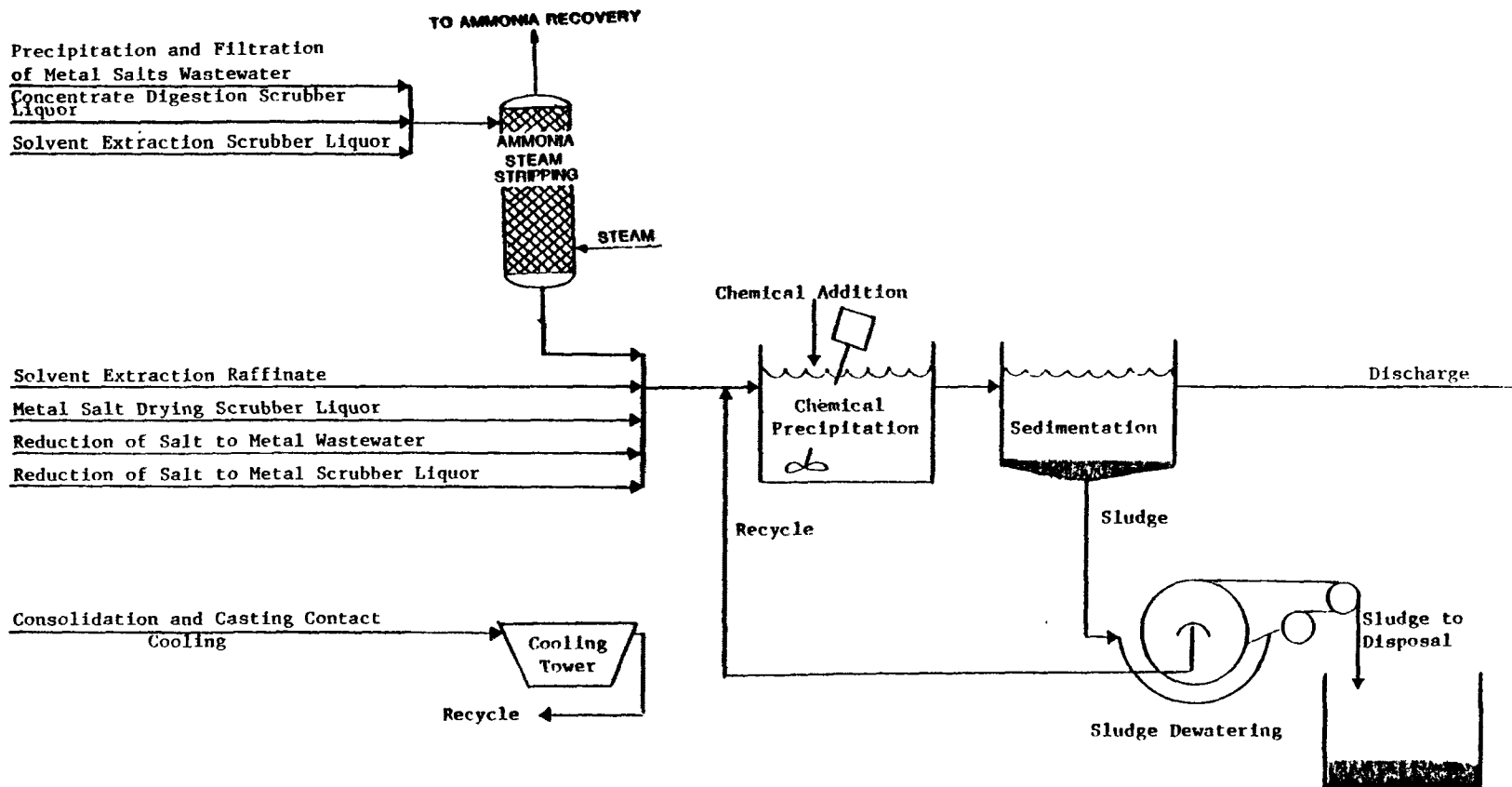


Figure X-1  
BAT TREATMENT SCHEME FOR OPTION A

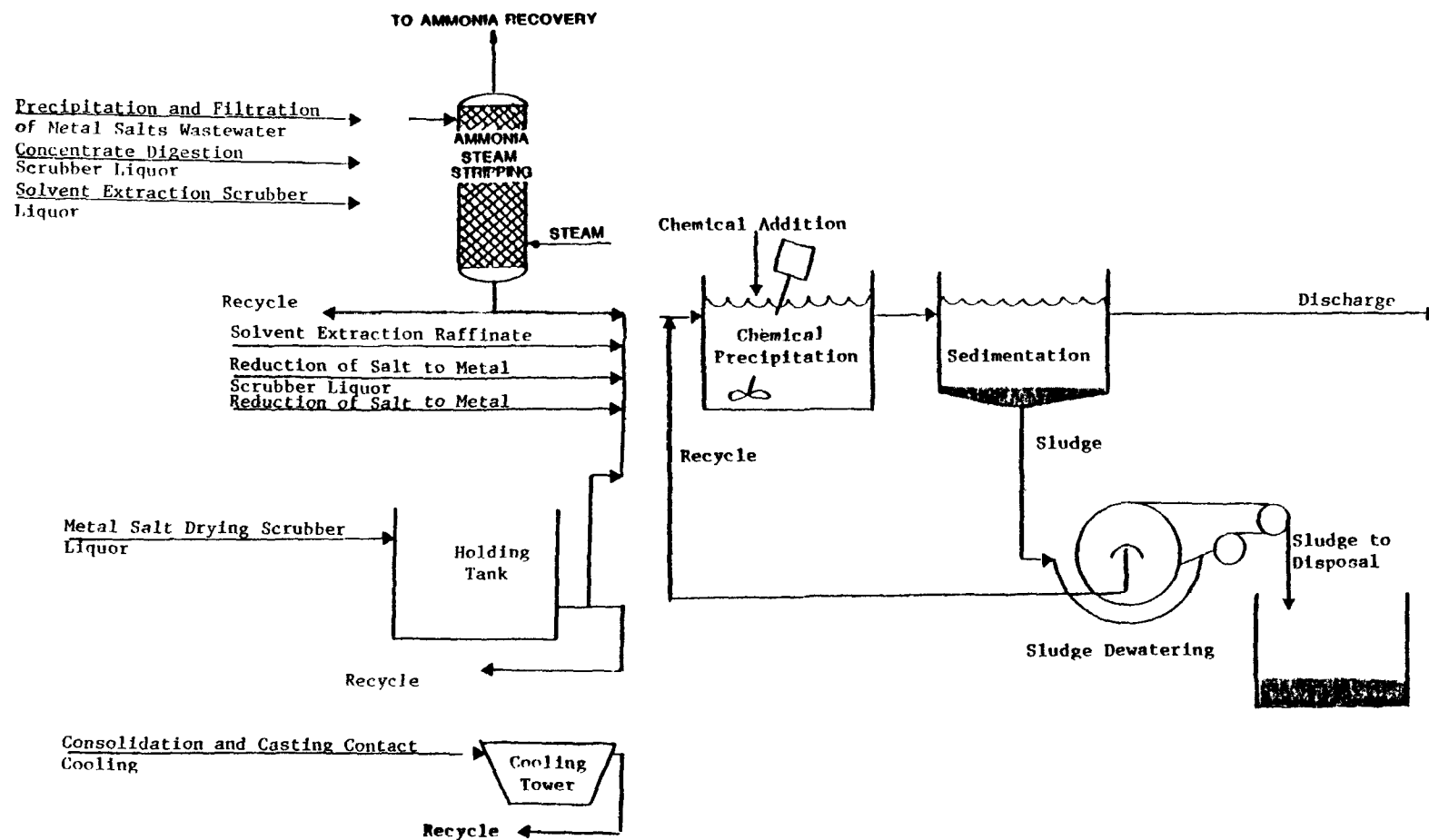


Figure X-2

BAT TREATMENT SCHEME FOR OPTION B

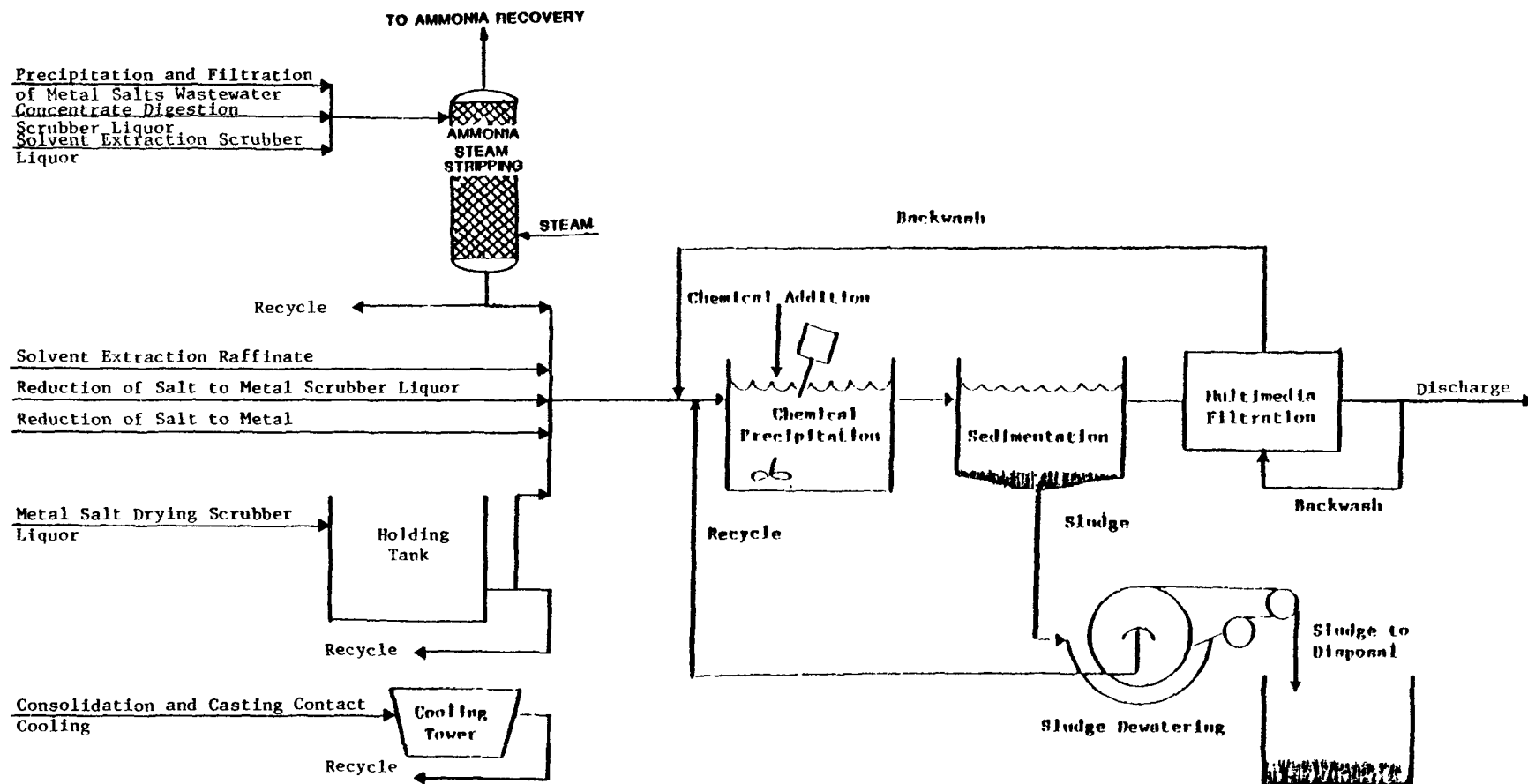


Figure X-3

BAT TREATMENT SCHEME FOR OPTION C



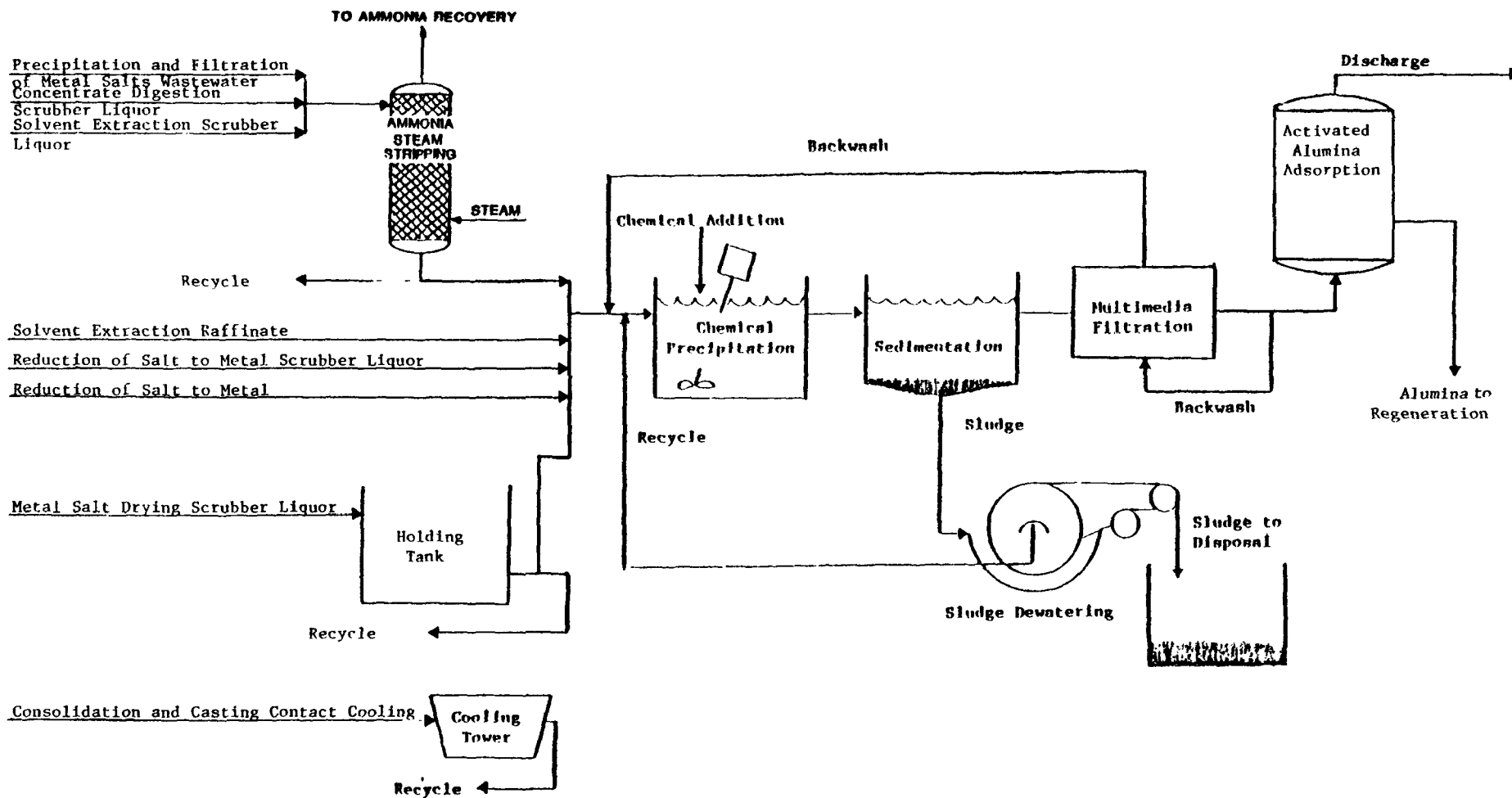


Figure X-4

BAT TREATMENT SCHEME FOR OPTION D

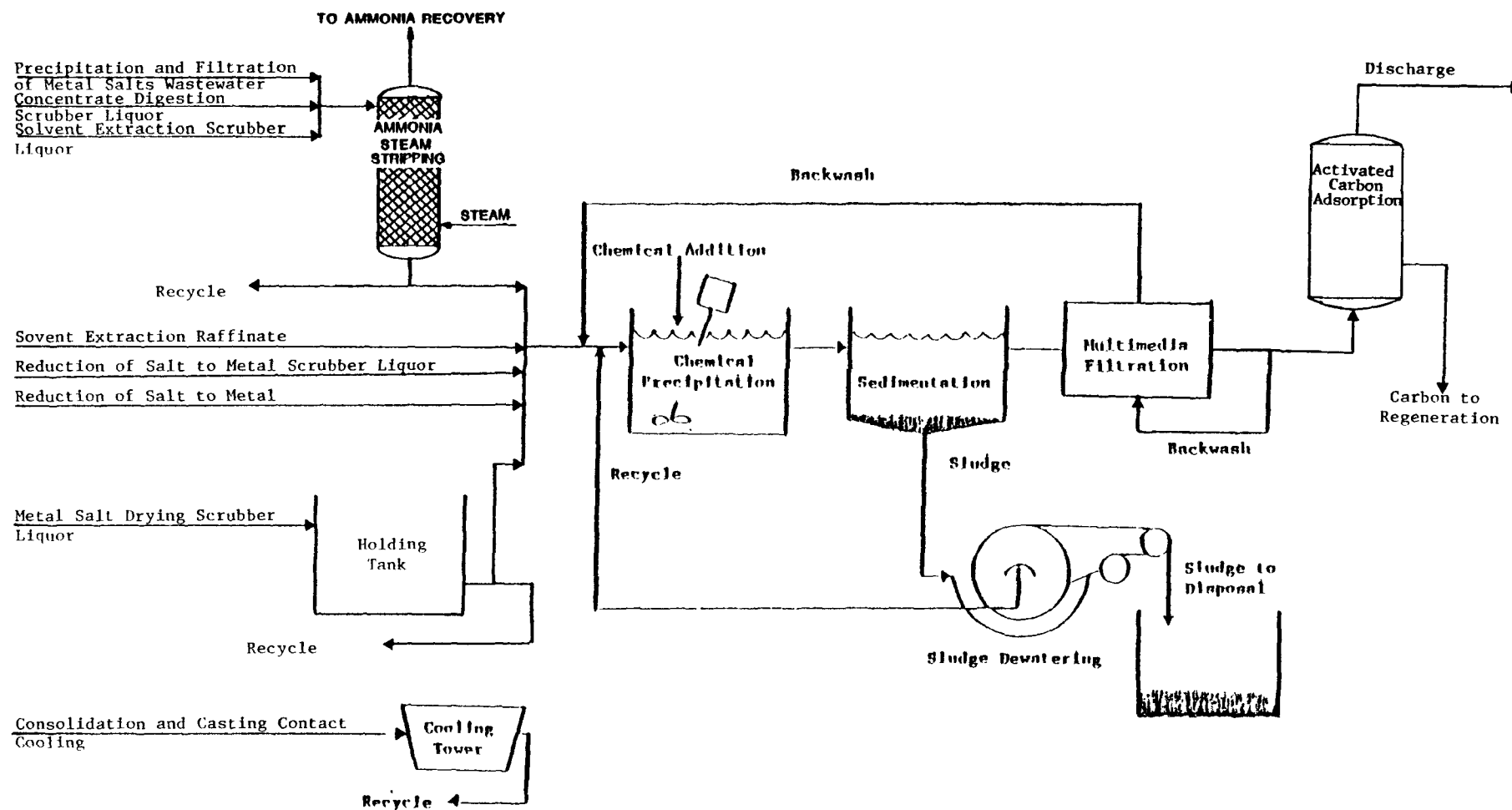


Figure X-5

BAT TREATMENT SCHEME FOR OPTION E

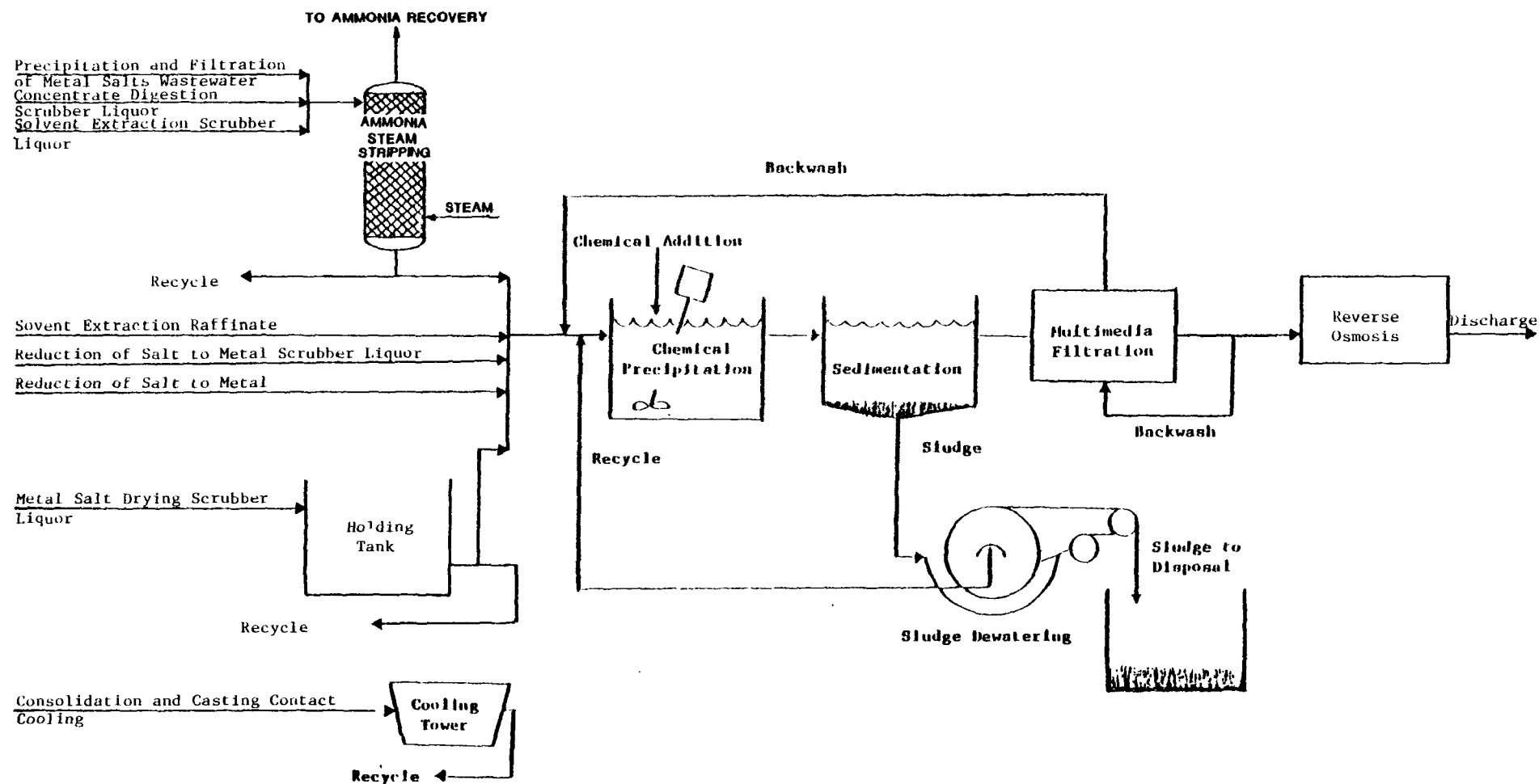


Figure X-6

BAT TREATMENT SCHEME FOR OPTION F

# PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

## SECTION XI

### NEW SOURCE PERFORMANCE STANDARDS

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

This section describes the control technology for treatment of wastewater from new sources, and presents mass discharge limitations of regulated pollutants for NSPS in the primary columbium-tantalum subcategory, based on the described control technology.

#### TECHNICAL APPROACH TO BDT

As discussed in the General Development Document, all of the treatment technology options applicable to a new source were previously considered for the BAT options. For this reason, six options were considered for BDT, all identical to BAT Options A, B, C, D, E, and F, which are discussed in Section X. Briefly, the treatment technologies used for the six options are as follows:

##### OPTION A

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia

##### OPTION B

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction

##### OPTION C

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration

#### OPTION D

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration
- o Activated alumina adsorption for fluoride removal

#### OPTION E

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration
- o Activated carbon adsorption

#### OPTION F

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration
- o Reverse osmosis and multiple-effect evaporation

Partial or complete recycle and reuse of wastewater is an essential part of the last four options. Recycle and reuse can precede or follow end-of-pipe treatment. A more detailed discussion of the treatment options is presented in Section X.

#### BDT OPTION SELECTION

EPA is proposing that the best available demonstrated technology for the primary columbium-tantalum subcategory be equal to BAT (Option C). Review of the subcategory indicates that no new demonstrated technologies that improve on BAT technology exist.

Dry scrubbing is not demonstrated for controlling emissions from concentrate digestion, metal salt drying and salt to metal reduction. The nature of these emissions (acidic fumes, hot particulate matter) technically precludes the use of dry scrubbers. Therefore, EPA is including an allowance for these sources at NSPS equivalent to that proposed for BAT. The Agency also does not believe that new plants could achieve any additional flow reduction beyond that proposed for BAT.

Activated alumina (Option D) was considered; however, this technology was rejected because it too was not demonstrated in this category, nor was it clearly transferable to nonferrous wastewater. Activated carbon (Option E) was also considered; however, this technology was eliminated because it is not necessary, since toxic organic pollutants are not selected for limitation in this subcategory.

Reverse osmosis (Option F) was considered for the purpose of achieving zero discharge of process wastewater; however, the Agency ultimately rejected this technology because it was determined that its performance for this specific purpose was not adequately demonstrated in this category nor was it clearly transferable from another category.

#### 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 in Section X are also selected for limitation in NSPS.

#### NEW SOURCE PERFORMANCE STANDARDS

The NSPS discharge flows for each wastewater source are the same as the BAT discharge rates listed in Section X. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the appropriate achievable treatment concentration by the production normalized wastewater discharge flows (l/kg). These treatment concentrations are listed in Table VII-19 of the General Development Document. The results of these calculations are the production-based new source performance standards, and are presented in Table XI-1. Since both the discharge flows and the achievable treatment concentrations are the same for new sources and BAT, the NSPS are identical to the BAT mass limitations.

Table XI-1

## NSPS FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Concentrate Digestion Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium or tantalum salt produced from digestion		
Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88
Total Suspended Solids	77,344.50	61,875.60
pH	Within the range of 7.5 to 10.0 at all times	

Solvent Extraction Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60
Total Suspended Solids	403,740.0	322,992.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-1 (Continued)

## NSPS FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Solvent Extraction Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76
Total Suspended Solids	6,451.50	5,161.20
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Metal Salts

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80
Total Suspended Solids	3,708,345.0	2,966,676.0
pH	Within the range of 7.5 to 10.0 at all times	



Table XI-1 (Continued)

## NSPS FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Metal Salt Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40
Total Suspended Solids	247,185.0	197,748.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction of Salt to Metal

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80
Total Suspended Solids	5,289,945.0	4,231,956.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-1 (Continued)

## NSPS FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Reduction of Salt to Metal Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6
Total Suspended Solids	322,815.0	258,252.0
pH	Within the range of 7.5 to 10.0 at all times	

Consolidation and Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

## PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

### SECTION XII

#### PRETREATMENT STANDARDS

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES), which must be achieved within three years of promulgation. 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 of 1977 requires pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives. Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time that it promulgates NSPS. 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 technology for removal of toxic pollutants.

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the primary columbium-tantalum subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technology.

#### TECHNICAL APPROACH TO PRETREATMENT

Before proposing 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: (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 nor 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 EXISTING AND NEW SOURCES

Options for pretreatment of wastewaters 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 PSES and PSNS, 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 and achievable treatment concentrations are presented in Section VII of the General Development Document.

The treatment technology options for the PSES and PSNS are:

##### Option A

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping of wastewaters containing treatable concentrations of ammonia

##### Option B

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction

##### Option C

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration

#### Option D

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration
- o Activated alumina for fluoride removal

#### Option E

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration
- o Activated carbon adsorption

#### Option F

- o Chemical precipitation and sedimentation
- o Ammonia steam stripping of wastewaters containing treatable concentrations of ammonia
- o In-process flow reduction
- o Multimedia filtration
- o Reverse osmosis and multiple-effect evaporation

#### INDUSTRY COST AND ENVIRONMENTAL BENEFITS

The industry cost and environmental benefits of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Table XII-1 shows the estimated pollutant reduction benefits for direct and indirect dischargers, while compliance costs are presented in Table XII-2.

#### PSES AND PSNS OPTION SELECTION

The technology basis for proposed PSES and PSNS is identical to NSPS and BAT (Option C). EPA knows of no demonstrated technology that provides more efficient pollutant removal than NSPS and BAT technology.

Activated alumina (Option D) was considered; however, this technology was rejected because it was not demonstrated in this category, nor was it clearly transferable to nonferrous wastewater. Activated carbon (Option E) was also considered; however, this technology was eliminated because it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory.

Reverse osmosis (Option F) was considered for the purpose of achieving zero discharge of process wastewater; however, the Agency ultimately rejected this technology because it was determined that its performance for this specific purpose was not adequately demonstrated in this category nor was it clearly transferable from another category.

#### REGULATED POLLUTANT PARAMETERS

The pollutants and pollutant parameters selected for limitation, in accordance with the rationale of Section X, are identical to those selected for limitation for BAT. PSES and PSNS prevent the pass-through of lead, zinc, fluoride, and ammonia.

#### PRETREATMENT STANDARDS

The PSES and PSNS discharge flows are identical to the BAT discharge flows for all processes. These discharge flows are listed in Table XII-3. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the achievable treatment concentration (mg/l) by the normalized wastewater discharge flow (l/kkg). The achievable treatment concentrations are presented in Table VII-19 of the General Development Document. Pretreatment standards for existing and new sources, as determined from the above procedure, are shown in Tables XII-4 and XII-5 for each waste stream.

Mass-based standards are proposed for the columbium-tantalum subcategory to ensure that the standards are achieved by means of pollutant removal rather than by dilution. They are particularly important since the standards are based upon flow reduction; pollutant limitations associated with flow reduction cannot be measured any other way but as a reduction of mass discharged. The flow reduction over estimated current flow for the columbium-tantalum subcategory is 16.1 percent.

Table XII-1

POLLUTANT REDUCTION BENEFITS  
FOR  
INDIRECT DISCHARGERS

Flow (l/yr)		122.60 x 10 <sup>6</sup>		100.9 x 10 <sup>6</sup>		100.9 x 10 <sup>6</sup>	
	Raw Waste	Option 1	Option 1	Option 2	Option 2	Option 3	Option 3
Pollutant	kg/yr	Removed	Discharged	Removed	Discharged	Removed	Discharged
		kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Acenaphthene	0.1	0.0	0.1	0.0	0.1	0.0	0.1
Chlorobenzene	4.5	0.0	4.5	0.0	4.5	0.0	4.5
1,2,4-trichloro- benzene	0.2	0.0	0.2	0.0	0.2	0.0	0.2
1,2-trans-dichloro- ethylene	46.8	0.0	46.8	0.0	46.8	0.0	46.8
Nitrobenzene	0.9	0.0	0.9	0.0	0.9	0.0	0.9
Tetrachlorethylene	5.0	0.0	5.0	0.0	5.0	0.0	5.0
Trichloroethylene	2.4	0.0	2.4	0.0	2.4	0.0	2.4
Antimony	216.9	210.7	6.1	211.8	5.0	213.4	3.4
Arsenic	237.4	174.8	62.5	185.9	51.4	203.1	34.3
Cadmium	879.4	869.7	9.7	871.4	8.0	874.4	4.9
Chromium	8,797.3	8,787.5	9.8	8,789.2	8.1	8,790.3	7.1
Copper	6,698.2	6,627.1	71.1	6,639.7	58.5	6,658.8	39.3
Lead	23,280.4	23,265.7	14.7	23,268.3	12.1	23,272.3	8.1
Nickel	208.2	138.3	69.9	150.7	57.5	186.0	22.2
Zinc	24,714.6	24,677.8	36.8	24,684.3	30.3	24,691.4	23.2
TSS	771,549.1	770,078.0	1,471.1	770,338.9	1,210.2	771,286.9	262.2
Ammonia	10,875.6	8,519.2	2,356.5	8,808.2	2,067.5	8,808.2	2,067.5
Fluoride	647,691.8	645,950.9	1,740.9	646,259.7	1,432.1	646,737.7	954.1
Total Toxic Organics	59.9	0.0	59.9	0.0	59.9	0.0	59.9
Total Toxic Metals	65,032.2	64,751.6	280.6	64,801.3	230.9	64,889.7	142.5
Total Toxics	65,092.1	64,751.6	340.5	64,801.3	290.8	64,889.7	202.4
Total Conventional	771,549.1	770,078.0	1,471.1	770,338.9	1,210.2	771,286.9	262.2
Total Nonconven- tionals	658,567.4	654,470.1	4,097.4	655,067.9	3,499.6	655,545.9	3,021.6
Total Pollutants	1,495,208.7	1,489,299.7	5,909.0	1,490,208.1	5,000.6	1,491,722.5	3,486.2

Table XII-1 (Continued)

POLLUTANT REDUCTION BENEFITS  
FOR  
INDIRECT DISCHARGERS

Flow (l/yr)	100.9 x 10 <sup>6</sup>		100.9 x 10 <sup>6</sup>		0.0	
Pollutant	Option 4 Removed kg/yr	Option 4 Discharged kg/yr	Option 5 Removed kg/yr	Option 5 Discharged kg/yr	Option 6 Removed kg/yr	Option 6 Discharged kg/yr
Acenaphthene	0.0	0.1	0.0	0.1	0.1	0.0
Chlorobenzene	0.0	4.5	3.5	1.0	4.5	0.0
1,2,4-trichloro- benzene	0.0	0.2	0.0	0.2	0.2	0.0
1,2-trans-dichloro- ethylene	0.0	46.8	45.8	1.0	46.8	0.0
Nitrobenzene	0.0	0.9	0.0	0.9	0.9	0.0
Tetrachlorethylene	0.0	5.0	4.0	1.0	5.0	0.0
Trichloroethylene	0.0	2.4	1.4	1.0	2.4	0.0
Antimony	213.4	3.4	213.4	3.4	216.9	0.0
Arsenic	227.3	10.1	203.1	34.3	237.4	0.0
Cadmium	874.4	4.9	874.4	4.9	879.4	0.0
Chromium	8,790.4	7.1	8,790.3	7.1	8,797.3	0.0
Copper	6,658.8	39.3	6,658.8	39.3	6,698.2	0.0
Lead	23,272.3	8.1	23,272.3	8.1	23,280.4	0.0
Nickel	186.0	22.2	186.0	22.2	208.2	0.0
Zinc	24,691.4	23.2	24,691.4	23.2	24,714.6	0.0
TSS	771,286.9	262.2	771,286.9	262.2	771,549.1	0.0
Ammonia	8,808.2	2,067.5	10,668.9	206.7	10,875.6	0.0
Fluoride	647,590.9	100.9	647,514.3	177.5	647,691.8	0.0
Total Toxic Organics	0.0	59.9	54.6	5.2	59.9	0.0
Total Toxic Metals	64,913.9	118.3	64,889.7	142.5	65,032.2	0.0
Total Toxics	64,913.9	178.2	64,944.3	147.7	65,092.1	0.0
Total Conventional	771,286.9	2,62.25	771,286.9	262.2	771,549.1	0.0
Total Nonconven- tionals	656,399.1	2,168.4	658,183.2	384.2	658,567.4	0.0
Total Pollutants	1,492,599.9	2,608.8	1,494,414.4	794.1	1,495,208.7	0.0

Note: Total Toxic Metals = Antimony + Arsenic + Cadmium + Chromium + Copper + Lead + Nickel + Zinc  
 Total Toxics = Total Toxic Metals + Total Toxic Organics  
 Total Conventional = TSS  
 Total Nonconventional = Ammonia + Fluoride  
 Total Pollutants = Total Toxic Metals + Total Conventional + Total Nonconventional

Option A = Lime precipitation and sedimentation.

Option B = Option A plus in-process flow reduction.

Option C = Option B plus multimedia filtration.

Option D = Option C plus activated alumina.

Option E = Option C plus activated carbon adsorption.

Option F = Option C plus reverse osmosis and multiple-effect evaporation.



Table XII-2

COST OF COMPLIANCE FOR THE  
PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	300,000	152,000
B	461,000	175,000
C	2,190,000	1,350,000
D	2,470,000	1,410,000
E	3,670,000	1,690,000
F	2,890,000	1,500,000

Table XII-3

## PSES WASTEWATER DISCHARGE RATES FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Concentrate Digestion Wet Air Pollution Control	5,156	1,237	Columbium-Tantalum Salt Produced from Digestion
Solvent Extraction Raffinate	26,916	6,470	Columbium or Tantalum Salt Extracted
Solvent Extraction Wet Air Pollution Control	430	103	Columbium or Tantalum Salt Extracted
Precipitation and Filtration Wastewater	247,223	59,428	Columbium or Tantalum Salt Precipitated
Metal Salt Drying Wet Air Pollution Control	16,479	3,961	Columbium or Tantalum Salt Dried
Reduction of Salt to Metal	352,663	84,775	Columbium or Tantalum Reduced
Reduction of Salt to Metal Wet Air Pollution Control	21,521	5,173	Columbium or Tantalum Reduced
Consolidation and Casting Contact Cooling	0	0	Columbium or Tantalum Cast or Consolidated

Table XII-4

## PSES FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Concentrate Digestion Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium-tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium-tantalum salt produced from digestion		
Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia (as N)	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88

Solvent Extraction Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60

Solvent Extraction Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76

Table XII-4 (Continued)

## PSES FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Precipitation and Filtration of Metal Salts

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80

Metal Salt Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40

Reduction of Salt to Metal

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80

Table XII-4 (Continued)

## PSES FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Reduction of Salt to Metal Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6

Consolidation and Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0

Table XII-5

## PSNS FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Concentrate Digestion Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium or tantalum salt produced from digestion		
Lead	515.63	464.07
Zinc	5,259.43	2,165.65
Ammonia (as N)	685,787.90	302,159.18
Fluoride	204,705.11	90,750.88

Solvent Extraction Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	2,691.60	2,422.44
Zinc	27,454.32	11,304.72
Ammonia (as N)	3,579,828.0	1,577,277.60
Fluoride	1,068,565.2	473,721.60

Solvent Extraction Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Lead	43.01	38.71
Zinc	438.70	180.64
Ammonia (as N)	57,203.30	25,203.86
Fluoride	17,074.97	7,569.76

Table XII-5 (Continued)

## PSNS FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Precipitation and Filtration of Metal Salts

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated		
English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Lead	24,722.30	22,250.07
Zinc	252,167.46	103,833.66
Ammonia (as N)	32,880,659.0	14,487,267.80
Fluoride	9,814,753.10	4,351,124.80

Metal Salt Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried		
English Units - lbs/billion lbs of columbium or tantalum salt dried		
Lead	1,647.90	1,483.11
Zinc	16,808.58	6,921.18
Ammonia (as N)	2,191,707.0	965,669.40
Fluoride	654,216.30	290,030.40

Reduction of Salt to Metal

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Lead	35,266.30	31,739.67
Zinc	359,716.26	148,118.46
Ammonia (as N)	46,904,179.0	20,666,051.80
Fluoride	14,000,721.10	6,206,868.80

Table XII-5 (Continued)

## PSNS FOR THE PRIMARY COLUMBIUM-TANTALUM SUBCATEGORY

Reduction of Salt to Metal Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of columbium or tantalum reduced  
 English Units - lbs/billion lbs of columbium or tantalum  
 reduced

Lead	2,152.10	1,936.89
Zinc	21,951.42	9,038.82
Ammonia (as N)	2,862,293.0	1,261,130.60
Fluoride	854,383.7	378,769.6

Consolidation and Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of columbium or tantalum cast or  
 consolidated  
 English Units - lbs/billion lbs of columbium or tantalum  
 cast or consolidated

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Fluoride	0	0



## PRIMARY COLUMBIUM-TANTALIM SUBCATEGORY

### SECTION XIII

#### BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

The 1977 amendments to the Clean Water Act added Section 301(b)(2)(E), establishing "best conventional pollutant control technology" (BCT) for discharge of conventional pollutants from existing industrial point sources. Biochemical oxygen-demanding pollutants (BOD<sub>5</sub>), total suspended solids (TSS), fecal coliform, oil and grease (O&G), and pH have been designated as conventional pollutants (see 44 FR 44501).

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. In addition to the other factors specified in Section 304(b)(4)(B), the Act requires that limitations for conventional pollutants be assessed in light of a two-part cost-reasonableness test. On October 29, 1982, the Agency proposed a revised methodology for carrying out BCT analyses (47 FR 39176). The purpose of the proposal was to correct errors in the BCT methodology originally established in 1977.

Part 1 of the proposed BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be compared with the cost and level of reduction to remove the same type of pollutants by publicly-owned treatment works (POTW). The POTW comparison figure has been calculated by evaluating the change in costs and removals between secondary treatment (30 mg/l BOD and 30 mg/l TSS) and advanced secondary treatment (10 mg/l BOD and 10 mg/l TSS). The difference in cost is divided by the difference in pounds of conventional pollutants removed, resulting in an estimate of the "dollars per pound" of pollutant removed, that is used as a benchmark value. The proposed POTW test benchmark is \$0.30 per pound (1978 dollars).

Part 2 of the BCT test required that the cost and level of reduction of conventional pollutants by industrial dischargers be evaluated internally to the industry. In order to develop a benchmark that assesses a reasonable relationship between cost and removal, EPA has developed an industry cost ratio which compares the dollar per pound of conventional pollutant removed in going from primary to secondary treatment levels with that of going from secondary to more advanced treatment levels. The basis of costs for the calculation of this ratio are the costs incurred by a POTW. EPA used these costs because: they reflect the treatment technologies most commonly used to remove conventional pollutants from wastewater; the treatment levels associated with them compare readily to the levels considered for industrial dischargers; and the costs are the most reliable for

the treatment levels under consideration. The proposed industry subcategory benchmark is 1.42. If the industry figure for a subcategory is lower than 1.43, the subcategory passes the BCT test.

The Agency usually considers two conventional pollutants in the cost test, TSS and an oxygen-demanding pollutant. Although both oil and grease and BOD<sub>5</sub> are considered to be oxygen-demanding substances by EPA (see 44 FR 50733), only one can be selected in the cost analysis to conform to procedures used to develop POTW costs. Oil and grease is used rather than BOD<sub>5</sub> in the cost analysis performed for nonferrous metals manufacturing waste streams due to the common use of oils in casting operations in this industry.

BPT is the base for evaluating limitations on conventional pollutants (i.e., it is assumed that BPT is already in place). The test evaluates the cost and removals associated with treatment and controls in addition to that specified as BPT.

If the conventional pollutant removal cost of the candidate BCT is less than the POTW cost, Part 1 of the cost-reasonableness test is passed and Part 2 (the internal industry test) of the cost-reasonableness test must be performed. If the internal industry test is passed, then a BCT limitation is promulgated equivalent to the candidate BCT level. If all candidate BCT technologies fail both parts of the cost-reasonableness test, the BCT requirements for conventional pollutants are equal to BPT.

The BCT test was performed for the proposed basis of lime precipitation, sedimentation, in-process flow reduction, and multimedia filtration. The columbium-tantalum subcategory failed Part 1 of the test with a calculated cost of \$76.16 per pound (1978 dollars) of removal of conventional pollutants using BAT technology. The intermediate flow reduction option was also examined, but it too failed with a cost of \$8.73 per pound (1978 dollars) of conventional removal.

Table XIII-1

BCT EFFLUENT LIMITATIONS FOR THE PRIMARY COLUMBIUM-TANTALUM  
SUBCATEGORYConcentrate Digestion Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium-tantalum salt produced from digestion		
English Units - lbs/billion lbs of columbium-tantalum salt produced from digestion		
Total Suspended Solids	447,515.0	218,300.0
pH	Within the range of 7.5 to 10.0 at all times	

Solvent Extraction Raffinate

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Total Suspended Solids	1,103,556.0	538,320.0
pH	Within the range of 7.5 to 10.0 at all times	

Solvent Extraction Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt extracted		
English Units - lbs/billion lbs of columbium or tantalum salt extracted		
Total Suspended Solids	176,357.40	86,028.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

BCT EFFLUENT LIMITATIONS FOR THE PRIMARY COLUMBIUM-TANTALUM  
SUBCATEGORYPrecipitation and Filtration of Metal Salts

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt precipitated English Units - lbs/billion lbs of columbium or tantalum salt precipitated		
Total Suspended Solids	10,136,143.0	4,944,460.0
pH	Within the range of 7.5 to 10.0 at all times	

Metal Salt Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum salt dried English Units - lbs/billion lbs of columbium or tantalum salt dried		
Total Suspended Solids	3,429,363.0	1,672,860.0
pH	Within the range of 7.5 to 10.0 at all times	

Reduction of Salt to Metal

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced English Units - lbs/billion lbs of columbium or tantalum reduced		
Total Suspended Solids	14,459,183.0	7,053,260.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

BCT EFFLUENT LIMITATIONS FOR THE PRIMARY COLUMBIUM-TANTALUM  
SUBCATEGORY

Reduction of Salt to Metal Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum reduced		
English Units - lbs/billion lbs of columbium or tantalum reduced		
Total Suspended Solids	882,361.0	430,420.0
pH	Within the range of 7.5 to 10.0 at all times	

Consolidation and Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of columbium or tantalum cast or consolidated		
English Units - lbs/billion lbs of columbium or tantalum cast or consolidated		
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

## SECONDARY SILVER SUBCATEGORY

### SECTION I

#### SUMMARY AND CONCLUSIONS

Pursuant to Sections 301, 304, 306, 307, and 501 of the Clean Water Act and the provisions of the Settlement Agreement in Natural Resources Defense Council v. Train, 8 ERC 2120 (D.D.C. 1976) modified, 12 ERC 1833 (D.D.C. 1979), EPA has collected and analyzed data for plants in the secondary silver subcategory. EPA has never proposed or promulgated effluent limitations or standards for this subcategory. This document and the administrative record provide the technical basis for proposing 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 silver subcategory is comprised of 44 plants. Of the 44 plants, four discharge directly to rivers, lakes, or streams; 17 discharge to publicly owned treatment works (POTW); and 23 achieve zero discharge of process wastewater.

EPA first studied the secondary silver subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including (1) the sources and volume of water used, the processes used, and the sources of pollutants and wastewaters in the plant; and (2) the constituents of wastewaters, including toxic pollutants.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary silver subcategory. The Agency analyzed both historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts (such as air quality impacts and 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 category. 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 Economic Impact Analysis of Proposed Effluent Limitations and Standards for the Nonferrous Smelting and Refining Industry.

Based on consideration of the above factors, EPA identified various control and treatment technologies which formed the basis for BPT and selected control and treatment appropriate for each set of standards and limitations. The mass limitations and standards for BPT, BAT, NSPS, PSES, PSNS, and BCT are presented in Section II.

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on lime 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, the secondary silver subcategory will incur an estimated capital cost of \$0.124 million (1978 dollars) and an annual cost of \$0.263 million (1978 dollars).

Due to current adverse structural economic changes that are not reflected in EPA's current economic analysis, the Agency has identified alternative technologies as a basis for BAT effluent limitations. For Alternative A, the Agency has built upon the BPT basis of steam stripping for ammonia limitation and lime precipitation and sedimentation for metals removed by adding in-process control technologies which include recycle of process water from air pollution control and metal contact cooling waste streams. To meet the Alternative A BAT effluent limitations, the secondary silver subcategory will incur an estimated capital cost of \$0.184 million (1978 dollars) and an annual cost of \$0.278 million (1978 dollars). For Alternative B, filtration is added as an effluent polishing step to the in-process flow reduction, steam stripping, lime precipitation, and sedimentation technology considered in Alternative A. To meet the Alternative B BAT effluent limitations, the secondary silver subcategory will incur an estimated capital cost of \$0.206 million (1978 dollars) and an annual cost of \$0.345 million (1978 dollars).

The best demonstrated technology, BDT, which is the technical basis of NSPS, is equivalent to BAT. In selecting BDT, 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 because no additional process modifications or treatment technologies have been identified that substantially improve BAT performance.

The Agency selected the same alternative technologies as BAT for PSES. To meet the Alternative A pretreatment standards for existing sources, the secondary silver subcategory will incur an estimated capital cost of \$1.03 million (1978 dollars) and an annual cost of \$0.958 million (1978 dollars).

Alternative B pretreatment standards for existing sources are estimated to result in a capital cost of \$1.14 million (1978 dollars) and an annual cost of \$1.07 million (1978 dollars). For pretreatment standards for new sources (PSNS), the Agency selected preliminary treatment, end-of-pipe treatment, and in-process flow reduction control techniques equivalent to BDT. As such, the PSNS are identical to the NSPS for all waste streams.

The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. The technology basis of BCT is the BPT treatment of lime precipitation and sedimentation, with ammonia steam stripping preliminary treatment for selected waste streams.



## SECONDARY SILVER SUBCATEGORY

### SECTION II

#### RECOMMENDATIONS

1. EPA has divided the secondary silver subcategory into 14 subdivisions for the purpose of effluent limitations and standards. These subdivisions are:
  - (a) Film Stripping,
  - (b) Film Stripping Wet Air Pollution Control,
  - (c) Precipitation and Filtration of Film Stripping Solutions,
  - (d) Precipitation and Filtration of Film Stripping Solutions Wet Air Pollution Control,
  - (e) Precipitation and Filtration of Photographic Solutions,
  - (f) Precipitation and Filtration of Photographic Solutions Wet Air Pollution Control,
  - (g) Electrolytic Refining,
  - (h) Furnace Wet Air Pollution Control,
  - (i) Casting Contact Cooling,
  - (j) Casting Wet Air Pollution Control,
  - (k) Leaching,
  - (l) Leaching Wet Air Pollution Control,
  - (m) Precipitation and Filtration of Nonphotographic Solutions, and
  - (n) Precipitation and Filtration of Nonphotographic Solutions Wet Air Pollution Control.
2. BPT is proposed 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 proposed for existing sources:
  - (a) Film Stripping  
BPT EFFLUENT LIMITATIONS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of silver produced from film stripping English Units - lbs/billion lbs of silver produced from film stripping		
Copper	3,076,100.0	1,619,000.0
Zinc	2,153,270.0	906,640.0
Ammonia (as N)	215,327,000.0	94,873,400.0
Total Suspended Solids	66,379,000.0	32,380,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Film Stripping Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	29,602.0	15,580.0
Zinc	20,721.40	8,724.80
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Precipitation and Filtration of Film Stripping  
Solutions  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	3,516,900.0	1,851,000.0
Zinc	2,461,830.0	1,036,560.0
Ammonia (as N)	246,183,000.0	108,468,600.0
Total Suspended Solids	75,891,000.0	37,020,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	29,602.0	15,580.0
Zinc	20,721.40	8,724.80
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Precipitation and Filtration of Photographic  
Solutions  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,622,600.0	854,000.0
Zinc	1,135,820.0	478,240.0
Ammonia (as N)	113,582,000.0	50,044,400.0
Total Suspended Solids	35,014,000.0	17,080,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Precipitation and Filtration of Photographic  
Solutions Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	741,570.0	390,300.0
Zinc	519,099.0	218,568.0
Ammonia (as N)	51,909,900.0	22,871,580.0
Total Suspended Solids	16,002,300.0	7,806,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Electrolytic Refining  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	46,200.40	24,316.0
Zinc	32,340.28	13,616.96
Ammonia (as N)	3,234,028.0	1,424,917.60
Total Suspended Solids	996,956.0	486,320.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Furnace Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	40,886.10	21,519.0
Zinc	28,620.27	12,050.64
Ammonia (as N)	2,862,027.0	1,261,013.40
Total Suspended Solids	882,279.0	430,380.0
pH	Within the range of 7.5 to 10.0 at all times	

(i) Casting Contact Cooling  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	22,866.50	12,035.0
Zinc	16,006.55	6,739.60
Ammonia (as N)	1,600,655.0	705,251.0
Total Suspended Solids	493,435.0	240,700.0
pH	Within the range of 7.5 to 10.0 at all times	

(j) Casting Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	9,007.90	4,741.0
Zinc	6,305.53	2,654.96
Ammonia (as N)	630,553.0	277,822.60
Total Suspended Solids	194,381.0	94,820.0
pH	Within the range of 7.5 to 10.0 at all times	

(k) Leaching  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	5,282.0	2,780.0
Zinc	3,697.4	1,556.8
Ammonia (as N)	369,740.0	162,908.0
Total Suspended Solids	113,980.0	55,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(l) Leaching Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	270,539.10	142,389.0
Zinc	189,377.37	79,737.84
Ammonia (as N)	18,937,737.0	8,343,995.40
Total Suspended Solids	5,837,949.0	2,847,780.0
pH	Within the range of 7.5 to 10.0 at all times	

(m) Precipitation and Filtration of Nonphotographic  
Solutions  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	187,296.30	98,577.0
Zinc	131,107.41	55,203.12
Ammonia (as N)	13,110,741.0	5,776,612.20
Total Suspended Solids	4,041,657.0	1,971,540.0
pH	Within the range of 7.5 to 10.0 at all times	

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	151,868.90	79,931.0
Zinc	106,308.23	44,761.36
Ammonia (as N)	10,630,823.0	4,683,956.60
Total Suspended Solids	3,277,171.0	1,598,620.0
pH	Within the range of 7.5 to 10.0 at all times	

3. EPA is proposing two technology alternatives for BAT for the secondary silver subcategory. BAT Alternative A is proposed based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following BAT effluent limitations are proposed for existing sources:

(a) Film Stripping  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	3,076,100.0	1,619,000.0
Zinc	2,153,270.0	906,640.0
Ammonia(as N)	215,327,000.0	94,873,400.0

(b) Film Stripping Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

(c) Precipitation and Filtration of Film Stripping  
Solutions  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	3,516,900.0	1,851,000.0
Zinc	2,461,830.0	1,036,560.0
Ammonia (as N)	246,183,000.0	108,468,600.0

(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

(e) Precipitation and Filtration of Photographic Solutions  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,622,600.0	854,000.0
Zinc	1,135,820.0	478,240.0
Ammonia (as N)	113,582,000.0	50,044,400.0

(f) Precipitation and Filtration of Photographic  
Solutions Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	741,570.0	390,300.0
Zinc	519,099.0	218,568.0
Ammonia (as N)	51,909,900.0	22,871,580.0
	at all times	

(g) Electrolytic Refining  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	46,200.4	24,316.0
Zinc	32,340.28	13,616.96
Ammonia (as N)	3,234,028.0	1,424,917.60



(h) Furnace Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		

Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

(i) Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		

Copper	2,287.6	1,204.0
Zinc	1,601.32	674.24
Ammonia (as N)	160,132.0	70,554.40

(j) Casting Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		

Copper	9,007.8	4,741.0
Zinc	6,305.53	2,654.96
Ammonia (as N)	630,553.0	277,822.60

(k) Leaching  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	5,282.0	2,780.0
Zinc	3,697.4	1,556.8
Ammonia (as N)	369,740.0	165,662.20

(1) Leaching Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	270,539.1	142,389.0
Zinc	189,377.37	79,737.84
Ammonia (as N)	18,937,737.0	8,343,995.40

(m) Precipitation and Filtration of Nonphotographic  
Solutions  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	187,296.30	98,577.0
Zinc	131,107.41	55,203.12
Ammonia (as N)	13,110,741.0	5,776,612.20

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated English Units - lbs/billion lbs of silver precipitated		
Copper	151,868.9	79,931.0
Zinc	106,308.23	44,761.36
Ammonia (as N)	10,630,823.0	4,683,956.60

BAT Alternative B is proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods; along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following BAT effluent limitations are proposed for existing sources:

(a) Film Stripping  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping English Units - lbs/billion lbs of silver produced from film stripping		
Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia(as N)	215,327,000.0	94,873,400.0

(b) Film Stripping Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping English Units - lbs/billion lbs of silver produced from film stripping		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

(c) Precipitation and Filtration of Film Stripping  
Solutions  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia (as N)	246,183,000.0	108,468,600.0

(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

(e) Precipitation and Filtration of Photographic  
Solutions  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0

(f) Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0

(g) Electrolytic Refining  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60

(h) Furnace Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

(i) Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40

(j) Casting Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60

(k) Leaching  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	3,558.4	1,695.8
Zinc	2,835.6	1,167.6
Ammonia (as N)	369,740.0	162,908.0

(1) Leaching Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40

(m) Precipitation and Filtration of Nonphotographic  
Solutions  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia (as N)	10,630,823.0	4,683,956.60

4. NSPS are proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following effluent standards are proposed for new sources:

(a) Film Stripping NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia (as N)	215,327,000.0	94,873,400.0
Total Suspended Solids	24,285,000.0	19,428,000.0
pH	Within range of 7.5 to 10.0 at all times.	

(b) Film Stripping Wet Air Pollution Control NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	233,700.0	186,960.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Precipitation and Filtration of Film Stripping  
Solutions NSPS

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia(as N)	246,183,000.0	108,468,600.0
Total Suspended Solids	27,765,000.0	22,212,000.0
pH	Within the range of 7.5 to 10.0 at all times.	



(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	233,700.0	186,960.0
pH	Within the range of 7.5 to 10.0 at all times.	

(e) Precipitation and Filtration of Photographic  
Solutions NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0
Total Suspended Solids	12,810,000.0	10,248,000.0
pH	Within the range of 7.5 to 10.0 at all times.	

(f) Precipitation and Filtration of Photographic  
Solutions Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0
Total Suspended Solids	5,854,500.0	4,683,600.0
pH	Within the range of 7.5 to 10.0 at all times.	

(g) Electrolytic Refining NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60
Total Suspended Solids	364,740.0	291,792.0
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Furnace Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Casting Contact Cooling NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40
Total Suspended Solids	18,060.0	14,448.0
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Casting Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver cast  
English Units - lbs/billion lbs of silver cast

Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60
Total Suspended Solids	71,115.0	56,892.0
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Leaching NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver produced from leaching  
English Units - lbs/billion lbs of silver produced from leaching

Copper	3,558.4	1,695.8
Zinc	2,835.6	1,167.6
Ammonia (as N)	369,740.0	162,908.0
Total Suspended Solids	41,700.0	33,360.0
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Leaching Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver produced from leaching  
English Units - lbs/billion lbs of silver produced from leaching

Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40
Total Suspended Solids	2,135,835.0	1,708,668.0
pH	Within the range of 7.5 to 10.0 at all times	

(m) Precipitation and Filtration of Nonphotographic  
Solutions NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20
Total Suspended Solids	1,478,655.0	1,182,924.0
pH	Within the range of 7.5 to 10.0 at all times	

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia(as N)	10,630,823.0	4,683,956.60
Total Suspended Solids	1,198,965.0	959,172.0
pH	Within the range of 7.5 to 10.0 at all times	

5. EPA is proposing two technology alternatives for PSES for the secondary silver subcategory. PSES Alternative A is proposed based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following pretreatment standards are proposed for existing sources:

(a) Film Stripping PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	3,076,100.0	1,619,000.0
Zinc	2,153,270.0	906,640.0
Ammonia(as N)	215,327,000.0	94,873,400.0

(b) Film Stripping Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of silver produced from film stripping  
English Units - lbs/billion lbs of silver produced from  
film stripping

Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

(c) Precipitation and Filtration of Film Stripping  
Solutions PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	3,516,900.0	1,851,000.0
Zinc	2,461,830.0	1,036,560.0
Ammonia (as N)	246,183,000.0	108,468,600.0

(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

(e) Precipitation and Filtration of Photographic  
Solutions PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	1,622,600.0	854,000.0
Zinc	1,135,820.0	478,240.0
Ammonia (as N)	113,582,000.0	50,044,400.0

(f) Precipitation and Filtration of Photographic  
Solutions Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	741,570.0	390,300.0
Zinc	519,099.0	218,568.0
Ammonia (as N)	51,909,900.0	22,871,580.0

(g) Electrolytic Refining PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	46,200.4	24,316.0
Zinc	32,340.28	13,616.96
Ammonia (as N)	3,234,028.0	1,424,917.60

(h) Furnace Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

(i) Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	2,287.6	1,204.0
Zinc	1,601.32	674.24
Ammonia (as N)	160,132.0	70,554.40

(j) Casting Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	9,007.8	4,741.0
Zinc	6,305.53	2,654.96
Ammonia (as N)	630,553.0	277,822.60

(k) Leaching PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	5,282.0	2,780.0
Zinc	3,697.4	1,556.8
Ammonia (as N)	369,740.0	165,662.20

(l) Leaching Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	270,539.1	142,389.0
Zinc	189,377.37	79,737.84
Ammonia (as N)	18,937,737.0	8,343,995.40

(m) Precipitation and Filtration of Nonphotographic  
Solutions PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	187,296.30	98,577.0
Zinc	131,107.41	55,203.12
Ammonia (as N)	13,110,741.0	5,776,612.20

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	151,868.9	79,931.0
Zinc	106,308.23	44,761.36
Ammonia (as N)	10,630,823.0	4,683,956.60

PSES Alternative B is proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with preliminary treatment of ammonia steam stripping for selected waste streams. The following pre-treatment standards are proposed for existing sources:

(a) Film Stripping PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver produced from film stripping  
English Units - lbs/billion lbs of silver produced from  
film stripping

Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia (as N)	215,327,000.0	94,873,400.0

(b) Film Stripping Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of silver produced from film stripping  
English Units - lbs/billion lbs of silver produced from  
film stripping

Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0



(c) Precipitation and Filtration of Film Stripping  
Solutions PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia (as N)	246,183,000.0	108,468,600.0

(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

(e) Precipitation and Filtration of Photographic  
Solutions PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0

(f) Precipitation and Filtration of Photographic  
Solutions Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0

(g) Electrolytic Refining PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60

(h) Furnace Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

(i) Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40

(j) Casting Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60

(k) Leaching PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	3,558.40	1,695.80
Zinc	2,835.60	1,167.60
Ammonia (as N)	369,740.0	162,908.0

(l) Leaching Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40

(m) Precipitation and Filtration of Nonphotographic  
Solutions PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia(as N)	10,630,823.0	4,683,956.60

6. PSNS are proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following pre-treatment standards are proposed for new sources:

(a) Film Stripping PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping English Units - lbs/billion lbs of silver produced from film stripping		
Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia (as N)	215,327,000.0	94,873,400.0

(b) Film Stripping Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping English Units - lbs/billion lbs of silver produced from film stripping		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

(c) Precipitation and Filtration of Film Stripping  
Solutions PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia (as N)	246,183,000.0	108,468,600.0

(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

(e) Precipitation and Filtration of Photographic  
Solutions PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0

(f) Precipitation and Filtration of Photographic  
Solutions Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0

(g) Electrolytic Refining PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60

(h) Furnace Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion of silver roasted, smelted, or dried		

Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

(i) Casting Contact Cooling PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		

Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40

(j) Casting Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		

Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60

(k) Leaching PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		

Copper	3,558.40	1,695.80
Zinc	2,835.60	1,167.60
Ammonia (as N)	369,740.0	162,908.0

(1) Leaching Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of silver produced from leaching  
English Units - lbs/billion lbs of silver produced from leaching

Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40

(m) Precipitation and Filtration of Nonphotographic  
Solutions PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kkg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kkg of silver precipitated  
English Units - lbs/billion lbs of silver precipitated

Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia (as N)	10,630,823.0	4,683,956.60

7. BCT is proposed based on performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods, along with preliminary treatment consisting of ammonia steam stripping for selected waste streams. The following BCT effluent limitations are proposed for existing direct dischargers:

(a) Film Stripping  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Total Suspended Solids	66,379,000.0	32,380,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Film Stripping Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Precipitation and Filtration of Film Stripping  
Solutions  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	75,891,000.0	37,020,000.0
pH	Within the range of 7.5 to 10.0 at all times	



(d) Precipitation and Filtration of Film Stripping  
Solutions Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Precipitation and Filtration of Photographic Solutions  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	35,014,000.0	17,080,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	16,002,300.0	7,806,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Electrolytic Refining  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Total Suspended Solids	996,956.0	486,320.0
pH	Within the range of 7.5 to 10.0 at all times	

(h) Furnace Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted or dried		
Total Suspended Solids	882,279.0	430,380.0
pH	Within the range of 7.5 to 10.0 at all times	

(i) Casting Contact Cooling  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Total Suspended Solids	493,435.0	240,700.0
pH	Within the range of 7.5 to 10.0 at all times	

(j) Casting Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Total Suspended Solids	194,381.0	94,820.0
pH	Within the range of 7.5 to 10.0 at all times	

(k) Leaching  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Total Suspended Solids	113,980.0	55,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(l) Leaching Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Total Suspended Solids	5,837,949.0	2,847,780.0
pH	Within the range of 7.5 to 10.0 at all times	

(m) Precipitation and Filtration of Nonphotographic  
Solutions  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	4,041,657.0	1,971,540.0
pH	Within the range of 7.5 to 10.0 at all times	

(n) Precipitation and Filtration of Nonphotographic  
Solutions Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	3,277,171.0	1,598,620.0
pH	Within the range of 7.5 to 10.0 at all times	

## SECONDARY SILVER SUBCATEGORY

### SECTION III

#### INDUSTRY PROFILE

This section of the secondary silver supplement describes the raw materials and processes used in refining secondary silver and presents a profile of the secondary silver plants identified in this study. For a discussion of the purpose, authority and methodology for this study and a general description of the nonferrous metals category, refer to Section III of the General Development Document.

#### DESCRIPTION OF SECONDARY SILVER PRODUCTION

The production of secondary silver can be divided into two subdivisions based on the source of raw materials: photographic and nonphotographic. Photographic processes for recovering silver include film stripping and precipitation, film incineration, chemical precipitation from solution, metallic replacement in solution, and direct electrolytic refining. Nonphotographic manufacturing involves precipitation of silver from waste plating solutions, melting and casting of sterling-silver scrap, and processing electrical component scrap.

#### RAW MATERIALS

The principal raw materials used by plants recovering silver from photographic materials are discarded photographic film (both color and black and white) and silver-rich sludges and solutions from photographic processing. Waste plating solutions, sterling ware scrap, and electrical component scrap are the principal raw materials used in the nonphotographic category.

#### PHOTOGRAPHIC MATERIALS

Photographic raw materials silver recovery can be divided into two primary sources, discarded film and film processing solutions.

#### Discarded Film

The silver in emulsion on discarded film can be recovered by two methods: stripping, precipitation and drying, and incineration. Figure III-1 represents a general flow diagram of photographic film scrap processes. The primary steps are:

1. Granulation,
2. Stripping,
3. Sedimentation and filtration,
4. Precipitation,

5. Roasting,
6. Casting,
7. Purification, and
8. Melting and casting.

Stripping Method. Photographic film can be stripped directly or first shredded and granulated. Dust generated by granulation is collected with a baghouse and recycled to the precipitation step further along in the process. The film can be stripped of the silver-bearing emulsion by a number of ways. In one method, the film is stripped using nitric acid, resulting in a silver nitrate solution. The reaction of emulsion with nitric acid produces nitrogen-containing air emissions ( $\text{NO}_x$ ), which are removed with a scrubber, resulting in a wastewater stream. Another method uses wet oxidation with a catalyst at high temperature and pressure to produce a silver liquor. A third stripping process converts silver in the film to silver chloride using ferric chloride solution containing hydrochloric acid.

A silver-rich solution is usually separated from the granulated film residue by sedimentation, decantation, and filtration. The residue is discarded as solid waste, usually in a landfill.

Silver in solution can be precipitated by various precipitating agents. Caustic soda, soda ash ( $\text{Na}_2\text{CO}_3$ ), and proteolytic enzymes are commonly used. Alum is used as a flocculating agent in some processes. The addition of chloride ion will precipitate silver chloride which can be reduced to silver by hydrogen reduction. Thiosulfate solution also converts silver chloride to a soluble silver complex, silver thiosulfate. Recovered baghouse dust from the granulation step may also be added during the precipitation step.

The silver-free supernatant is decanted and sent to waste treatment. Silver sludge is dewatered by gravity or filter thickening, vacuum filtration, centrifuging, or drying. The water removed is sent to waste treatment or recycled. Alkaline or acidic fumes emitted from the precipitation step are scrubbed, resulting in a wastewater stream. Silver sludge filtration produces another silver-free wastewater stream.

The dried cake is roasted in a reverberatory furnace. Most processes have baghouses for pollution control of particulates in furnace off-gases. Some use scrubbers and electrostatic precipitators. The impure silver is then cast into ingots or Dore plates. The furnace slag is crushed and classified, and the silver concentrate recycled as furnace feed, while the tailings are landfilled.

Dore plates are electrolytically refined on-site or shipped to other facilities. The electrolytic purification is carried out in either Balbach-Thum cells (horizontal electrodes) or Moebius cells (vertical electrodes). A typical electrolyte solution consists of silver nitrate and a small amount of nitric acid. The electrolyte is kept slightly to mildly acidic, a pH range of approximately 2 to 6. In addition to refined silver, electrolysis produces a waste stream of spent electrolyte and a slime containing precious metals such as gold and platinum. The slime is further refined for precious metal recovery.

The refined silver is melted in a melting furnace and cast as ingots. Pollution control of furnace off-gases is handled with a baghouse, scrubber, or electrostatic precipitator. Contact cooling water is used in the casting steps, as well as casting scrubbers which produce wastewater streams.

Incineration. Photographic film may be incinerated, rather than processed by granulation, stripping, and precipitation. The temperature and rate of burning must be carefully controlled if high efficiency is to be maintained. Air emissions include organic vapors from the volatilization and decomposition of organic scrap contaminants, as well as combustion gases and dust. The emissions are usually controlled by afterburners in series with a baghouse or scrubber. Scrubbing techniques produce a wastewater discharge. Silver-bearing ash is then fed directly to roasting and the process proceeds as described above. Some refineries buy silver-bearing ash from scrap dealers.

### Film Processing Solutions

There are three basic methods for recovering silver from photographic processing solutions: chemical precipitation, metallic replacement, and direct electrolytic refining. Silver recovery from baths has also been successful by adsorption from solution by ion exchange. Reverse osmosis has been used on dilute solutions.

Chemical Precipitation. Silver-rich solutions from photographic film developing and manufacturing undergo precipitation and purification as described above. One alternate method uses sulfide compounds, particularly sodium sulfide as the precipitating agent. Emission gases, such as hydrogen sulfide, are controlled with a wet scrubber, resulting in a wastewater stream. The subsequent process for silver recovery is identical to other precipitation methods.

Metallic Replacement. Silver ions can be effectively reduced from solution to a solid state by a replacement reaction. Any metal more active than silver will go into solution as an ion, while the silver ion becomes solid metal. Zinc, aluminum,

copper, and iron are commonly used to recover silver by replacement from photographic fixing solutions. The silver sludge produced can be filtered, roasted and cast as described previously.

Direct Electrolytic Refining. Although used as a purification step in other recovery processes, electrolytic refining is also a direct means of silver recovery. In the electrolytic method, a current is passed between an anode and a cathode which are suspended in a solution which contains greater than one mg/l of silver. Solutions containing silver below this concentration are difficult to refine electrolytically. Silver, about 99 percent pure, collects on the cathode. The cathode is periodically stripped to recover the silver. If the current density is too high for the amount of silver in the solution, thiosulfate in solution will decompose, forming silver sulfide. This reduces current efficiency and will render the regenerated solution unsuitable for reuse. Spent electrolyte solution is discarded or further refined for other precious metals. If the thiosulfate in solution is allowed to decompose, gaseous sulfur emissions ( $\text{SO}_x$ ), must be removed with a scrubber.

## NONPHOTOGRAPHIC MATERIALS

Based on the source of raw materials, the nonphotographic materials category can be divided into three basic processes for the recovery of silver: precipitation of waste plating solutions, melting of sterling-silver industry scraps, and refining of electrical components scrap.

### Waste Plating Solutions

Silver-plated tableware is produced by electroplating silver from cyanide solutions onto preformed shapes made of tin, iron, zinc, or copper. Silver wastes generated are spills of silver-rich electrolyte, dilute wash solutions, and spent electrolyte. Cyanide plating solutions are treated to precipitate the silver and oxidize the cyanide. As shown in Figure III-2, the process consists of precipitation, filtration and washing, drying or roasting, casting, refining, and recasting. Some processors cast the silver before refining and sell the ingots to other refiners.

Precipitation is usually accomplished by addition of sodium hypochlorite, resulting in silver chloride. After settling, the silver chloride is washed, filtered, and dried to be sold as product or further processed with methods similar to those used for photographic silver precipitates. The cyanide left in solution may be oxidized with sodium hypochlorite and lime to form a waste stream. Wastewater streams also result from waste washing water and the filtrate and dewatering wastes. Wet scrubbers are used

to control fumes from the precipitation and filtration steps. Roasting and melting furnaces may also require air pollution control to remove particulates.

An alternate silver recovery method is precipitation of silver as the metal, using zinc metal with sodium chloride solution. The subsequent steps are identical to other precipitation processes.

### Sterling-Silver Industry Scraps

The solid waste products from the sterling-silver industry include defective tableware, trimmings, turnings, punchings, fumes, spillage, drosses from melting and casting, and dusts. The different wastes vary in impurity and the relatively pure materials are melted, assayed, and reused. Lower quality wastes are combined, melted and cast, and the bullions are electrolytically refined as described above.

### Electrical Component Scrap

Silver scrap from electrical components includes electrical contacts, wire, silver-bearing batteries, condensers and solders. Figure III-3 shows typical production processes followed if electrical scrap is not suitable for electrolytic refining.

After careful sorting and sampling, the scrap is smelted in a reverberatory furnace to produce lead bullion, copper matte, and slag. The slag is smelted in a blast furnace to separate the lead and copper portions, which are recycled. Blast furnace slag is discarded. Dust and fumes from both the reverberatory and blast furnaces are collected and recycled.

The copper matte is crushed, ground, roasted, and leached. A wet scrubber may be used to control particulate air emissions from the roasting furnace, producing a wastewater stream. Leaching may be effected with nitric, sulfuric, or hydrochloric acid, using two methods. In one process, the leaching agent dissolves the base metals, leaving silver as a residue which can be filtered and washed for further processing. This leaching operation usually produces two wastewater streams: a silver-free leachate, which may be discharged or recycled, and a scrubber discharge stream.

In the second leaching process, silver is dissolved by the leaching agent and later precipitated from solution. This leaching also results in two wastewater streams: a lead-iron residue and a scrubber discharge stream, resulting from the control of acid fumes.



Electrical component parts may also be stripped directly with cyanide or nitric acid solutions to produce solutions from which silver can be precipitated.

Silver in solution from leaching or direct stripping is precipitated by metallic replacement with copper and then filtered. Copper sulfate composes most of the supernatant and filtrate and is either purified for copper recovery or discarded. Wet scrubbers may provide control of acidic fumes emitted during the precipitation step, producing an additional wastewater stream.

The recovered silver is melted in a furnace and cast as refined ingots. Silver of insufficient purity may undergo electrolytic refining. Particulate emissions from the melting furnace are controlled with a baghouse or scrubber. Venturi scrubbers are commonly used and a wastewater stream is discharged.

The lead bullion from the reverberatory smelting furnace and lead from the blast furnace is fed to a reverberatory-type cupola furnace. The cupellation produces litharge and precious metal layers. The litharge is sent to a lead refinery or reduced for recycle to the reverberatory smelting unit. The cupola furnace requires a baghouse or scrubber to remove emission gas pollutants.

The precious metal layer is cast into anodes (Dore plates) for electrolytic refining. The silver collects on the cathodes, which are melted and cast as refined ingots. The slime residue, containing gold and platinum, is further refined. The spent electrolyte solution may be discarded as waste. Wastewater streams may also be generated by contact cooling water used in casting, and melting furnace and casting scrubbers, which remove particulates emitted from these operations.

### Silver-Rich Sludges

Silver-rich sludges from waste plating solutions, stripping solutions, and photographic solutions are leached and the silver recovered, resulting in a silver-rich solution. Leaching agents used are hydrochloric acid, sulfuric acid, or nitric acid. The silver-rich solution is put through precipitation, filtration, roasting, melting, and casting steps to produce refined silver ingots.

### PROCESS WASTEWATER SOURCES

The principal uses of water in secondary silver plants are:

1. Film stripping,
2. Film stripping wet air pollution control,

3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of film stripping solutions wet air pollution control,
5. Precipitation and filtration of photographic solutions,
6. Precipitation and filtration of photographic solutions wet air pollution control,
7. Electrolytic refining,
8. Furnace wet air pollution control,
9. Casting contact cooling water,
10. Casting wet air pollution control,
11. Leaching,
12. Leaching wet air pollution control,
13. Precipitation and filtration of nonphotographic solutions, and
14. Precipitation and filtration of nonphotographic solutions wet air pollution control.

#### OTHER WASTEWATER SOURCES

There are other waste streams associated with the production of secondary silver. These waste streams include but are not limited to:

1. Maintenance and cleanup water, and
2. Direct electrolytic refining wet air pollution control wastewater

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

#### AGE, PRODUCTION, AND PROCESS PROFILE

Of the 44 plants recovering silver (from photographic and non-photographic materials), Figure III-4 shows that the plants are concentrated in the Northeast and California, with plants also located in Idaho, Utah, Louisiana, Florida, and Texas.

Table III-1 summarizes the general type and shows the relative ages of the secondary silver plants. Four plants discharge directly, 17 are indirect dischargers, and 23 are zero dischargers. Fourteen plants process only photographic materials, 14 process only nonphotographic materials, and 16 plants process both types of materials. The average plant age is between 15 and 24 years.

Table III-2 shows the production ranges for the 44 secondary silver plants. Over half of the plants that reported production data produce in excess of 100,000 troy ounces per year. Twelve of these plants produce over 1,000,000 troy ounces of silver per year. Only five plants reported producing less than 50,000 troy ounces per year.

Table III-3 provides a summary of the plants having the various secondary silver processes. The number of plants generating wastewater from the processes is also shown.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS  
IN THE SECONDARY SILVER SUBCATEGORY BY DISCHARGE TYPE

Type of Plant Discharge	1982- 1973 0-9	1972- 1968 10-14	1967- 1958 15-24	1957- 1948 25-34	1947- 1938 35-44	1937- 1928 45-54	1927- 1918 55-64	1917- 1903 65-79	Before 1903 80+	Not Reported in dcp	Total
Direct	0	1	0	0	0	1	1	0	0	1	4
Indirect	4	3	4	1	1	0	1	1	0	3	17
Zero	<u>4</u>	<u>5</u>	<u>4</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>9</u>	<u>23</u>
Total	8	9	8	1	1	1	2	1	0	13	44

Table III-2

## PRODUCTION RANGES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Type of Plant</u>	<u>Silver Production Ranges for 1976 (troy ounces/year)</u>					
	<u>0 - 50,000</u>	<u>50,001- 100,000</u>	<u>100,001- 500,000</u>	<u>500,001- 1,000,000</u>	<u>1,000,000+</u>	<u>Not Reported in dcp</u>
Direct Discharger	0	0	1	0	1	2
Indirect Discharger	4	2	4	0	4	3
Zero Discharger	<u>1</u>	<u>1</u>	<u>4</u>	<u>1</u>	<u>7</u>	<u>9</u>
Total	5	3	9	1	12	14

Table III-3

SUMMARY OF SECONDARY SILVER SUBCATEGORY PROCESSES  
AND ASSOCIATED WASTE STREAMS

<u>Process</u>	<u>Number of Plants With Process</u>	<u>Number of Plants Reporting Generation* of Wastewater</u>
Film stripping	8	3
Film stripping air pollution control	1	1
Precipitation and filtration of film stripping solutions	6	4
Precipitation and filtration of film stripping solutions air pollution control	1	1
Precipitation and filtration of photographic solutions	15	10
Precipitation and filtration of photographic solutions air pollution control	4	3
Electrolytic refining	20	12
Furnace air pollution control	19	11
Casting	28	11
Casting air pollution control	4	2
Leaching	15	12
Leaching air pollution control	12	11
Precipitation and filtration of nonphotographic solutions	9	7
Precipitation and filtration of nonphotographic solutions air pollution control	4	3

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

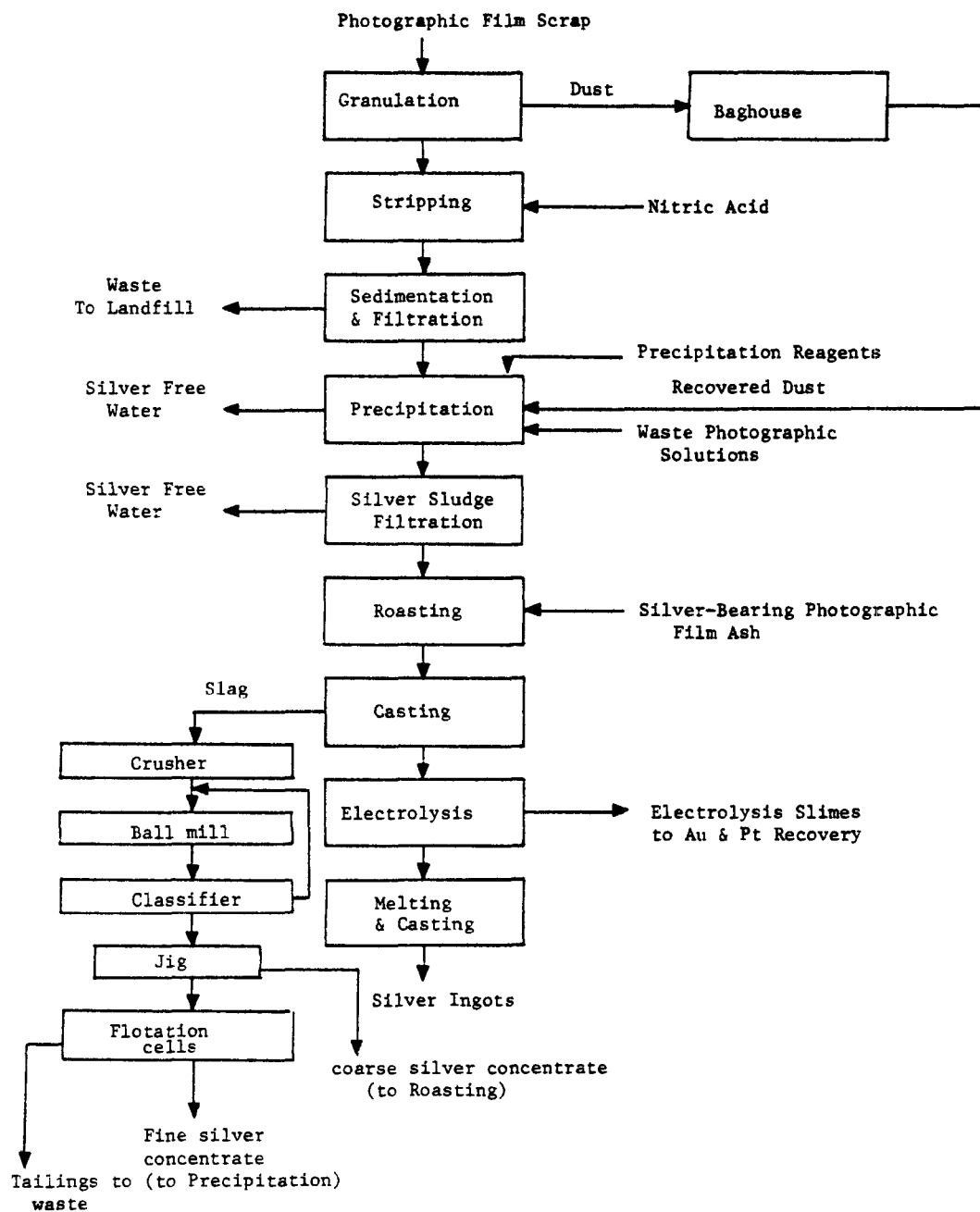


Figure III-1  
SILVER REFINING FROM PHOTOGRAPHIC MATERIALS

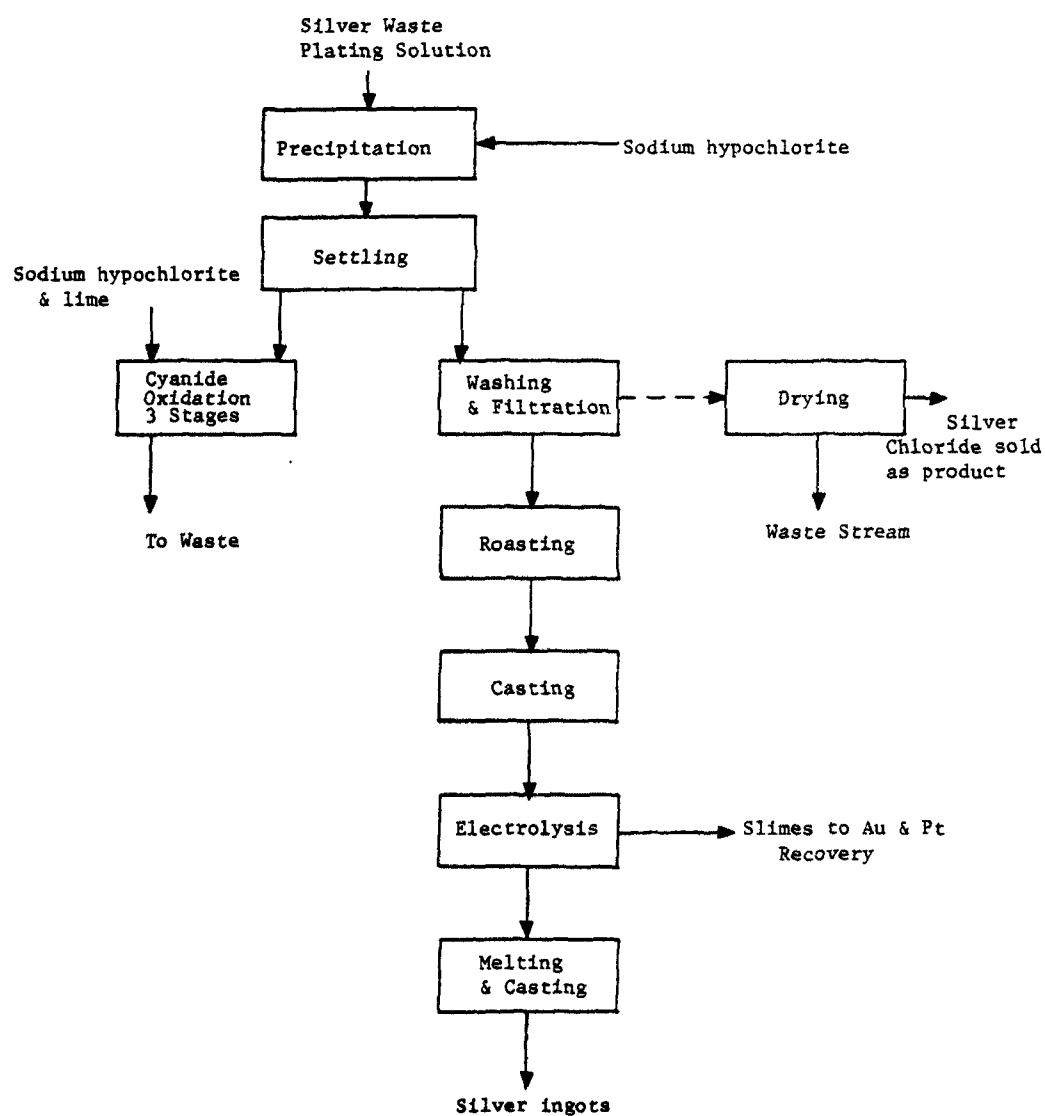


Figure III-2  
SILVER REFINING FROM WASTE PLATING SOLUTIONS  
425



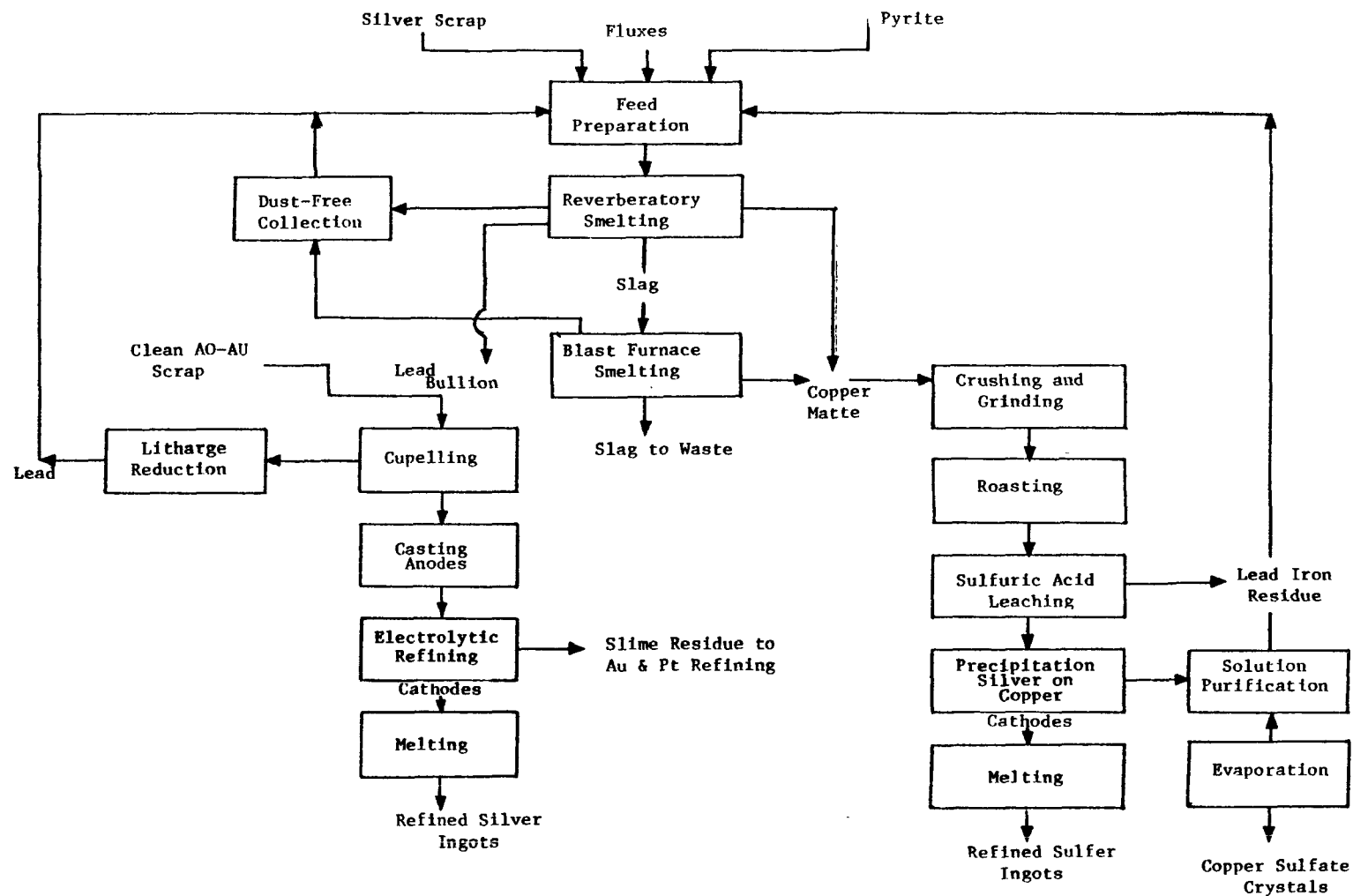


Figure III-3  
SECONDARY SILVER PRODUCTION PROCESS FROM NONPHOTOGRAPHIC SCRAP

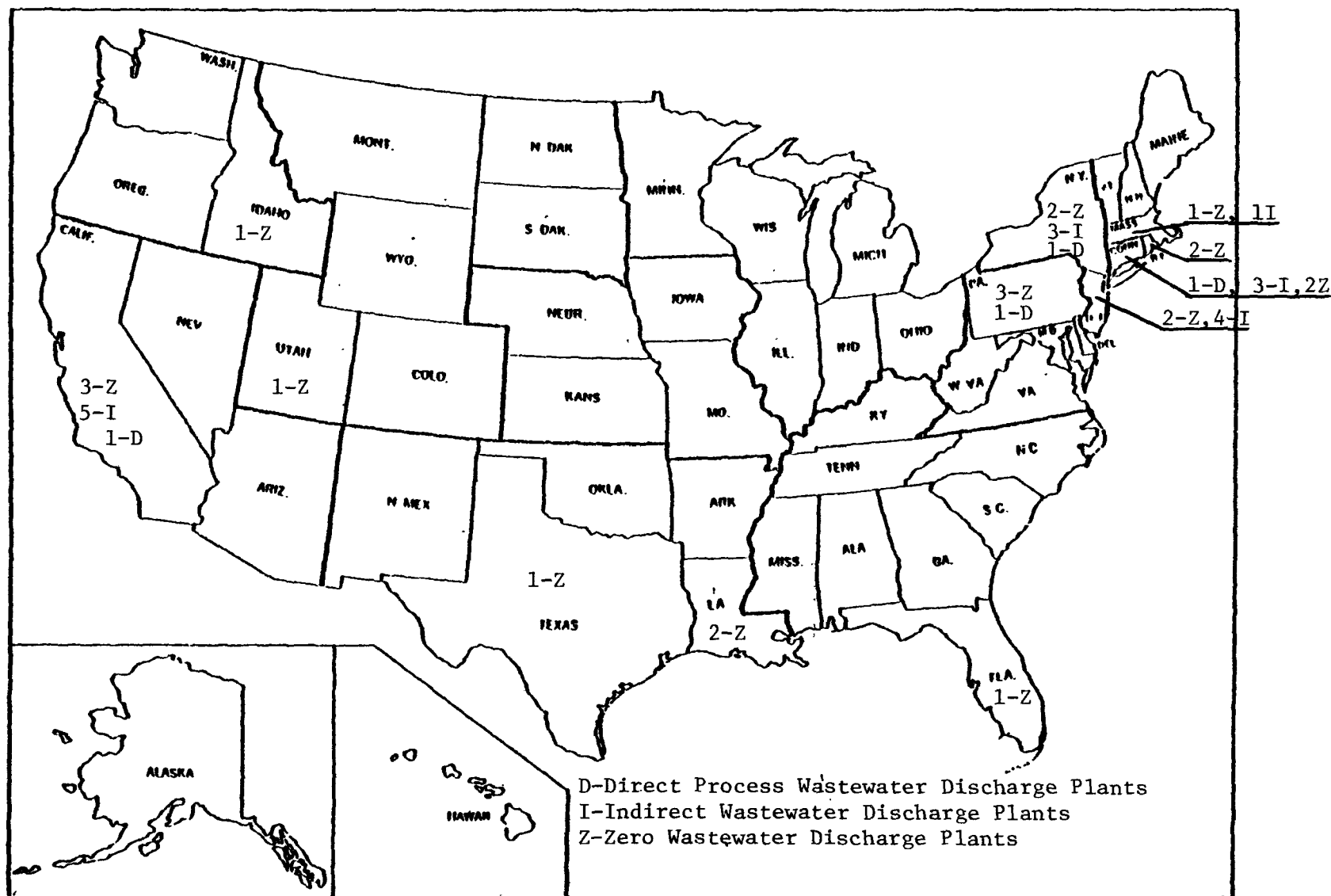


Figure III-4  
GEOGRAPHIC LOCATIONS OF THE SECONDARY SILVER INDUSTRY

## SECONDARY SILVER SUBCATEGORY

### SECTION IV

#### SUBCATEGORIZATION

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

#### FACTORS CONSIDERED IN SUBCATEGORIZATION

The following factors were evaluated for use in determining appropriate subcategories for the nonferrous metals industry:

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

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

In Section IV of the General Development Document, each of these factors is described, and the rationale for selecting metal products, manufacturing processes and raw materials as the principal factors used for subcategorization is discussed. On the basis of these factors, the nonferrous metals manufacturing category (phase I) was divided into 12 subcategories, one of them being secondary silver.

The secondary silver subcategory has not been considered during previous rulemaking. The purpose of this rulemaking is to establish BPT and BAT effluent limitations, and NSPS, PSES, and PSNS for the secondary silver subcategory.

## FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY SILVER SUBCATEGORY

The factors listed previously were each evaluated when considering subdivision of the secondary silver 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 secondary silver subcategory is based primarily on the production processes used. Within the subcategory, a number of different operations are performed, which may or may not have a water use or discharge, and which may require the establishment of separate effluent limitations and standards. While the secondary silver industry is still considered a single subcategory, a more thorough examination of the production processes, water use and discharge practices, and pollutant generation rates has illustrated the need for limitations and standards based on a specific set of waste streams. Limitations and standards will be based on specific flow allowances for the following subdivisions:

1. Film stripping,
2. Film stripping wet air pollution control,
3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of film stripping solutions wet air pollution control,
5. Precipitation and filtration of photographic solutions,
6. Precipitation and filtration of photographic solutions wet air pollution control,
7. Electrolytic refining,
8. Furnace wet air pollution control,
9. Casting contact cooling water,
10. Casting wet air pollution control,
11. Leaching,
12. Leaching wet air pollution control,
13. Precipitation and filtration of nonphotographic solutions, and
14. Precipitation and filtration of nonphotographic solutions wet air pollution control.

## OTHER FACTORS

A number of other factors considered in this evaluation either supported the establishment of the secondary silver subcategory and its subdivisions or were shown to be inappropriate bases for subcategorization. Air pollution control methods, treatment costs, nonwater quality aspects, and total energy requirements are functions of the selected subcategorization factors--raw materials and production processes. As such, they support the

method of subcategorization which has been applied. Factors determined to be inappropriate for use as bases for subcategorization are discussed briefly below.

#### PLANT SIZE

It is difficult to categorize secondary silver plants on the basis of size. The individual processes involved in silver production often process different amounts of silver-bearing material. Therefore, it is more appropriate to categorize silver plants on the basis of process production, e.g., precipitation production.

#### PLANT AGE

Plants within the secondary silver subcategory differ in age, in terms of initial operating year. However, to remain competitive, plants are constantly modernized. Modifications to process operations have been made, resulting in greater production efficiency and reduced air pollution emissions. As a result, neither the concentration of constituents in wastewater nor the capability to meet the limitations is related to plant age.

#### PRODUCTION NORMALIZING PARAMETERS

The effluent limitations and standards developed in this document establish mass limitations on the discharge of specific pollutant parameters. To allow these limitations to be applied to plants with various production capacities, the mass pollutant discharged must be related to a unit of production. This factor is known as the production normalizing parameter (PNP). In general, the actual silver production from the respective manufacturing process is used as the PNP. This is based on the principle that the amount of water generated is proportional to the amount of product made. Therefore, the PNP's for the 14 secondary silver subdivisions are as follows:

<u>Subdivision</u>	<u>PNP</u>
1. Film stripping	kkg of silver produced from film stripping
2. Film stripping wet air pollution control	kkg of silver produced from film stripping
3. Precipitation and filtration of film stripping	kkg of silver precipitated

<u>Subdivision</u>	<u>PNP</u>
4. Precipitation and filtration of film stripping solutions wet air pollution control	kkg of silver precipitated
5. Precipitation and filtration of photographic solutions	kkg of silver precipitated
6. Precipitation and filtration of photographic solutions wet air pollution control	kkg of silver precipitated
7. Electrolytic refining	kkg of silver refined
8. Furnace wet air pollution control	kkg of silver smelted, roasted, or dried
9. Casting contact cooling water	kkg of silver cast
10. Casting wet air pollution control	kkg of silver cast
11. Leaching	kkg of silver produced from leaching
12. Leaching wet air pollution control	kkg of silver produced from leaching
13. Precipitation and filtration of nonphotographic solutions	kkg of silver precipitated
14. Precipitation and filtration of nonphotographic solution wet air pollution control	kkg of silver precipitated

## SECONDARY SILVER SUBCATEGORY

### SECTION V

#### WATER USE AND WASTEWATER CHARACTERISTICS

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

Section V of the General Development Document contains a detailed description of the data sources and methods of analysis used to characterize wastewater from the nonferrous metals manufacturing category. To summarize this information briefly, two principal data sources were used: 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 secondary silver 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. Wastewater samples were collected in two phases: screening and verification. The first phase, screen sampling, was to identify which toxic pollutants were present in the wastewaters from production of the various metals. Screening samples were analyzed for 128 of the 129 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. There is no reason to expect that TCDD would be present in secondary silver wastewater). A total of 10 plants were selected for screen sampling in the nonferrous metals manufacturing category, one of these being a secondary silver plant. Of the 36 plants selected for verification sampling, three were from the secondary silver 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).

As described in Section IV of this supplement, the secondary silver subcategory has been further categorized into 14 subdivisions, so that the proposed regulation contains mass discharge limitations and standards for 14 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.

## WASTEWATER SOURCES, DISCHARGE RATES, AND CHARACTERISTICS

The wastewater data presented in this section were evaluated in light of production process information compiled during this study. As a result, it was possible to identify the principal wastewater sources in the secondary silver subcategory. They are:

1. Film stripping,
2. Film stripping wet air pollution control,
3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of film stripping solutions wet air pollution control,
5. Precipitation and filtration of photographic solutions,
6. Precipitation and filtration of photographic solutions wet air pollution control,
7. Electrolytic refining,
8. Furnace wet air pollution control,
9. Casting contact cooling water,
10. Casting wet air pollution control,
11. Leaching,
12. Leaching wet air pollution control,
13. Precipitation and filtration of nonphotographic solutions, and
14. Precipitation and filtration of nonphotographic solutions wet air pollution control.

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 or other fluid (e.g., emulsions, lubricants) required for a given process per mass of silver 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 silver produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carryover 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. The production normalized flows were compiled and statistically analyzed by stream type. 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 X, XI, and XII where representative BAT, BDT, and pretreatment discharge flows are selected for use in calculating the effluent limitations and standards. As an example, silver precipitation and filtration scrubbing wastewater flow is related to precipitate production. As such, the discharge rate is expressed in liters of scrubber wastewater discharged per metric ton of silver produced by precipitation.

In order to quantify the concentrations of pollutants present in wastewater from secondary silver plants, wastewater samples were collected at four plants. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 through V-4 (at the end of this section).

The raw wastewater sampling data for the secondary silver subcategory are presented in Tables V-2, V-5, and V-8 (at the end of this section). Treated wastewater sampling data are shown in Tables V-16 through V-18. The stream codes presented in the tables may be used to identify the location of each of the samples on the process flow diagrams in Figures V-1 through V-4. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected. If the analysis did not detect a pollutant in a waste stream, the pollutant was omitted from the table.

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

These 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. Data reported as an asterisk are considered as detected but below quantifiable

concentrations, and a value of zero is used for averaging. Toxic 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 excluded in calculating the average. Finally, toxic metal values reported as less than a certain value were considered as not detected and a value of zero is used in the calculation of the average. For example, three samples reported as ND, \*, and 0.021 mg/l have an average value of 0.010 mg/l.

The method by which each sample was collected is indicated by number, as follows:

- 1 one-time grab
- 2 24-hour manual composite
- 3 24-hour automatic composite
- 4 48-hour manual composite
- 5 48-hour automatic composite
- 6 72-hour manual composite
- 7 72-hour automatic composite

In the data collection portfolios, the secondary silver plants which discharge wastewater were asked to specify the presence or absence of the toxic pollutants in their effluent. Of the 44 secondary silver plants, 19 did not respond to this portion of the questionnaire. All plants responding to the organic compounds portion of the questionnaire reported that all toxic organic pollutants were known to be absent or believed to be absent from their wastewater.

The responses for the toxic metals and cyanide are summarized below:

<u>Pollutant</u>	<u>Known Present</u>	<u>Believed Present</u>	<u>Believed Absent</u>	<u>Known Absent</u>
Antimony	2	4	14	5
Arsenic	1	2	16	6
Beryllium	0	2	16	7
Cadmium	4	5	10	6
Chromium	5	4	10	6
Copper	10	4	6	5
Cyanide	4	1	13	7
Lead	7	4	8	6
Mercury	1	2	16	6
Nickel	8	3	9	5
Selenium	1	2	15	7
Silver	13	5	3	4
Thallium	0	1	16	8
Zinc	10	4	7	4

## FILM STRIPPING

Photographic film may be stripped of emulsion and the silver precipitated. The emulsion can be screened and rinsed, producing wastewater. Water discharge rates are presented in Table V-1 in liters per metric ton of silver produced from film stripping. Table V-2 (stream 14) shows combined raw wastewater data from film stripping and wet air pollution control on film stripping and film stripping precipitation. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, film stripping wastewater should contain toxic organics and metals, cyanide, and suspended solids above treatable concentrations, as well as phenolics at a quantifiable concentration.

## FILM STRIPPING WET AIR POLLUTION CONTROL

One plant engaged in film stripping uses a wet scrubber to control air emissions. This plant uses the same scrubber to control emissions from film stripping and film stripping precipitation. A 99+ percent recycle of the scrubber water is maintained and the discharge rate is 2,152 liters per metric ton (516 gal/ton) of silver produced from film stripping. Table V-2 (stream 14) shows combined raw wastewater data from film stripping and wet air pollution control on film stripping and film stripping precipitation. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, film stripping wet air pollution control wastewater should contain toxic organics and metals, cyanide, phenolics, and suspended solids.

## PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

In film stripping processes, the solution resulting from washing granulated film is treated to precipitate the silver. After settling or filtration, the silver-free solution may be discarded as wastewater. Four of the six photographic plants that use this process discharge a waste stream. The water discharge rates, reported in liters per metric ton of silver precipitated, are shown in Table V-3. Sampling data for film stripping solutions precipitation are summarized in Table V-2 (Stream 12). Raw wastewater from this process contains toxic organics and metals, cyanide, and suspended solids at treatable concentrations, as well as measurable concentrations of phenolics.

## PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS WET AIR POLLUTION CONTROL

One plant uses a wet scrubber on its film stripping precipitation process, producing a waste stream. This plant uses the same scrubber to control air emissions from film stripping and film stripping precipitation, therefore the water discharge rates and stream characteristics are identical for both subdivisions. This wastewater should be characterized by the presence of toxic organics and metals above treatable concentrations, as well as suspended solids, and cyanide.

## PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

Silver can be precipitated from discarded hypo solutions. After filtration, the silver-free solution constitutes a waste stream. Fifteen of the 30 photographic silver recovery plants have precipitation processes, nine of these discharging process wastewater. The discharge rates from these plants, presented in liters per metric ton of silver precipitated, are shown in Table V-4. The Agency did not sample the raw wastewater from silver solution precipitation directly; however, wastewater samples were collected after filtering with sawdust (which is part of the process). This wastewater contains 1,2-dichloroethane, chloroform, phthalates, and tetrachloroethylene, all above treatable concentrations (0.025 to 0.132 mg/l). Toxic metals are also found, including a high concentration of zinc (200 mg/l). Ammonia (4,630 mg/l), and chloride (734 mg/l) are also present. Suspended solids are evident, but most solids in the raw wastewater were probably removed by the filter. Raw wastewater sampling data are given in Table V-5.

## PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

Of the 15 photographic silver plants precipitating silver solutions, four use wet air pollution control, three discharging wastewater from wet scrubbers. The water discharge flow rates are shown in Table V-6. Although wastewater samples were not collected from precipitation of photographic solutions wet air pollution control, raw wastewater data are available from a film stripping precipitation scrubber. The wastewater characteristics for the two scrubbers are expected to be similar because of the similarities in the raw materials and processes used. Wastewater samples collected from the analogous wet scrubber stream contain toxic organics and metals, cyanide, and suspended solids above treatable concentrations, as well as phenolics at quantifiable concentrations.

## ELECTROLYTIC REFINING

Twenty plants use electrolytic refining as a purification step in secondary silver processing. Thirteen plants generate waste streams consisting of spent electrolyte; 12 of those discharge the wastewater. Table V-7 shows the water discharge rates in liters per metric ton of silver refined.

Electrolytic refining is similar for photographic and nonphotographic plants, therefore wastewater from each may have similar characteristics. Table V-8 summarizes the raw wastewater sampling data for the toxic and selected conventional and nonconventional pollutants.

The samples were collected at a nonphotographic plant from a combined waste stream comprised of raw wastewater from electrolytic refining, as well as metal-depleted solutions. This raw wastewater contains toxic organics and metals, ammonia, fluoride, cyanide, and suspended solids above treatable concentrations, as well as quantifiable concentrations of phenolics.

## FURNACE WET AIR POLLUTION CONTROL

Of the secondary silver plants with furnaces or incinerators, 19 control off-gas emissions. Eleven plants use wet scrubbers, four of these discharging wastewater, as shown in Table V-9. Although the Agency did not collect samples from furnace scrubber waste streams, the furnace scrubber wastewater is analogous to scrubber wastewater from other secondary silver processes because of the similarity in raw materials used. Therefore, furnace scrubber wastewater should contain toxic organics and metals, cyanide, and suspended solids. Increased suspended solids may be present in wastewater from furnace scrubbers not preceded by baghouse ash collectors.

## CASTING CONTACT COOLING WATER

Contact cooling water may be used for casting. Of the 28 secondary silver plants reporting casting operations, 11 use, and 10 discharge contact cooling water. The water discharge rates are presented in liters per metric ton of silver cast in Table V-10.

Since casting operations are similar in photographic and nonphotographic plants, wastewater from both should exhibit similar characteristics. Table V-8 (stream 44) summarizes field sampling data from combined raw wastewater, of which casting contact cooling water is a constituent. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, casting contact

cooling wastewater should contain treatable concentrations of toxic organics and metals, ammonia, cyanide, fluoride, and suspended solids.

#### CASTING WET AIR POLLUTION CONTROL

Four of the 28 silver plants with casting operations use either baghouses or scrubbers to control air emissions from casting. One plant with a wet scrubber discharges water, as shown in Table V-11.

Although the Agency did not collect samples from casting scrubber waste streams, this wastewater is analogous to scrubber wastewater from other secondary silver processes because of the similarity in raw materials used. Casting scrubber water should contain toxic organics and metals above treatable concentrations. The wastewater may also contain cyanide, phenolics, and suspended solids.

#### LEACHING

In nonphotographic materials plants, leaching is used to recover silver from silver sludges and copper matte associated with the melting of electrical component parts. Of the 15 nonphotographic plants that leach, 12 discharge wastewater, consisting of either silver-free leachate or lead-iron residue. Water discharge rates are given in Table V-12 in liters per metric ton of silver produced from leaching.

Table V-8 (stream 40) shows combined raw wastewater data from nonphotographic solutions precipitation and electrolytic refining. Leaching wastewaters have similar characteristics as precipitation wastewater because of the nature of the nonphotographic materials processed. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, raw wastewater from leaching should contain toxic organics and metals, ammonia, fluoride, cyanide, and suspended solids above treatable concentrations.

#### LEACHING WET AIR POLLUTION CONTROL

For leaching emissions, discharge rates are shown in Table V-13. Of the 12 plants with leaching emissions control, eight discharge wastewater. This wastewater is analogous to scrubber wastewater from other secondary silver processes and should be similarly characterized. Toxic organics and metals, cyanide, and suspended solids should be present above treatable concentrations.

## PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS

Silver may be recovered by precipitation from leachates, waste silver-plating solutions or melted silver scrap. Nine nonphotographic plants report this process, seven discharging wastewater. Depleted solutions may be discarded as wastewater, along with washwater and silver-free filtrates. Discharge water rates are presented in Table V-15.

Table V-8 (stream 40) shows combined raw wastewater data from nonphotographic solutions precipitation and electrolytic refining. Data are not available for separate waste streams because discrete points in each stream were not accessible. However, based on the combined wastewater data and the raw materials and process used, precipitation of nonphotographic solutions wastewater should be characterized by the presence of toxic organics and metals, ammonia, cyanide, chloride, fluoride, and suspended solids above treatable concentrations.

## PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

Air emissions control may be applied to precipitation and filtration processes. Of the four plants using emission control, three discharge water, as shown in Table V-15. Toxic organics and metals, phenolics, cyanide, and suspended solids characterize wastewater from scrubbers on similar silver processes. Raw wastewater sampling data are presented in Table V-2.

Table V-1

WATER USE AND DISCHARGE RATES FOR FILM STRIPPING  
(10<sup>3</sup> l/kg of silver produced from film stripping)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
30927	0	1,617.0	1,617.0
566	NR	NR	NR
596	NR	NR	NR

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NR = Present but data not reported in dcp.



Table V-2

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
4. benzene	12	1		0.084			0.084
	14	1		0.17	0.132	2.05	0.784
	16	1		0.149			0.149
6. carbon tetra- chloride	12	1		ND			
	14	1		ND	ND	0.07	0.07
	16	1		ND			
10. 1,2-dichloro- ethane	12	1		0.061			0.061
	14	1		0.58	ND	ND	0.58
	16	1		0.156			0.156
11. 1,1,1-trichloro- ethane	12	1		ND			
	14	1		ND	ND	ND	
	16	1		0.022			0.022
23. chloroform	12	1		0.244			0.244
	14	1		1.31	ND	ND	1.31
	16	1		0.36			0.36
29. 1,1-dichloro- ethylene	12	1		ND			
	14	1		0.33	ND	ND	0.33
	16	1		6.1			6.1
38. ethylbenzene	12	1		0.017			0.017
	14	1		0.016	*	ND	0.008
	16	1		*			*

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
44. methylene chloride	12	1		0.67		ND	0.67
	14	1		3.23	ND	ND	3.23
	16	1		3.1			3.1
66. bis(2-ethylhexyl) phthalate	12	1		*			*
	14	1		0.034			0.034
	16	1		0.011			0.011
68. di-n-butyl phthalate	12	1		0.015			0.015
	14	1		0.014			0.015
	16	1		0.047			0.047
69. di-n-octyl phthalate	12	1		0.033			0.033
	14	1		0.058			0.058
	16	1		ND			
70. diethyl phthalate	12	1		ND			
	14	1		0.038			
	16	1		ND			
85. tetrachloro- ethylene	12	1		*			*
	14	1		0.087	ND	ND	0.087
	16	1		0.042			0.041
86. toluene	12	1		0.029			0.029
	14	1		0.027	ND	0.032	0.03
	16	1		0.013			0.013

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
87. trichloro- ethylene	12	1		0.473			0.473
	14	1		0.93	ND	ND	0.93
	16	1		0.832			0.832
91. chlordane	12	1		**			**
	16	1		<0.01			<0.01
106. PCB-1242 (c)	12	1		<0.014			<0.0
107. PCB-1254 (c)	16	1		<0.007			<0.0
108. PCB-1221 (c)	230	6		0.012			0.012
109. PCB-1232 (d)	12	1		<0.017			<0.017
110. PCB-1248 (d)	16	1		<0.015			<0.015
111. PCB-1260 (d)	230	6		0.012			0.012
113. toxaphene	12	1		**			**
	16	1		<0.01			<0.01
	230	1		ND			
114. antimony	12	1		12			12.0
	14	1		0.7			0.7
	16	1		1.5			1.5
115. arsenic	12	1		2.2			2.2
	14	1		0.2			0.2
	16	1		1.9			1.9

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
117. beryllium	12	1		<0.02			<0.02
	14	1		<0.02			<0.02
	16	1		<0.02			<0.02
118. cadmium	12	1		0.37			0.37
	14	1		5			5.0
	16	1		0.65			0.65
119. chromium	12	1		100			100.0
	14	1		9			9.0
	16	1		7			7.0
120. copper	12	1		30			30.0
	14	1		2			2.0
	16	1		0.72			0.72
121. cyanide	12	1		5.95			5.95
	14	1		1.83	1.13	1.29	1.416
	16	1		0.311			0.311
122. lead	12	1		9			9.0
	14	1		2			2.0
	16	1		6			6.0
123. mercury	12	1		0.017			0.017
	16	1		0.0008			0.0008

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
124. nickel	12	1		<0.5			<0.5
	14	1		1			1.0
	16	1		2			2.0
125. selenium	12	1		0.9			0.9
	14	1		0.6			0.6
	16	1		0.25			0.25
126. silver	12	1		5			5.0
	16	1		3			3.0
127. thallium	12	1		0.4			0.4
	16	1		0.2			0.2
128. zinc	12	1		20			20.0
	14	1		4			4.0
	16	1		10			10.0
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	12	1	10,100				10,100
	16	1	6,460				6,460
	230	6	14,800				14,800
phenols (total; by 4-AAP method)	12	1		0.197			0.197
	14	1		32	28.8	16.7	25.8
	16	1		62.5			62.5

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
total organic carbon (TOC)	12	1		4,040			4,040
	16	1		2,410			2,410
	230	6		13,040			13,040
<u>Conventionals</u>							
oil and grease	12	1		111			111
	14	1		130			130
	16	1		20			20
total suspended solids (TSS)	12	1		3,664			3,664
	16	1		162			162.0
	230	6		484			484.0
pH (standard units)	12	1		2.95			
	14	1		8.4	6.05	5.88	
	16	1		1.1			

- (a) Three samples were analyzed for the acid extractable pollutants; none were detected. The samples were also analyzed for pesticides, but none were detected, except as noted.
- (b) No source water samples were analyzed.
- (c), (d) Reported together

Table V-2 (Continued)

SECONDARY SILVER SAMPLING DATA  
PHOTO - MISCELLANEOUS  
RAW WASTEWATER

†Sample type. Note: These numbers also apply to subsequent data tables.

- 1 one-time grab
- 2 24-hour manual composite
- 3 24-hour automatic composite
- 4 48 hour manual composite
- 5 48 hour automatic composite
- 6 72 hour manual composite
- 7 72 hour automatic composite

\* Less than or equal to 0.01 mg/l

\*\* Less than or equal to 0.005 mg/l

Table V-3

WATER USE AND DISCHARGE RATES FOR PRECIPITATION  
AND FILTRATION OF FILM STRIPPING SOLUTIONS

(10<sup>3</sup> l/kg of silver produced from film stripping)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
30927	0	3,623.0	3,623.0
541	0	74.17	74.17
74	0	23.71	23.71
566	NR	NR	NR
602		No Wastewater Produced	

---

NR = Present but data not reported in dcp.



Table V-4

WATER USE AND DISCHARGE RATES FOR PRECIPITATION  
AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

(10<sup>3</sup> l/kg of silver precipitated)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
30927	0	2,890.0	2,890.0
538	0	680.0	680.0
9022	0	433.0	433.0
437	0	217.0	217.0
615	0	50.6	50.6
563	0	NR	NR
567	0	NR	NR
4301	0	NR	NR
74	0	NR	NR

---

NR = Present but data not reported in dcp.

Table V-5

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Toxic Pollutants</u>							
10. 1,2-dichloro-ethane	61	1		0.068			0.068
15. 1,1,2,3-tetra-chloroethane	61	1		<0.029			<0.029
23. chloroform	61	1		0.132			0.132
29. 1,1-dichloro-ethylene	61	1		0.049			0.049
30. 1,2-trans-dichloroethylene	61	1		0.049			0.049
66. bis(2-ethyl-hexyl)phthalate	61	1		0.1195			0.1195
67. butyl benzyl phthalate	61	1		0.052			0.052
85. tetrachloro-methylene	61	1		<0.025			<0.025
115. arsenic	61	1		0.03			0.03
118. cadmium	61	1		6			6.0
119. chromium	61	1		0.3			0.3
120. copper	61	1		1			1.0
122. lead	61	1		0.5			0.5
123. mercury	61	1		1			1.0
124. nickel	61	1		0.4			0.4
125. selenium	61	1		<0.04			<0.04
126. silver	61	1		<9.2			<9.2
127. thallium	61	1		<0.2			<0.2
128. zinc	61	1		200			200

Table V-5 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - MISCELLANEOUS  
 RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type†</u>	Concentrations (mg/l, except as noted)				<u>Average</u>
			<u>Source(b)</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Nonconventionals</u>							
ammonia	61	1		4,630			4,630
chemical oxygen demand (COD)	61	1		40,700			40,700
chloride	61	1		734			734
total organic carbon (TOC)	61	1		3,085			3,085
<u>Conventionals</u>							
oil and grease	61	1		3			3
total suspended solids (TSS)	61	1		92			92

(a) One sample was analyzed for pesticides: dieldrin, chlordane, 4,4'DDT, 4,4'DDE, endrin, endrin aldehyde, heptachlor, alpha-BHC, beta-BHC and gamma-BHC were detected but below the quantification limit. One sample was analyzed for PCB fractions. PCB-1242, 1254, 1221, 1232, 1248, 1260 and 1016 were detected, but below the quantification limit.

(b) No source water samples were analyzed.

Table V-6

WATER USE AND DISCHARGE RATES FOR PRECIPITATION  
AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR  
POLLUTION CONTROL(10<sup>3</sup> l/kg of silver precipitated)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
553	99+	39,021.1	18.76
74	99	NR	NR
459	100	NR	0
567	68	NR	NR

---

NR = Present but data not reported in dcp.

Table V-7  
WATER USE AND DISCHARGE RATES FOR ELECTROLYTIC  
REFINING

(10<sup>3</sup> l/kg of silver refined)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
567	0	63.22	63.22
457	0	52.64	52.64
553	0	20.3	20.3
615	0	15.81	15.81
460	0	9.85	9.85
65	0	8.96	8.96
4301	0	2.19	2.19

Table V-8

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - MISCELLANEOUS  
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type	Concentrations (mg/l, except as noted)				Average
			Source	Day 1	Day 2	Day 3	
<u>Toxic Pollutants</u>							
1. acenaphthne	40	6	ND	0.010	ND	ND	0.01
4. benzene	40	2	ND	0.054	*	0.038	0.031
	44	1	ND	*			*
6. carbon tetra- chloride	40	2	ND	ND	2.3	1.66	1.98
	44	1	ND	ND			
7. chlorobenzene	40	2	ND	*	*	<0.022	*
	44	1	ND	*			*
11. 1,1,1-trichlo- roethane	40	2	ND	ND	0.022	ND	0.022
	44	1	ND	ND			
15. 1,1,2,3-tetra- chloroethane	40	2	ND	ND	ND	ND	
	44	1	*	<0.038			<0.038
23. chloroform	40	2	0.021	ND	ND	0.312	0.312
	44	1	*	0.109			0.109
38. ethylbenzene	40	2	ND	0.021	*	ND	0.011
	44	1	ND	ND			
47. bromoform	40	2	ND	0.065	ND	ND	0.065
	44	1	ND	ND			
51. chlorodibro- momethane	40	2	ND	ND	<0.064	ND	<0.064
	44	1	ND	ND			
66. bis(2-ethyl- hexyl)phthalate	40	2	0.016	0.047			0.047
	44	1	*	0.011			0.011
67. butyl benzyl phthalate	40	2	ND	0.054			0.054
	44	1	*	ND			
68. di-n-butyl phthalate	40	2	*	0.3			0.3
	44	1	*	*			*

Table V-8 (Continued)

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - MISCELLANEOUS  
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type	Concentrations (mg/l, except as noted)				Average
			Source	Day 1	Day 2	Day 3	
69. di-n-octyl	40	2	ND	0.055			0.055
phthalate	44	1	*	*			*
78. anthracene (b)	40	2	*	<0.014			<0.014
81. phenanthrene (b)	44	1	ND	ND			
84. pyrene	40	2	*	2.15			2.150
	44	1	ND	ND			
85. tetrachloro-	40	2	0.011	0.123	0.017	ND	0.07
ethylene	44	1	*	<0.046			<0.046
86. toluene	40	2	*	0.057	*	<0.014	0.019
	44	1	ND	0.013			0.013
87. trichloro-	40	2	ND	ND	<0.019	ND	<0.019
ethylene	44	1	ND	<0.015			<0.015
90. dieldrin	44	1	**	**			**
91. chlordane	44	1	**	**			**
92. 4,4'-DDT	44	1	**	**			**
93. 4,4'-DDE	44	1	ND	**			**
98. endrin	44	1	**	**			**
100. heptechlor	44	1	**	**			**
103. b-BHC-Beta	44	1	**	**			**
107. PCB-1254	44	1	**	**			**
110. PCB-1248	44	1	**	**			**
114. antimony	40	2	<0.1	<0.1			<0.1
115. arsenic	40	2	<0.01	0.05			0.05
	44	1	<0.01	0.05			0.05
117. beryllium	40	2	<0.001	<0.001			<0.001
	44	1	<0.001	0.02			0.02
118. cadmium	40	2	<0.002	1.0			1.0
	44	1	<0.002	80.0			80.0

Table V-8 (Continued)

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - MISCELLANEOUS  
RAW WASTEWATER

Pollutant(a)	Stream Code	Sample Type	Concentrations (mg/l, except as noted)				Average
			Source	Day 1	Day 2	Day 3	
119. chromium	40	2	<0.005	2.0			2.0
	44	1	<0.005	20.0			20.0
120. copper	40	2	0.2	70.0			70.0
	44	1	0.04	60.0			60.0
121. cyanide	40	2		0.018	0.132	0.019	0.056
	44	1		0.001			0.001
122. lead	40	2	<0.02	4.0			4.0
	44	1	<0.02	50.0			50.0
123. mercury	40	2	<0.0001	<0.0001			<0.0001
	44	1	0.0002	0.0001			0.0001
124. nickel	40	2	<0.005	30.0			30.0
	44	1	<0.005	800			800
125. selenium	40	2	<0.01	<0.01			<0.01
	44	1	<0.01	<0.01			<0.01
126. silver	40	2	<0.02	0.43			0.43
	44	1	<0.02	4.7			4.7
127. thallium	40	2	<0.1	<0.1			<0.1
	44	1	<0.1	<0.1			<0.1
128. zinc	40	2	<0.06	20.0			20.0
	44	1	<0.06	2,000		2,000	
<u>Nonconventionals</u>							
ammonia	40	1		2,180	750	675	1,202
	44	1		9.5			9.5
chemical oxygen demand (COD)	40	2	<5		3,040		3,040
	44	1	<5	231			231



Table V-8 (Continued)

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - MISCELLANEOUS  
RAW WASTEWATER

<u>Pollutant(a)</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
chloride	44	1	41.0	32,300			32,300
fluoride	40		1.3		1.2		1.2
phenols (total; by	40	2		0.017	0.012	0.014	0.014
4-AAP method)	44	1		0.044			0.044
total organic	40	2	4.0		435.0		435.0
carbon (TOC)	44	1	5.0	24.0			24.0
<u>Conventionals</u>							
oil and grease	40	1		11	27	13	17.0
	44	1		8			8.0
total suspended	40	2	14		118		118
solids (TSS)	44	1	<1	112			112
pH (standard units)	40	1			2.2	2.3	
	44	1		1.9			

(a) Stream 40 was analyzed for the pesticide fraction, but none were detected above its quantification limit.

(b) Reported together.

Table V-9  
WATER USE AND DISCHARGE RATES FOR FURNACE WET AIR  
POLLUTION CONTROL

(10<sup>3</sup> l/kg of silver produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
78	99.9	4,620.0	4.62
553	99.7	1,580.5	4.74
65	100	638.3	0
549	100	373.1	0
437	100	303.5	0
9020	0	252.9	252.9
596	100	NR	0
441	100	NR	0
62	100	NR	0
459	100	NR	0
4567	NR	NR	NR

---

NR = Present but data not reported in dcp.

Table V-10  
WATER USE AND DISCHARGE RATES FOR CASTING  
CONTACT COOLING WATER

(10<sup>3</sup> l/kg of silver cast)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
460	0	47.4	47.4
553	0	6.32	6.32
9020	0	3.53	3.53
25	0	1.58	1.58
564	0	1.34	1.34
448	0	NR	NR
459	*	NR	0
567	0	NR	NR
578	0	NR	NR
456	NR	NR	NR

---

NR = Present but data not reported in dcp.

\*Evaporated.

Table V-11  
WATER USE AND DISCHARGE RATES FOR CASTING  
WET AIR POLLUTION CONTROL  
(10<sup>3</sup> l/kg of silver cast)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
553	99.7	1,580.0	4.74
459	100	NR	NR

---

NR = Present but data not reported in dcp.

Table V-12

WATER USE AND DISCHARGE RATES FOR LEACHING  
 (10<sup>3</sup> l/kg of silver produced from leaching)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9022	0	20,425.2	20,425.2
9020	0	3,161.0	3,161.0
549	0	86.7	86.7
615	0	3.61	3.61
78	0	2.54	2.54
553	0	2.19	2.19
25	NR	NR	NR
82	NR	NR	NR
448	NR	NR	NR
567	0	NR	NR
459	NR	NR	NR
664	NR	NR	NR
74	No Wastewater Produced		

---

NR = Present but data not reported in dcp.

Table V-13

WATER USE AND DISCHARGE RATES FOR LEACHING  
WET AIR POLLUTION CONTROL

(10<sup>3</sup> l/kg of silver produced from leaching)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9020	99	15,805.0	158.05
74	99+	7,021.5	4.01
549	99	2,894.0	28.9
83	79.2	1,753.4	364.7
553	99+	225.0	0.45
78	100	2.5	0
82	97.4	NR	NR
459	100	NR	0
664	100	NR	0
448	NR	NR	NR
567	65	NR	NR

---

NR = Present but data not reported in dcp.

Table V-14

WATER USE AND DISCHARGE RATES FOR PRECIPITATION  
AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS(10<sup>3</sup> l/kg of silver precipitated)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9020	0	2,528.8	2,528.8
615	0	252.9	252.9
74	0	29.06	29.06
460	0	13.37	13.37
82	0	NR	NR
9023	0	NR	NR
578	NR	NR	NR

---

NR = Present but data not reported in dcp.

Table V-15

WATER USE AND DISCHARGE RATES FOR PRECIPITATION  
AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS  
WET AIR POLLUTION CONTROL(10<sup>3</sup> l/kg of silver precipitated)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
9020	99	15,805.0	158.05
74	99+	7,021.5	1.62
578	NR	NR	NR

---

NR = Present but data not reported in dcp.



Table V-16

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - TREATMENT PLANT SAMPLES - PLANT A

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Toxic Pollutants</u>							
4. benzene	41	2	ND	0.014	ND	ND	0.014
6. carbon tetra- chloride	41	2	ND	0.394	0.305	0.401	0.367
15. 1,1,2,3-tetra- chloroethane	41	2	ND	ND	0.025	ND	0.025
23. chloroform	41	2	0.021	0.04	0.305	ND	0.173
38. ethylbenzene	41	2	ND	0.012	ND	*	0.006
39. fluoranthene	41	7	*	0.198			0.198
47. bromoform	41	2	ND	ND	0.013	ND	0.013
48. dichlorobromo- methane	41	2	ND	2.8	2.4	1.58	2.26
51. chlorodibro- momethane	41	2	ND	<0.047	ND	ND	<0.047
66. bis(2-ethyl- hexyl)phthalate	41	7	0.016	0.022			0.022
67. butyl benzyl phthalate	41	7	ND	0.038			0.038
68. di-n-butyl phthalate	41	7	*	0.082			0.082
69. di-n-octyl phthalate	41	7	ND	0.069			0.069
84. pyrene	41	7	*	0.179			0.179
85. tetrachloro- ethylene	41	2	0.011	0.017	*	*	0.006
87. trichloro- ethylene	41	2	ND	<0.014	ND	ND	<0.014
114. antimony	41	7	<0.1	1.5			1.5

Table V-16 (Continued)

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - TREATMENT PLANT SAMPLES - PLANT A

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
115. arsenic	41	7	<0.01	1.26			1.26
121. cyanide	41	7		0.020	0.075	0.053	0.049
126. silver	41	7	<0.02	6.9			6.9
<u>Nonconventionals</u>							
ammonia	41	1		2,200	2,080	1,600	1,960
chemical oxygen demand (COD)	41	7	<5		556		556
fluoride	41	7	1.3		2.4		2.4
phenols (total; by 4-AAP method)	41	2		0.008	0.023	0.018	0.016
total organic carbon (TOC)	41	7	4		97		97
<u>Conventionals</u>							
oil and grease	41	1		82	5	10	32
total suspended solids (TSS)	41	7	14		3,140		3,140
pH (standard units)	41	1		7.3	8.1	8.7	

Table V-17

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - TREATMENT PLANT SAMPLES - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Toxic Pollutants</u>							
6. carbon tetra- chloride	45	1	ND	0.019			0.019
66. bis(2-ethyl- hexyl) phthalate	45	2	*	0.03			0.03
118. cadmium	45	2	<0.002	0.1			0.1
119. chromium	45	2	<0.005	<0.05			<0.05
120. copper	45	2	0.04	0.6			0.6
121. cyanide	45	2		0.001			0.001
122. lead	45	2	<0.02	<0.2			<0.2
123. mercury	45	2	<0.0002	0.0001			0.0001
124. nickel	45	2	<0.005	<0.05			<0.05
128. zinc	45	2	<0.06	1			1
<u>Nonconventionals</u>							
ammonia	45	1		0.49			0.49
chemical oxygen demand (COD)	45	1	<5	<5			<5.0
chloride	45	1	41	669			669
phenols (total; by by 4-AAP method)	45	1		0.011			0.011
total organic carbon (TOC)	45	1	5	<1			<1.0

Table V-17 (Continued)

SECONDARY SILVER SAMPLING DATA  
NONPHOTO - TREATMENT PLANT SAMPLES - PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Conventionals</u>							
oil and grease	45	1		10			10
total suspended solids (TSS)	45	1	<1	10			10
pH (standard units)	45	1		9.9			

Table V-18

SECONDARY SILVER SAMPLING DATA  
 PHOTO - TREATMENT PLANT SAMPLE - PLANT C

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Toxic Pollutants</u>							
4. benzene	13	1		0.06			0.06
	15	1		*	3.2	ND	1.6
	17	1		0.03			0.03
10. 1,2-dichloro-ethane	13	1		0.126			0.126
	15	1		0.044	ND	0.05	0.047
	17	1		0.26			0.26
23. chloroform	13	1		0.404			0.404
	15	1		0.076	0.07	0.032	0.0593
	17	1		3.18			3.18
29. 1,1-dichloro-ethylene	13	1		0.101			0.101
	15	1		0.013	ND	ND	0.013
	17	1		3.418			3.418
38. ethylbenzene	13	1		0.014			0.014
	15	1		ND	0.036	0.05	0.043
	17	1		ND			
44. methylene chloride	13	1		0.876			0.876
	15	1		0.086	ND	ND	0.086
	17	1		0.89			0.89
85. tetrachloro-methylene	13	1		0.012			0.012
	15	1		ND	ND	ND	
	17	1		0.041			0.041

Table V-18 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - TREATMENT PLANT SAMPLE - PLANT C

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
86. toluene	13	1		0.019			0.019
	15	1		*	ND	ND	*
	17	1		ND			
87. trichloro- ethylene	13	1		0.334			0.334
	15	1		0.047	ND	ND	0.047
	17	1		0.19			0.19
114. antimony	15	1		0.45			0.45
	17	1		ND			
115. arsenic	15	1		0.7			0.7
	17	1		ND			
117. beryllium	15	1		<0.02			<0.02
	17	1		ND			
118. cadmium	15	1		3			3.0
	17	1		ND			
119. chromium	15	1		8			8.0
	17	1		ND			
120. copper	15	1		1			1.0
	17	1		ND			

Table V-18 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - TREATMENT PLANT SAMPLE - PLANT C

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				<u>Average</u>
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
121. cyanide	13	1		2.19			2.19
	15	1		1.29	1.62	2.04	1.65
	17	1		0.098			0.098
122. lead	15	1		3			3.0
	17	1		ND			
123. mercury	13	1		0.0032			0.0032
	15	1		0.0016			0.0016
	17	1		ND			
124. nickel	15	1		4			4.0
	17	1		ND			
125. selenium	15	1		0.4			0.4
	17	1		ND			
126. silver	13	1		1			1.0
	15	1		1			1.0
127. thallium	13	1		0.65			0.65
	15	1		0.2			0.2
128. zinc	15	1		5			5.0
	17	1		ND			

Table V-18 (Continued)

SECONDARY SILVER SAMPLING DATA  
 PHOTO - TREATMENT PLANT SAMPLE - PLANT C

Pollutant	Stream Code	Sample Type	Concentrations (mg/l, except as noted)				Average
			Source	Day 1	Day 2	Day 3	
<u>Nonconventionals</u>							
phenols (total; by 4-AAP method)	13	1		0.421			0.421
	15	1		26.5	26.8	20.3	24.5
	17	1		51.3			51.3
CONVENTIONALS							
oil and grease	15	1		50	51	195	99
	17	1		21			21.0
pH (standard units)	13	1		7.14			
	15	1		8.55	7.16	6.97	
	17	1		6.68			



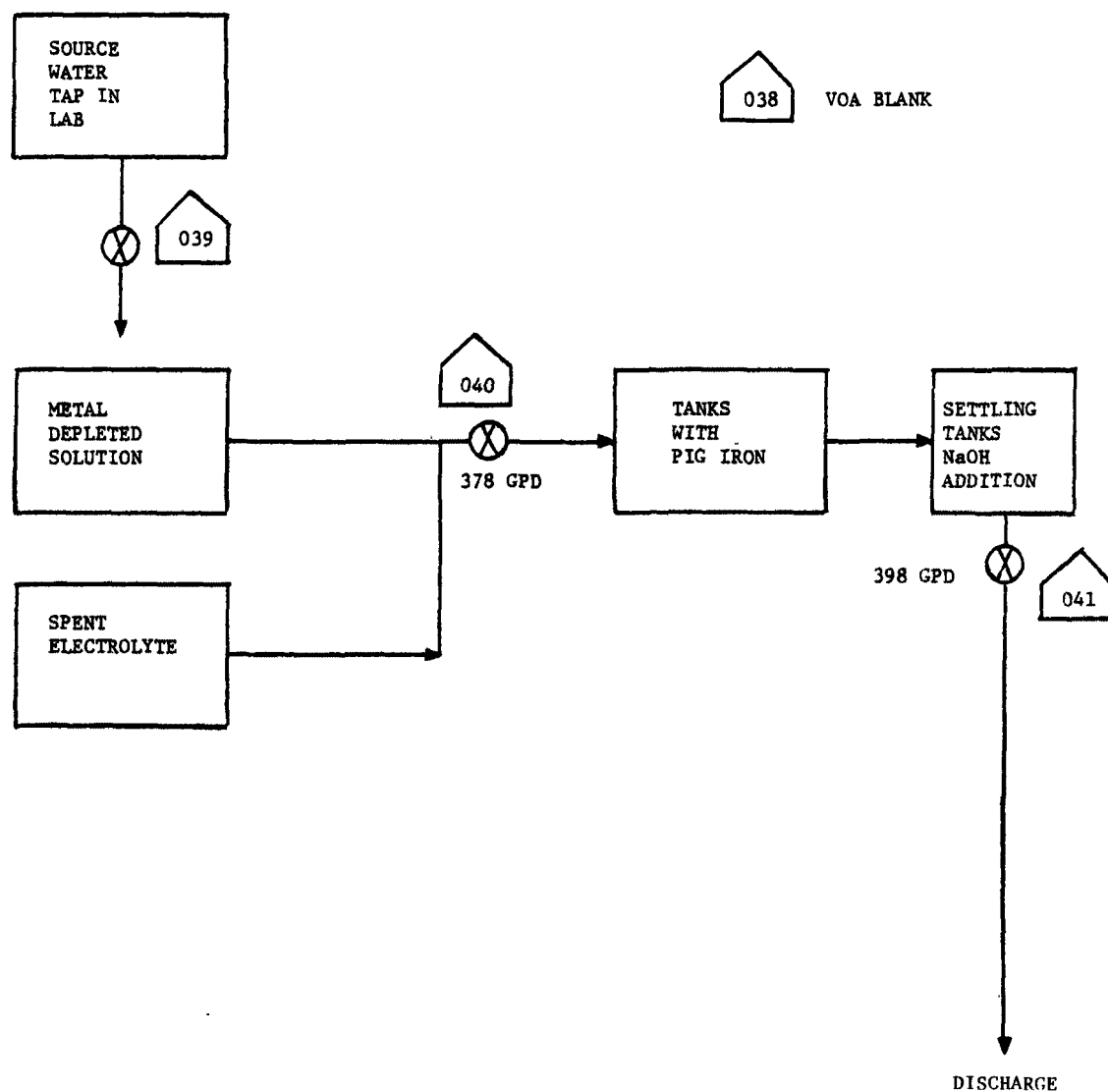


Figure V-1  
SAMPLING SITES AT SECONDARY SILVER PLANT A

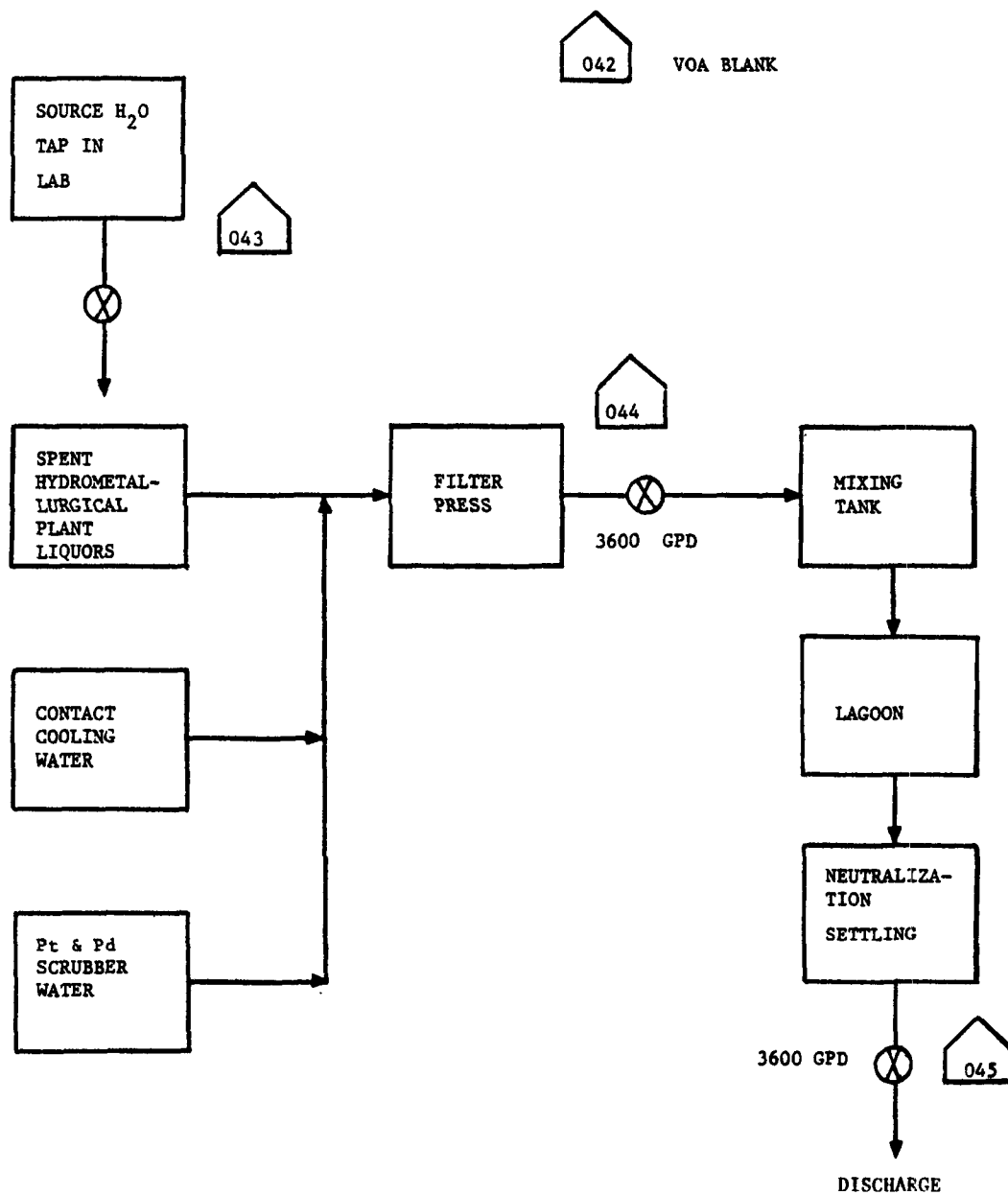


Figure V-2  
SAMPLING SITES AT SECONDARY SILVER PLANT B  
476

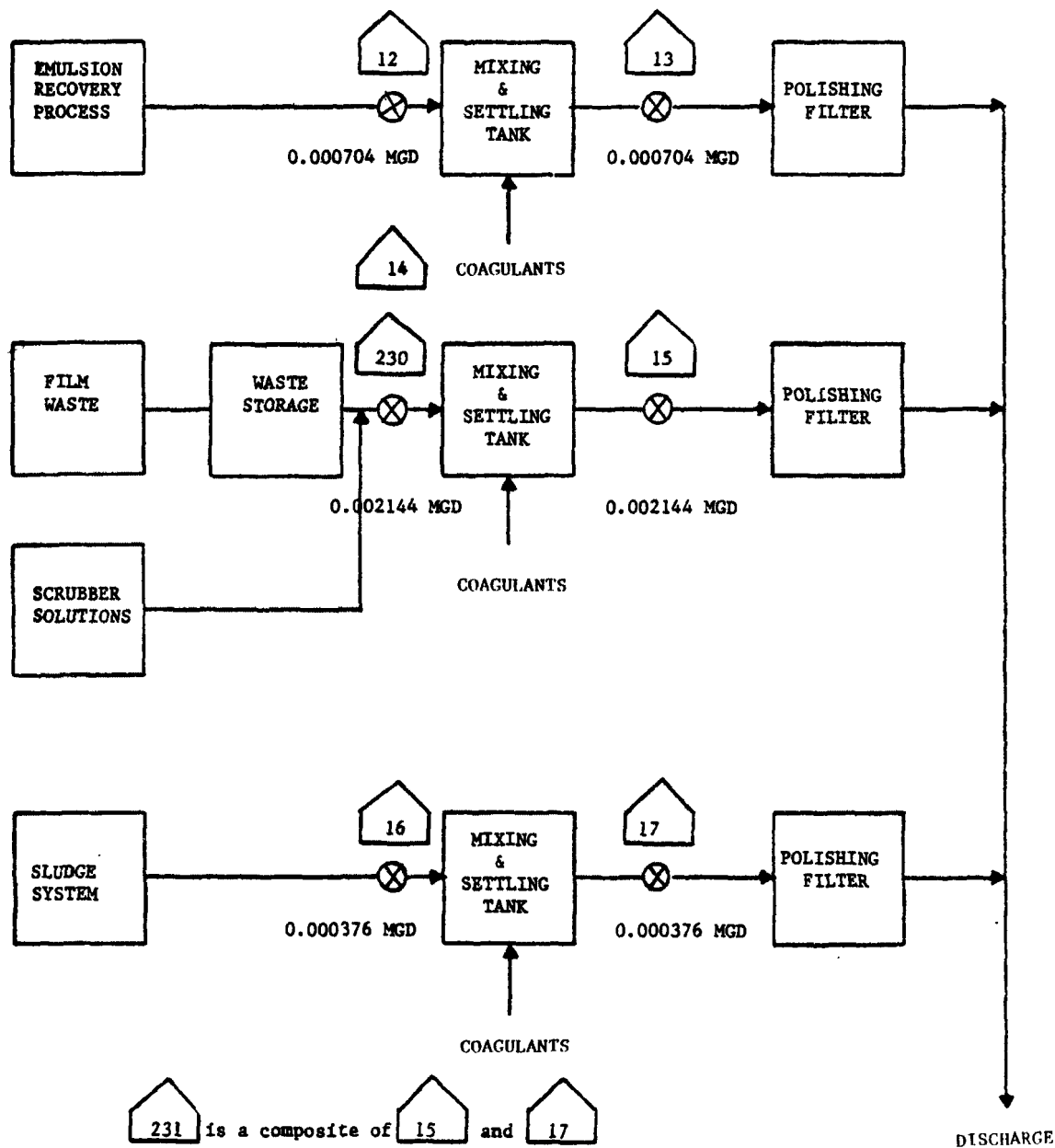


Figure V-3  
SAMPLING SITES AT SECONDARY SILVER PLANT C

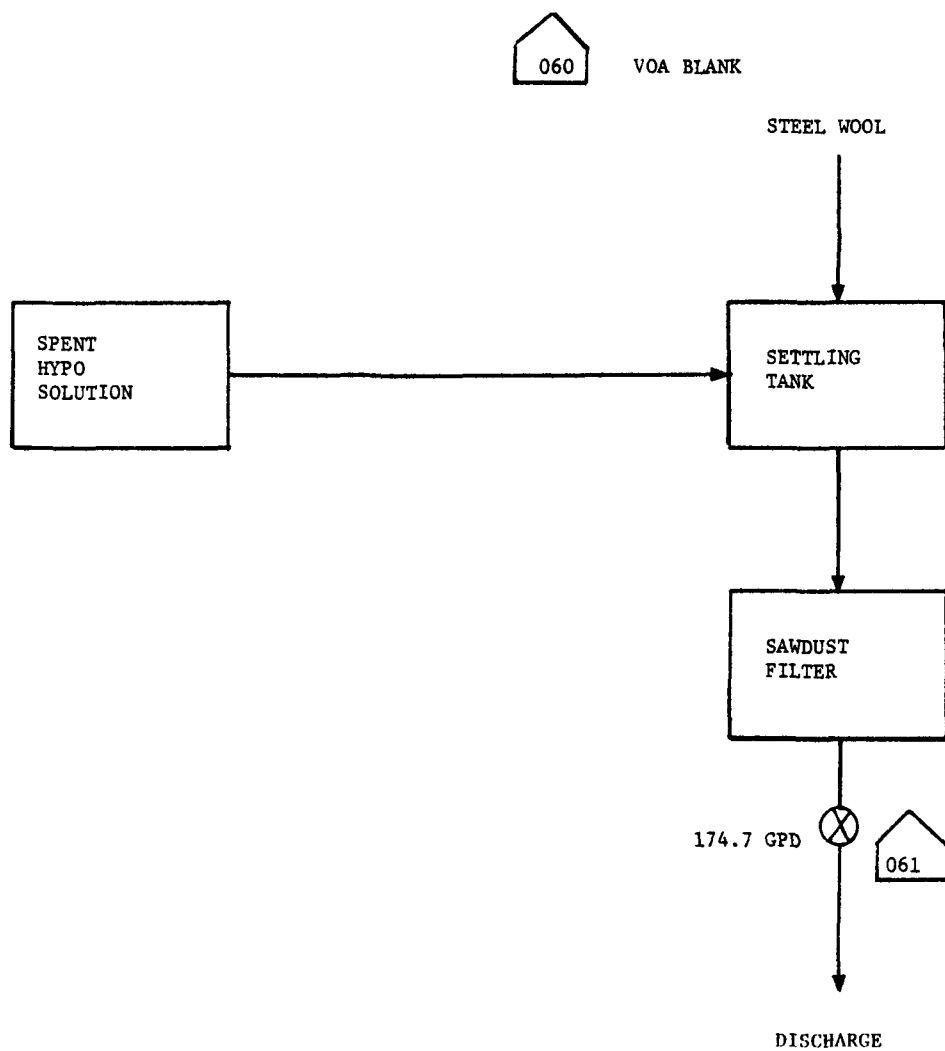


Figure V-4  
SAMPLING SITES AT SECONDARY SILVER PLANT D

## SECONDARY SILVER SUBCATEGORY

### SECTION VI

#### SELECTION OF POLLUTANT PARAMETERS

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

Each pollutant selected for potential limitation is discussed in Section VI of the General Development Document. That discussion provides information concerning where the pollutant originates (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 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 toxic metals were the long-term performance values achievable by lime precipitation, sedimentation, and filtration. The treatable concentrations used for the toxic organics were the long-term values achievable by carbon adsorption (see Section VII of the General Development Document - Combined Metals Data Base).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS

This study examined samples from the secondary silver subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and six nonconventional pollutant parameters (ammonia, chemical oxygen demand, chloride, fluoride, total organic carbon, and total phenols).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

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

- ammonia
- phenols (total; by 4-AAP method)

total suspended solids (TSS)  
pH

Ammonia was found in all four samples analyzed in concentrations ranging from 675 to 4,630 mg/l. All of the values recorded are well above the treatable concentration of 32.2 mg/l, attainable by the available treatment technology. Therefore, ammonia is selected for consideration for limitation.

Total phenols are detected in all eight samples analyzed. Four samples contained phenols in concentrations above the treatable concentration of 0.25 m/g1. Concentrations for all samples ranged from 0.012 to 62.5 mg/l. Therefore, total phenols are also selected for consideration for limitation.

Total suspended solids (TSS) concentrations ranging from 92 to 3,664 mg/l were observed in the five samples analyzed for this study. All five samples exhibited concentrations above the treatable concentration attainable by the identified treatment technology. Furthermore, most of the specific methods for removing toxic metals do so by precipitation, and the resulting toxic metals precipitates should not be discharged. Meeting a limitation on TSS also aids in removal of precipitated toxic metals. For these reasons, total suspended solids is considered for limitation in this subcategory.

The pH values observed in four of seven samples were outside the 6.0 to 10.0 range considered desirable for discharge to receiving waters. Four pH values ranged from 1.1 to 2.95. The remaining three samples ranged from 5.9 to 8.4. Effective removal of toxic metals by chemical precipitation requires careful control of pH. Therefore, pH is considered for limitation in this subcategory.

#### TOXIC POLLUTANTS

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-1. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater data from streams 12, 14, 16, 40, 61, and 230 (see Section V). Treatment plant samples were not considered in the frequency count. Raw waste stream 44 was not used in the count because it contained gold, platinum, and palladium processing wastewater in addition to silver processing wastewater.

## TOXIC POLLUTANTS NEVER DETECTED

Paragraph 8(a)(iii) of the Revised Settlement Agreement allows the Administrator to exclude from regulation those toxic pollutants not detectable by Section 304(h) analytical methods or other state-of-the-art methods. The toxic pollutants listed below were not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

2. acrolein
3. acrylonitrile
5. benzidine
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
16. chloroethane
17. 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-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-chloroethoxy) methane
45. methyl chloride
46. methyl bromide
48. dichlorobromomethane
49. DELETED
50. DELETED
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone

- 55. naphthalene
- 56. nitrobenzene
- 57. 2-nitrophenol
- 58. 4-nitrophenol
- 59. 2,4-dinitrophenol
- 60. 4,6-dinitro-o-cresol
- 61. N-nitrosodimethylamine
- 62. N-nitrosodiphenylamine
- 63. N-nitrosodi-n-propylamine
- 64. pentachlorophenol
- 65. phenol
- 71. dimethyl phthalate
- 72. benzo(a)anthracene
- 73. benzo(a)pyrene
- 74. 3,4-benzofluoranthene
- 75. benzo(k)fluoranthene
- 76. chrysene
- 77. acenaphthylene
- 79. benzo(ghi)perylene
- 80. fluorene
- 82. dibenzo(a,h)anthracene
- 83. indeno(1,2,3-cd)pyrene
- 88. vinyl chloride
- 89. aldrin
- 94. 4,4'-DDD
- 95. alpha-endosulfan
- 96. beta-endosulfan
- 97. endosulfan sulfate
- 101. heptachlor epoxide
- 105. delta-BHC
- 117. beryllium
- 129. 2,3,7,8-tetrachlorodibenzo-p-dioxin

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LIMIT

The provision of Paragraph 8(a)(iii) of the Revised Settlement Agreement excluding from regulation those toxic pollutants which are not detectable includes those pollutants whose concentrations fall below EPA's nominal detection limit. The toxic pollutants listed below were never found above their analytical quantification concentration in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

- 7. chlorobenzene
- 15. 1,1,2,2-tetrachloroethane
- 51. chlorodibromomethane
- 78. anthracene (a)



- 81. phenanthrene (a)
- 90. dieldrin
- 91. chlordane
- 92. 4,4'-DDT
- 93. 4,4'-DDE
- 98. endrin
- 99. endrin aldehyde
- 100. heptachlor
- 102. alpha-BHC
- 103. beta-BHC
- 104. gamma-BHC
- 113. toxaphene
- 116. asbestos

(a) Reported together.

#### TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

Paragraph 8(a)(iii) of the Revised Settlement Agreement also allows the exclusion of toxic pollutants which were detected in quantities too small to be effectively reduced by technologies known to the Administrator. The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

- 1. acenaphthene
- 30. 1,2-trans-dichloroethylene
- 38. ethylbenzene

Acenaphthene was detected in only one of nine samples analyzed. That sample contained 0.010 mg/l, which is the treatable concentration. Since the pollutant was not detected above the concentration attainable by identified treatment technology, acenaphthene is not considered for limitation.

1,2-trans-dichloroethylene was found in only one sample above its quantification limit. The reported concentration was 0.049 mg/l, which is below the treatable concentration of 0.1 mg/l. Therefore, 1,2-trans-dichloroethylene is not considered for limitation.

Ethylbenzene was detected in five of nine samples analyzed. Three samples contained this pollutant above its quantification limit, but below its treatable concentration of 0.05 mg/l. Ethylbenzene concentrations were 0.021, 0.017, and 0.016 mg/l. Therefore, ethylbenzene is not considered for limitation.

## TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant if it is detectable in the effluent from only a small number of sources within the subcategory and it is uniquely related to only those sources. The following pollutants were not selected for limitation on this basis.

11. 1,1,1-trichloroethane
23. chloroform
44. methylene chloride
47. bromoform
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
84. pyrene
85. tetrachloroethylene
86. toluene
106. PCB-1242 (b)
107. PCB-1254 (b)
108. PCB-1221 (b)
109. PCB-1232 (c)
110. PCB-1248 (c)
111. PCB-1260 (c)
112. PCB-1016 (c)
123. mercury

(b),(c) Reported together.

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

1,1,1-Trichloroethane was detected at two plants in two of nine samples, both at concentrations of 0.022 mg/l. The treatability concentration is 0.01 mg/l for this pollutant. Since it was not detected in seven other samples, the measurements may be regarded as specific to the site and not characteristic of the subcategory as a whole. Also, 1,1,1-trichloroethane cannot be attributed to specific materials and processes used in the secondary silver subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, 1,1,1-trichloroethane is not considered for limitation.

Chloroform was found at concentrations ranging from 0.109 to 1.31 mg/l in five of nine samples. The achievable concentration treatment for chloroform is 0.1 mg/l. Chloroform cannot be traced to specific materials or processes associated with the

secondary silver subcategory; however, it is a common laboratory solvent and the high concentrations found could be attributed to sample contamination. The presence of chloroform in the blank samples taken attest to this possibility, particularly since the pollutant was not detected in four samples. The results cannot be generalized as characteristic of the subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, chloroform is not considered for limitation.

Methylene chloride was measured at a concentration above its treatable concentration in three of nine samples in one plant, with values of 0.67, 3.10, and 3.32 mg/l. The treatable concentration is 0.1 mg/l. This pollutant is not attributable to specific materials or processes associated with the secondary silver subcategory, but is a common solvent used in analytical laboratories. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Because methylene chloride was not detected in six of nine samples, as well as the high probability of sample contamination, this pollutant is not considered for limitation.

Bromoform was not detected in eight of nine samples, but was found above its treatable concentration in one sample. The 0.065 mg/l found is only slightly higher than the 0.05 mg/l treatable concentration. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Since bromoform is present at only one source, bromoform is assumed to be unique to that source and not considered for limitation.

Bis(2-ethylhexyl) phthalate was found above its treatable concentration of 0.01 mg/l in four of five samples. The concentrations ranged from 0.011 to 0.119 mg/l. This pollutant is not associated with specific processes used in the secondary silver subcategory, but is commonly used as a plasticizer in laboratory and field sampling equipment. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Since the presence of this pollutant may be attributed to sample contamination, bis(2-ethylhexyl) phthalate is not considered for limitation.

Butyl benzyl phthalate was measured in two of five samples at concentrations of 0.052 and 0.054 mg/l. The treatable concentration for this pollutant ranges from 0.001 to 0.01 mg/l.

This pollutant is used as a plasticizer in laboratory and field sampling equipment. Since it was not detected in three of five samples, the measurements may be regarded as specific to the site and not characteristic of the subcategory as a whole. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, butyl benzyl phthalate is not considered for limitation.

Di-n-butyl phthalate was found above its treatable concentration (0.025 mg/l) in two of five samples analyzed. However, this compound is a plasticizer used in many products found in manufacturing plants; it is not associated with specific processes used in this subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, di-n-butyl phthalate is not considered for limitation.

Di-n-octyl phthalate was measured above its treatable concentration (0.01 mg/l) in three of five samples analyzed. However, this compound is a plasticizer used in many products found in manufacturing plants; it is not associated with specific processes in this subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, di-n-octyl phthalate is not considered for limitation.

Diethyl phthalate was detected above its treatable concentration (0.025 mg/l) in one of five samples analyzed. However, this compound is a plasticizer used in many products found in manufacturing plants; it is not associated with specific processes in this subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Because of the site-specificity of the one result, diethyl phthalate is not considered for limitation.

Pyrene was found in one of five samples at a concentration of 2.15 mg/l. The treatable concentration for this pollutant ranges from 0.001 to 0.01 mg/l. Pyrene was not detected in four other samples, including two samples from the same plant at the treatable value. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. This site-specific result cannot be generalized as characteristic of the whole subcategory, so pyrene is not considered for limitation.

Tetrachloroethylene was detected above its treatable concentration (0.05 mg/l) in two of nine samples. The concentrations found were 0.087 and 0.123 mg/l. Tetrachloroethylene was also found in plant source water and sample blanks. This pollutant is not attributable to the materials and processes in this subcategory and the results cannot be generalized as characteristic of the subcategory as a whole. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, tetrachloroethylene is not considered for limitation.

Toluene was found above its treatable concentration (0.05 mg/l) in one of nine samples, at 0.057 mg/l. This pollutant is not attributable to specific materials and processes in this subcategory. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Therefore, toluene is not considered for limitation.

The seven toxic pollutant PCB's (polychlorinated biphenyls) are not clearly separated by the analytical protocol used in this study; thus, they are reported in two groups. The first group contains PCB-1242, PCB-1254, and PCB-1221; the second PCB-1232, PCB-1248, PCB-1260, and PCB-1016. Both groups were found in one of five samples at the same plant. The concentration for each group was 0.012 mg/l, which exceeds the treatable concentration of 0.001 mg/l. All 25 of the secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that this pollutant was either known or believed to be absent from their wastewater. Since these pollutants were found in only one plant, they are assumed to be unique to that source and are not considered for limitation.

Mercury was measured above its treatable concentration (0.036 mg/l) in one of four samples. Even though found at 1.0 mg/l, this pollutant is not attributable to specific materials and processes in this subcategory. Also, 22 of the 25 secondary silver plants reporting the presence or absence of toxic pollutants indicated in the dcp that mercury was known to be absent or believed to be absent from their wastewater. Since it was found in only one plant, mercury is not considered for limitation.

## TOXIC POLLUTANTS SELECTED FOR CONSIDERATION IN ESTABLISHING LIMITATIONS

- 4. benzene
- 6. carbon tetrachloride
- 10. 1,2-dichloroethane
- 29. 1,1-dichloroethylene
- 87. trichloroethylene
- 114. antimony
- 115. arsenic
- 118. cadmium
- 119. chromium
- 120. copper
- 121. cyanide
- 122. lead
- 124. nickel
- 125. selenium
- 126. silver
- 127. thallium
- 128. zinc

Benzene was detected above its treatable concentration (0.05 to 0.010 mg/l) in six of nine samples. The concentrations ranged from 0.054 to 2.05 mg/l. Since benzene was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Carbon tetrachloride was found above its treatable concentration (0.05 mg/l) in three of nine samples. Concentrations ranged from 0.07 to 2.3 mg/l. Since carbon tetrachloride was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

1,2-Dichloroethane was detected above its quantification limit in four of nine samples in two plants. Two samples, with concentrations of 0.58 and 0.156 mg/l, were above the concentration considered attainable by treatment (0.1 mg/l). Since 1,2-dichloroethane was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

1,1-Dichloroethylene was measured above its quantification limit in three of nine samples in two plants. Two samples were above the treatable concentration (0.1 mg/l) for this pollutant with concentrations of 0.33 and 6.1 mg/l. Since 1,1-dichloroethylene was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Trichloroethylene was detected above its treatable concentration (0.01 mg/l) in three of nine samples. The concentrations ranged from 0.473 to 0.93 mg/l. Since trichloroethylene was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Antimony was found above its treatable concentration (0.47 mg/l) in three of five samples. The concentrations ranged from 0.7 to 12.0 mg/l. Since antimony was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Arsenic was measured above its quantification limit in all five samples analyzed. Two of the five samples contained this pollutant above the treatable concentration (0.34 mg/l), with concentrations of 1.9 and 2.2 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 found above its treatable concentration (0.07 mg/l) in all five samples analyzed. The concentrations ranged from 0.3 to 100 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 all five samples analyzed. The concentrations ranged from 0.72 to 70.0 mg/l. Since copper was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Cyanide was measured above its treatable concentration (0.047 mg/l) in six of nine samples from four of the five waste streams. The concentrations ranged from 0.132 to 5.95 mg/l, in two plants (one photographic and one nonphotographic). Since cyanide was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Lead was found above its treatable concentration (0.08 mg/l) in all five samples analyzed. The concentrations ranged from 0.5 to 9.0 mg/l. Since lead was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Nickel was measured above its treatable concentration (0.22 mg/l) in four of five samples. The concentrations ranged from 0.4 to 30.0 mg/l. Since nickel was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Selenium was found above its treatable concentration (0.20mg/l) in three of five samples. The concentrations ranged from 0.25 to 0.9 mg/l. Since selenium was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Silver was detected above its quantification limit in three of five samples analyzed. Concentrations ranged from 0.07 to 5.0 mg/l. Three samples contained silver at concentrations above the concentration considered attainable by treatment (0.07 mg/l). Since silver was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Thallium was found above its quantification limit in two of the five samples analyzed for this pollutant. One of the five samples contained thallium at a concentration of 0.4 mg/l, above the treatable concentration (0.34 mg/l) for this pollutant. Since thallium was present in concentrations exceeding the concentration achievable by identified treatment technology, it is selected for consideration for limitation.

Zinc was measured above its treatable concentration (0.23 mg/l) in all five samples analyzed. The concentrations ranged from 4.0 to 2,000 mg/l. Since zinc was present in concentrations exceeding the concentration attainable by identified treatment technology, it is selected for for consideration for limitation.



Table VI-1

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY SILVER  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentra- tion (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able concen- tration
1. acenaphthene	0.010	0.010	5	5	4		1	
2. acrolein	0.010	0.100	5	9	9			
3. acrylonitrile	0.010	0.01	5	9	9			
4. benzene	0.010	0.05 - 0.10	5	9	1	1	1	6
5. benzidine	0.010	0.01	5	5	5			
6. carbon tetrachloride	0.010	0.05	5	9	6			3
7. chlorobenzene	0.010	0.025	5	9	6	3		
8. 1,2,4-trichlorobenzene	0.010	0.01	5	5	5			
9. hexachlorobenzene	0.010	0.01	5	5	5			
10. 1,2-dichloroethane	0.010	0.1	5	9	5		2	2
11. 1,1,1-trichloroethane	0.010	0.01	5	9	7			2
12. hexachloroethane	0.010	0.01	5	5	5			
13. 1,1-dichloroethane	0.010	0.01	5	9	9			
14. 1,1,2-trichloroethane	0.010	0.1	5	9	9			
15. 1,1,2,2-tetrachloroethane	0.010	0.05	5	9	8	1		
16. chloroethane	0.010	0.01	5	9	9			
17. bis(chloromethyl) ether	0.010	0.01	5	9	9			
18. bis(2-chloroethyl) ether	0.010	0.01	5	5	5			
19. 2-chloroethyl vinyl ether	0.010	0.01	5	9	9			
20. 2-chloronaphthalene	0.010	0.01	5	5	5			
21. 2,4,6-trichlorophenol	0.010	0.025	5	3	3			
22. parachlorometa cresol	0.010	0.05	5	3	3			
23. chloroform	0.010	0.1	5	9	4			5
24. 2-chlorophenol	0.010	0.05	5	3	3			
25. 1,2-dichlorobenzene	0.010	0.05	5	5	5			
26. 1,3-dichlorobenzene	0.010	0.01	5	5	5			
27. 1,4-dichlorobenzene	0.010	0.01	5	5	5			
28. 3,3'-dichlorobenzidine	0.010	0.01	5	5	5			
29. 1,1-dichloroethylene	0.010	0.1	5	9	6		1	2
30. 1,2-trans-dichloroethylene	0.010	0.1	5	9	8		1	
31. 2,4-dichlorophenol	0.010	0.01	5	3	3			
32. 1,2-dichloropropane	0.010	0.01	5	9	9			
33. 1,3-dichloropropylene	0.010	0.01	5	9	9			
34. 2,4-dimethylphenol	0.010	0.05	5	3	3			
35. 2,4-dinitrotoluene	0.010	0.05	5	5	5			
36. 2,6-dinitrotoluene	0.010	0.05	5	5	5			
37. 1,2-diphenylhydrazine	0.010	0.05	5	5	5			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY SILVER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Analytical Quantification Concentration (mg/l)(a)</u>	<u>Treatable Concentra- tion (mg/l)(b)</u>	<u>Number of Streams Analyzed</u>	<u>Number of Samples Analyzed</u>	<u>ND</u>	<u>Detected Below Quantification Concentration</u>	<u>Detected Below Treat- able Concen- tration</u>	<u>Detected Above Treat- able Concen- tration</u>
38. ethylbenzene	0.010	0.05	5	9	3	3	3	
39. fluoranthene	0.010	0.01	5	5	5			
40. 4-chlorophenyl phenyl ether	0.010	0.01	5	5	5			
41. 4-bromophenyl phenyl ether	0.010	0.01	5	5	5			
42. bis(2-chloroisopropyl) ether	0.010	0.01	5	5	5			
43. bis(2-chloroethoxy) methane	0.010	0.01	5	5	5			
44. methylene chloride	0.010	0.10	5	9	6			3
45. methyl chloride	0.010	0.01	5	9	9			
46. methyl bromide	0.010	0.01	5	9	9			
47. bromoform	0.010	0.05	5	9	8			1
48. dichlorobromomethane	0.010	0.10	5	9	9			
49. trichlorofluoromethane	0.010	0.01	5	9	9			
50. dichlorodifluoromethane	0.010	0.01	5	9	9			
51. chlorodibromomethane	0.010	0.10	5	9	8	1		
52. hexachlorobutadiene	0.010	0.01	5	5	5			
53. hexachlorocyclopentadiene	0.010	0.01	5	5	5			
54. isophorone	0.010	0.05	5	5	5			
55. naphthalene	0.010	0.05	5	5	5			
56. nitrobenzene	0.010	0.05	5	5	5			
57. 2-nitrophenol	0.010	0.01	5	3	3			
58. 4-nitrophenol	0.010	0.05	5	3	3			
59. 2,4-dinitrophenol	0.010	0.025	5	3	3			
60. 4,6-dinitro-o-cresol	0.010	0.025	5	3	3			
61. N-nitrosodimethylamine	0.010	0.01	5	5	5			
62. N-nitrosodiphenylamine	0.010	0.01	5	5	5			
63. N-nitrosodi-n-propylamine	0.010	0.01	5	5	5			
64. pentachlorophenol	0.010	0.01	5	3	3			
65. phenol	0.010	0.05	5	3	3			
66. bis(2-ethylhexyl) phthalate	0.010	0.01	5	5	0	1		4
67. butyl benzyl phthalate	0.010	0.001 - 0.01	5	5	5			
68. di-n-butyl phthalate	0.010	0.025	5	5	1		2	2
69. di-n-octyl phthalate	0.010	0.01	5	5	2			3
70. diethyl phthalate	0.010	0.025	5	5	4			1
71. dimethyl phthalate	0.010	0.025	5	5	5			
72. benzo(a)anthracene	0.010	0.01	5	5	5			
73. benzo(a)pyrene	0.010	0.01	5	5	5			
74. 3,4-benzofluoranthene	0.010	0.01	5	5	5			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY SILVER  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentra- tion (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
75. benzo(k)fluoranthene	0.010	0.01	5	5	5			
76. chrysene	0.010	0.001	5	5	5			
77. acenaphthylene	0.010	0.01	5	5	5			
78. anthracene (c)	0.010	0.01	5	5	4	1		
79. benzo(ghi)perylene	0.010	0.01	5	5	5			
80. fluorene	0.010	0.01	5	5	5			
81. phenanthrene (c)	0.010	0.01	5	5	4	1		
82. dibenzo(a,h)anthracene	0.010	0.01	5	5	5			
83. indeno(1,2,3-cd)pyrene	0.010	0.01	5	5	5			
84. pyrene	0.010	0.001 - 0.01	5	5	4			1
85. tetrachloroethylene	0.010	0.05	5	9	3	2	2	2
86. toluene	0.010	0.05	5	9	2	2	4	1
87. trichloroethylene	0.010	0.01	5	9	5	1		3
88. vinyl chloride	0.010	0.01	5	9	9			
89. aldrin	0.005	0.001	5	5	5			
90. dieldrin	0.005	0.01	5	5	3	2		
91. chlordane	0.005	0.01	5	5	2	3		
92. 4,4'-DDT	0.005	0.01	5	5	3	2		
93. 4,4'-DDE	0.005	0.01	5	5	3	2		
94. 4,4'-DDD	0.005	0.01	5	5	5			
95. alpha-endosulfan	0.005	0.001	5	5	5			
96. beta-endosulfan	0.005	0.01	5	5	5			
97. endosulfan sulfate	0.005	0.01	5	5	5			
98. endrin	0.005	0.01	5	5	3	2		
99. endrin aldehyde	0.005	0.01	5	5	4	1		
100. heptachlor	0.005	0.01	5	5	3	2		
101. heptachlor epoxide	0.005	0.01	5	5	5			
102. alpha-BHC	0.005	0.01	5	5	4	1		
103. beta-BHC	0.005	0.01	5	5	3	2		
104. gamma-BHC	0.005	0.01	5	5	4	1		
105. delta-BHC	0.005	0.01	5	5	5			
106. PCB-1242 (d)	0.005	0.001	5	5	4			1
107. PCB-1254 (d)	0.005							
108. PCB-1221 (d)	0.005							
109. PCB-1232 (e)	0.005	0.001	5	5		4		1
110. PCB-1248 (e)	0.005							
111. PCB-1260 (e)	0.005							
112. PCB-1016 (e)	0.005							

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY SILVER  
RAW WASTEWATER

<u>Pollutant</u>	<u>Analytical Quantification Concentration (mg/l)(a)</u>	<u>Treatable Concentra- tion (mg/l)(b)</u>	<u>Number of Streams Analyzed</u>	<u>Number of Samples Analyzed</u>	<u>ND</u>	<u>Detected Below Quantification Concentration</u>	<u>Detected Below Treat- able Concen- tration</u>	<u>Detected Above Treat- able Concen- tration</u>
113. toxaphene	0.005	0.01	5	5	3	2		
114. antimony	0.100	0.47	5	5	2			3
115. arsenic	0.010	0.34	5	5			3	2
116. asbestos	10 MFL	10 MFL	2	2	1	1		
117. beryllium	0.010	0.20	5	5	5			
118. cadmium	0.002	0.49	5	5				5
119. chromium	0.005	0.07	5	5				5
120. copper	0.009	0.39	5	5				5
121. cyanide	0.02 (f)	0.047	5	9	1	2		6
122. lead	0.020	0.08	5	5				5
123. mercury	0.0001	0.036	4	4	1		2	1
124. nickel	0.005	0.22	5	5	1			4
125. selenium	0.01	0.20	5	5	2			3
126. silver	0.02	0.07	5	5	2			3
127. thallium	0.100	0.34	5	5	3		1	1
128. zinc	0.050	0.23	5	5				5
129. 2,3,7,8-tetrachlorodibenzo- p-dioxin (TCDD)		Not Analyzed						

(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.

SECONDARY SILVER SUBCATEGORY  
SECTION VII  
CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the sources, flows, and characteristics of the wastewaters from secondary silver plants. This section summarizes the description of these wastewaters and indicates the level of treatment which is currently practiced by the secondary silver subcategory for each waste stream.

CURRENT CONTROL AND TREATMENT PRACTICES

Control and treatment technologies are discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability of wastewater similar to that found in this subcategory are presented there. This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary silver subcategory is characterized by the presence of the toxic metal pollutants and suspended solids. (The raw (untreated) wastewater data for specific sources as well as combined waste streams are presented in Section V). Generally, these pollutants are present in each of the waste streams at concentrations above treatability, so these waste streams are commonly combined for treatment to reduce the concentrations of these pollutants. 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. Seven plants in this subcategory currently have combined wastewater treatment systems, five have lime precipitation and sedimentation, and three have lime precipitation, sedimentation and filtration. As such, four options have been selected for consideration for BPT, BAT, BDT, BCT, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

FILM STRIPPING

The emulsion resulting from the stripping of photographic film can be screened and rinsed, producing wastewater. Three of the eight plants with this process reported an effluent, none of which is recycled. As discussed in Section V, this wastewater should contain treatable concentrations of toxic metals, oil and grease, cyanide, and suspended solids. One plant treats film stripping wastewater in an activated sludge system. Two plants reported no wastewater treatment.

## FILM STRIPPING WET AIR POLLUTION CONTROL

One of the eight plants engaged in film stripping uses a wet scrubber to control air emissions. Toxic organics, toxic metals, phenolics, suspended solids, and cyanide should be present at treatable concentrations. This plant practices 99+ percent recycle of film stripping scrubber water. Treatment of the wastewater consists of neutralization, flocculation, and sedimentation.

## PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

Depleted silver solutions from film stripping must be discarded after precipitation. Four of six plants discharge this wastewater. Toxic organics, toxic metals, suspended solids, phenolics, and cyanide should be present at treatable concentrations. No plants reported recycling this wastewater. Treatment at one plant consists of an activated sludge system. Another plant treats by neutralization with caustic soda or acid, flocculation by polymer addition, and settling. Two plants discharge into municipal sewer lines without treatment.

## PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS WET AIR POLLUTION CONTROL

One plant uses a wet scrubber to control air emissions from a precipitation process. Toxic organics, toxic metals, cyanide, phenolics, and suspended solids should be found at treatable concentrations in the scrubber wastewater. The scrubber wastewater recycle is 99 percent. Treatment before discharge consists of neutralization, flocculation (with a polymer agent), and settling.

## PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

Silver-free solutions are usually discarded after precipitation. Nine of the 15 plants precipitating photographic solutions produce wastewater from this process. Treatable concentrations of ammonia and toxic metals characterize this wastewater. Most suspended solids will have been removed with the silver precipitate during filtration. There are no plants that recycle this wastewater. A number of treatment methods are applied before this wastewater is discharged. They are:

1. Neutralization - two plants,
2. Neutralization and sedimentation - one plant,
3. Neutralization, sedimentation, and filtration - two plants, and
4. Activated sludge system - one plant.

## PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

Four plants use wet scrubbers on precipitation and filtration processes. The wastewater characteristics are similar to scrubber wastewater from film stripping precipitation because of the similar materials and processes used. Toxic organics, metals, phenolics, cyanide, and suspended solids should be present in this wastewater at treatable concentrations. One plant practices complete recycle of silver solution scrubber water. The three others practice partial recycle of the scrubber liquor (from 68 to >99+ percent). The following treatment schemes are currently in use in the subcategory:

1. 100 percent evaporation - one plant,
2. Neutralization - one plant,
3. Contractor disposal - one plant, and
4. No treatment - one plant.

## ELECTROLYTIC REFINING

Wastewater discharges from electrolytic refining consist of spent electrolyte solution. Of the 20 plants having an electrolytic refining process, 12 discharge wastewater. This wastewater should contain treatable concentrations of carbon tetrachloride, pyrene, bromoform, benzene, and tetrachloroethylene. Toxic metals, ammonia, cyanide, and suspended solids are present above treatable concentrations. One plant reported recycling the spent electrolyte to a precipitation process. The following treatment methods are currently practiced:

1. No treatment - seven plants,
2. Neutralization - one plant,
3. Precipitation with sodium chloride and sedimentation - one plant,
4. Contractor disposal - one plant,
5. Chemical reduction, neutralization, and sedimentation - one plant, and
6. Flocculation and sedimentation - one plant.

## FURNACE WET AIR POLLUTION CONTROL

Air emission sources in secondary silver furnace operations are incinerators, roasting and drying furnaces, and melting furnaces. Nineteen secondary silver producers control air emissions, using various methods. These are:

1. Baghouse - seven plants,
2. Dry electrostatic precipitator (ESP) - one plant,

3. Wet electrostatic precipitator - one plant,
4. Wet scrubber - five plants,
5. Baghouse and wet scrubber - three plants,
6. Scrubber and ESP - one plant, and
7. Afterburners (for incinerators).

Toxic organics, metals, phenolics, cyanide, and suspended solids should be present at treatable concentrations in the wastewater produced by wet air pollution control. Seven plants producing this wastewater practice complete recycle. Four others practice partial recycle (>99 percent). Treatment methods used are:

1. No treatment - one plant,
2. 100 percent evaporation - one plant,
3. Neutralization, flocculation with polymer, and sedimentation - one plant, and
4. Contractor disposal - one plant.

#### CASTING CONTACT COOLING WATER

Of the 44 secondary silver plants, 28 have casting operations, 11 using contact cooling water. One plant achieves zero discharge through evaporation and no plants practice recycle. Casting contact cooling water should contain dissolved and suspended solids, and metals. Current treatment methods used are:

1. Neutralization - two plants,
2. Neutralization, flocculation with polymer, and filtration - one plant,
3. Neutralization and sedimentation - one plant, and
4. No treatment - seven plants.

#### CASTING WET AIR POLLUTION CONTROL

Air emissions from casting operations are controlled in four plants. Two plants use baghouses, one plant uses a wet scrubber, and another reported a scrubber and a baghouse. Water from scrubbers should contain treatable concentrations of toxic metals, suspended solids, and organics and must be treated before recycling. One plant practices complete recycle of the scrubber water, the other plant recycles 99+ percent. No treatment of this wastewater was reported.

#### LEACHING

Of the 15 nonphotographic silver plants that leach, 12 discharge wastewater. This wastewater should contain treatable concentrations of toxic organics and metals, ammonia, cyanide, phenolics, and suspended solids. One plant practices complete recycle of the wastewater. The other plants do not recycle. One plant



recovers precious metals from the waste by electrolysis.  
Wastewater treatment methods used are:

1. Neutralization - one plant,
2. Neutralization, sedimentation, and filtration - two plants, and
3. Contractor disposal - two plants.

#### LEACHING WET AIR POLLUTION CONTROL

Twelve plants that leach nonphotographic materials reported air emissions controls. Devices commonly used are packed bed, spray tower, and venturi scrubbers. Eight plants discharge wastewater, which should contain treatable concentrations of toxic organics, toxic metals, ammonia, cyanide, and suspended solids. Three plants practice complete recycle of the scrubber water. Seven other plants recycle from 65 to 99+ percent. Treatment methods used consist of:

1. Neutralization - one plant,
2. Neutralization, sedimentation, and filtration - two plants, and
3. No treatment - five plants.

#### PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS

Seven of the nine nonphotographic silver plants with this process produce wastewater. This wastewater should contain toxic organics, toxic metals, ammonia, cyanide, phenolics, and suspended solids. No plants reported recycling this waste stream. Treatment methods for this wastewater consist of:

1. Neutralization and sedimentation - two plants,
2. Neutralization, sedimentation, and filtration - two plants,
3. Contractor disposal - one plant, and
4. No treatment - two plants.

#### PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

Scrubbers are used in four plants to control fumes from precipitation and filtration processes. This wastewater should contain treatable concentrations of toxic organics, toxic metals, phenolics, cyanide, and suspended solids. Three plants discharge this wastewater while two plants practice 99+ percent recycle. Scrubber water is commonly combined with other process wastewater and treated in a central plant facility. Treatment methods used are:

1. Neutralization - one plant, and
2. Neutralization, sedimentation, and filtration - two plants.

## CONTROL AND TREATMENT OPTIONS CONSIDERED

Based on an examination of the wastewater sampling data, four control and treatment technologies that effectively control the pollutants found in secondary silver wastewaters were selected for evaluation. These technology options are discussed below.

Other treatment technologies included activated alumina adsorption (Option D) and reverse osmosis (Option F). Although these technologies are theoretically applicable to wastewaters generated in the secondary silver subcategory, they were not selected for evaluation because they are not demonstrated in the nonferrous metals manufacturing category, nor are they clearly transferable.

### OPTION A

Option A for the secondary silver subcategory requires treatment technologies to reduce pollutant mass. The Option A treatment scheme consists of ammonia steam stripping preliminary treatment applied to the combined stream of precipitation and filtration of photographic and nonphotographic solutions. Preliminary treatment is followed by lime and settle (chemical precipitation and sedimentation) applied to the combined stream steam stripper effluent and the combined stream of all other wastewater. Chemical precipitation is used to remove metals and fluoride by the addition of lime followed by gravity sedimentation. Suspended solids are also removed from the process.

### OPTION B

Option B for the secondary silver subcategory consists of the ammonia steam stripping, lime precipitation, and sedimentation technology considered in Option A plus control technologies to reduce the discharge of wastewater volume. Water recycle and reuse of scrubber water and casting contact cooling water are the principal control mechanisms for flow reduction.

### OPTION C

Option C for the secondary silver subcategory consists of the ammonia steam stripping, in-process flow reduction, lime precipitation, and sedimentation technology considered in Option B plus multimedia filtration technology added at the end of the Option B 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 satisfactorily. 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.

## OPTION E

Option E for the secondary silver subcategory consists of the ammonia steam stripping, in-process flow reduction, lime precipitation, sedimentation, and multimedia filtration technology considered in Option C with the addition of granular activated carbon technology at the end of the Option C treatment scheme. The activated carbon process is utilized to control the discharge of toxic organics.

## SECONDARY SILVER SUBCATEGORY

### SECTION VIII

#### COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section describes the method used to develop the costs associated with the control and treatment technologies discussed in Section VII for wastewaters from secondary silver plants. The energy requirements of the considered options as well as solid waste and air pollution aspects are also discussed. Section VIII of the General Development Document provides background on the capital and annual costs for each of the technologies discussed herein.

The various sources of wastewater that have been discussed throughout this document are combined into two groups. These groups are based on the source of raw materials in the secondary silver subcategory: photographic and nonphotographic. These groups are selected because the combinations of wastestreams in each is representative of the processing that occurs in most plants. In addition, the wastestreams associated with each group also require varying degrees of preliminary treatment with ammonia steam stripping. This will be discussed further below. Since all the plants in the subcategory can be classified in one or the other or both of these groups, a division of the waste streams along these lines is appropriate. The wastewater sources in the secondary silver subcategory have been divided for the purposes of cost estimation as follows:

##### Photographic Group

1. Film stripping
2. Film stripping wet air pollution control
3. Precipitation and filtration of film stripping solutions
4. Precipitation and filtration of film stripping wet air pollution control
5. Precipitation and filtration of photographic solutions
6. Precipitation and filtration of photographic solutions wet air pollution control
7. wet air pollution control
8. Electrolytic refining
9. Furnace wet air pollution control
10. Casting contact cooling water
11. Casting wet air pollution control.

##### Nonphotographic Group

1. Leaching
2. Leaching wet air pollution control

3. Precipitation and filtration of nonphotographic solutions
4. Precipitation and filtration of nonphotographic solutions wet air pollution control
5. Furnace wet air pollution control
6. Electrolytic refining
7. Casting contact cooling water
8. Casting wet air pollution control.

Plants which process both photographic and nonphotographic materials are included in the photographic group, since the processes in both groups are similar and the photographic group encompasses the waste streams requiring preliminary treatment for the secondary silver subcategory.

Section VI indicated that significant pollutants or pollutant parameters in the secondary silver subcategory are copper, zinc, TSS, ammonia, and pH. As explained in Section VI of the General Development Document, metals are most economically removed by chemical precipitation, sedimentation, and filtration. Ammonia may be removed from waste streams by steam stripping, and activated carbon is a technology for removing organics.

#### TREATMENT OPTIONS COSTED FOR EXISTING SOURCES

As discussed in Section VII, four control and treatment options have been developed for both the photographic group and the nonphotographic group. Cost estimates in the form of annual cost curves were developed for each of these control and treatment options. The options are summarized below and schematically presented in Figures X-1 through X-4.

##### OPTION A

Option A requires preliminary ammonia steam stripping treatment, and end-of-pipe technology consisting of lime precipitation and sedimentation. The cost curves for the photographic group assume that 94 percent of the combined wastewaters undergo preliminary ammonia steam stripping treatment, while the nonphotographic group cost curves assume 25 percent. Specific streams that will require ammonia steam stripping preliminary treatment include precipitation and filtration of photographic solutions wastewater, and precipitation and filtration of nonphotographic solutions wastewater.

##### OPTION B

Option B requires in-process flow reduction measures, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation and sedimentation. The in-process flow reduction measures consist of the recycle of wet air pollution control water, through holding tanks, and the

recycle of casting contact cooling water through cooling towers. The holding tank cost curve is based on a retention time of one day for the scrubber water which is to be recycled. To determine the cost of Option B, the holding tank and cooling tower costs are added to the cost of Option A.

#### OPTION C

Option C requires the in-process flow reduction measures of Option B, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation, sedimentation, and multimedia filtration. The cost curves developed for Option C do not include the cost of in-process flow reduction. Therefore, the total cost of Option C is determined by adding the holding tank and cooling tower costs to the costs determined from the Option C cost curves.

#### OPTION E

Option E requires the in-process flow reduction measures of Option B and C, preliminary ammonia steam stripping treatment, and end-of-pipe treatment technology consisting of lime precipitation, sedimentation, multimedia filtration, and activated carbon adsorption. The cost curves developed for Option E do not include the cost of in-process flow reduction. Therefore, the total cost of Option E is determined by adding holding tank and cooling tower costs to the costs determined from the Option E cost curves.

The cost curves for the options summarized above are presented in the figures listed below the respective options which the curves are based on are also shown.

<u>Group</u>	<u>Figure VIII-</u>	<u>Option Costed</u>
Photographic	1-3	A, C, E
Nonphotographic	4-6	A, C, E

The holding tank and cooling tower cost curves are presented in Figures VIII-7 and VIII-8, respectively.

#### 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 silver 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. Briefly, the energy usage of the various

options is determined for the secondary silver plant with the median wastewater flow. The energy usage of the options is then compared to the energy usage of the median secondary silver energy consumption plant. As shown in Table VIII-1, the most energy intensive option is reverse osmosis, which increases the median secondary silver energy consumption by 0.25 percent. The remaining three options would increase this plant's energy consumption by less than 0.25 percent.

#### SOLID WASTE

Sludges associated with the secondary silver subcategory will necessarily contain additional quantities (and concentrations) of toxic metal pollutants. Wastes generated by secondary metals 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. None of these wastes is 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, sedimentation, and filtration. By the addition of excess 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 8261.24. 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 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 non-ferrous 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), 47 FR 32274 (July 26, 1982).

Even if these wastes were 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. For more details, see Section VIII of the General Development Document.

#### 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, multimedia filtration and activated carbon adsorption. These technologies transfer pollutants to solid waste and do not involve air stripping or any other physical process likely to transfer pollutants to air. Water vapor containing some particulate matter will be released in the drift from the cooling tower systems which are used as the basis for flow reduction in the secondary silver subcategory. However, the Agency does not consider this impact to be significant.



Table VIII-1  
ENERGY REQUIREMENTS

Median of Total Plant Energy Consumption (Btu/Yr)	Median Size Plant By Flow (gal/day)	Maximum Energy Requirement (Btu/Yr) and Percent of Median Plant Energy Consumption							
		Option A		Option B		Option C		Option E	
		Usage	%	Usage	%	Usage	%	Usage	%
$3.498 \times 10^{10}$	521	$2.44 \times 10^7$	0.07	$7.62 \times 10^7$	0.22	$7.62 \times 10^7$	0.22	$8.8 \times 10^7$	0.25

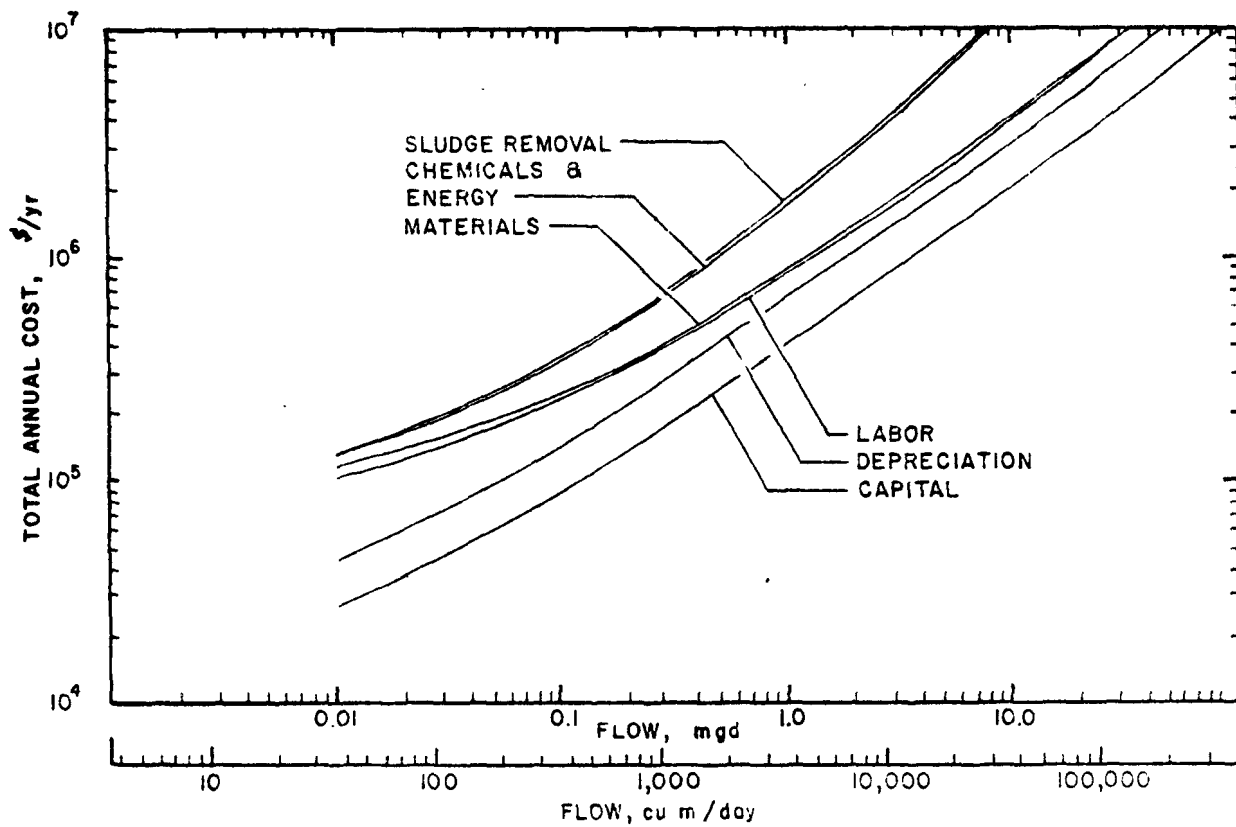


Figure VIII-1

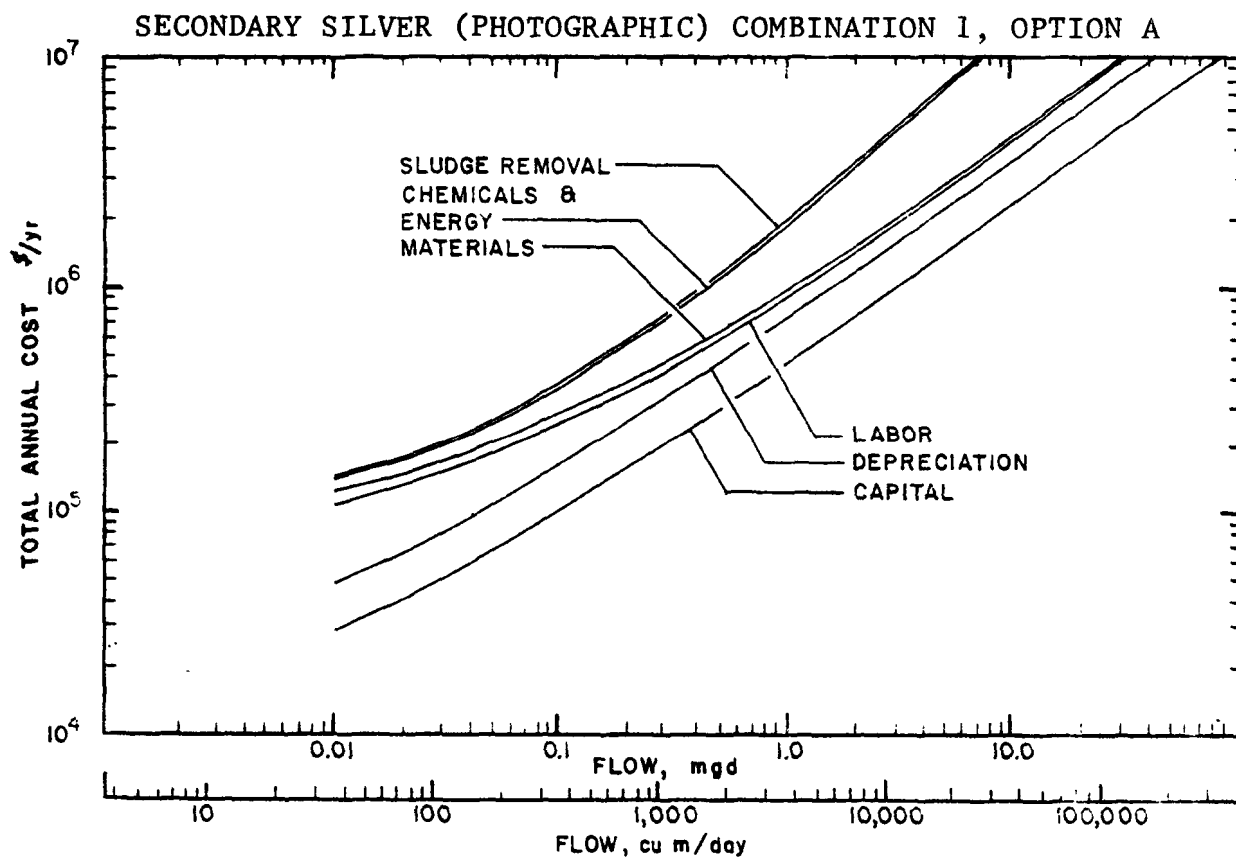


Figure VIII-2

SECONDARY SILVER (PHOTOGRAPHIC) COMBINATION 1, OPTION C

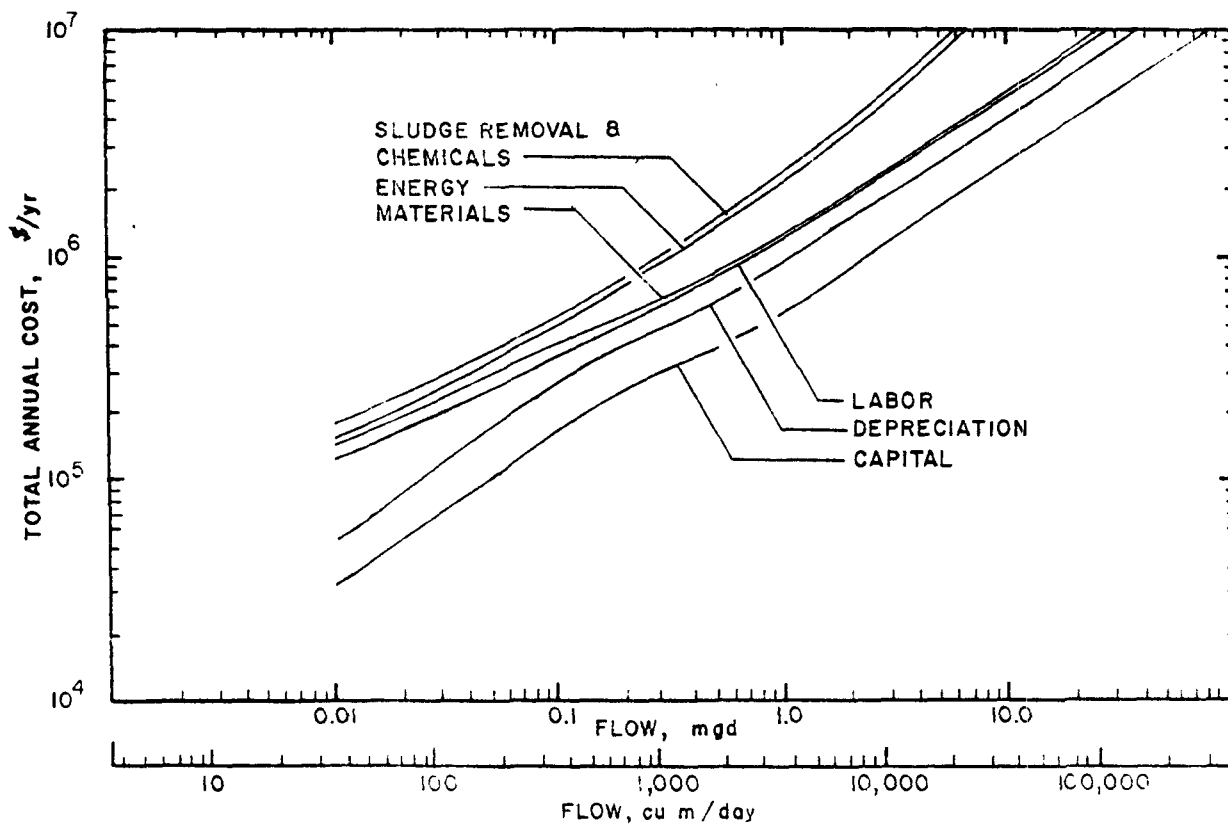


Figure VIII-3

SECONDARY SILVER (PHOTOGRAPHIC) COMBINATION 1, OPTION E

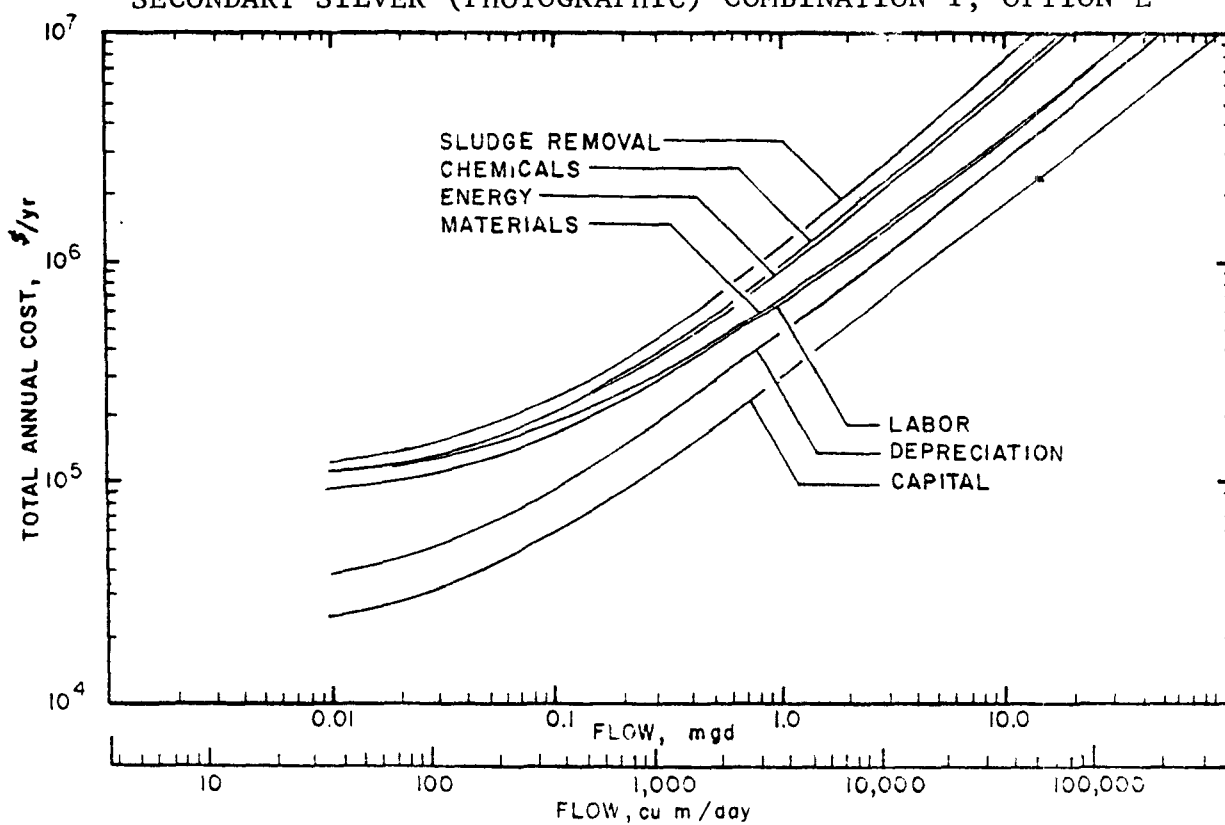


Figure VIII-4

SECONDARY SILVER (NON-PHOTOGRAPHIC) COMBINATION 1, OPTION A

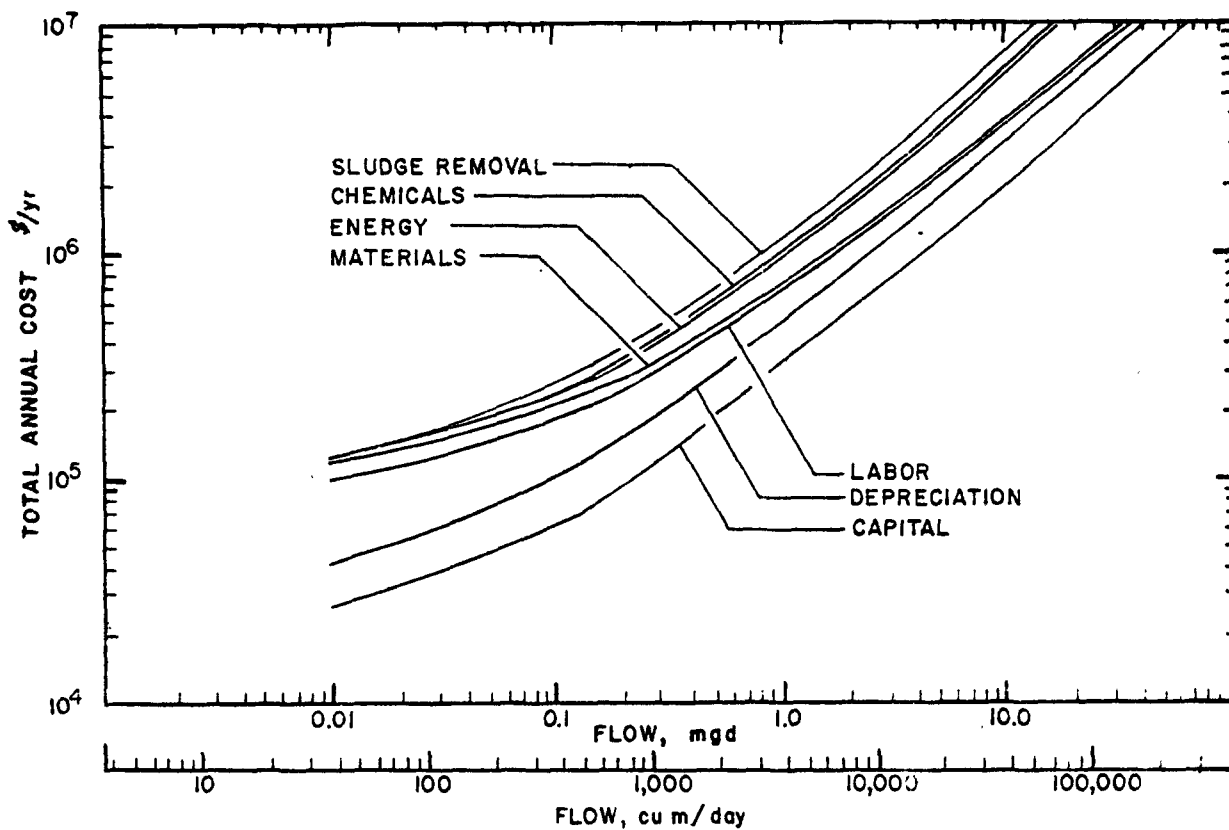


Figure VIII-5

SECONDARY SILVER (NON-PHOTOGRAPHIC) COMBINATION 1, OPTION C

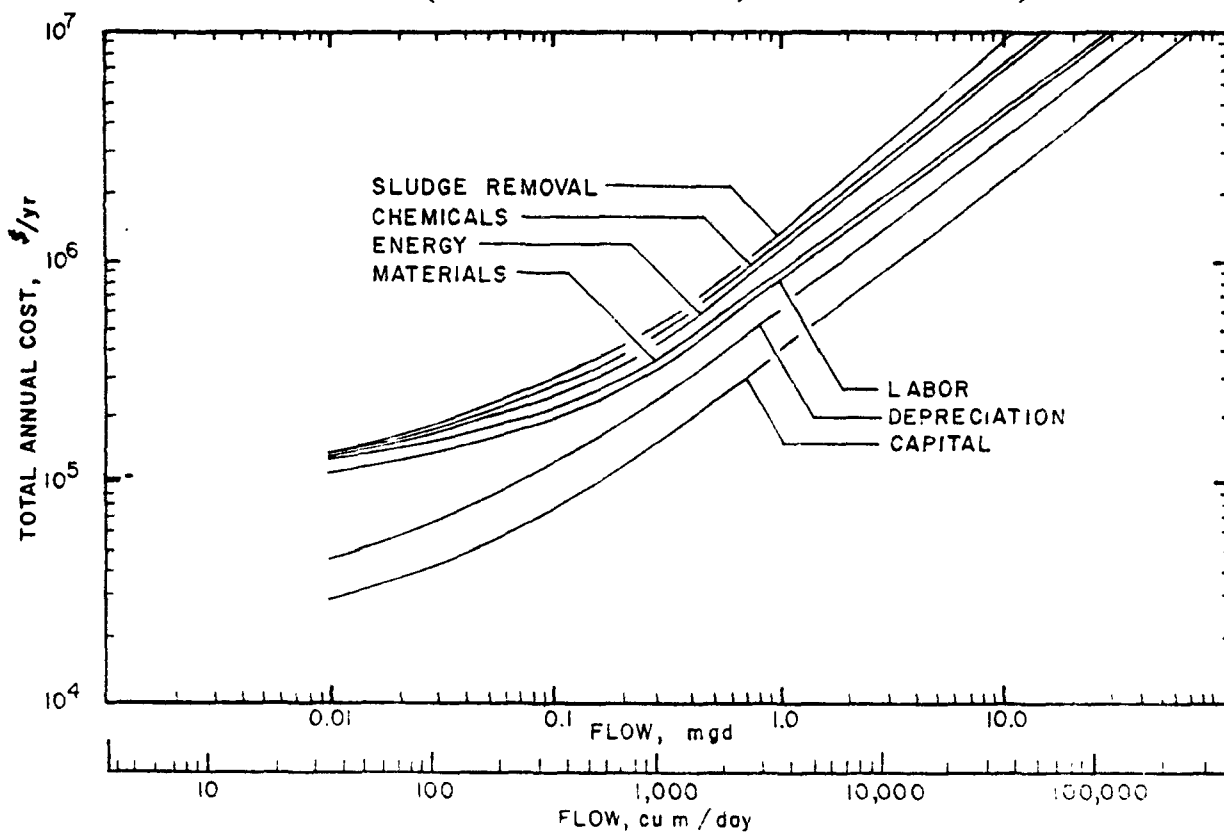


Figure VIII-6

SECONDARY SILVER (NON-PHOTOGRAPHIC) COMBINATION 1, OPTION E

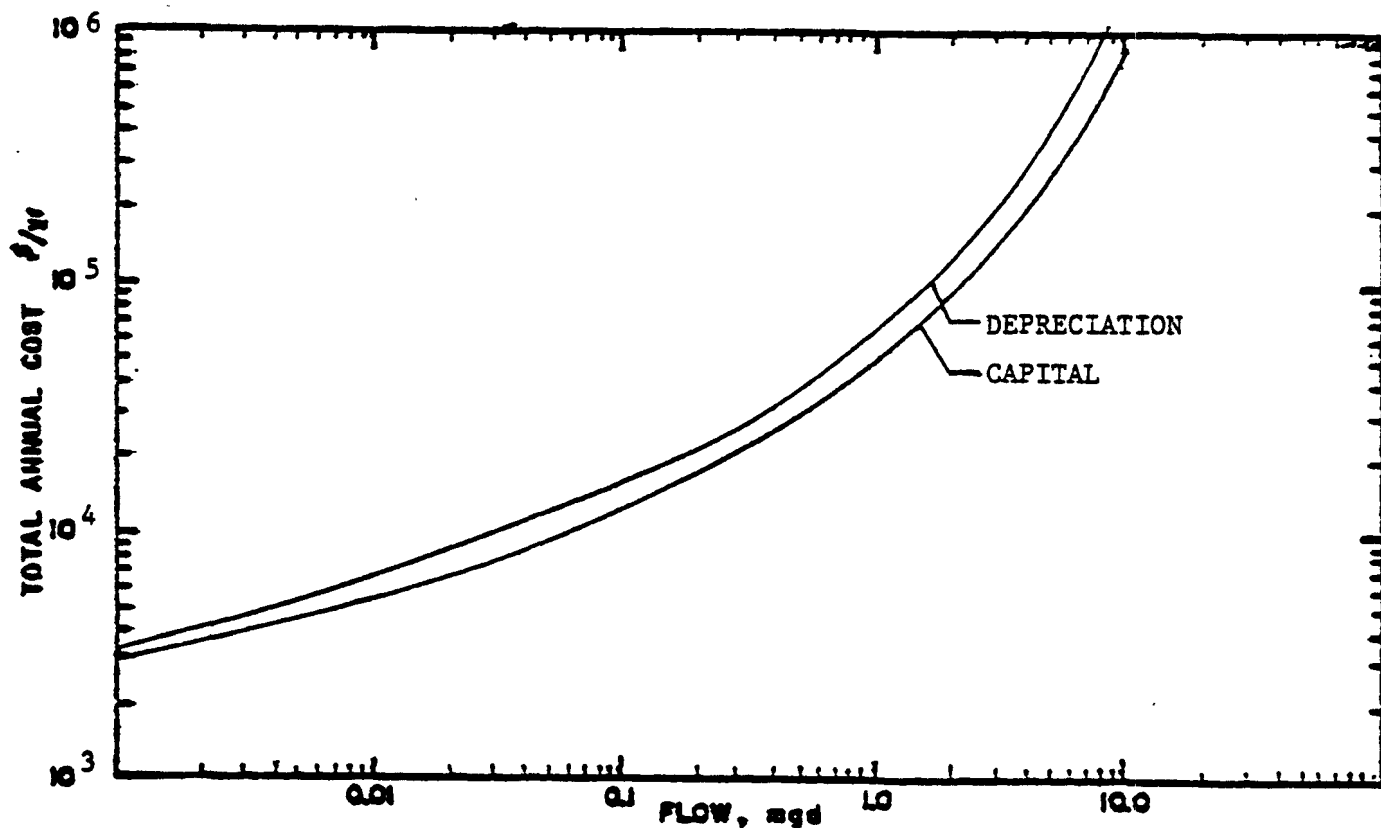


Figure VIII-7

### SECONDARY SILVER HOLDING TANK COSTS

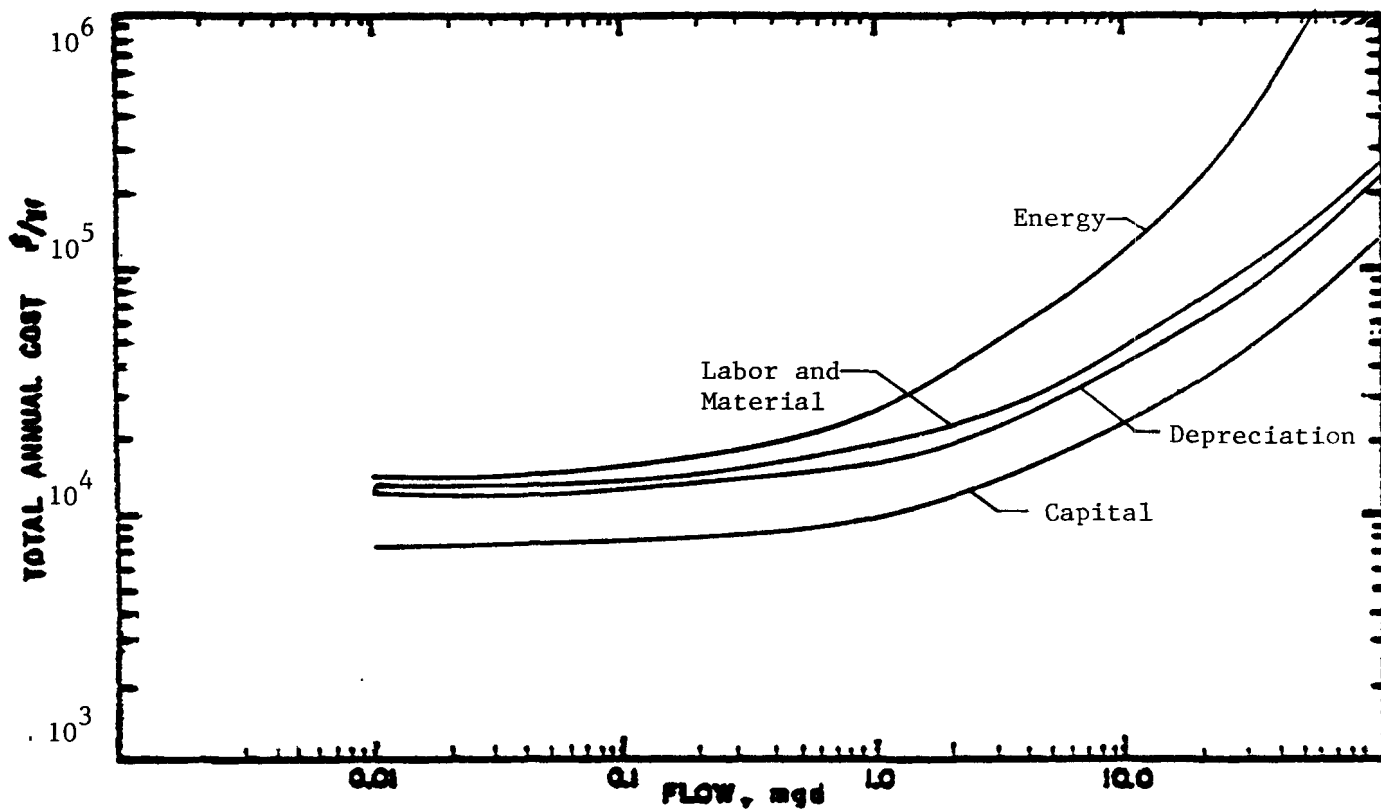


Figure VIII-8

### SECONDARY SILVER COOLING TOWER COSTS CASTING CONTACT COOLING

## SECONDARY SILVER SUBCATEGORY

### 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), Section 301(b)(a)(A). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the secondary silver 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 employed, 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. 1176)). BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common within the subcategory.

#### TECHNICAL APPROACH TO BPT

The Agency studied the nonferrous metals manufacturing category to identify the processes used, the wastewaters generated, and the treatment processes installed. Information was collected from industry using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. Some of the factors which must be considered in establishing effluent limitations based on BPT have already been discussed. The age of equipment and facilities, processes used, and raw materials were taken into account in subcategorization and subdivision and are discussed fully in Section IV. Nonwater quality impacts and energy requirements are considered in Section VIII.

As explained in Section IV, the secondary silver subcategory has been subdivided into 14 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 14 subdivisions.

For each of the subdivisions, a specific approach was followed for the development of BPT mass limitations. To account for production and flow variability from plant to plant, 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 (1) whether or not operations included generated wastewater, (2) specific flow rates generated, and (3) the specific production normalized flows for each process. 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.

Normalized flows were analyzed to determine which flow was 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 subcategory. The BPT normalized 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. In most cases, this will involve improving housekeeping practices, better maintenance to limit water leakage, or reducing excess flow by turning down a flow valve. It is not believed that these modifications would incur any costs for the plants.

For the development of effluent limitations, mass loadings were calculated for each wastewater source or subdivision. This calculation was made on a stream-by-stream basis, primarily because plants in this category may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per metric ton of production unit - mg/kkg) were calculated by multiplying the BPT normalized flow (l/kkg) by the achievable treatment concentrations using the BPT treatment system (mg/l) for each pollutant parameter to be limited under BPT.

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 secondary silver 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/kg) 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.

BPT effluent limitations are based on the average of the discharge flow rates for each source; consequently, the treatment technologies which are currently used by the lowest dischargers will be the treatment technologies most likely required to meet BPT guidelines. Section VII discusses the various treatment technologies which are currently in place for each wastewater source. In most cases, the current 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 added to streams containing treatable concentrations of ammonia.

The overall effectiveness of end-of-pipe treatment for the removal of wastewater pollutants is improved by the application of water flow controls within the process to limit the volume of wastewater requiring treatment. The controls or in-process technologies recommended under BPT include only those measures which are commonly practiced within the subcategory and which reduce flows to meet the production normalized flow for each operation.

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

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 BPT. See Weyerhaeuser Company v. Costle, 590 F.2d 1011 (D.C. Cir. 1978).



The methodology for calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Tables X-2 and XII-1 show the estimated pollutant reduction benefits for each treatment option for direct and indirect dischargers. Compliance costs are presented in Table X-3.

#### BPT OPTION SELECTION

The best practicable technology consists of chemical precipitation and sedimentation (lime and settle technology) with ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia. The best practicable technology is presented schematically in Figure IX-1. BPT is equivalent to Option A described in Section X.

Ammonia steam stripping is demonstrated in the nonferrous metals manufacturing category. One plant in the secondary aluminum subcategory, one plant in the secondary lead subcategory, two plants in the primary columbium-tantalum subcategory, and four plants in the primary tungsten subcategory reported steam stripping in-place.

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 data 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 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 secondary silver subcategory contained ammonia concentrations of 1,202 and 4,630 mg/l.

The proposed BPT will result in the removal of approximately 27,070 kg/yr of toxic pollutants and 578,350 kg/yr of ammonia from the estimated raw discharge. The estimated capital cost of BPT is \$124,000 (1978 dollars) and the estimated annual cost is \$263,000 (1978 dollars).

## 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 the dcp. The discharge rate is used with the achievable treatment concentration 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 14 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 intermediate product which is produced by the process associated with the waste stream in question. These production normalizing parameters, or PNP's, are also listed in Table IX-1.

Section V of this supplement further describes the discharge flow rates and presents the water use and discharge flow rates for each plant by subdivision.

### FILM STRIPPING

The BPT wastewater discharge rate for film stripping is 1,619,000 l/kg (388,300 gal/ton) of silver produced from film stripping. Three plants reported wastewater discharges from film stripping, but the dcp data provided by two plants were insufficient to calculate discharge rates. Therefore, the discharge rate from one plant was used.

### FILM STRIPPING WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for film stripping wet air pollution control is 15,580 l/kg (3,737 gal/ton) of silver produced from film stripping, based on 99 percent recycle. This rate is allocated only for plants practicing wet air pollution control for film stripping. One plant reported this wastewater, recycling 99+ percent. This plant uses the same scrubber to control air emissions from film stripping and film stripping precipitation. Since the BPT limitation is based on 99 percent recycle, this plant meets the BPT discharge rate.

### PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS

The BPT wastewater discharge rate for film stripping precipitation and filtration waste streams is 1,851,000 l/kg (444,000 gal/ton) of silver precipitated. Of the six plants with this process, four reported producing wastewater. The BPT rate is based on the average discharge rate of two plants, which generate 3,623,000 and 74,170 l/kg (869,000 and 17,790 gal/ton). A third plant reported insufficient data to calculate the discharge rate. Another plant reported this waste stream as a combination of photographic and nonphotographic wastewater, therefore this plant also was omitted from the calculation. The distribution of wastewater rates for this waste stream is presented in Section V (Table V-3).

## PRECIPITATION AND FILTRATION OF FILM STRIPPING SOLUTIONS WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for film stripping precipitation and filtration wet scrubbing is 15,580 l/kg (3,737 gal/ton) of silver precipitated, based on 99 percent recycle. This rate is allocated only for plants which use wet air pollution control on precipitation or filtration processes for film stripping solutions. One plant reported this wastewater, recycling 99+ percent. This plant uses the same scrubber to control air emissions from film stripping and film stripping precipitation. Since the BPT rate is based on 99 percent recycle, this plant currently meets the BPT discharge rate.

## PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS

The BPT wastewater discharge rate for the precipitation and filtration of photographic solutions is 854,000 l/kg (204,850 gal/ton) of silver precipitated. Of the 15 plants reporting this process, nine discharge wastewater. Four plants did not provide sufficient data to calculate discharge rates. The discharge rates for the five other plants range from 50,600 l/kg (12,100 gal/ton) to 2,890,000 l/kg (693,000 gal/ton). Wastewater discharge rates are presented in Table V-4. The BPT rate is based on the average of the discharge rates of these five plants. Four of the five plants reporting this discharge meet the BPT discharge rate.

## PRECIPITATION AND FILTRATION OF PHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for precipitation and filtration of photographic solutions wet air pollution control is 390,000 l/kg (93,600 gal/ton) of silver precipitated. This rate is allocated only to plants having wet air pollution control for precipitation and filtration of photographic solutions. Of the 15 plants that have this process, four use wet air pollution control devices. Three of the four plants did not report sufficient production data to calculate a discharge rate for this waste stream, although sufficient data was reported to determine recycle practices. One of the four plants achieves zero discharge of this waste stream through complete recycle, while two plants practice 99 percent recycle or greater. The fourth plant recycles 68 percent of its precipitation and filtration of photographic solutions wet air pollution control water. Thus, extensive recycle is possible for this wastewater stream. However, zero discharge may not be technically feasible unless (1) a recycle system controls dissolved solids buildup; (2) the wastewater is evaporated; or (3) this wastewater can be reused in another production operation that can accept water of this quality. Some of these zero-discharge possibilities are site-specific and, therefore, are not applicable to all secondary

silver pollutants that generate this wastewater. Therefore, a BPT wastewater discharge rate is allocated for precipitation and filtration of photographic solutions wet air pollution control. This discharge rate is based on 99 percent recycle of the water used for precipitation and filtration of photographic solutions wet air pollution control at the only plant for which a discharge rate could be determined. The Agency's general policy is 90 percent recycle, however, the plant that the discharge rate is based on recycles 99.9 percent of this wastewater, and two other plants practice 99 and 100 percent recycle. Thus 99 percent recycle represents current subcategory practices for precipitation and filtration of photographic solutions wet air pollution control water.

#### ELECTROLYTIC REFINING

The BPT wastewater discharge rate for electrolytic refining is 24,316 l/kg (5,833 gal/ton) of silver refined. Of the 20 plants reporting electrolytic refining operations, 12 produce wastewater. Four plants reported insufficient data to calculate discharge rates. Data from seven plants, with discharge rates ranging from 2,190 l/kg (525 gal/ton) to 63,221 l/kg (15,165 gal/ton), were used to calculate the BPT rate. Only one plant practices recycle of this wastewater and achieves zero discharge by 100 percent reuse. The distribution of wastewater rates for electrolytic refining is presented in Table V-7. Five of the seven discharging plants meet the BPT discharge rate.

#### FURNACE WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for the furnace air wet scrubbing stream is 21,519 l/kg (5,162 gal/ton) of silver smelted, roasted, or dried. This rate is allocated only for plants practicing wet air pollution control for furnace emissions. Emissions from furnace operations are controlled by dry or wet control devices. Common dry methods involve baghouses or dry electrostatic precipitators. Wet devices include packed bed, spray, and Venturi scrubbers, and wet electrostatic precipitators. Of the 19 plants reporting furnace air pollution control, 11 produce waste streams. Seven of the eleven plants achieve zero discharge through 100 percent recycle. Two of the four plants that discharge this waste stream practice 99 percent recycle or greater, while one plant uses a once-through operation. The remaining plant did not report production or wastewater flow data for this waste stream. Water use and discharge rates are presented in Table V-9. The BPT discharge rate is based on 99 percent recycle of the average water use at the three plants for which discharge rates were determined. The 99 percent recycle basis represents current subcategory practices since nine of the eleven plants that produce this waste stream recycle 99 percent or greater. Each of those nine plants meets the BPT discharge rate.

## CASTING CONTACT COOLING WATER

The BPT wastewater discharge rate for casting contact cooling water is 12,035 l/kg (2,887 gal/ton) of silver cast. Casting is done in 28 secondary silver plants, 11 plants using contact cooling water. One of the ten plants achieves zero discharge of this waste stream through evaporation. None of the remaining nine plants practice recycle or reuse. Five of the nine plants reported sufficient data to calculate a discharge rate. The discharge rates from the five reporting plants range from 1,340 l/kg (320 gal/ton) to 47,416 l/kg (11,374 gal/ton). Wastewater rates are presented in Table V-10. The BPT discharge rate is the average discharge rate of these five plants. Only one of the five plants does not meet the BPT rate.

## CASTING WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for the casting wet scrubber waste stream is 4,741 l/kg (1,137 gal/ton) of silver cast. This rate is allocated only for plants practicing wet air pollution control for casting. Only four plants of the 28 with casting operations use air pollution control. Two plants use dry systems and one recycles 100 percent. One plant, using 99.7 percent recycle, reported a discharge rate of 4,741 l/kg (1,137 gal/ton) for processing photographic and nonphotographic materials. The BPT rate is based on this plant.

## LEACHING

The BPT discharge rate for plants with nonphotographic leaching processes is 2,780 l/kg (667 gal/ton) of silver produced from leaching. Of the 15 plants using this process, 12 discharge wastewater. Six plants supplied sufficient information to calculate discharge rates. Three plants with once-through discharge had rates ranging from 2,190 l/kg (525 gal/ton) to 3,611 l/kg (866 gal/ton). The BPT rate is an average of the discharge from these three plants. Three other once-through dischargers reported rates ranging from 86,690 l/kg (20,800 gal/ton) to 20,425,200 l/kg (4,899,400 gal/ton). The rates from these three plants were omitted from the BPT rate calculation because there is no reason to believe that water is needed in these amounts, in light of rates from the other plants. Table V-12 shows the distribution of wastewater rates for leaching.

## LEACHING WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for nonphotographic leaching wet scrubbing is 142,389 l/kg (35,155 gal/ton) of silver produced from leaching. This rate is allocated only for plants using wet air pollution control on leaching processes. Three

plants achieve zero discharge through 100 percent recycle or reuse. The recycle in seven additional plants ranges from 65 to 99+ percent, four of those using at least 99 percent. Some of the zero discharge possibilities are site-specific and are not applicable on a nationwide basis. The BPT discharge rate is based on the average of five plants with discharge rates ranging from 450 to 364,700 l/kg (110 to 37,900 gal/ton). Insufficient data to calculate a discharge rate was reported from three of the eight discharging plants. Three of the eight discharging plants meet the BPT rate. Water use and discharge rates are shown in Table V-13.

#### PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS

The BPT wastewater discharge rate for nonphotographic precipitation and filtration is 98,577 l/kg (23,650 gal/ton) of silver precipitated. Of the nine plants using this process, two produce no wastewater. Three plants supplied insufficient information to calculate discharge rates. Four plants are once-through dischargers with rates ranging from 13,374 l/kg (3,208 gal/ton) to 2,528,800 l/kg (606,600 gal/ton). Table V-14 presents the wastewater rates for this waste stream. The BPT discharge rate is based on the average discharge rate of three of these plants. The plant with the 2,528,800 l/kg (606,600 gal/ton) rate was not considered in the average because this discharge rate is nearly ten times that of the next highest plant. Two of the discharging plants meet the BPT rate.

#### PRECIPITATION AND FILTRATION OF NONPHOTOGRAPHIC SOLUTIONS WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for nonphotographic precipitation and filtration wet scrubbing is 79,931 l/kg (19,173 gal/ton) of silver precipitated. Three plants produce this waste-stream. The BPT discharge rate is the average discharge rate of two of these plants. One plant did not report sufficient data to determine its discharge rate. Wastewater rates are presented in Table V-15.

#### 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. Five pollutants are selected for limitation under BPT and are listed below:

- 120. copper
- 128. zinc
- ammonia (N)
- total suspended solids (TSS)
- pH

## EFFLUENT LIMITATIONS

The concentrations achievable by application of the proposed BPT treatment are explained in Section VII of the General Development Document and summarized there in Table VII-19. The achievable treatment 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 metric ton of product represent the BPT effluent limitations and are presented in Table IX-2 for each individual waste stream.

Table IX-1

## BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Wastewater Stream</u>	<u>BPT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>1/kg</u>	<u>gal/ton</u>	
Film stripping	1,619,000	388,300	kg of silver produced from film stripping
Film stripping wet air pollution control	15,580	3,737	kg of silver produced from film stripping
Precipitation and filtration of film stripping solutions	1,851,000	444,000	kg of silver precipitated
Precipitation and filtration of film stripping solutions wet air pollution control	15,580	3,737	kg of silver precipitated
Precipitation and filtration of photographic solutions	854,000	204,850	kg of silver precipitated
Precipitation and filtration of photographic solutions wet air pollution control	390,300	93,600	kg of silver precipitated
Electrolytic refining	24,316	5,833	kg of silver refined
Furnace wet air pollution control	21,519	5,162	kg of silver smelted, roasted, or dried
Casting contact cooling water	12,035	2,887	kg of silver cast



Table IX-1 (Continued)

## BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Wastewater Stream</u>	<u>BPT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Casting wet air pollution control	4,741	1,137	kkg of silver cast
Leaching	2,780	667	kkg of silver produced from leaching
Leaching wet air pollution control	142,389	35,155	kkg of silver produced from leaching
Precipitation and filtration of non-photographic solutions	98,577	23,650	kkg of silver precipitated
Precipitation and filtration of non-photographic solutions wet air pollution control	79,931	19,173	kkg of silver precipitated

Table IX-2

## BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	3,076,100.0	1,619,000.0
Zinc	2,153,270.0	906,640.0
Ammonia (as N)	215,327,000.0	94,873,400.0
Total Suspended Solids	66,379,000.0	32,380,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	29,602.0	15,580.0
Zinc	20,721.40	8,724.80
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	3,516,900.0	1,851,000.0
Zinc	2,461,830.0	1,036,560.0
Ammonia (as N)	246,183,000.0	108,468,600.0
Total Suspended Solids	75,891,000.0	37,020,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

## BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	29,602.0	15,580.0
Zinc	20,721.40	8,724.80
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,622,600.0	854,000.0
Zinc	1,135,820.0	478,240.0
Ammonia (as N)	113,582,000.0	50,044,400.0
Total Suspended Solids	35,014,000.0	17,080,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	741,570.0	390,300.0
Zinc	519,099.0	218,568.0
Ammonia (as N)	51,909,900.0	22,871,580.0
Total Suspended Solids	16,002,300.0	7,806,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

## BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	46,200.40	24,316.0
Zinc	32,340.28	13,616.96
Ammonia (as N)	3,234,028.0	1,424,917.60
Total Suspended Solids	996,956.0	486,320.0
pH	Within the range of 7.5 to 10.0 at all times	

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	40,886.10	21,519.0
Zinc	28,620.27	12,050.64
Ammonia (as N)	2,862,027.0	1,261,013.40
Total Suspended Solids	882,279.0	430,380.0
pH	Within the range of 7.5 to 10.0 at all times	

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	22,866.50	12,035.0
Zinc	16,006.55	6,739.60
Ammonia (as N)	1,600,655.0	705,251.0
Total Suspended Solids	493,435.0	240,700.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

## BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	9,007.90	4,741.0
Zinc	6,305.53	2,654.96
Ammonia (as N)	630,553.0	277,822.60
Total Suspended Solids	194,381.0	94,820.0
pH	Within the range of 7.5 to 10.0 at all times	

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	5,282.0	2,780.0
Zinc	3,697.4	1,556.8
Ammonia (as N)	369,740.0	162,908.0
Total Suspended Solids	113,980.0	55,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	270,539.10	142,389.0
Zinc	189,377.37	79,737.84
Ammonia (as N)	18,937,737.0	8,343,995.40
Total Suspended Solids	5,837,949.0	2,847,780.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

## BPT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	187,296.30	98,577.0
Zinc	131,107.41	55,203.12
Ammonia (as N)	13,110,741.0	5,776,612.20
Total Suspended Solids	4,041,657.0	1,971,540.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	151,868.90	79,931.0
Zinc	106,308.23	44,761.36
Ammonia (as N)	10,630,823.0	4,683,956.60
Total Suspended Solids	3,277,171.0	1,598,620.0
pH	Within the range of 7.5 to 10.0 at all times	

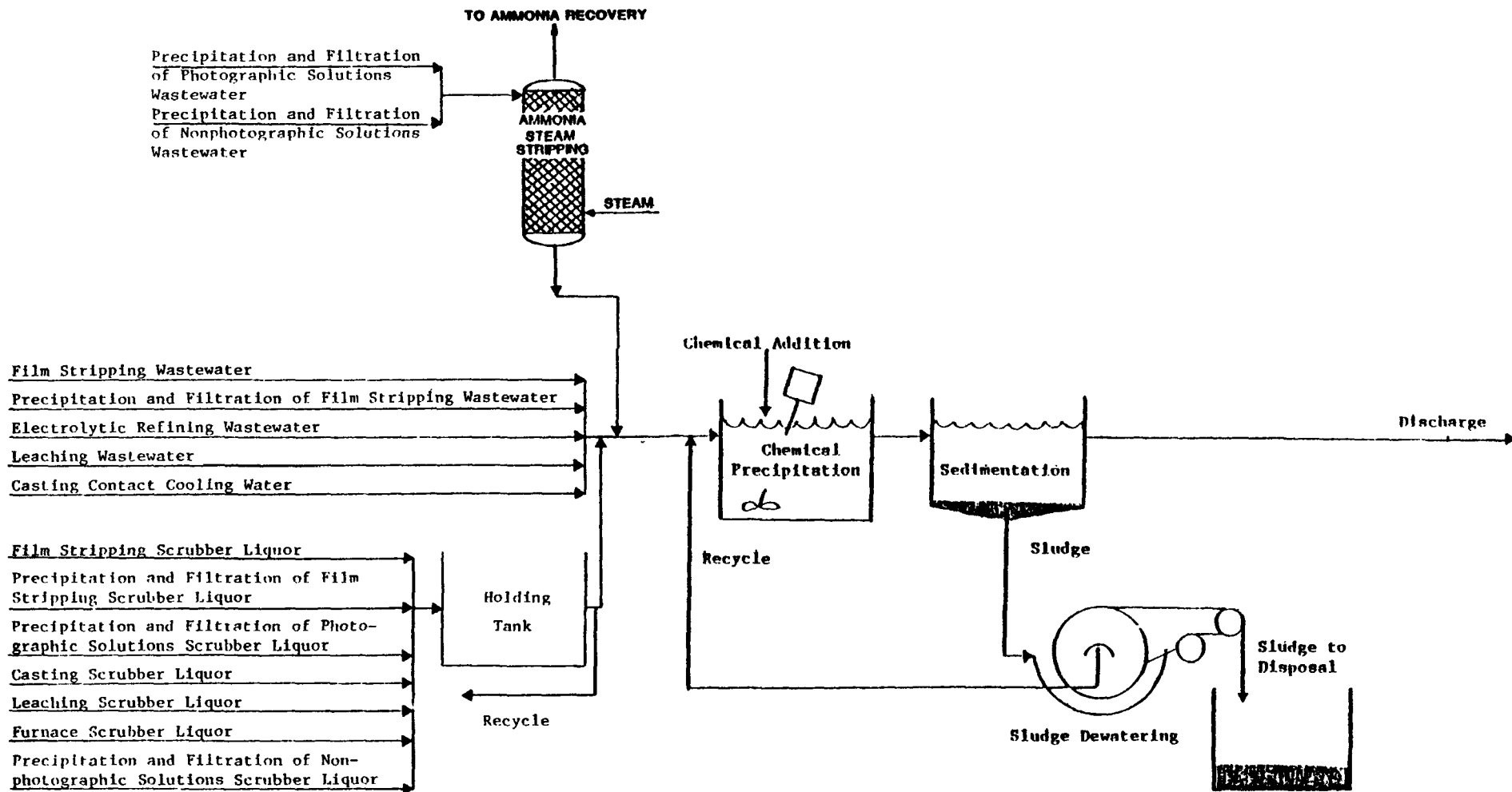


Figure IX-1

BPT TREATMENT SCHEME FOR THE SECONDARY SILVER SUBCATEGORY

## SECONDARY SILVER SUBCATEGORY

### SECTION X

#### BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

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

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

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

#### TECHNICAL APPROACH TO BAT

In pursuing this second round of effluent regulations, 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 four technology options which could be applied to the secondary silver 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.

In summary, the treatment technologies considered for the secondary silver subcategory are:

Option A (Figure X-1) is based on

- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation

Option B (Figure X-2) is based on

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation

Option C (Figure X-3) is based on

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation
- o Multimedia filtration

Option E (Figure X-4) is based on

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation
- o Multimedia filtration
- o Activated carbon adsorption end-of-pipe technology

The four options examined for BAT are discussed in greater detail below. The first option considered is the same as the BPT treatment technology which was presented in the previous section.

#### OPTION A

Option A for the secondary silver 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 (lime and settle), with

ammonia steam stripping preliminary treatment of wastewaters containing treatable concentrations of ammonia (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 B

Option B for the secondary silver subcategory achieves lower pollutant discharge by building upon the Option A (ammonia steam stripping, chemical precipitation, and sedimentation) treatment technology. Flow reduction measures are added to the Option A treatment scheme (see Figure X-2). These flow reduction measures, including in-process changes, result in the elimination of some wastewater streams and the concentration of pollutants in other effluents. As explained in Section VII of the General Development Document, treatment of a more concentrated effluent allows achievement of a greater net pollutant removal and introduces the possible economic benefits associated with treating a lower volume of wastewater.

Option B flow reduction measures are reflected in the BAT wastewater discharge rates. Flow reduction has been included in determining the BAT discharge rates for furnace wet air pollution control, and casting contact cooling water. Based on available data, the Agency did not feel that further flow reduction over BPT would be feasible for the remaining 12 waste streams in the secondary silver subcategory. These waste streams are:

1. Film stripping,
2. Film stripping wet air pollution control,
3. Precipitation and filtration of film stripping solutions,
4. Precipitation and filtration of film stripping solutions wet air pollution control,
5. Precipitation and filtration of photographic solutions,
6. Precipitation and filtration of photographic solutions wet air pollution control,
7. Electrolytic refining,
8. Casting wet air pollution control,
9. Leaching,
10. Leaching wet air pollution control,
11. Precipitation and filtration of nonphotographic solutions, and
12. Precipitation and filtration of nonphotographic solutions wet air pollution control.

Flow reduction measures used in Option B to reduce process wastewater generation or discharge rates include the following:

### Recycle of Casting Contact Cooling Water Through Cooling Towers

The function of casting contact cooling water is to quickly remove heat from the newly formed silver ingots. Therefore, the principal requirements of the water are that it be cool and not contain dissolved solids at a concentration that would cause water marks or other surface imperfections. There is sufficient experience within the category with the cooling and recycling of similar wastewaters to assure the success of this technology using cooling towers or heat exchangers (refer to Section VII of the General Development Document). A blowdown or periodic cleaning is likely to be needed to prevent a build-up of dissolved and suspended solids. EPA has determined that a blowdown of 10 percent of the water applied in a process is adequate. The BAT discharge rate allowance (discussed below) provides for this by requiring a partial recycle of 90 percent (refer to Section VII of the General Development Document).

### Recycle of Water Used in Wet Air Pollution Control

There are seven wastewater sources associated with wet air pollution control which are regulated under these effluent limitations:

1. Film stripping scrubber,
2. Precipitation and filtration of film stripping solutions scrubber,
3. Precipitation and filtration of photographic solutions scrubber,
4. Furnace scrubber,
5. Casting scrubber,
6. Leaching scrubber, and
7. Precipitation and filtration of nonphotographic solutions scrubber.

Table X-1 presents the number of plants reporting wastewater with the wet air pollution control sources listed above, the number of plants practicing recycle, and the range of recycle values being listed. Complete recycle of furnace scrubber water will be required for BAT. The Agency is not requiring further flow reduction at BAT for the remaining wet air pollution control waste streams.

### OPTION C

Option C for the secondary silver subcategory consists of all control and treatment requirements of Option B (in-process flow reduction, ammonia steam stripping, chemical precipitation, and sedimentation) plus multimedia filtration technology added at the end of the Option B treatment scheme (see Figure X-3). Multimedia filtration is used to remove suspended solids, including

precipitates of toxic metals, beyond the concentration 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 satisfactorily.

#### OPTION E

Option E for the secondary silver subcategory consists of all of the control and treatment technologies of Option C (in-process flow reduction, ammonia steam stripping, chemical precipitation, sedimentation, and multimedia filtration) with the addition of granular activated carbon technology at the end of the Option C treatment scheme (see Figure X-4). The activated carbon process is provided to control the discharge of toxic organics.

#### INDUSTRY COST AND ENVIRONMENTAL BENEFITS

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 REDUCTION BENEFITS

A complete description of the methodology used to calculate the estimated pollutant reduction, or benefit, achieved by the application of the various treatment options is presented in Section X of the General Development Document. In short, sampling data collected during the field sampling program were used to characterize the 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 silver subcategory. By multiplying the total subcategory production for a unit operation by the corresponding raw waste value, the mass of pollutant generated for that unit operation was estimated.

The volume of wastewater discharged after the application of each treatment option was estimated by multiplying the regulatory flow determined for each unit process by the total subcategory production. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed, referred to as the benefit, is simply 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 Agency varied this procedure slightly in computing estimated BPT discharge in a subcategory where there is an existing BPT limitation. In this case, EPA took the mass limits from the BPT guidelines (for all pollutants limited at BPT) and multiplied these limits by the total subcategory production (from dcp). (The assumption is that plants are discharging a volume equal to their BPT allowance times their production.) Where pollutants are not controlled by existing BPT, EPA used the achievable concentration for the associated technology proposed today, and multiplied these concentrations by the total end-of-pipe discharge of process wastewater for the subcategory (from dcp). The total of both these calculations represents estimated mass loadings for the subcategory.

The pollutant reduction benefit estimates for direct dischargers in the secondary silver subcategory are presented in Table X-2.

#### COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop uniformly-applicable cost curves, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied these curves on a per plant basis, a plant's costs (both capital, and operating and maintenance) being 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. These costs were used in assessing economic achievability. Table X-3 shows the compliance costs of the various options for direct dischargers in the secondary silver subcategory. Compliance costs for indirect dischargers are presented in Table XII-2.

#### BAT OPTION SELECTION

EPA has selected both Option B and Option C as the basis for alternative BAT effluent limitations for the secondary silver subcategory due to current adverse structural economic changes that are not reflected in the Agency's current economic analysis. These alternative limitations are based on ammonia steam stripping preliminary treatment, lime precipitation and sedimentation, end-of-pipe technology, and in-process control technologies to reduce the volume of process wastewater discharged for Option B, and the addition of multimedia filtration to the end-of-pipe technology for Option C. Significant economic changes in the secondary silver subcategory have occurred due to the tremendous fluctuation of silver prices over the past few years. A more detailed explanation concerning this economic analysis can be found in Economic Impact Analysis of Proposed Effluent Standards and Limitations for the Nonferrous Smelting and Refining Industry, EPA 440/2-82-002.

The proposed BAT Alternative A (Option B) increases the removal of toxic pollutants by approximately 13 kg/yr over the estimated BPT discharge. The estimated capital cost of proposed Alternative A is \$0.184 million (1978 dollars) and the annual cost is \$0.278 million (1978 dollars). The proposed BAT Alternative B (Option C) would remove approximately 27,163 kg/yr of toxic metals and 578,429 kg/yr of ammonia above the raw discharge. This proposed alternative will result in the removal of an estimated 92 kg/yr of toxic pollutants above the estimated BPT discharge. The estimated capital cost of Alternative B is \$0.206 million (1978 dollars) and the annual cost is an estimated \$0.345 million (1978 dollars).

Option E was eliminated because the addition of activated carbon technology is not necessary since toxic organic pollutants are not selected for limitation in this subcategory. (Refer to the end of this section for a discussion on the exclusion of toxic organic pollutants.)

#### 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 concentration 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 14 wastewater sources were determined and are summarized in Table X-4. 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 (PNP) are also listed in Table X-4.

As discussed previously, the BAT wastewater discharge rate equals the BPT wastewater discharge rate for 12 of the 14 waste streams in the secondary silver subcategory. Based on the available data, the Agency did not feel that further flow reduction would be feasible for these wastewater sources. Wastewater streams for which BAT discharge rates differ from BPT are discussed below.

#### FURNACE WET AIR POLLUTION CONTROL

No BAT wastewater discharge rate is allocated for furnace wet air pollution control. This rate applies to all air pollution control of furnace operations and is based on complete recycle of wastewater. Since 15 of the 19 plants with furnace air pollution control do not currently discharge water, the Agency believes that zero discharge is feasible for all secondary silver furnace air pollution control.

## CASTING CONTACT COOLING WATER

The BAT wastewater discharge rate is 1,204 l/kg (289 gal/ton) of silver cast. This rate is based on 90 percent recycle of the BPT discharge rate. Ten of the 28 plants using casting contact cooling water are once-through dischargers. Data were available from five plants to calculate discharge rates. One other plant achieves zero discharge by evaporation. Available discharge rates range from 1,340 l/kg (320 gal/ton) to 47,416 l/kg (11,374 gal/ton). The distribution of wastewater rates is presented in Section V (Table-10). One of five plants reporting sufficient dcp information meet the BAT rate.

## REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in *NRDC v. Train*, Op. Cit., and 33 U.S.C. §1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutant parameters for consideration for limitation. This examination and evaluation, presented in Section VI, concluded that 20 pollutants and pollutant parameters are present in secondary silver wastewaters at concentrations that can be effectively reduced by identified treatment technologies. (Refer to Section VI, p. 488 ).

However, 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 wastewaters from a given subcategory, the Agency is proposing effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant reduction benefit analysis. The pollutants selected for specific limitation are listed below:

- 120. copper
- 128. zinc  
ammonia

By establishing limitations and standards for certain toxic metal pollutants, dischargers will attain the same degree of control over toxic 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 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 lime 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 secondary silver subcategory to control the discharges of toxic metal pollutants are copper and zinc. Ammonia is also selected for limitation since the methods used to control copper and zinc are not effective in the control of ammonia.

The following toxic pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations developed for lead and zinc:

- 114. antimony
- 115. arsenic
- 118. cadmium
- 119. chromium
- 122. lead
- 124. nickel
- 125. selenium
- 126. silver
- 127. thallium

The secondary silver subcategory generates an estimated 37,800 kg/yr of toxic pollutants, of which only 33 kkg/yr are toxic organic pollutants. The Agency believes that the toxic organic pollutants in this subcategory are present only in trace (de minimus quantities) and are neither causing nor likely to cause toxic effects. Therefore, the following toxic organic pollutants are excluded from limitation:

- 4. benzene
- 6. carbon tetrachloride
- 10. 1,2-dichloroethane
- 29. 1,1-dichloroethylene
- 87. trichloroethylene

Cyanide was present in the secondary silver subcategory in certain waste streams at concentrations that can be effectively reduced by identified treatment technologies. Treatable concentrations of cyanide were found in one photographic materials plant and one nonphotographic materials plant. Five different process waste streams were sampled; four contained cyanide at treatable concentrations, in six of nine samples. However, when waste streams were combined for treatment, cyanide was found at a concentration below that achievable by identified treatment technology. This determination was made by comparing the raw



the raw (untreated) wasteload and treated discharge estimates presented in the pollutant reduction benefits. Cyanide is thus excluded from limitation.

The conventional pollutant parameters TSS and pH will be limited by the best conventional technology (BCT) effluent limitations. These effluent limitations and a discussion of BCT are presented in Section XIII of this supplement.

#### EFFLUENT LIMITATIONS

The treatable concentrations, achievable by application of the two BAT technologies (Options B and C) are summarized in Table VII-19 of the General Development Document. These treatable concentrations (both one day maximum and monthly average) are multiplied by the BAT normalized discharge flows summarized in Table X-4 to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per metric ton of product represent the BAT effluent limitations for the secondary silver subcategory. Two sets of BAT effluent limitations, each based on one of the two alternative BAT options, have been developed for the secondary silver subcategory. BAT effluent limitations based on Option B (ammonia steam stripping, lime precipitation, sedimentation, and in-process flow reduction) are presented in Table X-5, while limitations based on Option C (ammonia steam stripping, lime precipitation, sedimentation, in-process flow reduction, and multimedia filtration) are presented in Table X-6.

Table X-1

## CURRENT RECYCLE PRACTICES WITHIN THE SECONDARY SILVER SUBCATEGORY

	<u>Number of Plants with Wastewater</u>	<u>Number of Plants Practicing Recycle</u>	<u>Range of Recycle Values (%)</u>
Film stripping scrubber	1	1	99+
Film stripping precipitation and filtration scrubber	1	1	99+
Photographic solution precipi- tation and filtration scrubber	4	4	68 - 100
Furnace scrubber	11	9	99.7 - 100
Casting scrubber	4	2	99.7 - 100
Leaching scrubber	12	11	65 - 100
Precipitation and filtration of nonphotographic solutions scrubber	4	2	99 - 99+

Table X-2

POLLUTANT REDUCTION BENEFITS  
FOR  
DIRECT DISCHARGERS

Flow (1/yr)		975.9 x 10 <sup>6</sup>		966.4 x 10 <sup>6</sup>		966.4 x 10 <sup>6</sup>	
	Raw Waste	Option A	Option A	Option B	Option B	Option C	Option C
Pollutant	kg/yr	Removed	Discharged	Removed	Discharged	Removed	Discharged
		kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Benzene	0.7	0.0	0.7	0.0	0.7	0.0	0.7
Carbon Tetrachloride	0.2	0.0	0.2	0.0	0.2	0.0	0.2
1,2-Dichloroethane	9.9	0.0	9.9	0.0	9.9	0.0	9.9
1,1-Dichloroethylene	11.7	0.0	11.7	0.0	11.7	0.0	11.7
Trichloroethylene	1.3	0.0	1.3	0.0	1.3	0.0	1.3
Antimony	4.4	0.0	4.4	0.0	4.4	0.0	4.4
Arsenic	5.8	0.0	5.8	0.0	5.8	0.0	5.8
Cadmium	4.5	0.0	4.5	0.1	4.4	0.1	4.4
Chromium	77.5	0.0	77.5	0.2	77.3	9.8	67.7
Copper	157.2	4.8	152.4	10.3	146.9	10.5	146.7
Cyanide	2.8	0.0	2.8	0.0	2.8	0.0	2.8
Lead	75.9	0.0	75.9	0.5	75.4	0.5	75.4
Nickel	61.2	0.0	61.2	4.0	57.2	4.4	56.8
Selenium	0.8	0.0	0.8	0.0	0.8	0.0	0.8
Silver	4.3	0.0	4.3	0.0	4.3	0.0	4.3
Thallium	0.3	0.0	0.3	0.0	0.3	0.0	0.3
Zinc	27,359.4	66.7	292.7	27,269.4	290.0	137.1	222.3
Oil and Grease	549.5	0.0	549.5	0.0	549.5	0.0	549.5
TSS	13,132.4	1,531.2	11,601.2	1,535.2	11,597.2	10,619.7	2,512.7
Phenol	51.3	0.0	51.3	0.0	51.3	0.0	51.3
Ammonia	633,449.3	578,349.9	55,099.4	578,429.2	55,020.1	578,429.2	55,020.1
Total Toxic Organics	23.8	0.0	23.8	0.0	23.8	0.0	23.8
Total Toxic Metals	27,751.4	27,071.6	679.8	27,084.6	666.8	27,162.5	588.9
Total Toxics	27,778.0	27,071.6	706.4	27,084.6	693.4	27,162.5	615.5
Total Conventionals	13,681.9	1,531.2	12,150.7	1,535.2	12,146.7	10,619.7	3,062.2
Total Nonconventionals	633,500.6	578,349.9	55,150.7	578,429.2	55,071.4	578,429.2	55,071.4
Total Pollutants	674,960.5	606,952.7	68,007.8	607,049.0	67,911.5	616,211.4	58,749.1

Table X-2 (Continued)

POLLUTANT REDUCTION BENEFITS  
FOR  
DIRECT DISCHARGERS

Flow (l/yr)	966.4 x 10 <sup>6</sup>	
Pollutant	Option E Removed kg/yr	Option E Discharged kg/yr
Benzene	0.0	0.7
Carbon Tetrachloride	0.0	0.2
1,2-Dichloroethane	0.2	9.7
1,1-Dichloroethylene	11.7	0.0
Trichloroethylene	0.0	1.3
Antimony	0.0	4.4
Arsenic	0.0	5.8
Cadmium	0.1	4.4
Chromium	9.8	67.7
Copper	10.5	146.7
Cyanide	0.0	2.8
Lead	0.5	75.4
Nickel	4.4	56.8
Selenium	0.0	0.8
Silver	0.0	4.3
Thallium	0.0	0.3
Zinc	137.1	222.3
Oil and Grease	0.0	549.5
TSS	10,619.7	2,512.7
Phenol	46.2	5.1
Ammonia	627,947.3	5,502.0
Total Toxic Organics	11.9	11.9
Total Toxic Metals	27,162.5	588.9
Total Toxics	27,174.4	603.6
Total Conventional	10,619.7	3,062.2
Total Nonconventionals	627,993.5	5,507.1
Total Pollutants	597,779.8	9,172.9

NOTE: Total Toxic Metals = Antimony + Arsenic + Cadmium + Chromium + Copper + Lead + Nickel + Selenium + Silver + Thallium + Zinc  
 Total Toxics = Total Toxic Metals + Total Toxic Organics + Cyanide  
 Total Conventional = TSS + Oil and Grease  
 Total Nonconventional = Phenol + Ammonia  
 Total Pollutants = Total Toxics + Total Conventional + Total Nonconventional

Option A = Ammonia steam stripping, lime precipitation, and sedimentation.

Option B = Flow reduction, ammonia steam stripping, lime precipitation, and sedimentation.

Option C = Flow reduction, ammonia steam stripping, lime precipitation, sedimentation, and multimedia filtration.

Option E = Flow reduction, ammonia steam stripping, lime precipitation, sedimentation, multimedia filtration, and activated carbon adsorption

Table X-3

COST OF COMPLIANCE FOR DIRECT DISCHARGERS IN THE  
SECONDARY SILVER SUBCATEGORY

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	124,000	263,000
B	184,000	278,000
C	206,000	345,000

Table X-4

## BAT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>1/kg</u>	<u>gal/ton</u>	
Film stripping	1,619,000	388,300	kg of silver produced from film stripping
Film stripping wet air pollution control	15,580	3,737	kg of silver produced from film stripping
Precipitation and filtration of film stripping solutions	1,851,000	444,000	kg of silver precipitated
Precipitation and filtration of film stripping solutions wet air pollution control	15,580	3,737	kg of silver precipitated
Precipitation and filtration of photographic solutions	854,000	204,850	kg of silver precipitated
Precipitation and filtration of photographic solutions wet air pollution control	390,300	93,600	kg of silver precipitated
Electrolytic refining	24,316	5,833	kg of silver refined
Furnace wet air pollution control	0	0	kg of silver smelted, roasted, or dried
Casting contact cooling water	1,204	289	kg of silver cast

Table X-4 (Continued)

## BAT WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Casting wet air pollution control	4,741	1,137	kg of silver cast
Leaching	2,780	667	kg of silver produced from leaching
Leaching wet air pollution control	142,389	35,155	kg of silver produced from leaching
Precipitation and filtration of non-photographic solutions	98,577	23,650	kg of silver precipitated
Precipitation and filtration of non-photographic solutions wet air pollution control	79,931	19,173	kg of silver precipitated

Table X-5

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	3,076,100.0	1,619,000.0
Zinc	2,153,270.0	906,640.0
Ammonia(as N)	215,327,000.0	94,873,400.0

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	3,516,900.0	1,851,000.0
Zinc	2,461,830.0	1,036,560.0
Ammonia (as N)	246,183,000.0	108,468,600.0



Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,622,600.0	854,000.0
Zinc	1,135,820.0	478,240.0
Ammonia (as N)	113,582,000.0	50,044,400.0

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	741,570.0	390,300.0
Zinc	519,099.0	218,568.0
Ammonia (as N)	51,909,900.0	22,871,580.0
	at all times	

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	46,200.4	24,316.0
Zinc	32,340.28	13,616.96
Ammonia (as N)	3,234,028.0	1,424,917.60

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	2,287.6	1,204.0
Zinc	1,601.32	674.24
Ammonia (as N)	160,132.0	70,554.40

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	9,007.8	4,741.0
Zinc	6,305.53	2,654.96
Ammonia (as N)	630,553.0	277,822.60

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	5,282.0	2,780.0
Zinc	3,697.4	1,556.8
Ammonia (as N)	369,740.0	165,662.20

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	270,539.1	142,389.0
Zinc	189,377.37	79,737.84
Ammonia (as N)	18,937,737.0	8,343,995.40

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	187,296.30	98,577.0
Zinc	131,107.41	55,203.12
Ammonia (as N)	13,110,741.0	5,776,612.20

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	151,868.9	79,931.0
Zinc	106,308.23	44,761.36
Ammonia (as N)	10,630,823.0	4,683,956.60

Table X-6

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia(as N)	215,327,000.0	94,873,400.0

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia (as N)	246,183,000.0	108,468,600.0

Table X-6 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0

Table X-6 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40

Table X-6 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of silver cast  
English Units - lbs/billion lbs of silver cast

Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of silver produced from leaching  
English Units - lbs/billion lbs of silver produced from leaching

Copper	3,558.4	1,695.8
Zinc	2,835.6	1,167.6
Ammonia (as N)	369,740.0	162,908.0

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of silver produced from leaching  
English Units - lbs/billion lbs of silver produced from leaching

Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40



Table X-6 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia (as N)	10,630,823.0	4,683,956.60

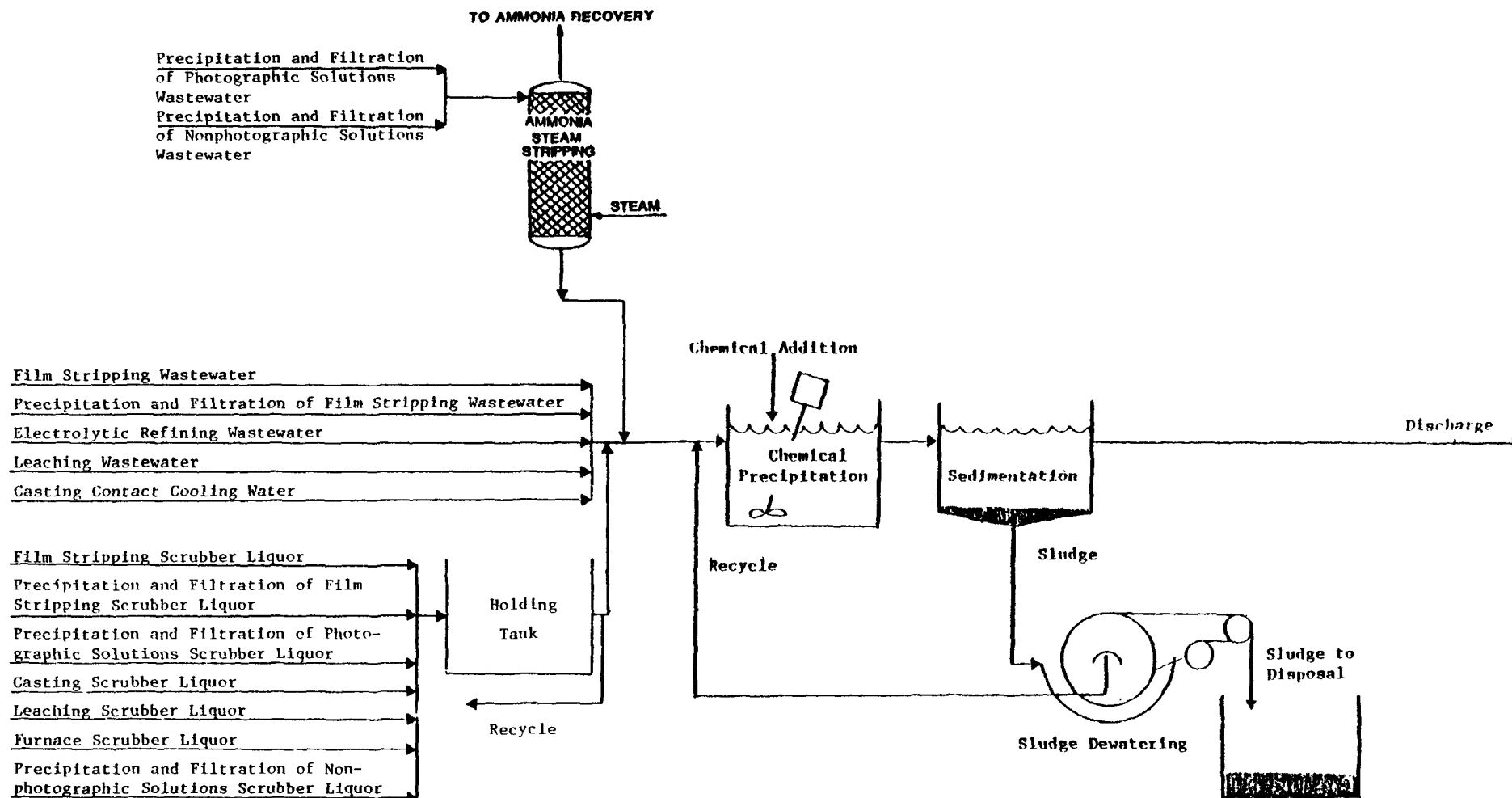


Figure X-1

BAT TREATMENT SCHEME FOR OPTION A

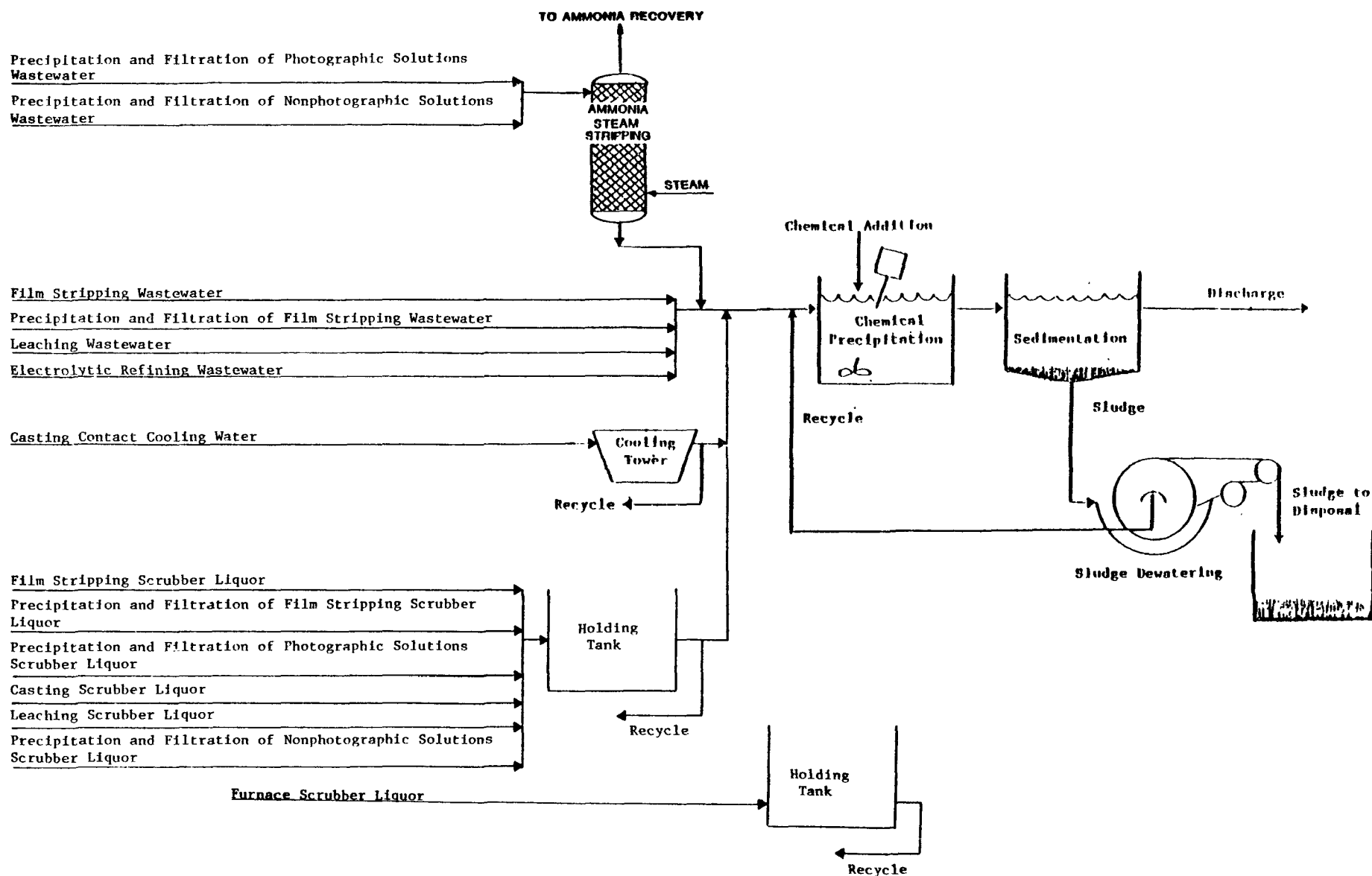


Figure X-2

BAT TREATMENT SCHEME FOR OPTION B

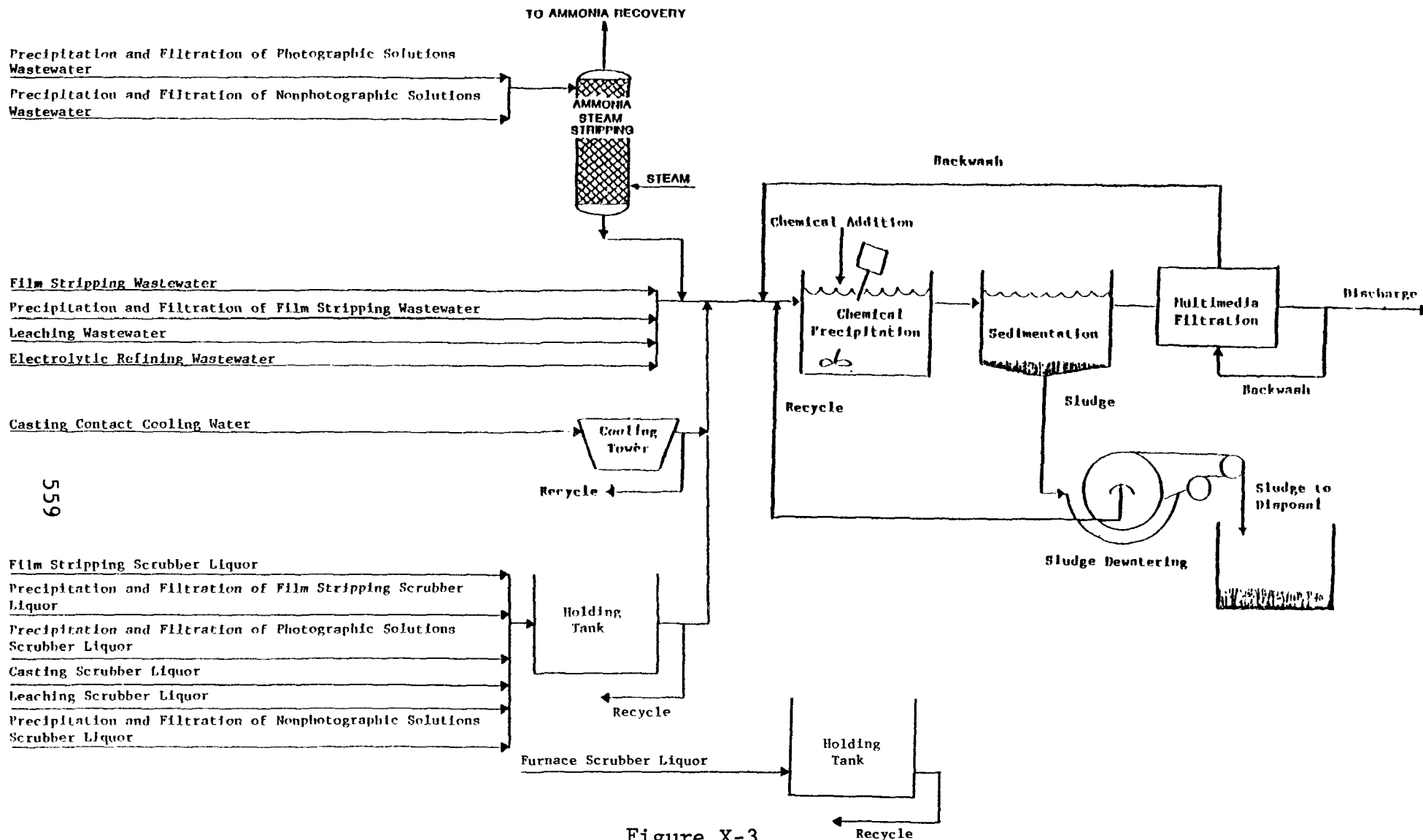
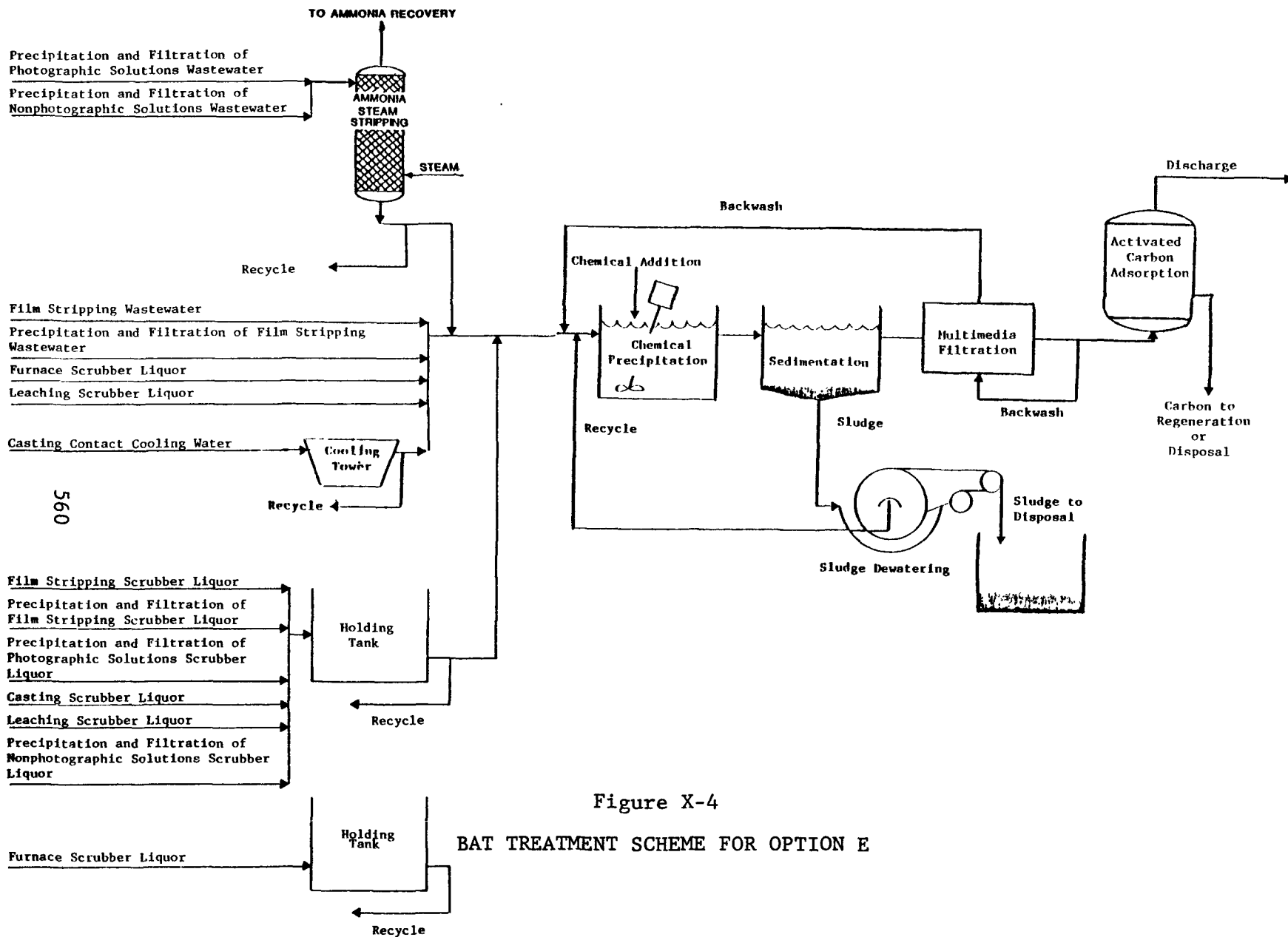


Figure X-3

BAT TREATMENT SCHEME FOR OPTION C



SECONDARY SILVER SUBCATEGORY  
SECTION XI  
NEW SOURCE PERFORMANCE STANDARDS

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

This section describes the control technology for treatment of wastewater from new sources and presents mass discharge limitations of regulatory pollutants for NSPS in the secondary silver subcategory based on the described control technology.

TECHNICAL APPROACH TO BDT

As discussed in the General Development Document, all of the treatment technology options applicable to a new source were previously considered for the BAT options. For this reason, four options were considered for BDT, all identical to the BAT options discussed in Section X.

Treatment and control technologies used for the BDT options are:

OPTION A

- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation

OPTION B

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation

#### OPTION C

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation
- o Multimedia-filtration

#### OPTION E

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation
- o Multimedia-filtration
- o Activated carbon adsorption end-of-pipe technology

Partial or complete recycle and reuse of wastewater is an essential part of the last three options. Recycle and reuse can precede or follow end-of-pipe treatment. A more detailed discussion of the treatment options is presented in Section X.

#### BDT OPTION SELECTION

EPA is proposing that the best available demonstrated technology for the secondary silver technology be equal to Option C (in-process flow reduction, ammonia steam stripping preliminary treatment, lime precipitation, sedimentation, and multimedia filtration end-of-pipe treatment). The Agency recognizes that new sources have the opportunity to implement more advanced levels of treatment without incurring the costs of retrofitting and the costs of partial or complete shutdown necessary for installation of the new equipment that existing plants should have. Therefore, NSPS will be based on the Option C technology only, rather than considering two alternatives (Option B and C) as in BAT. Review of the subcategory indicates that no new demonstrated technologies that improve on BAT exist.

Activated carbon adsorption technology (Option E) was eliminated because it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory. (Refer to the discussion of exclusion of toxic organic pollutants in Sections VI and X.)

Dry scrubbing is not demonstrated for controlling emissions from film stripping, precipitation and filtration of film stripping solutions, precipitation and filtration of photographic solutions, reduction furnaces, leaching and precipitation and filtration. The nature of these emissions (acidic fumes, hot particulate matter) technically precludes the use of dry scrubbers.

Therefore, EPA is including an allowance for these sources at NSPS equivalent to that proposed for BAT Option C. The Agency also does not believe that new plants could achieve any additional flow reduction beyond that proposed for BAT.

#### 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 Section 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 listed in Table XI-1. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the appropriate effluent concentration by the production normalized wastewater discharge flows (l/kg). The treatment concentrations are listed in Table VII-19 of the General Development Document. New source performance standards are presented in Table XI-2.



Table XI-1

## NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Wastewater Stream</u>	<u>NSPS Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>1/kgg</u>	<u>gal/ton</u>	
Film stripping	1,619,000	388,300	kgg of silver produced from film stripping
Film stripping wet air pollution control	15,580	3,737	kgg of silver produced from film stripping
Precipitation and filtration of film stripping solutions	1,851,000	444,000	kgg of silver precipitated
Precipitation and filtration of film stripping solutions wet air pollution control	15,580	3,737	kgg of silver precipitated
Precipitation and filtration of photographic solutions	854,000	204,850	kgg of silver precipitated
Precipitation and filtration of photographic solutions wet air pollution control	390,300	93,600	kgg of silver precipitated
Electrolytic refining	24,316	5,833	kgg of silver refined
Furnace wet air pollution control	0	0	kgg of silver smelted, roasted, or dried
Casting contact cooling water	1,204	289	kgg of silver cast

Table XI-1 (Continued)

## NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Wastewater Stream</u>	<u>NSPS Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>1/kgg</u>	<u>gal/ton</u>	
Casting wet air pollution control	4,741	1,137	kgg of silver cast
Leaching	2,780	667	kgg of silver produced from leaching
Leaching wet air pollution control	142,389	35,155	kgg of silver produced from leaching
Precipitation and filtration of non-photographic solutions	98,577	23,650	kgg of silver precipitated
Precipitation and filtration of non-photographic solutions wet air pollution control	79,931	19,173	kgg of silver precipitated

Table XI-2

## NSPS FOR THE SECONDARY SILVER SUBCATEGORY

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia (as N)	215,327,000.0	94,873,400.0
Total Suspended Solids	24,285,000.0	19,428,000.0
pH	Within range of 7.5 to 10.0 at all times.	

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	233,700.0	186,960.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia(as N)	246,183,000.0	108,468,600.0
Total Suspended Solids	27,765,000.0	22,212,000.0
pH	Within the range of 7.5 to 10.0 at all times.	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY SILVER SUBCATEGORY

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0
Total Suspended Solids	233,700.0	186,960.0
pH	Within the range of 7.5 to 10.0 at all times.	

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0
Total Suspended Solids	12,810,000.0	10,248,000.0
pH	Within the range of 7.5 to 10.0 at all times.	

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0
Total Suspended Solids	5,854,500.0	4,683,600.0
pH	Within the range of 7.5 to 10.0 at all times.	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY SILVER SUBCATEGORY

Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60
Total Suspended Solids	364,740.0	291,792.0
pH	Within the range of 7.5 to 10.0 at all times.	

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times.	

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40
Total Suspended Solids	18,060.0	14,448.0
pH	Within the range of 7.5 to 10.0 at all times.	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY SILVER SUBCATEGORY

Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60
Total Suspended Solids	71,115.0	56,892.0
pH	Within the range of 7.5 to 10.0 at all times.	

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	3,558.4	1,695.8
Zinc	2,835.6	1,167.6
Ammonia (as N)	369,740.0	162,908.0
Total Suspended Solids	41,700.0	33,360.0
pH	Within the range of 7.5 to 10.0 at all times.	

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40
Total Suspended Solids	2,135,835.0	1,708,668.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY SILVER SUBCATEGORY

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20
Total Suspended Solids	1,478,655.0	1,182,924.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia(as N)	10,630,823.0	4,683,956.60
Total Suspended Solids	1,198,965.0	959,172.0
pH	Within the range of 7.5 to 10.0 at all times	

## SECONDARY SILVER SUBCATEGORY

### SECTION XII

#### PRETREATMENT STANDARDS

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES), which must be achieved within three years of promulgation. 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 of 1977 requires pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives. Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time that it promulgates NSPS. 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 technology for removal of toxic pollutants.

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the secondary silver subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technologies.

#### TECHNICAL APPROACH TO PRETREATMENT

Before proposing 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: (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 nor 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 EXISTING AND NEW SOURCES

Options for pretreatment of wastewaters 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 PSES and PSNS, 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 and achievable treatment concentration for each option, is presented in Section VII of the General Development Document.

Treatment technology used for the PSES and PSNS options are:

##### OPTION A

- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation

##### OPTION B

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation

##### OPTION C

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation
- o Multimedia-filtration

## OPTION E

- o In-process flow reduction of casting contact cooling water and wet air pollution control water
- o Ammonia steam stripping preliminary treatment for streams containing ammonia at treatable concentrations
- o Chemical precipitation and sedimentation
- o Multimedia-filtration
- o Activated carbon adsorption end-of-pipe technology

## INDUSTRY COST AND ENVIRONMENTAL BENEFITS

The industry cost and environmental benefits of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Table XII-1 shows the estimated pollutant reduction benefits for direct and indirect dischargers, while compliance costs for indirect discharges are presented in Table XII-2.

## PSES OPTION SELECTION

EPA has selected in-process flow reduction, ammonia steam stripping preliminary treatment, lime precipitation, and sedimentation (Option B) and in-process flow reduction, ammonia steam stripping preliminary treatment, chemical precipitation, sedimentation, and multimedia filtration (Option C) as alternative pretreatment standards for existing sources for this subcategory. This selection follows from the rationale used in selecting alternative options as the basis for BAT. (Refer to Section X.)

The proposed PSES Alternative A (Option B) would remove approximately 9,731 kg/yr of toxic pollutants over the estimated raw discharge and an estimated 149,300 kg/yr of ammonia. The estimated capital cost of proposed Alternative A is \$1.03 million (1978 dollars) and the annual cost is \$0.958 million (1978 dollars). The proposed PSES Alternative B (Option C) would remove approximately 9,792 kg/yr of toxic pollutants and 149,300 kg/yr of ammonia above the estimated raw discharge. The estimated capital cost of Alternative B is \$1.14 million (1978 dollars) and the annual cost is an estimated \$1.07 million (1978 dollars).

Activated carbon adsorption technology (Option E) was eliminated because it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory. (Refer to the discussion of selection of pollutants for limitation in Section X.)

## PSNS OPTION SELECTION

EPA has selected in-process flow reduction, ammonia steam stripping preliminary treatment, lime precipitation, sedimentation, and multimedia filtration (Option C) as the technology basis for PSNS. The Agency recognizes that new sources have the opportunity to implement more advanced levels of treatment without incurring the costs of retrofitting and the costs of partial or complete shutdown necessary for installation of the new equipment that existing plants should have. Therefore, PSNS will be based on the Option C technology only, rather than considering two alternatives (Option B and C) as in PSES.

EPA has not identified any demonstrated technology that provides more efficient pollutant removal than PSNS technology. No additional flow reduction for new sources is feasible because dry scrubbing is not demonstrated for controlling emissions from film stripping, precipitation and filtration of photographic solutions, reduction furnaces, leaching and precipitation and filtration. The nature of these emissions (acidic fumes, hot particulate matter) technically precludes the use of dry scrubbers. Activated carbon adsorption technology (Option E) was eliminated because it is not necessary since toxic organic pollutants are not selected for limitation in this subcategory (see Section X). Since PSNS does not include any additional costs compared to NSPS, the Agency does not believe PSNS will be a barrier to entry for new facilities.

## REGULATED POLLUTANT PARAMETERS

Pollutants and pollutant parameters selected for limitation for PSES and PSNS, in accordance with the rationale of Section VI and X, are identical to those selected for limitation for BAT. EPA is proposing PSNS for copper, zinc, and ammonia to prevent pass-through. The conventional pollutants, TSS and pH, are not limited under PSES and PSNS because they are effectively controlled by POTW.

## PRETREATMENT STANDARDS

The PSES and PSNS discharge flows are identical to the BAT discharge flows for all processes. These discharge flows are listed in Table XII-3. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the achievable treatment concentration (mg/l) by the normalized wastewater discharge flow (l/kg). The achievable treatment concentrations are presented in Table VII-19 of the General Development Document. Pretreatment standards for existing and new sources, as determined from the above procedure, are shown in Tables XII-4 through XII-6 for each waste stream.

Mass-based standards are proposed for the secondary silver subcategory to ensure that the standards are achieved by means of pollutant removal rather than by dilution. They are particularly important since the standards are based upon flow reduction. Pollutant limitations associated with flow reduction cannot be measured any way but as a reduction of mass discharged. Mass-based PSES without alternative concentration-based standards are proposed in this subcategory, although the flow reduction for the entire subcategory is not great. However, several plants grossly exceed the flow basis of PSES. Mass-based standards are needed to ensure that these plants reduce their water usage. Mass-based PSNS are proposed in this subcategory because PSNS for secondary silver is based on 90 percent flow reduction of raw wastewater by recycle, and new plants would lack incentive to achieve these reductions without a mass-based standard.

Table XII-1

POLLUTANT REDUCTION BENEFITS  
FOR  
INDIRECT DISCHARGERS

Flow (1/yr)		379.4 x 10 <sup>6</sup>		326.0 x 10 <sup>6</sup>		326.0 x 10 <sup>6</sup>	
	Raw Waste	Option A	Option A	Option B	Option B	Option C	Option C
Pollutant	kg/yr	Removed kg/yr	Discharged kg/yr	Removed kg/yr	Discharged kg/yr	Removed kg/yr	Discharged kg/yr
Benzene	0.4	0.0	0.4	0.0	0.4	0.0	0.4
Carbon Tetrachloride	0.1	0.0	0.1	0.0	0.1	0.0	0.1
1,2-Dichloroethane	2.7	0.0	2.7	0.0	2.7	0.0	2.7
1,1-Dichloroethylene	5.1	0.0	5.1	0.0	5.1	0.0	5.1
Trichloroethylene	0.9	0.0	0.9	0.0	0.9	0.0	0.9
Antimony	3.0	0.0	3.0	0.0	3.0	0.0	3.0
Arsenic	3.4	0.0	11.9	0.0	3.4	0.0	3.4
Cadmium	26.6	13.9	11.3	19.4	7.1	21.0	5.5
Chromium	82.4	52.1	30.3	56.3	26.1	59.5	22.9
Copper	1,698.5	1,595.6	102.9	1,626.5	72.0	1,636.7	61.8
Cyanide	1.9	0.0	1.9	0.0	1.9	0.0	1.9
Lead	116.5	81.8	34.7	88.2	28.3	90.4	26.1
Nickel	724.6	648.7	75.9	679.0	45.6	697.8	26.8
Selenium	0.6	0.0	0.6	0.0	0.6	0.0	0.6
Silver	13.0	0.0	13.0	4.7	8.2	6.4	6.6
Thallium	0.2	0.0	0.2	0.0	0.2	0.0	0.2
Zinc	7,354.7	7,240.9	113.8	7,256.9	97.8	7,279.8	74.9
Oil and Grease	198.4	0.0	198.4	0.0	198.4	0.0	198.4
TSS	6,235.6	1,683.2	4,552.4	2,323.9	3,911.7	5,388.0	847.6
Phenol	35.0	0.0	35.0	0.3	34.7	0.3	34.7
Ammonia	187,713.5	149,317.8	38,395.7	149,332.6	38,380.9	149,332.6	38,380.9
Total Toxic Organics	9.2	0.0	9.2	0.0	9.2	0.0	9.2
Total Toxic Metals	10,023.4	9,634.2	389.2	9,731.1	292.3	9,791.6	231.8
Total Toxics	10,034.5	9,634.2	398.3	9,731.1	303.3	9,791.6	242.8
Total Conventional	6,434.0	1,683.2	4,750.8	2,323.8	4,110.2	5,388.0	1,046.0
Total Nonconventional	187,748.5	149,317.8	38,430.7	149,333.1	38,415.4	149,333.1	38,415.4
Total Pollutants	204,217.0	160,635.2	43,581.7	161,388.0	42,829.0	164,512.7	39,704.3

Table XII-1 (Continued)

POLLUTANT REDUCTION BENEFITS  
FOR  
INDIRECT DISCHARGERS

Flow (l/yr)	326.0 x 10 <sup>6</sup>	
Pollutant	Option E Removed kg/yr	Option E Discharged kg/yr
Benzene	0.0	0.4
Carbon Tetrachloride	0.0	0.1
1,2-Dichloroethane	0.0	2.7
1,1-Dichloroethylene	5.1	0.0
Trichloroethylene	0.0	0.9
Antimony	0.0	3.0
Arsenic	0.0	3.4
Cadmium	21.0	5.5
Chromium	59.3	22.9
Copper	1,636.4	61.8
Cyanide	0.0	1.9
Lead	90.2	26.1
Nickel	697.7	26.8
Selenium	0.0	0.6
Silver	6.4	6.6
Thallium	0.0	0.2
Zinc	7,279.8	74.9
Oil and Grease	0.0	198.4
TSS	5,379.9	847.6
Phenol	31.5	3.5
Ammonia	183,875.4	3,838.1
Total Toxic Organics	5.1	4.1
Total Toxic Metals	9,791.6	231.8
Total Toxics	9,796.7	237.8
Total Conventional	5,388.0	1,046.0
Total Nonconventional	183,907.0	3,841.5
Total Pollutants	199,091.6	5,125.4

NOTE: Total Toxic Metals = Antimony + Arsenic + Cadmium + Chromium + Copper + Lead + Nickel + Selenium + Silver + Thallium + Zinc  
 Total Toxics = Total Toxic Metals + Total Toxic Organics + Cyanide  
 Total Conventional = TSS + Oil and Grease  
 Total Nonconventional = Phenol + Ammonia  
 Total Pollutants = Total Toxics + Total Conventional + Total Nonconventional

Option A = Ammonia Steam Stripping, Lime Precipitation, and Sedimentation.  
 Option B = Flow Reduction, Ammonia Steam Stripping, Lime Precipitation, and Sedimentation.  
 Option C = Flow Reduction, Ammonia Steam Stripping, Lime Precipitation, Sedimentation, and Multimedia Filtration.  
 Option E = Flow Reduction, Ammonia Steam Stripping, Lime Precipitation, Sedimentation, Multimedia Filtration, and Activated Carbon Adsorption.

Table XII-2

COST OF COMPLIANCE FOR INDIRECT DISCHARGERS  
IN THE SECONDARY SILVER SUBCATEGORY

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	784,000	907,000
B	1,030,000	958,000
C	1,140,000	1,070,000

Table XII-3

## PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

	<u>Wastewater Stream</u>	<u>PSES and PSNS Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
		<u>1/kg</u>	<u>gal/ton</u>	
	Film stripping	1,619,000	388,300	kg of silver produced from film stripping
	Film stripping wet air pollution control	15,580	3,737	kg of silver produced from film stripping
	Precipitation and filtration of film stripping solutions	1,851,000	444,000	kg of silver precipitated
579	Precipitation and filtration of film stripping solutions wet air pollution control	15,580	3,737	kg of silver precipitated
	Precipitation and filtration of photographic solutions	854,000	204,850	kg of silver precipitated
	Precipitation and filtration of photographic solutions wet air pollution control	390,300	93,600	kg of silver precipitated
	Electrolytic refining	24,316	5,833	kg of silver refined
	Furnace wet air pollution control	0	0	kg of silver smelted, roasted, or dried
	Casting contact cooling water	1,204	289	kg of silver cast



Table XII-3 (Continued)

## PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY SILVER SUBCATEGORY

<u>Wastewater Stream</u>	<u>PSES and PSNS Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>1/kg</u>	<u>gal/ton</u>	
Casting wet air pollution control	4,741	1,137	kg of silver cast
Leaching	2,780	667	kg of silver produced from leaching
Leaching wet air pollution control	142,389	35,155	kg of silver produced from leaching
Precipitation and filtration of non- photographic solutions	98,577	23,650	kg of silver precipi- tated
Precipitation and filtration of non- photographic solutions wet air pollution control	79,931	19,173	kg of silver precipi- tated

Table XII-4

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	3,076,100.0	1,619,000.0
Zinc	2,153,270.0	906,640.0
Ammonia(as N)	215,327,000.0	94,873,400.0

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	3,516,900.0	1,851,000.0
Zinc	2,461,830.0	1,036,560.0
Ammonia (as N)	246,183,000.0	108,468,600.0

Table XII-4 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	29,602.0	15,580.0
Zinc	20,721.0	8,724.8
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,622,600.0	854,000.0
Zinc	1,135,820.0	478,240.0
Ammonia (as N)	113,582,000.0	50,044,400.0

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	741,570.0	390,300.0
Zinc	519,099.0	218,568.0
Ammonia (as N)	51,909,900.0	22,871,580.0

Table XII-4 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	46,200.4	24,316.0
Zinc	32,340.28	13,616.96
Ammonia (as N)	3,234,028.0	1,424,917.60

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	2,287.6	1,204.0
Zinc	1,601.32	674.24
Ammonia (as N)	160,132.0	70,554.40

Table XII-4 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of silver cast  
English Units - lbs/billion lbs of silver cast

Copper	9,007.8	4,741.0
Zinc	6,305.53	2,654.96
Ammonia (as N)	630,553.0	277,822.60

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of silver produced from leaching  
English Units - lbs/billion lbs of silver produced from leaching

Copper	5,282.0	2,780.0
Zinc	3,697.4	1,556.8
Ammonia (as N)	369,740.0	165,662.20

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of silver produced from leaching  
English Units - lbs/billion lbs of silver produced from leaching

Copper	270,539.1	142,389.0
Zinc	189,377.37	79,737.84
Ammonia (as N)	18,937,737.0	8,343,995.40

Table XII-4 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION B)

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	187,296.30	98,577.0
Zinc	131,107.41	55,203.12
Ammonia (as N)	13,110,741.0	5,776,612.20

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	151,868.9	79,931.0
Zinc	106,308.23	44,761.36
Ammonia (as N)	10,630,823.0	4,683,956.60

Table XII-5

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia (as N)	215,327,000.0	94,873,400.0

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia (as N)	246,183,000.0	108,468,600.0

Table XII-5 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0



Table XII-5 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40

Table XII-5 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	3,558.40	1,695.80
Zinc	2,835.60	1,167.60
Ammonia (as N)	369,740.0	162,908.0

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40

Table XII-5 (Continued)

PSES FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia(as N)	10,630,823.0	4,683,956.60

Table XII-6

PSNS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	2,072,320.0	987,590.0
Zinc	1,651,380.0	679,980.0
Ammonia (as N)	215,327,000.0	94,873,400.0

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping		
English Units - lbs/billion lbs of silver produced from film stripping		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	2,369,280.0	1,129,110.0
Zinc	1,888,020.0	777,420.0
Ammonia (as N)	246,183,000.0	108,468,600.0

Table XII-6 (Continued)

PSNS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	19,942.40	9,503.80
Zinc	15,891.60	6,543.60
Ammonia (as N)	2,072,140.0	912,988.0

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	1,093,120.0	520,940.0
Zinc	871,080.0	358,680.0
Ammonia (as N)	113,582,000.0	50,044,400.0

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	499,584.0	238,083.0
Zinc	398,106.0	163,926.0
Ammonia (as N)	51,909,900.0	22,871,580.0

Table XII-6 (Continued)

PSNS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Copper	31,124.48	14,832.76
Zinc	24,802.32	10,212.72
Ammonia (as N)	3,234,028.0	1,424,917.60

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion of silver roasted, smelted, or dried		
Copper	0	0
Zinc	0	0
Ammonia (as N)	0	0

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	1,541.12	734.44
Zinc	1,228.08	505.68
Ammonia (as N)	160,132.0	70,554.40

Table XII-6 (Continued)

PSNS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Copper	6,068.48	2,892.01
Zinc	4,835.82	1,991.22
Ammonia (as N)	630,553.0	277,822.60

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	3,558.40	1,695.80
Zinc	2,835.60	1,167.60
Ammonia (as N)	369,740.0	162,908.0

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Copper	182,257.92	86,857.29
Zinc	145,236.78	59,803.38
Ammonia (as N)	18,937,737.0	8,343,995.40

Table XII-6 (Continued)

PSNS FOR THE SECONDARY SILVER SUBCATEGORY  
(BASED ON OPTION C)

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	126,178.56	60,131.97
Zinc	100,548.54	41,402.34
Ammonia (as N)	13,110,741.0	5,776,612.20

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Copper	102,311.68	48,757.91
Zinc	81,529.62	33,571.02
Ammonia (as N)	10,630,823.0	4,683,956.60



## SECONDARY SILVER SUBCATEGORY

### SECTION XIII

#### BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

The 1977 amendments to the Clean Water Act added Section 301(b)(2)(E), establishing "best conventional pollutant control technology" (BCT) for discharge of conventional pollutants from existing industrial point sources. Biochemical oxygen-demanding pollutants (BOD<sub>5</sub>), total suspended solids (TSS), fecal coliform, oil and grease (O&G), and pH have been designated as conventional pollutants (see 44 FR 44501).

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. In addition to the other factors specified in Section 304(b)(4)(B), the Act requires that limitations for conventional pollutants be assessed in light of a two-part cost-reasonableness test. On October 29, 1982, the Agency proposed a revised methodology for carrying out BCT analyses (47 FR 49176). The purpose of the proposal was to correct errors in the BCT methodology originally established in 1977.

Part 1 of the proposed BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be compared with the cost and level of reduction to remove the same type of pollutants by publicly-owned treatment works (POTW). The POTW comparison figure has been calculated by evaluating the change in costs and removals between secondary treatment (30 mg/l BOD and 30 mg/l TSS) and advanced secondary treatment (10 mg/l BOD and 10 mg/l TSS). The difference in cost is divided by the difference in pounds of conventional pollutants removed, resulting in an estimate of the "dollars per pound" of pollutant removed, that is used as a benchmark value. The proposed POTW test benchmark is \$0.30 per pound (1978 dollars).

Part 2 of the BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be evaluated internally to the industry. In order to develop a benchmark that assesses a reasonable relationship between cost and removal, EPA has developed an industry cost ratio which compares the dollar per pound of conventional pollutant removed in going from primary to secondary treatment levels with that of going from secondary to more advanced treatment levels. The basis of costs for the calculation of this ratio are the costs incurred by a POTW. EPA used these costs because: they reflect the treatment technologies most commonly used to remove conventional pollutants from wastewater; the treatment levels associated with them compare readily to the levels considered for industrial dischargers; and the costs are the most reliable for the treatment levels under consideration. The proposed industry

subcategory benchmark is 1.42. If the industry figure for a subcategory is lower than 1.43, the subcategory passes the BCT test.

The Agency usually considers two conventional pollutants in the cost test, TSS and an oxygen-demanding pollutant. Although both oil and grease and BOD<sub>5</sub> are considered to be oxygen-demanding substances by EPA (see 44 FR 50733), only one can be selected in the cost analysis to conform to procedures used to develop POTW costs. Oil and grease is used rather than BOD<sub>5</sub> in the cost analysis performed for nonferrous metals manufacturing waste streams due to the common use of oils in casting operations in this industry.

BPT is the base for evaluating limitations on conventional pollutants (i.e., it is assumed that BPT is already in place). The test evaluates the cost and removals associated with treatment and controls in addition to that specified as BPT.

If the conventional pollutant removal cost of the candidate BCT is less than the POTW cost, Part 1 of the cost-reasonableness test is passed and Part 2 (the internal industry test) of the cost-reasonableness test must be performed. If the internal industry test is passed, then a BCT limitation is promulgated equivalent to the candidate BCT level. If all candidate BCT technologies fail both parts of the cost-reasonableness test, the BCT requirements for conventional pollutants are equal to BPT.

The BCT test was performed for the proposed BAT technology basis of in-process flow reduction, ammonia steam stripping preliminary treatment, and lime precipitation, sedimentation, and multimedia filtration end-of-pipe technology. The secondary silver subcategory failed Part 1 of the test with a calculated cost of \$4.09 per pound (1978 dollars) of removal of conventional pollutants using BAT technology. The intermediate flow reduction option (in-process flow reduction, ammonia steam stripping preliminary treatment, and lime precipitation and sedimentation end-of-pipe treatment) was also examined, but it too failed with a cost of \$1,700 per pound (1978 dollars) of conventional pollutants removal.

Table XIII-1

## BCT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Film Stripping

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping English Units - lbs/billion lbs of silver produced from film stripping		
Total Suspended Solids	66,379,000.0	32,380,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Film Stripping Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver produced from film stripping English Units - lbs/billion lbs of silver produced from film stripping		
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Film Stripping Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	75,891,000.0	37,020,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

## BCT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Precipitation and Filtration of Film Stripping Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	638,780.0	311,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Photographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	35,014,000.0	17,080,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Photographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	16,002,300.0	7,806,000.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

BCT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Electrolytic Refining

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver refined		
English Units - lbs/billion lbs of silver refined		
Total Suspended Solids	996,956.0	486,320.0
pH	Within the range of 7.5 to 10.0 at all times	

Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver roasted, smelted, or dried		
English Units - lbs/billion lbs of silver roasted, smelted or dried		
Total Suspended Solids	882,279.0	430,380.0
pH	Within the range of 7.5 to 10.0 at all times	

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver cast		
English Units - lbs/billion lbs of silver cast		
Total Suspended Solids	493,435.0	240,700.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

## BCT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Casting Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver cast		
English Units - lbs/billion lbs of silver cast		
Total Suspended Solids	194,381.0	94,820.0
pH	Within the range of 7.5 to 10.0 at all times	

Leaching

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Total Suspended Solids	113,980.0	55,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Leaching Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of silver produced from leaching		
English Units - lbs/billion lbs of silver produced from leaching		
Total Suspended Solids	5,837,949.0	2,847,780.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

BCT EFFLUENT LIMITATIONS FOR THE SECONDARY SILVER SUBCATEGORY

Precipitation and Filtration of Nonphotographic Solutions

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	4,041,657.0	1,971,540.0
pH	Within the range of 7.5 to 10.0 at all times	

Precipitation and Filtration of Nonphotographic Solutions  
Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of silver precipitated		
English Units - lbs/billion lbs of silver precipitated		
Total Suspended Solids	3,277,171.0	1,598,620.0
pH	Within the range of 7.5 to 10.0 at all times	

## SECONDARY COPPER SUBCATEGORY

### SECTION I

#### SUMMARY AND CONCLUSIONS

On February 27, 1975, EPA promulgated technology-based effluent limitations guidelines for the secondary copper subcategory of the Nonferrous Metals Manufacturing Point Source category. Best practicable control technology currently available (BPT) and best available technology economically achievable (BAT) effluent limitations were established. Under these limitations, the discharge of process wastewater pollutants into navigable waters was prohibited with the following exceptions. For the BPT effluent limitations, discharge without limitation was allowed for a volume of process wastewater equivalent to the volume of stormwater in excess of that attributable to a 10-year, 24-hour rainfall event falling on a wastewater cooling impoundment. The BAT effluent limitations also contain the stormwater exemption except the storm is a 25-year, 24-hour rainfall event. For both the BPT and BAT effluent limitations, discharge, subject to concentration-based limitations, was allowed for a volume of process wastewater equal to the net monthly precipitation on the wastewater cooling impoundment.

On December 15, 1976, EPA promulgated pretreatment standards for existing sources (PSES) for the secondary copper subcategory. These standards allowed a continuous discharge of process wastewater to publicly owned treatment works (POTW) subject to concentration-based standards for oil and grease, copper, and cadmium. PSES is based on lime precipitation and sedimentation treatment technology.

Since 1974, implementation of the technology-based effluent limitations and standards has been guided by a series of settlement agreements into which EPA entered with several environmental groups, the latest of which occurred in 1979. NRDC v. Costle, 12 ERC 1833 (D.D.C. 1979), aff'd and remd'd, EDF v. Costle, 14 ERC 2161 (1980). Under the settlement agreements, EPA was required to develop BAT limitations and pretreatment and new source performance standards for 65 classes of pollutants discharged from specific industrial point source categories, including primary copper smelting and electrolytic copper refining. The list of 65 classes was subsequently expanded to a list of 129 specific toxic pollutants.

Congress amended the Clean Water Act in 1977 to encompass many of the provisions of the earlier settlement agreements, including the list of 65 classes of pollutants. As a result of the settlement agreements and the Clean Water Act Amendments, EPA undertook



an extensive effort to develop technology-based BAT limitations and pretreatment and new source performance standards for the toxic pollutants.

EPA is proposing modifications to BAT, and PSES for the secondary copper subcategory pursuant to the provisions of the Settlement Agreement and Sections 301, 304, 306, and 307 of the Clean Water Act and its amendments. In addition, EPA is proposing NSPS and PSNS for this subcategory. This supplement provides a compilation and analysis of the background material used to develop these effluent limitations and standards.

The secondary copper subcategory is comprised of 31 plants. Of the 31 plants, five discharge directly to rivers, lakes, or streams; six discharge to publicly owned treatment works (POTW); and 20 achieve zero discharge of process wastewater pollutants.

EPA first studied the secondary copper 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 (1) the sources and volume of water used, the processes used, and the sources of pollutants and wastewaters in the plant; and (2) the constituents of wastewaters, including toxic pollutants.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary copper subcategory. The Agency analyzed both historical and newly generated data on the performance of these technologies. EPA also studied various flow reduction and complete recycle techniques reported in the data collection portfolios (dcp) and plant visits.

Based on consideration of the above factors, EPA identified various control and treatment technologies which formed the basis for BAT and selected control and treatment appropriate for each set of standards and limitations. The mass limitations and standards for BPT, BAT, NSPS, PSNS, and BCT are presented in Section II.

For BAT, the Agency is proposing to eliminate the discharge allowance for net monthly precipitation on cooling impoundments. The BAT effluent limitations will still allow a discharge for stormwater resulting from the 25-year, 24-hour rainfall event. EPA is eliminating the net precipitation discharge for BAT because these guidelines are based on cooling impoundments rather than settling and evaporative impoundments. Cooling impoundments require much smaller surface areas than the settling and evaporative impoundments for which the net precipitation discharge was

allowed. Cooling towers were costed for BAT in the 1975 rulemaking when a plant had insufficient existing cooling impoundment capacity or cooling impoundments were not feasible due to space limitations. EPA believes that secondary copper plants can accommodate the small volume of water resulting from net precipitation on cooling impoundments. There is no cost associated with the proposed BAT effluent limitations.

For NSPS, EPA is proposing zero discharge of process wastewater pollutants. In selecting NSPS, EPA recognizes that new plants have the opportunity to implement the best and most efficient manufacturing processes and treatment technology. EPA believes that new sources can be constructed with cooling towers exclusively rather than cooling impoundments. The Agency is thus eliminating the allowance for catastrophic stormwater discharge provided at BAT.

For PSES, EPA is proposing zero discharge of process wastewater pollutants to POTW. The technology bases for the proposed PSES is lime precipitation and sedimentation with cooling towers and holding tanks to achieve zero discharge of process wastewater pollutants. EPA believes that the costs associated installation and operation of cooling towers and holding tanks for indirect dischargers will be insignificant. In addition, costs for cooling towers and holding tanks were considered during the 1976 PSES rulemaking. At that time EPA concluded that the additional cost was not significant.

For PSNS, EPA is also proposing zero discharge of process wastewater pollutants.

## SECONDARY COPPER SUBCATEGORY

### SECTION II

#### RECOMMENDATIONS

1. The secondary copper subcategory has been divided into seven subdivisions for the purpose of effluent limitations and standards. These subdivisions are:
  - (a) Residue concentration,
  - (b) Slag granulation,
  - (c) Reverberatory and rotary furnace wet air pollution control,
  - (d) Spent electrolyte,
  - (e) Scrap anode rinsing,
  - (f) Casting contact cooling, and
  - (g) Casting wet air pollution control.
2. EPA promulgated BPT effluent limitations for the secondary copper subcategory on February 27, 1975 as Subpart F of 40 CFR Part 421. No modifications are proposed for BPT for the secondary copper subcategory. Promulgated BPT for the secondary copper subcategory is zero discharge of all process wastewater pollutants, subject to discharge allowances for catastrophic stormwater and net precipitation. Facilities in the secondary copper subcategory may discharge, regardless of effluent quality, a volume of water falling within a cooling impoundment in excess of the 10-year, 24-hour storm, when a storm of at least that magnitude occurs. Further, they can discharge once per month, subject to concentration-based effluent limitations, a volume of water equal to the difference between precipitation and evaporation on the cooling impoundment in that month. Process wastewater discharged pursuant to the net precipitation allowance must comply with the following concentration-based effluent limitations:

<u>Effluent Characteristic</u>	<u>Effluent Limitations</u>	
	<u>Maximum for Any One Day</u>	<u>Average of Daily Values for 30 Consecutive Days Shall Not Exceed-</u>
	Metric Units (mg/l)	
	English Units (ppm)	
Total Suspended Solids	50	25
Copper	0.5	0.25
Zinc	10	5
Oil and Grease	20	10
pH	Within the range of 6.0 to 9.0	

3. EPA is proposing to modify BAT effluent limitations for the secondary copper subcategory. EPA is proposing that BAT for the secondary copper subcategory be zero discharge of all process wastewater pollutants, subject to a discharge allowance for catastrophic stormwater. Facilities in the secondary copper subcategory may discharge, regardless of effluent cooling impoundment in excess of the 25-year, 24-hour storm when a storm of at least that magnitude occurs.
4. EPA is proposing that NSPS for the secondary copper subcategory be zero discharge of all process wastewater pollutants.
5. EPA is proposing to modify PSES for the secondary copper subcategory. EPA is proposing that PSES for the secondary copper subcategory be zero discharge of all process wastewater pollutants.
6. EPA is proposing that PSNS for the secondary copper subcategory be zero discharge of all process wastewater pollutants.
7. EPA is not proposing BCT effluent limitations for the secondary copper subcategory at this time.

## SECONDARY COPPER SUBCATEGORY

### SECTION III

#### INDUSTRY PROFILE

This section of the secondary copper supplement describes the raw materials and processes used in smelting and refining secondary copper and copper-base alloys, and presents a profile of the secondary copper subcategory. For a discussion of the purpose, authority, and methodology for this study and a general description of the nonferrous metals manufacturing category, refer to Section III of the General Development Document.

#### DESCRIPTION OF SECONDARY COPPER PRODUCTION

There are a variety of manufacturing processes (as shown in Figure III-1) involved in the production of secondary copper or copper-base alloys. The raw materials and desired end product play an important role in determining the manufacturing process of a particular plant. The principal steps involved in the production of secondary copper and copper-base alloys are as follows:

1. Pretreatment of scrap;
2. Smelting of low-grade scrap and residues;
3. Melting, refining, and alloying intermediate-grade copper-base scrap and residues;
4. Refining high-grade copper scrap; and
5. Casting.

Each of these production steps, along with raw materials, is discussed in detail below.

#### RAW MATERIALS

Discarded consumer products, industrial copper-bearing scrap metal (solids) and melting wastes (slags and residues) are the basic raw materials used in secondary copper facilities. About two-thirds of the recycled copper tonnage is in the form of brass and bronze, with the remaining one-third in the form of copper. Additional copper values are recovered from copper-bearing wastes, such as skimmings, grindings, ashes, iron brass and copper residues and slags. The United States Department of Interior has estimated that 60 percent of all copper-base metal is reclaimed as old metal and comes back into production again. The cycle between its original use and recovery is approximately 40 years.

The segregation and classification of scrap metal are important steps in the production of alloyed ingots or pure copper. Segregation of copper-base scrap is done in a preliminary way by the scrap dealer (old scrap) or by the fabrication plant as the scrap is generated (new scrap). The copper-bearing scrap sold to the smelters contains metallic and nonmetallic impurities. Included among these are lead, zinc, tin, antimony, iron, manganese, nickel, chromium, precious metals, and organic-base constituents, such as insulation (plastic and other types), oil, grease, paint, rubber, and antifreeze.

#### PRETREATMENT OF SCRAP

Before scrap, in the form of solids (metal) and residues, is used by the smelter, various types of pretreatment are performed. The materials are usually presorted by secondary material dealers or shipped directly by foundries and metal shops; however, additional sorting is often done by the smelter to attain tighter control of the alloy constituents and the copper content. The steps used in the pretreatment of scrap depend on the type of scrap being processed. These pretreatment steps are discussed below in the context of the type of scrap being processed.

##### Stripping

Insulation and lead sheathing are removed from electrical conductors, such as cables, by specially designed stripping machines or by hand. Water is not used or generated during stripping and atmospheric emissions are not generated by this process. The lead is sold, reclaimed, or used in producing copper-base alloys. The organic solid wastes are reclaimed or disposed by burning or landfill.

##### Briquetting

Compressing bulky scrap, such as borings, turnings, tubing, thin plate, wire screen, and wire, into small bales compacts the scrap, allows for less storage area, and makes for easier handling and faster melting. The problem of oxidation of the metal is also diminished. Briquetting is carried out by compacting the scrap with hydraulic presses. Water is not used or generated during briquetting and atmospheric emissions are not generated by this process.

##### Size Reduction

Size reduction is used for all types of scrap materials. Large thin pieces of scrap metal are reduced in size by pneumatic cutters, electric shears, and manual shearing. Tramp iron liberated from the scrap by size reduction is removed from the shredded product magnetically. The iron-free products are

usually briquetted for easy handling. Shredding is also used in the separation of insulation on copper wire. The insulation is broken loose from metal by shearing action and removed from the metal by air classification.

When treating bulky metal items, the process produces small quantities of atmospheric emissions, consisting of dusts of approximately the same composition as the metal. Collection of the dust via dry cyclones or baghouses permits recovery of the metal value.

### Crushing

Previously dried, brittle, spongy turnings, borings, and long chips are processed in hammer mills or ball mills. After crushing, tramp iron is removed magnetically. Dust particles consisting of dirt, organic compounds, and finely divided metal are generally collected using dry cyclones.

### Residue Concentration

Some secondary copper plants concentrate the copper values in slags and other residues, such as drosses, skimmings, spills, and sweepings, before charging the concentrates into rotary or reverberatory furnaces. Slags may be crushed, screened through a coarse screen to remove trash and lumps of copper, pulverized with a ball mill, and concentrated on a table classifier. The concentrate usually contains 70 to 90 percent copper or copper alloy, and the gangue, or depleted slag, contains 4 or 5 percent copper alloy. The depleted slag is usually retained at the plant site as landfill. Lower grade residues are wet milled and concentrated by gravity and table classifiers.

The concentration of residues is usually done by wet grinding and classifying. The water associated with this processing contains some milling fines as suspended solids and dissolved solids from the soluble components of the residue and metals. To limit water consumption, the water used for milling is recycled from holding tanks or ponds.

### Residue Pelletizing and Roll Briquetting

Most small brass and bronze ingot makers (facilities) do not process residues, but actually sell their copper bearing residues to the larger refineries for processing to recover the copper values. Some of the large refineries charge the residues into their cupola or blast furnaces for the recovery of the copper content in the slag or residues.

The fine slags or residues must be agglomerated before charging to prevent them from being blown out of the stacks. The fine

portions of the copper rich slags or other residues are pelletized by adding water and a binder, if necessary, and rolling the material in a disk or drum pelletizer until most of the fines are in the form of small marble size pellets. Although water is used in pelletizing, it is completely consumed during processing and wastewater is not discharged.

### Drying

Borings, turnings, and chips from machining are covered with cutting fluids, oils, and greases. These contaminants are removed in the drying process. The scrap is generally heated in a rotary kiln to vaporize and burn the contaminants.

Drying results in the evolution of considerable quantities of hydrocarbons, depending on the amount present in the scrap. The oils, greases, and cutting fluids contain sulfonated and chlorinated hydrocarbons. Therefore, gaseous emissions evolve and are composed of the oxidation products that include sulfur oxides, hydrogen chloride, hydrocarbons, and other combustion products.

The atmospheric emissions are controlled by burning the vaporized fumes in afterburners, which oxidize the hydrocarbons to carbon dioxide and water. Inorganic particulates settle out in the afterburner section. Sulfur oxides and chloride emissions are usually uncontrolled. As such, water is not used or generated during drying.

### Burning

Scrap may be covered with paper and organic polymer insulation, such as rubber, polyethylene, polypropylene, or polyvinyl chloride. These materials are usually not removed by stripping. They are most effectively removed from the scrap by the burning process using furnaces, such as rotary kilns.

The burning process generates the combustion products such as carbon dioxide and water, the emissions may contain such gases as phthalic anhydride and hydrogen chloride from the burning of polyvinyl chloride. Fluorocarbon insulation releases hydrogen fluoride when burned. Many of these gases are highly toxic and corrosive. These gases may be controlled through the use of wet scrubbers, however, no plants in this subcategory report the use of wet scrubbers for controlling burning furnace emissions.

### Sweating

Scrap containing low melting point materials, such as radiators, journal bearings, and lead sheathed cables, can be sweated to remove babbitt, lead, and solder as valuable by-products, which



would otherwise contaminate a melt. Scrap may be added directly to a melt without sweating if the melt requires substantial amounts of the sweatable constituents. Sweating is done by heating in an oil- or a gas-fired muffle type furnace with a sloped hearth, so that the charge can be kept on the high side and away from the fluid low melting components. The molten metal is collected in pots, and the sweated scrap is raked until most of the low melting metals have been freed. The process can be a continuous or a batch operation. Sweating is also done in pots by dumping the scrap into molten alloy, which absorbs the sweated babbitt, lead, or solder. Rotary kilns have been used on small size scrap. The tumbling action aids in removing the molten metals. For items which are difficult to sweat, a reverberatory furnace equipped with a shaking grate is used. Continuous sweating is done in tunnel furnaces that have provisions for solder, lead, and babbitt recovery.

Atmospheric emissions consist of fumes and combustion products originating from antifreeze residues, soldering fluxes, rubber hose remains, and the fuel used to heat the sweat furnace. None of the plants in this subcategory use wet scrubbing for sweating furnaces.

#### SMELTING OF LOW-GRADE SCRAP AND RESIDUES

Drosses, slags, skimmings, and low-grade copper and brass scrap are processed in blast furnaces or cupola furnaces. These low-grade, copper-bearing materials are melted to separate the copper values from slags or residues and to produce molten metal that can be processed further immediately after recovery, or after being cast into ingots or shot for later use or sale.

The product of cupola or blast furnace melting is known as black copper or cupola melt. It generally consists of a mixture of copper and variable amounts of most of the common alloying elements such as tin, lead, zinc, nickel, iron, phosphorus, and to a lesser extent arsenic, antimony, aluminum, beryllium, chromium, manganese, silicon, and precious metals. A matte is also formed when sufficient sulfur is present to form a complex copper-iron-nickel-lead sulfide. Other specialty furnaces, such as crucible or induction furnaces, are sometimes used for special alloy production or precious metal recovery.

The charge to the blast or cupola furnace may be in the form of irony brass and copper, fine insulated wire, motor armatures, foundry sweepings, slags, drosses, and many other low-grade materials. Fine materials are pretreated by pelletizing or briquetting to reduce losses in the stack gas. Limestone and millscale are added as fluxes to produce iron silicate slags (depleted slag). Low sulfur coke is used in cupolas or blast furnaces to reduce matte (copper sulfide) formation.

During the cupola and blast furnace processes, the metallic constituents melt, while the limestone aluminum, silicon and iron oxides fuse in the smelting zone and form a molten slag, which mixes with the metals. The copper compounds are reduced by the coke. The molten materials flow downward through the coke bed and are collected in a crucible below. After a period of quiescence, the metal and slag form separate layers and are tapped. The slag, containing less than 1 percent copper value, is granulated with a high pressure water spray or by directing it into a quench pit while still in its molten state. The granulated slag is then sent to a slag pile.

Cupola and blast furnace operations produce large quantities of particulate matter from dusty charge materials, such as fine slags, fine fluxes, and coke ash, as well as metal oxide fumes. These particulates and fumes are controlled through the use of air pollution control devices. Dry air pollution control devices such as baghouse filters and cyclones are currently used to contain these particulates and fumes.

The process of conversion in the secondary copper subcategory can be done in furnaces called converters or in other types of furnaces in which molten metal is contained. The operation is derived from primary copper operation in which the sulfide matte is converted to an oxide-rich copper melt by oxidation with air or oxygen-enriched air. In secondary copper operations, however, only small amounts of sulfide are present in the black copper, but it is heavily contaminated with alloy metals, such as zinc, lead, nickel, iron, manganese, aluminum, tin, antimony, silicon, silver, or other metals and nonmetals contained in the scrap or residues. Since the sulfur content is low in secondary black copper, fuel is required for converting operations; unlike primary copper where the sulfur serves as the fuel.

With the use of converters or converter-oriented operations, the copper value in mixed alloys is reclaimed by oxidizing most of the alloying elements and removing the oxides as a slag. Molten metal is sometimes oxidized in a converter by blowing air through ports in the bottom of the furnace until most of the oxidizable alloying elements and some of the copper are oxidized (blister copper). More commonly, the molten metal in reverberatory or rotary furnaces is oxidized by inserting water cooled lances into the bath and blowing the bath with air or oxygen under a silicate slag cover until the alloy impurities are reduced to the desired level. The slag containing the alloy metal oxides and some copper is removed, and the oxygen in the remaining copper is reduced with charcoal and green wood inserted in the bath. Depending on the extent of reduction, various grades of refined copper are

produced. Generally, after conversion, a blister copper is produced that is subsequently refined in the same plant or sold or transported to other plants.

Air emissions from converter furnaces are currently contained through the use of dry air pollution control devices. The control of reverberatory and rotary furnace air emission will be discussed later in this section.

#### MELTING, REFINING, AND ALLOYING INTERMEDIATE-GRADE COPPER-BASED SCRAP

Copper-based scrap metals, intermediate-grade copper metal scrap, black and blister copper, and residues with known origin or composition are melted, refined, and alloyed, if necessary, to produce either brass or bronze ingots of specific composition. These same materials are refined further to produce fire refined copper suited for end use or for casting anodes for electrolytic refining. Direct fired reverberatory and rotary furnaces are used to produce the product metals, brass and bronze, and fire refined copper.

In the production of brass and bronze ingots, the extent of refining is usually small, if the scrap is well sorted. If the residues are of known origin (usually a toll recovery operation), refining is also kept to a minimum. In the production of copper, the extent of refining is greater. The chemical principles of refining are applicable to both brass and bronze ingot manufacture and the preparation of fire refined copper.

In the refining step, impurities and other constituents of the charge, present in excess of specifications, are oxidized. Elements, such as iron, manganese, silicon, and aluminum, are normally considered to be contaminants in copper base alloys and must be removed by refining. In the preparation of refined copper, the alloying elements common to brass and bronze must also be removed. The methods used in refining vary with the type of furnace, the types of scrap in the charge, as well as the type of product being produced.

The reverberatory or rotary furnace is charged with scrap metal at the start of the heat and at intervals during the melt down period. Air is blown into the molten metal bath with lances in order to oxidize metals in near accordance with their position in the electromotive series. Thus, iron, manganese, aluminum, and silicon are oxidized, and in the refining of zinc-rich copper alloy scrap, the loss of zinc is unavoidable. In the production of refined copper, the blowing is for a longer duration, since most of the metal elements must be removed.

The oxidized metals form a slag layer on the surface of the melt, since the oxides have a lower density than the molten metal. These oxides combine with the slag cover, which is usually added to aid in the removal of the oxidized impurities. Borax, slaked lime or hydrated lime, glass or silica, soda ash, and caustic soda are all used as fluxes to modify the characteristics of the slag cover. The most common material used by the brass and bronze smelters is anhydrous borax, a sodium borate flux ( $\text{Na}_2\text{B}_4\text{O}_7$ ), which has a great affinity for metal oxides and siliceous materials. The slag cover protects the molten metal surface from unwanted oxidation and reduces volatilization of

2 nc.

To oxidize or degasify, as well as to alloy, a brass or bronze melt, metal fluxing agents are added to the melt. In almost all cases, these melt modifiers are binary alloys of copper with silicon, phosphorus, manganese, magnesium, lithium, or cadmium. The highly oxidized, refined copper melt, containing an appreciable amount of  $\text{Cu}_2\text{O}$  can be cast from the reverberatory or rotary furnace into blister copper shapes and used in the subsequent preparation of fire refined copper. More typically, however, the molten oxidized melt is reduced in the reverberatory or rotary furnace in which it was formed, by using carbon-based reducing agents and then poling. These operations are discussed in detail in the section on refining of high grade copper scrap.

Once a melt meets specifications, principally chemical analysis, the brass or bronze is cast into ingots, cooled, and then packaged for shipping. Refined copper, that has been analyzed and found to meet specification, is either cast into blister copper ingots or is subsequently reduced in the furnace as a continuation of the fire refining operation.

Fumes of metal oxides are produced when the molten metal is blown with air or oxygen to remove metallic impurities, or when green wooden poles are inserted into the bath to reduce the heat. Dust is produced during the charging of fine slags and fine flux materials. The dusts and fumes are controlled through the use of baghouse filters or wet scrubbers. The wet scrubbers on the reverberatory and rotary furnaces are the sole source of wastewater.

#### REFINING HIGH-GRADE COPPER SCRAP

Black copper produced from smelting of low-grade scrap, slags, drosses, and sludges, and blister copper prepared from intermediate-grade scrap, are eventually brought together with high quality copper scrap (usually No. 2 copper wire, No. 1 heavy copper, No. 2 copper, and light copper) for full fire refining. Full fire refining is required to produce specification copper billets, slabs, cakes, and wire bars. Copper ingots and shot are

also produced for making copper base alloys. Fire refined copper may be even further refined by casting the metal into anodes for electrolytic refining. The extent of refining is governed in part by the amount and type of metal impurities and the need for or difficulty of their removal (by fire refining) to meet specifications for the product.

### Fire Refining

Fire refining is used to remove excess zinc, lead, iron and tin. Fire refining involves blowing air or oxygen through the molten metal in a reverberatory or rotary furnace. In the production of pure copper products, the blowing is continued until the contained zinc, lead, iron, tin, and other impurities, along with about 3 percent of the copper, are removed by oxidation. Most of the oxides are trapped in the slag cover. After the contaminated slag is removed, the refined copper is deoxidized with green wood poles under a charcoal or coke cover. Once the oxygen content meets specifications, the copper is cast into anodes for electrolytic refining or into billets, wire bars, etc. Selected types of flux materials are generally added to assist in the removal of the impurities before poling.

The slags may contain various proportions of the fluxes, silica, iron oxide, phosphorus pentoxide, soda ash, rasorite (a borax type flux), and limestone depending on impurities needed to be removed to obtain the desired composition. Copper-rich slags are reprocessed or sold for that purpose. Copper-poor slags are discarded or sold.

### Skimming

After a copper alloy has been refined in a reverberatory or rotary furnace, it is analyzed and adjusted in composition if necessary. The temperature is adjusted and slags are skimmed from the furnace. These slags are generally reprocessed to remove copper values trapped in the slag. The slag may be processed by the smelter or sold to larger smelters for processing.

The slags are either crushed wet or dry and wet screened or tumbled to concentrate the copper content, or the entire copper-rich slag may also be charged into a blast furnace or cupola for remelting and separation of the copper from the other ingredients. If the metal content of the slag is 45 percent or above, some facilities will charge the slag directly into a rotary or reverberatory furnace. Wastewater is generated in plants that use wet crushing and concentrating.

## Electrolytic Refining

High-purity cathode copper is produced through electrolytic refining. Anode copper, often containing precious metals and impurities such as nickel, are placed into the cells in an alternating fashion with thin copper starter sheets, which after electrolytic deposition become cathodes of refined copper.

The cathodes are removed periodically from the electrolytic cells, melted, and cast into fine-shape castings, such as wire bar and billets. Used anodes are removed from the cells, rinsed to remove adhering acid, and remelted into new anodes. If nickel is present in the anodes, the nickel content of the electrolyte, as well as the copper content, will build up and a bleed from the circuit must occur. This bleed is often subjected to electro-winning for copper removal, wherein a lead cathode is used, and cementation.

The spent electrolyte, depleted in copper content, may be partially evaporated by open or barometric condensers in order to produce nickel sulfate as a by-product. Precious metals are recovered as a slime in the bottom of the electrolytic cells and are usually dried and sold to other facilities for precious metal value recovery.

## Postelectrolytic Melting and Refining

Refined copper in the form of cathodes along with No. 1 copper wire scrap are melted in reverberatory furnaces or shaft furnaces and cast into desired product shapes such as cakes, billets, and wire bars, as well as ingots. The melting process in the reverberatory furnace may be followed by a blowing step, skimming of the melt, and then poling, followed by preparation for pouring and casting.

The shaft furnace, which uses natural gas as a fuel and operates on the principle of a cupola furnace, continuously melts cathodes, home scrap, and No. 1 copper wire scrap, with "refining" by poling or charcoal reduction being done in a small reverberatory holding furnace just before casting. The molten copper is continuously cast into billets and cakes. Water is used principally for noncontact cooling in the two types of melting furnaces. Particulate air emissions from the operation are usually controlled by means of baghouses. Wet air pollution control may also be used to control air emissions. In such cases a wastewater is generated.

## CASTING

Molten metal from the smelting operations described above is cast into various shapes suitable for shipping, handling, or use in

subsequent operations. Copper-base alloys are usually cast into ingots. Black copper, blister copper, and anode copper are also cast in molds and shapes suited for the specific product. Refined copper is cast into shapes suitable for subsequent fabrication steps, taking the form of billets, cakes, wire bars, wire rod, and ingots, or it may be quenched into shot. Casting operations for the various products are described below.

#### Brass and Bronze Ingot

The melt, which has been analyzed and found to meet specifications, is adjusted to the proper temperature before pouring. Rotary and reverberatory furnaces containing the molten metal are tapped, and the metal is poured into various ingot filling systems. The metal may pour directly into a moving, automatically controlled mold line, in which one or more molds are filled at once; then the flow shuts off while a new set of molds moves into position on an endless conveyor. In another variation, the metal from the furnace is tapped into a ladle and then moved to a mold line, which may be stationary or movable. Molds are sprayed with a mold wash and then dried thoroughly before the ingot is cast. Automatic devices are often used to sprinkle ground charcoal in the molds or onto the molten metal in the molds to provide a special smooth top on the ingots.

The molds are cooled by a water spray or partial immersion of the mold in a tank of water. Once the molten metal has solidified, the ingots are quenched in a pit from which they are removed by a drag conveyor. After drying, they are packed for shipment.

Generally, only steam is discharged during the operation, and water is recycled after cooling and storage in tanks or ponds. The wastewater is discharged periodically to permit the storage tanks to be cleaned of charcoal and mold wash sludges containing some metals or their oxides.

#### Black and Blister Copper

Black copper (or cupola melt) produced from blast or cupola furnace operations is usually transported or transferred to a converter or a reverberatory or rotary furnace in the molten state to conserve heating requirements. In some cases where the conversion-oriented operation is backlogged or out of synchronization with black copper production, the black copper might be cast into convenient shapes for later use. These shapes take the form of shot, pigs, sows, or any convenient mold shape available. Crude molds formed in sand are often used to cast pigs, sows, or other shapes. Blister copper production may also be out of phase with subsequent reduction operations due to a furnace failure or plant shutdown. In such cases, the blister copper is cast into almost any available mold shape for subsequent use. These molds

may be contact or noncontact cooled with water, or they can be air cooled. In those cases where the blister copper is an end product of the smelter, the molds are made of graphite and are air cooled.

### Anodes

Partially fire refined copper, that is to be electrolytically refined to remove impurities that are not removed by fire refining or to recover impurities of value, is cast into anodes. The molten metal from the anode furnace is cast in a circular mold conveying system (known as a casting wheel) or a conveyor. The molds may be cooled indirectly, or spray cooled, or both, after the metal has been cast. Once the molten metal has solidified, it is removed from the mold and quenched in a tank of water. The mold is treated with a mold coating or "wash," commonly synthetic bone ash (calcium phosphate), before receiving the next charge of molten anode copper. Much of the spray water is converted to steam. Wastewater containing residual mold wash and some metal oxide scale is generated.

### Refined Copper

Fully fire refined copper and melted cathode copper are cast into various shapes suitable for fabrication end use. These shapes are billets, cakes, slabs, wire bar, wire rod, and ingots. Wire bar and ingots are cast into permanent molds on a casting wheel that is internally cooled with water. Once solidified, the wire bar or ingots are removed from the mold and quenched in tanks. The molds are treated with a mold wash and dried before reuse.

Billets, cakes, and wire rod are usually continuously cast or directly chill cast, and the metal is cooled within dies using noncontact and contact cooling water that is recirculated after passing through cooling towers. Wire-rod casting uses exclusively noncontact cooling water as the cast rod is reduced in diameter through a series of water cooled rolls.

### Copper Shot

Copper for alloying purposes is sometimes produced in the form of shot to facilitate handling and remelting. In some cases, the copper is alloyed with phosphorus to increase hardness. Copper shotting operations consist of pouring the molten refined copper directly into a quench pit. Wastewater is generated when the quench pit is periodically discharged for cleaning, and by wet air pollution control devices operating on gas streams generated by the melting furnace.



## PROCESS WASTEWATER SOURCES

The principal sources of wastewater in the secondary copper subcategory are:

1. Residue concentration,
2. Slag granulation,
3. Reverberatory and rotary furnace wet air pollution control,
4. Spent electrolyte,
5. Scrap anode rinse water,
6. Casting contact cooling water, and
7. Casting wet air pollution control.

## OTHER WASTEWATER SOURCES

There are other wastewater streams associated with the manufacture of secondary copper. These wastewater streams include but are not limited to:

1. Stormwater runoff, and
2. Maintenance and cleanup water.

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

## AGE, PRODUCTION, AND PROCESS PROFILE

A distribution of the secondary copper plants in the United States is shown in Figure III-2. Figure III-2 shows that most of the secondary copper plants are located around the Great Lakes and New England states.

Table III-1 shows that the average plant age is about 20 to 30 years, and that there are five direct, six indirect, and 20 zero discharge plants in the secondary copper subcategory. Table III-2 summarizes the distribution of secondary copper plants for 1976 production levels. Table III-3 provides a summary of the number of secondary copper plants that generate the various process wastewaters identified previously in this section.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS  
IN THE SECONDARY COPPER SUBCATEGORY BY DISCHARGE TYPE

<u>Type of Plant Discharge</u>	<u>1982 to 1968</u>	<u>1967 to 1958</u>	<u>1957 to 1948</u>	<u>1947 to 1938</u>	<u>1937 to 1928</u>	<u>1927 to 1918</u>	<u>1917 to 1903</u>	<u>Insuff. Data</u>	<u>Total</u>
Direct	2	2	1	0	0	0	0	0	5
Indirect	0	1	1	0	2	2	0	0	6
Zero	<u>0</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>3</u>	<u>20</u>
TOTAL	2	8	6	3	4	4	1	3	31

Table III-2

PRODUCTION RANGES FOR PROCESSING PLANTS  
OF THE SECONDARY COPPER SUBCATEGORY

<u>Production Ranges for 1976 (tons/year)</u>	<u>Number of Plants</u>
0 - 5,000	11
5,001 - 10,000	3
10,001 - 20,000	6
20,001 - 30,000	4
30,001 +	4
No Data Reported in dcp	<u>3</u>
Total Number of Plants in Survey	31

Table III-3

PRODUCTION PROCESSES UTILIZED BY THE  
SECONDARY COPPER SUBCATEGORY

<u>Production Process</u>	<u>Number of Plants with Process</u>	<u>Number of Plants Generating Wastewater*</u>
Residue Concentration	7	7
Slag Granulation	5	5
Reverberatory and Rotary Furnace Air Pollution Control	18	5
Electrolytic Refining	6	6
Casting	29	22
Casting Air Pollution Control**	8	3

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\*Due to in-process flow reduction measures, a plant may generate a wastewater but not discharge it.

\*\*Reverberatory and rotary furnace air pollution control plants are not included in the count for casting air pollution control. An attempt was made to distinguish the reverberatory and rotary furnace wet air pollution control systems and the casting wet air pollution control systems that do not use reverberatory and rotary furnaces for casting.

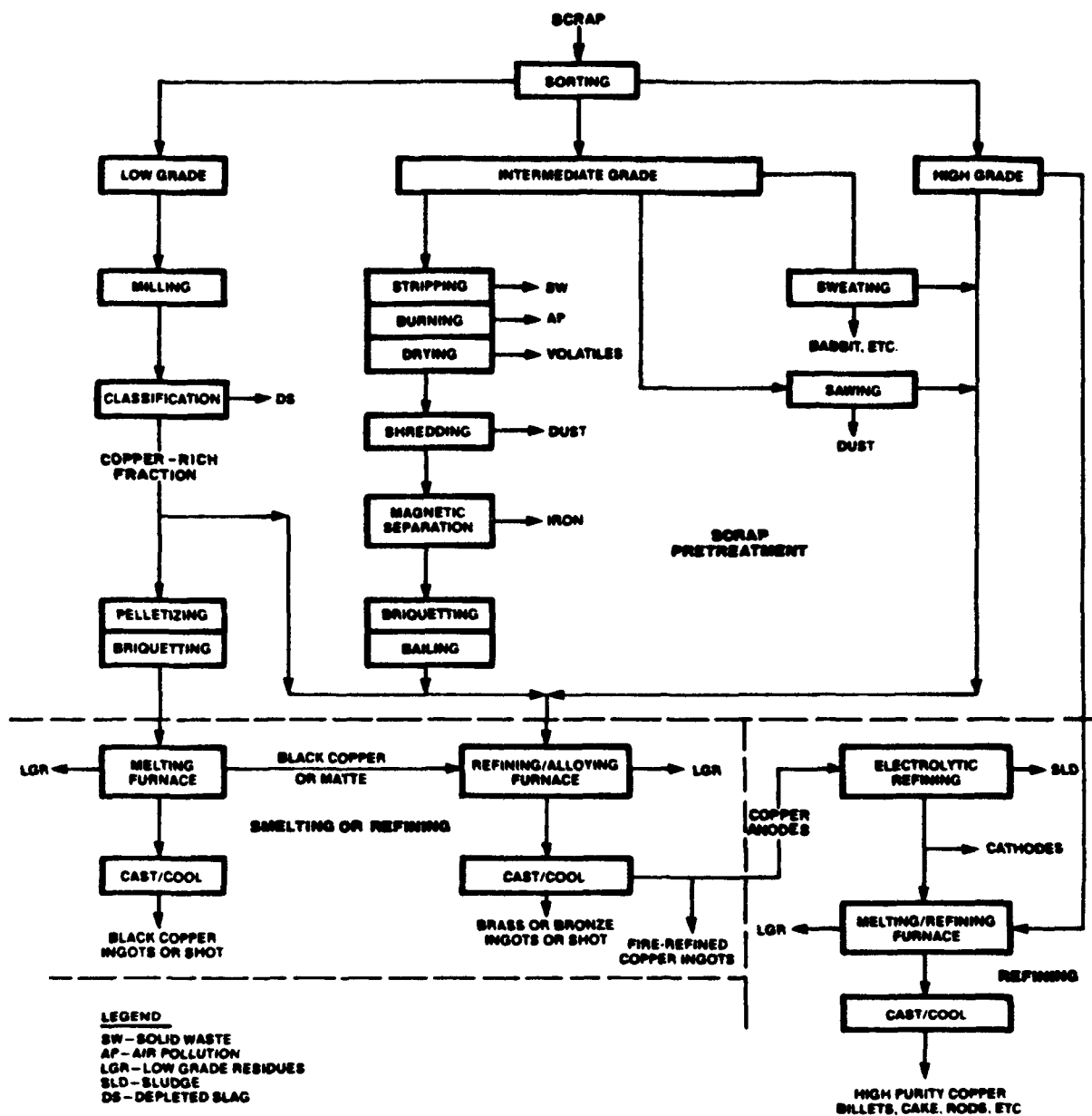


Figure III-1  
 SECONDARY COPPER PRODUCTION PROCESS

Figure III-2

## GEOGRAPHIC LOCATIONS OF THE SECONDARY COPPER INDUSTRY

## SECONDARY COPPER SUBCATEGORY

### SECTION IV

#### SUBCATEGORIZATION

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

#### FACTORS CONSIDERED IN SUBCATEGORIZATION

The following factors were evaluated for use in subcategorizing the nonferrous metals manufacturing category:

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

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

In Section IV of the General Development Document, each of these factors is described, and the rationale for selecting metal product, manufacturing processes, and raw materials as the principal factors used for subcategorization is discussed. On this basis, the nonferrous metals manufacturing category (phase I) was divided into 12 subcategories, one of them being secondary copper.

## FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY COPPER SUBCATEGORY

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

The rationale for considering further subdivision of the secondary copper 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 copper 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.

Each subdivision is discussed following the list.

1. Residue concentration,
2. Slag granulation,
3. Reverberatory and rotary furnace wet air pollution control
4. Spent electrolyte
5. Scrap anode rinsing,
6. Casting contact cooling,
7. Casting wet air pollution control.

Two subdivisions have been established for wastewater generated in the processing of slags and residues. Slag covers on reverberatory and rotary furnaces are generally raked off before the furnace is tapped. The copper content of the slag can be recovered by melting the slag (along with scrap copper, coke, and fluxes) in a cupola or blast furnace, or by milling and classifying the slag into a waste gangue material and a copper rich concentrate. Wastewater is generated in the concentration of slags or other residues such as drosses, skimming, spills, and sweepings through wet milling and classifying. When slags are melted with scrap copper, coke, and fluxes in blast or cupola furnaces, two products are tapped, a waste or depleted slag, and black copper. The waste slag is granulated in a quench pit or with a high pressure water stream, producing slag granulation wastewater.

Wet scrubbers are used to remove particulates and metal oxide fumes from reverberatory and rotary furnace off-gases. Therefore, a subdivision for reverberatory and rotary furnace wet air pollution control wastewater is necessary.



A subdivision has not been established for blast, cupola, or converter furnace wet air pollution control, since no plants in the subcategory use wet air pollution control devices in conjunction with these furnaces.

Two subdivisions are established for wastewater associated with electrolytic refining. These subdivisions are established for spent electrolyte wastewaters and scrap anode rinse water. Spent electrolyte is sometimes bled to prevent the build up of copper and nickel in the electrolyte. Depleted anodes are removed from the electrolytic cells and rinsed with water to remove adhering electrolyte.

Contact cooling water is used for metal cooling at 22 plants. Therefore a casting contact cooling subdivision is necessary. A subdivision has also been established for casting wet air pollution control, since three plants use wet scrubbers to remove fumes and particulates from casting operations.

#### OTHER FACTORS

The other factors considered in this evaluation either support the establishment of the seven subdivisions or 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 affect the subcategorization which has been applied. 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 metal plants.

#### PRODUCTION NORMALIZING PARAMETERS

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 six subdivisions in the secondary copper subcategory are:

<u>Subdivision</u>	<u>PNP</u>
1. Residue concentration	kgg of slag or residue processed

2. Slag granulation	kgg of blast and cupola furnace copper production
3. Reverberatory and furnace wet air pollution control	kgg of reverberatory and rotary furnace copper produced
4. Spent electrolyte	kgg of cathode copper produced
5. Scrap and rinse water	kgg of cathode copper produced
6. Casting contact cooling	kgg of copper cast
7. Casting wet air pollution control	kgg of copper cast

## SECONDARY COPPER SUBCATEGORY

### SECTION V

#### WATER USE AND WASTEWATER CHARACTERISTICS

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

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

In order to quantify the pollutant discharge from secondary copper plants, a field sampling program was conducted. Wastewater samples were collected in two phases: screening and verification. The first phase, screen sampling, was to identify which toxic pollutants were present in the wastewaters from production of the various metals. Screening samples were analyzed for 128 of the 129 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. There is no reason to expect that TCDD would be present in primary copper smelting and electrolytic refining wastewater.) A total of 10 plants were selected for screen sampling in the nonferrous metals manufacturing category. A complete list of the pollutants considered and a summary of the techniques used in sampling and laboratory analyses are included in Section V of the General Development Document. In general, the samples were analyzed for three classes of pollutants: toxic organic pollutants, toxic metal pollutants, and criteria pollutants (which includes both conventional and nonconventional pollutants).

As described in Section IV of this supplement, the secondary copper subcategory has been further categorized into seven subdivisions. As such, the proposed regulation contains mass discharge limitations and standards for seven 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.

## WASTEWATER SOURCES, DISCHARGE RATES, AND CHARACTERISTICS

The wastewater data presented in this section were evaluated in light of production process information compiled during this study. As a result, it was possible to identify the principal wastewater sources in the secondary copper subcategory. These include:

1. Residue concentration,
2. Slag granulation,
3. Reverberatory and rotary furnace wet air pollution control,
4. Spent electrolyte,
5. Scrap anode rinsing,
6. Casting contact cooling, and
7. Casting wet air pollution control.

Data supplied by dcp responses were used to calculate the amount of water used and discharged per metric ton of production. The two ratios calculated are differentiated by the flow rate used in the calculation. Water use is defined as the volume of water or other fluid (e.g., electrolyte) required for a given process per mass of copper 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 copper 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 calculations correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. The production normalized flows were compiled and statistically analyzed by stream type. Where appropriate, an attempt was made to identify factors that could account for variations in water use. This information is summarized in this section. As an example, scrap anode rinse wastewater flow is related to the cathode copper production. As such, the discharge rate is expressed in liters of rinse wastewater per metric ton of cathode copper production (gallons of rinse water per ton of cathode copper production).

Characteristics of wastewater from the previously listed processes were determined from sampling data collected at secondary copper plants. This data was used in two ways. From the sampling data, pollutants selected for regulation were determined. Secondly, the sampling data was used to estimate the yearly mass of pollutant generated by each waste stream for the entire subcategory. There were a total of five site visits, which represents 11 percent of the secondary copper subcategory. Diagrams

indicating the sampling sites and contributing production processes are shown in Figures V-1 to V-5 (at the end of this section).

In the data collection portfolios, plants were asked to indicate whether or not any of the toxic pollutants were believed to be present in their wastewater. The responses for the toxic metals are summarized below:

<u>Pollutant</u>	<u>Known Present</u>	<u>Believed Present</u>	<u>Believed Absent</u>	<u>Known Absent</u>
Antimony	2	1	7	-
Arsenic	1	-	8	1
Beryllium	1	-	9	-
Cadmium	3	-	7	-
Chromium	2	1	7	-
Copper	7	1	2	-
Lead	6	1	3	-
Mercury	2	1	6	1
Nickel	4	1	5	-
Selenium	-	-	9	1
Silver	1	1	8	-
Zinc	7	1	1	-

All plants responding to the portion of the dcp concerning the presence of the toxic organic pollutants indicated that they all were either known or believed to be absent with the exception of fluorene. Two plants reported that fluorene was known to be present while one plant reported that fluorene was believed to be present. However, as reported in Section VI, fluorene was not detected in 12 samples from five waste streams collected during the Agency's sampling and analysis program.

The raw wastewater sampling data for the secondary copper sub-category are presented in Tables V-8 through V-12 (at the end of this section). Treated wastewater sampling data are shown in Tables V-13 through V-16 (at the end of this section). The stream codes displayed in Tables V-8 through V-16 may be used to identify the location of each of the samples on the process flow diagrams in Figures V-1 through V-5. Where no data is listed for a specific day of sampling, the wastewater samples for the stream were not collected. If the analyses did not detect a pollutant in a waste stream, the pollutant was omitted from the table.

The data tables included some samples measured at concentrations considered not quantifiable. The base neutral extractable, acid extractable, and volatile toxic 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).

These 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. Data reported as an asterisk are considered as detected but below quantifiable concentrations, and a value of zero is used for averaging. Toxic 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 excluded in calculating the average. Finally, toxic metal values reported as less than a certain value were considered as not detected and a value of zero is used in the calculation of the average. For example, three samples reported as ND, \*, and 0.021 mg/l have an average value of 0.010 mg/l. The averages calculated are presented with the sampling data. These values were not used in the selection of pollutant parameters.

In the following discussion, water use and field sampling data are presented for each operation. Appropriate tubing or background blank and source water concentrations are presented with the summaries of the sampling data. Figures V-1 through V-5 show the location of wastewater sampling sites at each facility. The method by which each sample was collected is indicated by number, as follows:

- 1 one-time grab
- 2 24-hour manual composite
- 3 24-hour automatic composite
- 4 48-hour manual composite
- 5 48-hour automatic composite
- 6 72-hour manual composite
- 7 72-hour automatic composite

## SECONDARY COPPER WASTEWATER SOURCES AND CHARACTERISTICS

Presented below is a discussion of the characteristics of the significant wastewater sources attributable to the processing of secondary copper.

### Residue Concentration

The copper content can be concentrated in slags and other residues, such as drosses, skimmings, spills, and sweepings, before charging the concentrates into rotary or reverberatory furnaces. The residues are sometimes concentrated by wet milling and classifying, producing a residue concentration waste stream. The water use and discharge rates for residue concentration in liters of water per metric ton of slag or residue processed are shown in Table V-1.

Raw wastewater data for residue concentration are presented in Table V-8. This waste stream is characterized by treatable concentrations of dissolved toxic metal pollutants and suspended solids. The toxic metals are soluble components of the slags and residues, and the suspended solids are from milling fines that end up in the water.

### Slag Granulation

Five plants report the use of water for blast or cupola furnace slag granulation. This wastewater is generated when slag is granulated with high pressure water jets, or in quench pits prior to disposal. The water use and discharge rates for slag granulation in liters of water per metric ton of blast or cupola furnace production are shown in Table V-2.

The Agency did not collect any raw wastewater sampling data from slag granulation operations at secondary copper plants. However, the characteristics of this wastewater are generally comparable to those of residue concentration wastewater, since materials from nearly identical sources are being treated in either case. Thus, slag granulation wastewater contains treatable concentrations of dissolved toxic metal pollutants and suspended solids.

### Reverberatory and Rotary Furnace Wet Air Pollution Control

Five plants report the use of wet air pollution control devices to contain metal oxide fumes and dust from reverberatory and rotary furnace operations. Fumes of metal oxides are produced when the molten metal is blown with air or oxygen to remove metallic impurities, or when green wooden poles are inserted into the bath to deoxidize the heat. Dust will be produced during the charging of fine slags or fine flux materials. When wet air pollution control is used, the metal oxides and dust will be

contained in the water as suspended solids and dissolved toxic metals. Raw wastewater data for reverberatory and rotary furnace wet air pollution control are shown in Table V-9. As expected, toxic metal pollutants and suspended solids are present in treatable concentrations. Table V-9 also shows that this wastewater is acidic (pH of 1.6 to 2.5).

The water use and discharge rates for reverberatory and rotary furnace wet air pollution control are presented in Table V-3.

#### Spent Electrolyte

Normally, electrolyte is continuously circulated through thickeners and filters to remove solids, and recycled back through the electrolytic cells. It is necessary to blowdown a fraction of the electrolyte to prevent the buildup of copper and nickel. This slip stream is treated to recover nickel and copper, and recycled or discharged. Table V-4 presents the electrolyte use and discharge rates for spent electrolyte in liters per metric ton of cathode copper produced.

Raw wastewater sampling data for spent electrolyte are shown in Table V-10. This waste stream is characterized by treatable concentrations of toxic metal pollutants (particularly copper, lead, and zinc) and suspended solids. The pH of the spent electrolyte in the wastewater samples ranged from 1.48 to 3.45.

#### Scrap Anode Rinsing

Anodes removed from electrolytic cells are sometimes rinsed before further processing. As shown in Table V-5, only two plants reported the use of rinse water for scrap anode cleaning, and both of those plants practice 100 percent recycle of the rinse water. The Agency did not collect any raw wastewater samples from anode rinsing operations. Wastewater from this operation should contain treatable concentrations of total suspended solids and dissolved toxic metal pollutants, which are a result of impurities in the modes that are released into the rinse water.

#### Contact Cooling Water

Twenty-two plants report the use of contact cooling water to cool molten metal cast into ingots, shot, and anodes. Anodes and rough brass or bronze ingots are generally water spray-cooled to rapidly solidify the casting, and the casting is then quenched in a tank of water. Smooth brass or bronze ingots must be slowly cooled in the mold under a layer of charcoal to produce the smooth surface requested by certain customers. Ingot mold lines are quite long for the production of smooth ingots. The ingots



are permitted to air cool in the mold during the first portion of the conveyor travel, the bottom of the ingot mold is submerged in a tank of water during the second portion of the conveyor travel, and finally the solidified ingot is discharged into a quenching tank of water. Part of the charcoal burns during the ingots' travel period on the conveyor. The unburned charcoal and charcoal ash all go into the ingot cooling water. These residues settle as a sludge and are periodically cleaned out of the quenching tanks and subsequent settling tanks or ponds. The water may or may not be recycled. In addition to the charcoal and charcoal ash, the wastewater pollutants associated with contact cooling are metal oxides from the ingot surface, refractory mold wash (calcium phosphate), and flour dust. Charcoal is not used when casting copper anodes, but the mold wash is used and the wash ends up in the contact cooling water. The raw wastewater data for casting contact cooling water is presented in Table V-11. Copper, lead, zinc, and total suspended solids are all present in treatable concentrations.

The water use and discharge rates for casting contact cooling in liters of water per metric ton of copper cast are shown in Table V-6.

#### Casting Wet Air Pollution Control

Wet air pollution control devices are used to control fumes produced from casting operations at three plants. Two of these plants use scrubbers to contain fumes produced from alloying copper with phosphor in induction furnaces. The third plant did not report why it uses a scrubber for casting, however, this plant casts brass and bronze ingots which produce metal oxide fumes when poured. These fumes can be controlled by a scrubber.

The water use and discharge rates for casting wet air pollution control in liters of water per metric ton of copper cast are shown in Table V-7.

Raw wastewater samples were not collected for this stream. However, since both casting, and reverberatory and rotary furnace water pollution control devices control metal oxide fumes, their wastewaters will be similar. Therefore, casting wet air pollution water contains toxic metal pollutants and suspended solids.

Table V-1

WATER USE AND DISCHARGE RATES FOR RESIDUE CONCENTRATION  
(1/kg of slag or residue processed)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
15	0	6,702	6,702
23	100	NR	0
49	100	6,680	0
50	100	NR	0
55	100	NR	0
220	NR	NR	677
4507	100	NR	0

NR - Present, but data not reported in dcp.

Table V-2  
WATER USE AND DISCHARGE RATES FOR SLAG GRANULATION  
(1/kg of blast and cupola furnace production)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
26*	NR	NR	0
35	100	NR	0
36	100	17,210	0
49	100	40,900	0
62	100	65,800	0

\*Wastewater is evaporated.

NR - Present, but data not reported in dcp.

Table V-3

WATER USE AND DISCHARGE RATES FOR REVERBERATORY AND  
ROTARY FURNACE WET AIR POLLUTION CONTROL

(l/kg of reverberatory and rotary furnace copper produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
22	100	274,200	0
46	0	7,226	7,226
50	100	NR	0
52	100	NR	0
207	81	25,000	4,695

NR - Present, but data not reported in dcp.

Table V-4  
ELECTROLYTE USE AND DISCHARGE RATES  
(1/kgg of cathode copper produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
22*	0	263.2	263.2
62	100	NR	0
78*	NR	NR	1,499
207	NR	NR	1,124
220	100	NR	0
670	0	10,023	10,023

\*Spent electrolyte is contract hauled.

NR - Present, but data not reported in dcp.

Table V-5

WATER USE AND DISCHARGE RATES FOR SCRAP ANODE RINSING  
(1/kg of cathode copper produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
78	100	NR.	0
670	100	NR	0

NR - Present, but data not reported in dcp.

Table V-6

WATER USE AND DISCHARGE RATES FOR CASTING CONTACT COOLING  
(1/kkg of copper cast)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
15	0	148	148
16	0	925	925
17	0	1.45	1.45
18	100	NR	0
21	100	NR	0
22	0	21,586	21,586
23	100	NR	0
26	100	NR	0
35	100	NR	0
36	100	14,720	0
37	NR	NR	1,406
49	100	6,070	0
50	NR	NR	NR
52	100	NR	0
55	100	NR	0
58*	0	109	109
62	100	NR	0
207	0	12,614	12,614
220	99	23,700	237
662	0	4,100	4,100
4508	0	917	917
9050	0	109	109

\*Contact cooling water is dry well injected.

NR - Present, but data not reported in dcp.

Table V-7  
WATER USE AND DISCHARGE RATES FOR CASTING WET AIR  
POLLUTION CONTROL

(1/kg of copper cast)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Flow</u>
36	100	NR	0
37	NR	NR	281
78	0	337	337

NR - Present, but data not reported in dcp.



Table V-8

SECONDARY COPPER SAMPLING DATA  
RESIDUE CONCENTRATION  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			Average
				Day 1	Day 2	Day 3	
<u>Toxic Pollutants(a)</u>							
10. 1,2-dichloroethane	2	3		0.022		ND	0.022
23. chloroform	2	3		0.26		0.052	0.156
29. 1,1-dichloroethylene	2	3		0.667		ND	0.667
30. 1,2-trans-dichloro-ethylene	2	3		ND		0.012	0.012
44. methylene chloride	2	3		0.58		ND	0.58
66. bis(2-ethylhexyl) phthalate	2	3			1	0.06	0.53
	104	2	0.144	0.054			0.054
68. di-n-butyl phthalate	2	3			0.4	0.024	0.212
	104	2	*	0.012			0.012
86. toluene	2	3		0.015		ND	0.015
87. trichloroethylene	2	3		0.023		0.058	0.040
109. PCB-1232 (b)							
110. PCB-1248 (b)	2	3		<0.007			<0.007
111. PCB-1260 (b)	104	2	**	**			**
112. PCB-1016 (b)							

Table V-8 (Continued)

SECONDARY COPPER SAMPLING DATA  
RESIDUE CONCENTRATION  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants(a)</u>							
114. antimony	2	3		0.013	0.3	0.35	0.22
	104	2	<0.1	<0.1			<0.1
115. arsenic	2	3		0.067	0.175	1	0.414
	104	2	<0.01	0.11			0.11
117. beryllium	2	3		0.16	0.17	0.16	0.16
	104	2	<0.001	0.1			0.1
118. cadmium	2	3		0.8	0.8	0.4	0.7
	104	2	0.03	0.08			0.08
119. chromium	2	3		0.24	<0.24	<0.24	<0.08
	104	2	<0.005	0.7			0.7
120. copper	2	3		90	100	100	97
	104	2	<0.006	40			40
122. lead	2	3		40	20	60	40
	104	2	<0.02	10			10
123. mercury	2	3		0.0004	0.0007	0.005	0.0005
	104	2	0.0001	0.0007			0.0007
124. nickel	2	3		2	2	2	2
	104	2	<0.005	3			3

Table V-8 (Continued)

SECONDARY COPPER SAMPLING DATA  
RESIDUE CONCENTRATION  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants(a)</u>							
125. selenium	2	3		0.005	0.5	0.3	0.268
	104	2	<0.01	<0.01			<0.01
128. zinc	2	3		300	300		300
	104	2	<0.06	40			40
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	2	3		317	1,030		674
	104	2		122			122
total organic carbon (TOC)	2	3		82	189		136
	104	2		22			22
phenols (total; by 4-AAP method)	2	1		0.272	0.313		0.293
<u>Conventionals</u>							
oil and grease	2	1		20	180		100
total suspended solids (TSS)	2	3		7,660	8,790		8,230
	104	2		2,348			2,348
pH (standard units)	2	1		6.0	7.0	7.0	

Table V-8 (Continued)

SECONDARY COPPER SAMPLING DATA  
RESIDUE CONCENTRATION  
RAW WASTEWATER

(a) No samples were analyzed for the acid extractable toxic organic priority pollutants.

(b) Reported together.

Sample Type: Note: These numbers also apply to subsequent data tables.

- 1 - one-time grab
- 2 - 24-hour manual composite
- 3 - 24-hour automatic composite
- 4 - 48-hour manual composite
- 5 - 48-hour automatic composite
- 6 - 72-hour manual composite
- 7 - 72-hour automatic composite

\*Less than or equal to 0.01 mg/l.

\*\*Less than or equal to 0.005 mg/l.

Table V-9

SECONDARY COPPER SAMPLING DATA  
WET AIR POLLUTION CONTROL  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
6. carbon tetrachloride	58	1		ND	0.116	ND	0.116
23. chloroform	58	1	0.011	0.026	0.11	0.113	0.083
66. bis(2-ethylhexyl) phthalate	58	3	0.1650	0.1760	0.2290	*	0.1350
68. di-n-butyl phthalate	58	3	*	*	0.026	ND	0.013
69. di-n-octyl phthalate	58	3		ND	0.067	ND	0.067
78. anthracene (a)	58	3		ND	<0.012	ND	<0.012
81. phenanthrene (a)							
118. cadmium	58	3	<0.002	<0.02	<0.002	<0.002	<0.008
119. chromium	58	3	<0.005	0.4	0.03	0.01	0.15
120. copper	58	3	0.2	30	7	8	15
122. lead	58	3	<0.02	0.9	0.2	0.3	0.5
123. mercury	58	3	0.0001	0.0002	0.0006	0.0001	0.0003
124. nickel	58	3	<0.005	20	0.8	0.1	7.0
126. silver	58	3	<0.02	<0.08	<0.02	<0.02	<0.04
128. zinc	58	3	<0.06	3	0.7	0.7	1.5
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	58	3	<5	14	73	21	36
phenols (total; by 4-AAP method)	58	2		0.004	0.008	0.007	0.006
total organic carbon (TOC)	58	3	5	4	105	20	43

Table V-9 (Continued)

SECONDARY COPPER SAMPLING DATA  
WET AIR POLLUTION CONTROL  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Concentration (mg/l, except as noted)</u>			
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>							
oil and grease	58	1		7	2	5	5
total suspended solids (TSS)	58	3	7	6	3	3	4
pH (standard units)	58	1		2.0	1.6	2.5	

(a) Reported together.

Table V-10

SECONDARY COPPER SAMPLING DATA  
SPENT ELECTROLYTE  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants(a)</u>							
1. acenaphthene	19	3		0.019	0.036	ND	0.028
4. benzene	19	2		<0.27	0.019	<0.043	<0.006
10. 1,2-dichloroethane	19	2		ND	0.06	*	0.03
23. chloroform	19	2		0.077	1.19	0.124	0.464
25. 1,2-dichloroben- zene (b)	19	3		ND	0.117	0.113	0.115
26. 1,3-dichloroben- zene (b)							
27. 1,4-dichloroben- zene (b)							
29. 1,1-dichloroethylene	19	2		ND	0.038	ND	0.038
30. 1,2-trans-di-chloro- ethylene	19	2		0.157	ND	0.028	0.093
39. fluoranthene	19	3		ND	0.069	0.258	0.164
44. methylene chloride	19	2		ND	0.64	ND	0.64
55. naphthalene	19	3		0.042	5.0	1.6	2.214
66. bis(2-ethylhexyl) phthalate	19	3		ND	0.1	0.175	0.138
67. butyl benzyl phthalate	19	3		0.056	ND	ND	0.056
68. di-n-butyl phthalate	19	3		0.039	0.083	ND	0.075
70. diethyl phthalate	19	3		0.042	0.083	ND	0.063
76. chrysene	19	3		ND	0.056	ND	0.056
77. acenaphthylene	19	3		0.042	0.117	0.113	0.091
78. anthracene (c)	19	3		ND	ND	0.1	0.1
81. phenanthrene (c)							
84. pyrene	19	3		ND	0.158	0.204	0.182
85. tetrachloroethylene	19	2		*	0.072	*	0.024

Table V-10 (Continued)

SECONDARY COPPER SAMPLING DATA  
SPENT ELECTROLYTE  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
86. toluene	19	2		ND	0.015	ND	0.015
87. trichloroethylene	19	2		<0.716	0.106	0.121	<0.076
117. beryllium	19	3		0.05	<0.02	<0.02	<0.02
118. cadmium	19	3		2.0	0.9	0.6	1.2
119. chromium	19	3		5	2	0.39	2.13
120. copper	19	3		3,630	1,900	900	2,140
121. cyanide	19	3		0.005	0.002	0.005	0.004
122. lead	19	3		30	20	10	20
123. mercury	19	3		0.0007	0.0004	0.0005	0.0053
124. nickel	19	3		530	270	130	310
128. zinc	19	3		170	80	40	97
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	19	3		95	76	53	75
fluoride	19	3		0.19	0.47	0.2	0.29
phenols (total; by 4-AAP method)	19	1		0.027	0.141	0.073	0.803
total organic carbon (TOC)	19	3		40	28	22	30
<u>Conventionals</u>							
oil and grease	19	1		3	2	6	4
total suspended solids (TSS)	19	3		84	68	43	65
pH (standards units)	19	1		1.48	3.45	2	

(a) No samples were analyzed for the acid extractable toxic organic pollutants. Three samples were analyzed for the pesticide fraction; none was detected above its analytical quantification concentration.

(b),(c) Reported together.



Table V-11

SECONDARY COPPER SAMPLING DATA  
CASTING CONTACT COOLING  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
15. 1,1,2,2-tetrachloroethane	121	2	*	ND	*	*	*
23. chloroform	121	2	0.043		0.019	0.02	0.020
39. fluoranthene	121	2	ND	*	*	*	*
66. bis(2-ethylhexyl) phthalate	121	2	*	0.041	0.023	0.019	0.028
67. butyl benzyl phthalate	121	2	*	0.011	*	*	0.004
68. di-n-butyl phthalate	121	2	*	0.021	*	*	0.007
69. di-n-octyl phthalate	121	2	*	*	*	*	*
70. diethyl phthalate	121	2	ND	*	*	ND	*
71. dimthyl phthalate	121	2	ND	*	*	*	*
74. 3,4-benzofluoranthene (a)							
75. benzo(k)fluoranthene (a)	121	2	ND	ND	*	ND	*
76. chrysene	121	2	*	ND	*	ND	*
78. anthracene (b)							
81. phenanthrene (b)	121	2	ND	*	*	*	*
84. pyrene	121	2	*	*	*	*	*
85. tetrachloroethylene	121	2	*		*	*	*
115. arsenic	121	2	0.01	0.01	0.01	0.01	0.01
117. beryllium	121	2	0.001	0.001	0.001	0.001	0.001
118. cadmium	121	2	0.002	0.006	0.009	0.006	0.007
119. chromium	121	2	0.008	0.008	0.01	0.02	0.013
120. copper	121	2	0.008	0.3	1	0.6	0.6
121. cyanide	121	2		0.001	0.001	0.001	0.001
122. lead	121	2	0.02	1	4	3	3

Table V-11 (Continued)

SECONDARY COPPER SAMPLING DATA  
CASTING CONTACT COOLING  
RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
123. mercury	121	2	0.0001	0.0001	0.0001	0.0001	0.0001
124. nickel	121	2	0.005	0.007	0.02	0.01	0.012
125. selenium	121	2	0.01	0.01	0.01	0.01	0.01
126. silver	121	2	0.02	0.02	0.02	0.02	0.02
128. zinc	121	2	0.06	2	5	3	3
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	121	2		10	8	11	10
phenols (total; by 4-AAP	121	2		0.008	0.008	0.012	0.009
total organic carbon (TOC)	121	2		1	1	1	1
<u>Conventionals</u>							
oil and grease	121	2			3	2	3
total suspended solids (TSS)	121	2		22	8	8	13

(a),(b) Reported together.

Table V-12

SECONDARY COPPER SAMPLING DATA  
MISCELLANEOUS RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
4. benzene	1	3		*	0.016	<0.02	<0.005
	102	1	*	ND	ND	ND	
6. carbon tetrachloride	1	3		ND	0.011	ND	0.011
	102	1	ND	ND	ND	ND	
9. hexachloroethane	1	3			5.0	ND	5.0
	102	3	ND	ND	ND	ND	
10. 1,2-dichloroethane	1	3		0.014	ND	ND	0.014
	102	1	ND	ND	ND	ND	
23. chloroform	1	3		0.219	0.074	*	0.098
	102	1	*	0.016	0.012	0.04	0.023
29. 1,1-dichloroethylene	1	3		0.176	ND	ND	0.176
	102	1	ND	ND	ND	ND	
30. 1,2-trans-di-chloro-ethylene	1	3		ND	*	ND	*
	102	1	0.013	ND	ND	*	*
39. fluoranthene	1	3			3	ND	3
	102	3	*	ND			
44. methylene chloride	1	3		0.8	ND	ND	0.8
	102	1	ND	ND	ND	ND	

Table V-12 (Continued)

SECONDARY COPPER SAMPLING DATA  
MISCELLANEOUS RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Concentration (mg/l, except as noted)				
			Source	Day 1	Day 2	Day 3	Average
55. naphthalene	1	3			*	ND	*
	102	3	ND	ND			
60. 4,6-dinitro-o-cresol	1	3			0.0125	ND	0.0125
65. phenol	1	3			0.043	ND	0.043
66. bis(2-ethylhexyl) phthalate	1	3			7	0.015	3.508
	102	3	0.144	4.4			4.4
68. di-n-butyl phthalate	1	3			ND	*	*
	102	3	*	*			*
76. chrysene	1	3			10	ND	10
	102	3	ND	ND			
78. anthracene (a)	1	3		<6	ND	° .00	<6.00
	102	3	ND	ND			
84. pyrene	1	3			7	ND	7
	102	3	ND	ND			
85. tetrachloroethylene	1	3		0.054	<0.03	ND	<0.027
	102	1	*	*	*	*	*
86. toluene	1	3		0.025	ND	ND	0.025
	102	1	ND	ND	ND	ND	
87. trichloroethylene	1	3		0.039	0.091	0.1	0.077
	102	1	<0.038	ND	ND	ND	

Table V-12 (Continued)

SECONDARY COPPER SAMPLING DATA  
MISCELLANEOUS RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Concentration (mg/l, except as noted)				
			Source	Day 1	Day 2	Day 3	Average
106. PCB-1242 (b)							
107. PCB-1254 (b)	1	3		<0.009			<0.009
108. PCB-1221 (b)	102	3	**	**			**
109. PCB-1232 (c)							
110. PCB-1248 (c)	1	3		<0.011			<0.011
111. PCB-1260 (c)	102	3	**	**			**
112. PCB-1016 (c)							
114. antimony	1	3		0.011	2.0	0.012	0.674
	102	3	<0.1	<0.1			<0.1
115. arsenic	1	3		0.002	1.0	<0.002	<0.334
	102	3	<0.01	0.15			0.15
117. beryllium	1	3		<0.02	0.63	0.1	<0.25
	102	3	<0.001	<0.001			<0.001
118. cadmium	1	3		12.7	<0.2	10	<7.6
	102	3	0.03	2			2
119. chromium	1	3		<0.24	60	0.56	<20.27
	102	3	<0.005	0.01			0.01
120. copper	1	3		50.1	3	200	84.4
	102	3	<0.006	20			20
121. cyanide	1	3		0.001	0.028		0.015
	102	3		0.006	0.005	0.003	0.005

Table V-12 (Continued)

SECONDARY COPPER SAMPLING DATA  
MISCELLANEOUS RAW WASTEWATER

Pollutant	Stream Code	Sample Type	Concentration (mg/l, except as noted)				
			Source	Day 1	Day 2	Day 3	Average
122. lead	1	3		528	30	800	453
	102	3	<0.02	4			4
123. mercury	1	3		0.0091	0.1	0.0026	0.3723
	102	3	0.0001	0.0101			0.0101
124. nickel	1	3		0.56	4	2	2.19
	102	3	<0.005	0.3			0.3
125. selenium	1	3		0.018	0.55	0.3	0.289
	102	3	<0.01	<0.01			<0.01
128. zinc	1	3		1,374	40		707
	102	3	<0.06	40			40
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	1	3		620	4,100		2,360
	102	1		82			82
fluoride							
total oxygen demand (TOC)	1	3		181	611		396
	102	1		22			22
phenols (total; by 4-AAP method)	1	3		2.6	1.34		1.97
	102	1		0.582	0.196	0.156	0.311

Table V-12 (Continued)

SECONDARY COPPER SAMPLING DATA  
MISCELLANEOUS RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Concentration (mg/l, except as noted)</u>			
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>							
oil and grease	1	1		112	5		59
	102	1		11	7	28	15
total suspended solids (TSS)	1	3		9,220	80,500		44,860
	102	1		23			23
pH (standard units)	1	1		6.5	6.5	7	

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

Table V-13

SECONDARY COPPER SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT A

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
6. carbon tetrachloride	59	1		ND	0.264	ND	0.264
23. chloroform	59	1	0.011	0.045	0.234	0.024	0.101
66. bis(2-ethylhexyl) phthalate	59	3	0.1650	0.0140	*	0.1150	0.0430
68. di-n-butyl phthalate	59	3	*	*	*	*	*
69. di-n-octyl phthalate	59	3		ND	*	ND	*
78. anthracene (a)							
81. phenanthrene (a)	59	3		ND	<0.012	<0.011	<0.012
118. cadmium	59	3	<0.002	<0.002	<0.002	<0.002	<0.002
119. chromium	59	3	<0.005	<0.005	<0.005	<0.005	<0.005
120. copper	59	3	0.2	0.1	0.03	0.02	0.05
122. lead	59	3	<0.02	<0.02	<0.02	<0.02	<0.02
123. mercury	59	3	0.0001	0.0001	<0.0001	0.0001	<0.0001
124. nickel	59	3	<0.005	<0.005	0.02	<0.005	<0.010
126. silver	59	3	<0.02	<0.02	<0.02	<0.02	<0.02
128. zinc	59	3	<0.06	0.07	<0.06	<0.06	<0.02
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	59	3	<5	11	35	13	20
phenols (total; by 4-AAP method)	59	2		0.005	0.005		0.005
total organic carbon (TOC)	59	3	5	4	53	5	21
<u>Conventionals</u>							
oil and grease	59	1		8	2	<1	<3
total suspended solids (TSS)	59	3	7	7	2	<1	<3
pH (standard units)	59	1		8.5	8.4	8.8	

(a) Reported together.



Table V-14

SECONDARY COPPER SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT B

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
23. chloroform	103	1	*	0.03	0.038	0.037	0.035
30. 1,2-trans-dichloro-ethylene	103	1	0.013	ND	0.014	*	0.007
66. bis(2-ethylhexyl) phthalate	103	3	0.144	0.506			0.506
68. di-n-butyl phthalate	103	3	*	0.0615			0.0615
69. di-n-octyl phthalate	103	3	*	0.184			0.184
80. fluorene	103	3	ND	0.07			0.07
118. cadmium	103	3	0.03	0.01			0.01
120. copper	103	3	<0.006	0.1			0.1
123. mercury	103	3	0.0001	0.0011			0.0011
128. zinc	103	3	<0.0600	<0.07			<0.07
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	103	1		37			37
phenols (total; by 4-AAP method)	103	1		0.454	0.448	0.422	0.441
total organic carbon (TOC)	103	1		14			14
<u>Conventionals</u>							
oil and grease	103	1		5	8	14	9
total suspended solids (TSS)	103	1		<1			<1

Table V-15

SECONDARY COPPER SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
9. hexachlorobenzene	120	2	ND	0.219	0.169	ND	0.194
15. 1,1,2,2-tetrachloroethane	120	2	*	0.024	*	*	0.008
23. chloroform	120	2	0.043	0.018	*	*	0.006
39. fluoranthene	120	2	ND	*	*	0.017	0.006
66. bis(2-ethylhexyl) phthalate	120	2	*	0.06	ND	0.084	0.072
67. butyl benzyl phthalate	120	2	*	ND	ND	0.023	0.023
68. di-n-butyl phthalate	120	2	*	0.067	0.052	0.113	0.077
69. di-n-octyl phthalate	120	2	*	ND	*	0.015	0.008
70. diethyl phthalate	120	2	ND	0.082	ND	0.079	0.081
71. dimethyl phthalate	120	2	ND	1.271	0.8	0.551	0.874
74. 3,4-benzofluoranthene (a)	120	2	ND	ND	0.012	ND	0.012
75. benzo(k)fluoranthene (a)							
76. chrysene	120	2	*	ND	0.011	ND	0.011
78. anthracene (b)	120	2	ND	0.014	0.06	0.141	0.072
80. fluorene	120	2	ND	0.104	ND	0.074	0.089
81. phenanthrene (b)							
84. pyrene	120	2	*	0.027	0.016	0.038	0.027
85. tetrachloroethylene	120	2	*	0.024	*	*	0.008
115. arsenic	120	2	0.01	0.7	0.74	0.42	0.62
117. beryllium	120	2	0.001	0.4	0.2	0.5	0.4
118. cadmium	120	2	0.002	0.08	0.01	0.05	0.05
119. chromium	120	2	0.008	0.3	0.2	0.5	0.3
120. copper	120	2	0.008	70	30	90	63
121. cyanide	120	2		0.128	0.001	0.037	0.055
122. lead	120	2	0.02	50	20	60	43

Table V-15 (Continued)

SECONDARY COPPER SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

Pollutant	Stream Code	Sample Type	Concentration (mg/l, except as noted)				
			Source	Day 1	Day 2	Day 3	Average
123. mercury	120	2	0.0001	0.0004	0.0002	0.001	0.0005
124. nickel	120	2	0.005	2	0.8	2	1.6
125. selenium	120	2	0.01	0.23	0.38	0.41	0.34
126. silver	120	2	0.02	0.05	0.06	0.09	0.07
127. zinc	120	2	0.06	200	100	300	200
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	120	2		538	317	861	572
phenols (total; by 4-AAP method)	120	2		0.01	0.008	0.008	0.009
total organic carbon (TOC)	120	2		57	10	41	36
<u>Conventionals</u>							
oil and grease	120	2		21	8	32	20
total suspended solids (TSS)	120	2		2,918	1,582	5,250	3,251

(a), (b) Reported together.

Table V-16

SECONDARY COPPER SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT E

Pollutant	Stream Code	Sample Type	Source	Concentration (mg/l, except as noted)			
				Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
4. benzene	18	2		<0.118	ND	<0.03	<0.074
6. carbon tetrachloride	18	2		ND	ND	*	*
23. chloroform	18	2		0.116	0.48	0.101	0.232
30. 1,2-trans-di-chloro-ethylene	18	2		0.022	ND	0.011	0.017
44. methylene chloride	18	2		ND	0.59	ND	0.59
51. chlorodibromomethane	18	2		ND	ND	0.011	0.011
55. naphthalene	18	3		ND	0.2	0.921	0.561
66. bis(2-ethylhexyl) phthalate	18	3		0.05	0.013	0.126	0.063
68. di-n-butyl phthalate	18	3		0.082	0.06	0.012	0.051
70. diethyl phthalate	18	3		ND	0.02	ND	0.02
71. dimethyl phthalate	18	3		ND	0.074	ND	0.074
80. fluorene	18	3		ND	0.046	ND	0.046
85. tetrachloroethylene	18	2		*	ND	*	*
86. toluene	18	2		ND	0.08	*	0.04
87. trichloroethylene	18	2		<0.311	ND	<0.081	<0.196
117. beryllium	18	3		0.03	0.04	<0.02	<0.02
118. cadmium	18	3		4	2	0.9	2.3
119. chromium	18	3		4	2	0.67	2.22
120. copper	18	3		30	30	20	27
121. cyanide	18	3		0.005	0.003	0.002	0.003
122. lead	18	3		70	4	3	26
123. mercury	18	3		0.0002	0.0002	0.0003	0.0002
124. nickel	18	3		510	300	140	317
128. zinc	18	3		160	100	40	100

Table V-16 (Continued)

SECONDARY COPPER SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT E

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Concentration (mg/l, except as noted)</u>			
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	18	2		1,970	1,250	596	1,272
fluoride	18	2		0.27	0.52	0.54	0.44
phenols (total; by 4-AAP method)	18	2		0.039	0.216	0.084	0.113
total organic carbon (TOC)	18	2		26	24	14	21
<u>Conventionals</u>							
oil and grease	18	1		7	2	4	4
total suspended solids (TSS)	18	2		175	205	210	197
pH (standard units)	18	1		2.58	3.75	4.6	

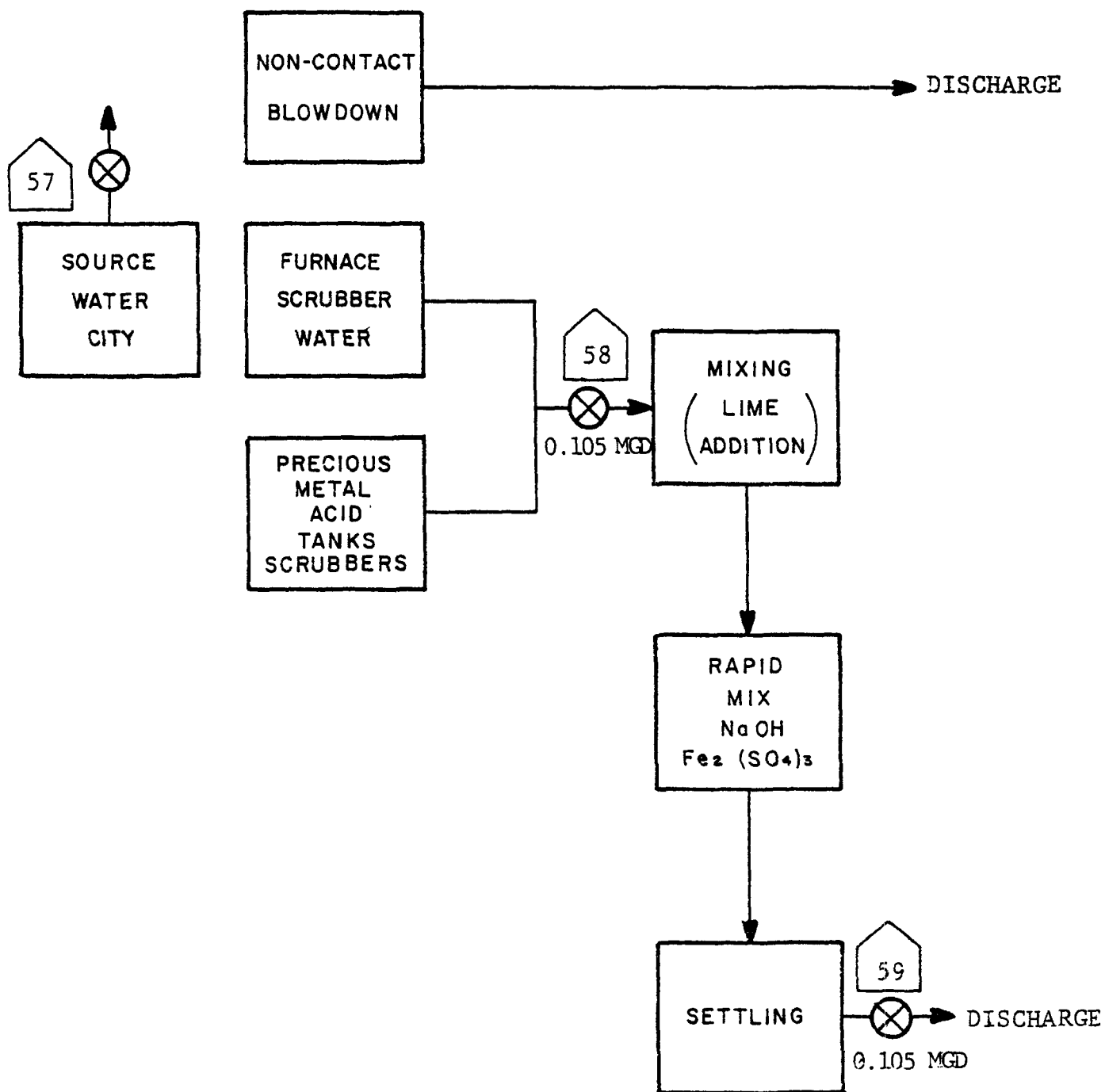


FIGURE V-1 -SAMPLING SITES AT SECONDARY COPPER PLANT A

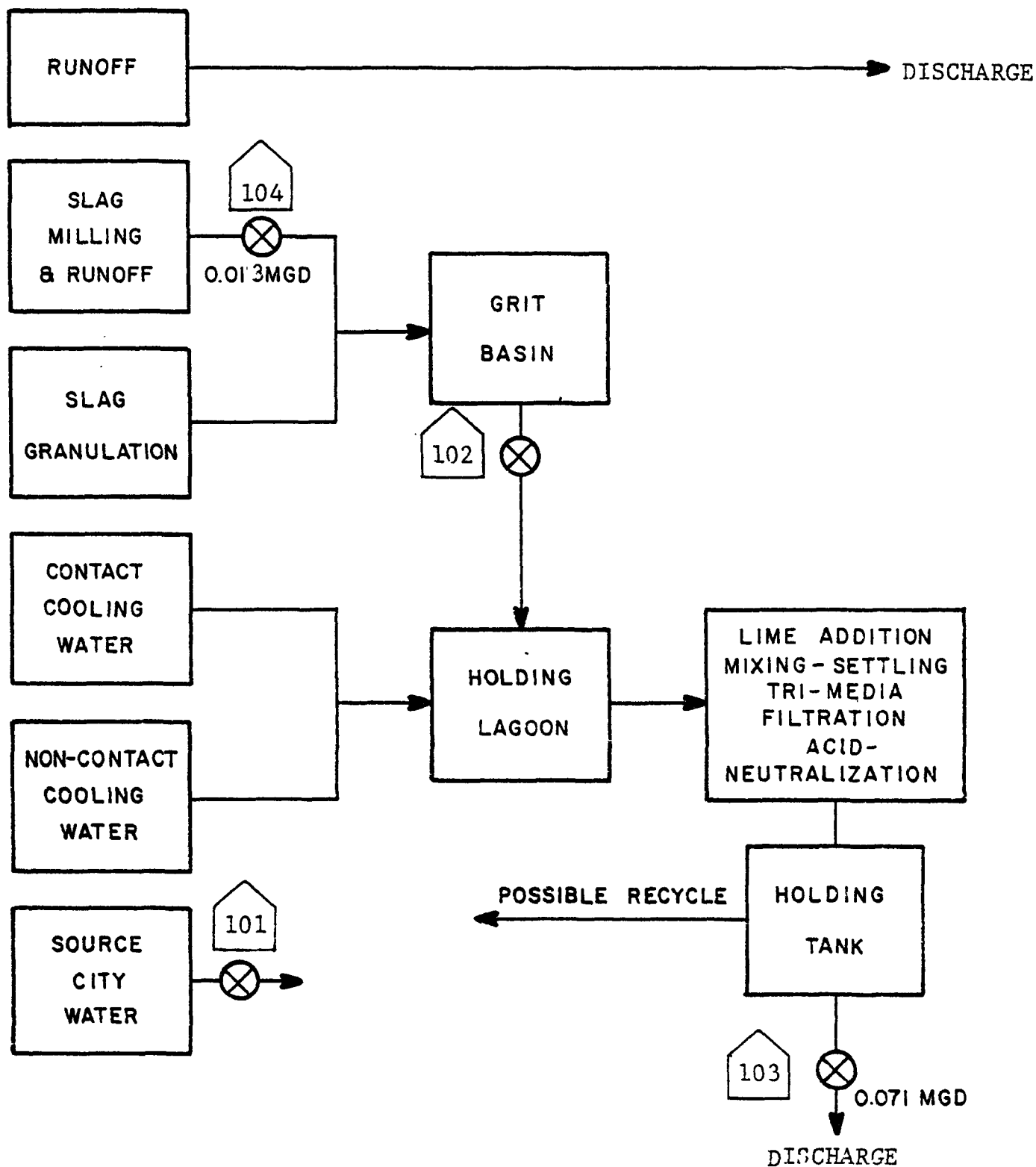


FIGURE V-2 - SAMPLING SITES AT SECONDARY COPPER PLANT B

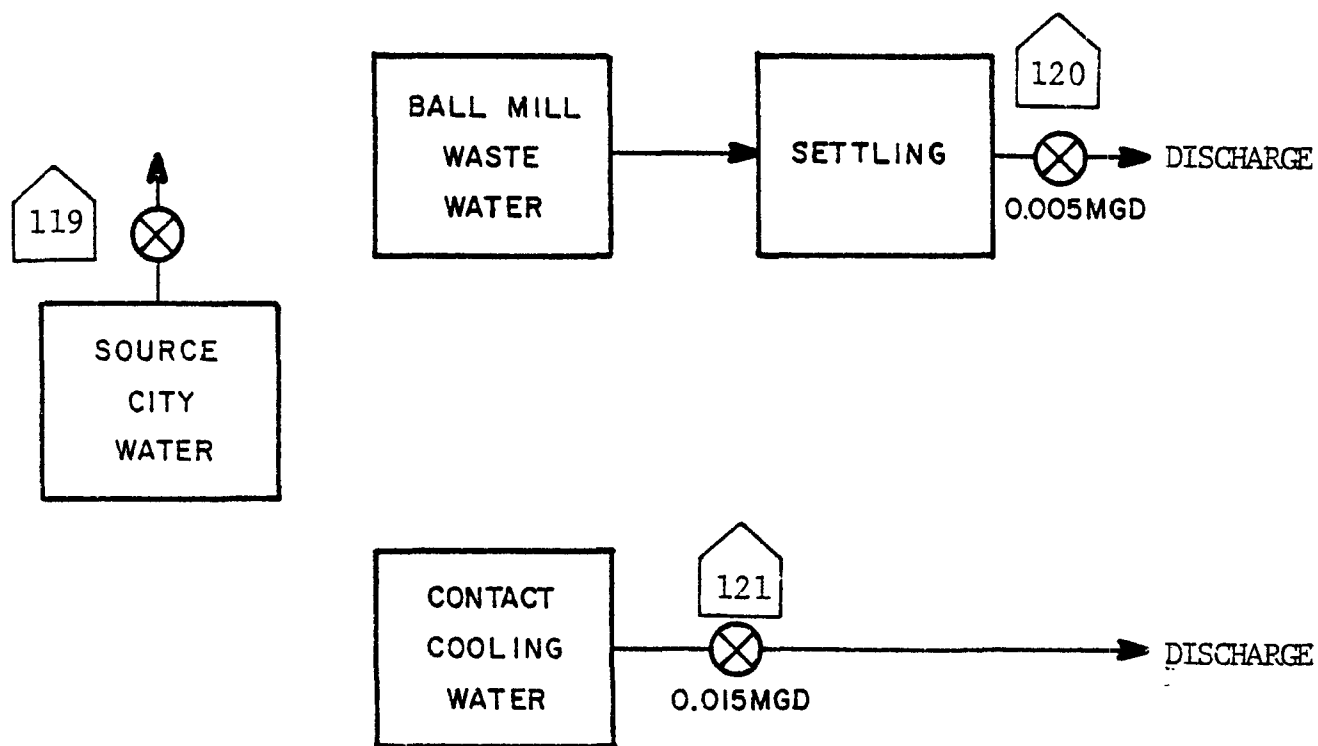


FIGURE V-3 -SAMPLING SITES AT SECONDARY COPPER PLANT C



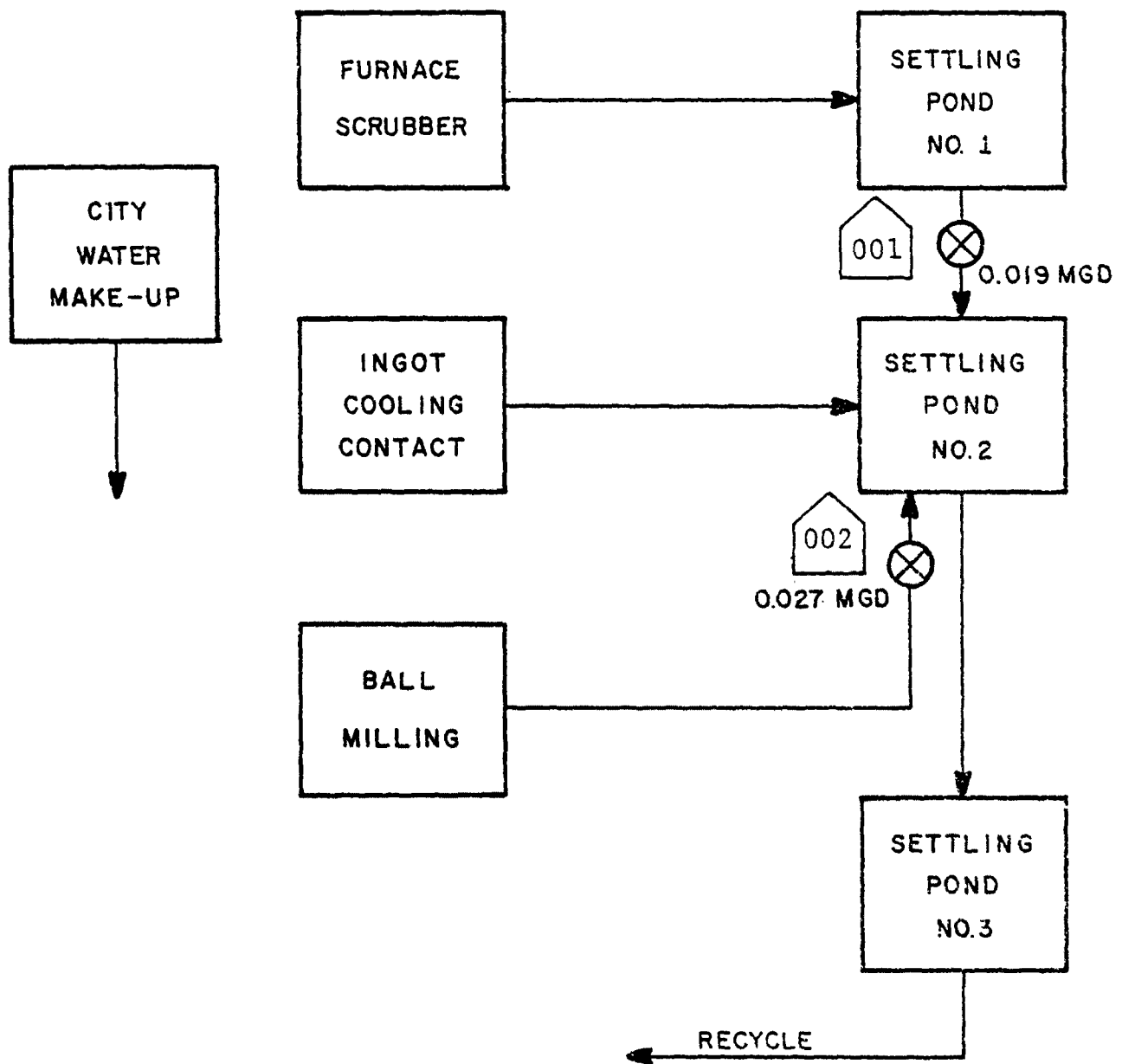


FIGURE V-4 -SAMPLING SITES AT SECONDARY COPPER PLANT D

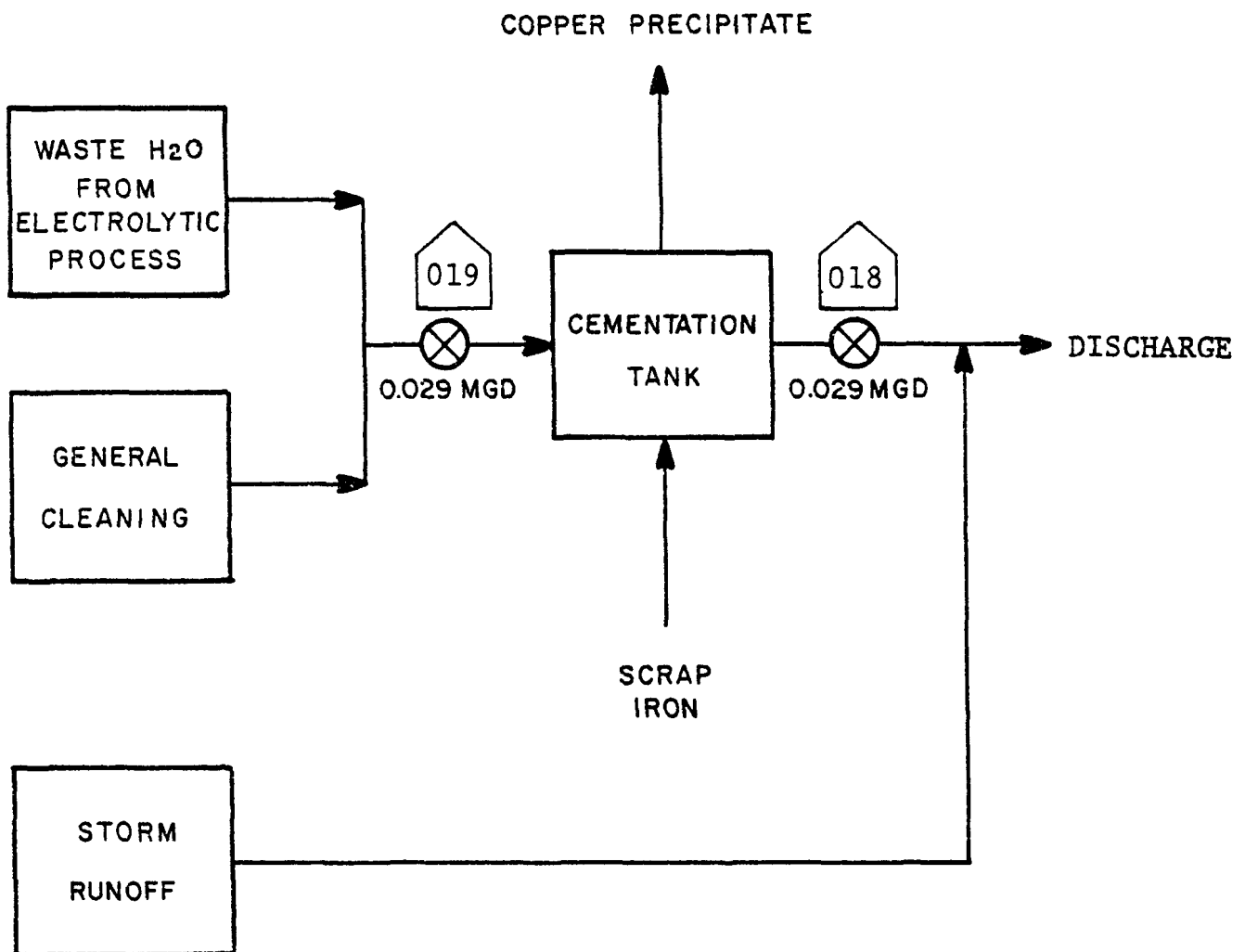


FIGURE V-5 - SAMPLING SITES AT SECONDARY COPPER PLANT E

## SECONDARY COPPER SUBCATEGORY

### SECTION VI

#### SELECTION OF POLLUTANT PARAMETERS

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

Each pollutant selected for potential limitation is discussed in Section VI of the General Development Document. That discussion provides information concerning where the pollutant originates (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 pollutants for further consideration for limitations and standards. Pollutants will be selected for further consideration if they are present in concentrations treatable by the technologies considered in this analysis. The treatable concentrations used for the toxic metals were the long-term performance values achievable by lime precipitation, sedimentation, and filtration. The treatable concentrations for the toxic organics were the long-term performance values achievable by carbon adsorption (see Section VII of the General Development Document - Combined Metals Data Base).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS

This study considered samples from the secondary copper subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and six nonconventional pollutant parameters (aluminum, ammonia, chemical oxygen demand, chloride, fluoride, total organic carbon, and total phenols).

#### CONVENTIONAL POLLUTANT PARAMETERS SELECTED

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

total suspended solids (TSS)  
oil and grease  
pH

Total suspended solids ranged from 3 to 8,790 mg/l. Twelve of 12 samples had concentrations above that achievable by identified treatment technology (2.6 mg/l). Furthermore, most of the technologies used to remove toxic metals do so by precipitating the metals. A limitation on total suspended solids ensures that sedimentation to remove precipitated toxic metals is effectively operating. Therefore, total suspended solids is selected for consideration for limitation.

Oil and grease concentrations in the wastewaters sampled ranged from 2 to 180 mg/l in 10 samples. Residue concentration is the principal source of these pollutants. The concentration in 2 of the 10 samples exceeded the treatable concentration (10 mg/l). Thus, this pollutant is selected for consideration for limitation.

The pH values observed ranged from 1.5 to 7.0. Effective removal of toxic metals by precipitation requires careful control of pH. Therefore, pH is considered for limitation in this subcategory.

#### TOXIC POLLUTANTS

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-1. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater data from streams 2, 104, 58, 19, and 121 (see Section V). Miscellaneous wastewater and treatment plant samples were not considered in the frequency count.

#### TOXIC POLLUTANTS NEVER DETECTED

Paragraph 8(a)(iii) of the Revised Settlement Agreement allows the Administrator to exclude from regulation those toxic pollutants not detectable by Section 304(h) analytical methods or other state-of-the-art methods. The toxic pollutants listed below were not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing regulations:

2. acrolein
3. acrylonitrile
5. benzidine
7. chlorobenzene

8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
11. 1,1,1-trichloroethane
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
16. chloroethane
17. 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
28. 3,3'-dichlorobenzidienne
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-chloroethoxy) methane
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. DELETED
50. DELETED
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
56. nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol
72. benzo(a)anthracene
73. benzo(a)pyrene
79. benzo(ghi)perylene

- 80. fluorene
- 82. dibenzo(a,h)anthracene
- 83. ideno(1,2,3-cd)pyrene
- 88. vinyl chloride
- 89. aldrin
- 90. dieldrin
- 91. chlordane
- 92. 4-4'-DDT
- 93. 4-4'-DDE
- 94. 4-4'-DDD
- 95. alpha-endosulfan
- 96. beta-endosulfan
- 97. endosulfan sulfate
- 98. endrin
- 99. endrin aldehyde
- 100. heptachlor
- 101. heptachlor epoxide
- 102. alpha-BHC
- 103. beta-BHC
- 104. gamma-BHC
- 105. delta-BHC
- 106. PCB-1242 (a)
- 107. PCB-1254 (a)
- 108. PCB-1221 (a)
- 113. toxaphene
- 127. thallium
- 129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

(a) Reported together

#### TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LEVEL

The provision of Paragraph 8(a)(iii) of the Revised Settlement Agreement excluding from regulation those toxic pollutants which are not detectable includes those pollutants whose concentrations fall below EPA's nominal detection limit. The toxic pollutants listed below were never found above their analytical quantification concentration in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing regulations.

- 15. 1,1,2,2-tetrachloroethane
- 71. dimethyl phthalate
- 74. benzo(b)fluoranthene (a)
- 75. benzo(k)fluoranthene (a)
- 109. PCB-1232 (b)
- 110. PCB-1248 (b)
- 111. PCB-1260 (b)
- 112. PCB-1016 (b)
- 116. asbestos

(a), (b) Reported together

## TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

Paragraph 8(a)(iii) of the Revised Settlement Agreement also allows the exclusion of toxic pollutants which were detected in quantities too small to be effectively reduced by technologies known to the Administrator. The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

- 4. benzene
- 10. 1,2-dichloroethane
- 86. toluene
- 114. antimony
- 117. beryllium
- 121. cyanide
- 123. mercury
- 126. silver

Benzene was detected above its analytical quantification limit in one of ten samples from five plants; however, this sample concentration was below the concentration achievable by identified treatment technology (0.05 mg/l). Therefore, benzene is not considered for limitation.

1,2-Dichloroethane was detected above its analytical quantification limit in two of ten samples from five plants; however, these sample concentrations were below that attainable by treatment. Therefore, 1,2-dichloroethane is not selected for limitation.

Toluene was detected above its analytical quantification limit in two of ten samples from five plants; however, these sample concentrations were below that attainable by treatment. Therefore, toluene is not selected for limitation.

Antimony was detected above its analytical quantification limit in three of thirteen samples from five plants; however, these sample concentrations were below that attainable by treatment. Therefore, antimony is not selected for limitation.

Beryllium was detected above its analytical quantification limit in eight of thirteen samples from five plants; however, these sample concentrations were below that attainable by treatment. Therefore, beryllium is not selected for limitation.

Cyanide was detected above its analytical quantification limit in six of eleven samples from four plants; however, these sample

concentrations were below that attainable by treatment. Therefore, cyanide is not selected for limitation.

Mercury was detected at, or above, its 0.0001 mg/l analytical quantification limit in thirteen of thirteen samples from five plants. All of the values are below the 0.026 mg/l concentration considered achievable by identified treatment technology. Therefore, mercury is not considered for limitation.

Silver was detected above its analytical quantification limit in three of ten samples from four plants; however, these sample concentrations were below that attainable by treatment. Therefore, silver is not selected for limitation.

#### TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant if it is detectable in the effluent from only a small number of sources within the subcategory and it is uniquely related to only those sources. The following pollutants were not selected for limitation on this basis.

1. acenapthene
6. carbon tetrachloride
23. chloroform
25. 1,2-dichlorobenzene (a)
26. 1,3-dichlorobenzene (a)
27. 1,4-dichlorobenzene (a)
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
39. fluoranthene
44. methylene chloride
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
76. chrysene
78. anthracene (b)
81. phenanthrene (b)
84. pyrene
85. tetrachloroethylene
115. arsenic
125. selenium

(a), (b) Reported together

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



Acenaphthene was found above its analytical quantification limit in two of twelve samples from five plants. The detected concentrations were 0.019 mg/l and 0.036 mg/l in the spent electrolyte wastewater sample. Both of these values are above the concentration considered achievable by identified technology. However, since the third sampling date at the plant showed a "not detected" value, acenaphthene is not considered for limitation because it is believed to be unique to that particular plant and is not expected to be a common pollutant in spent electrolyte wastewater.

Carbon tetrachloride was found above its analytical quantification limit in just one of ten samples from four plants. The reported value was 0.116 mg/l; this pollutant was not detected in any of the other nine samples. Because it was found in just one sample, carbon tetrachloride is not considered for limitation.

Chloroform, a common laboratory solvent, was detected above its analytical quantification limit in all ten samples from four plants. However, it was only found above the concentration considered achievable by identified technology in five of the ten samples, ranging from 1.11 mg/l to 1.19 mg/l. Concentrations above the analytical concentration limit in four blanks (0.070 mg/l, 0.181 mg/l, 0.127 mg/l, and 0.043 mg/l) analyzed raise the likelihood of sample contamination. Also, in the dcp, all of the secondary copper plants indicated that this pollutant was either known or believed to be absent. Chloroform, therefore, is not selected for consideration for limitation.

The toxic pollutants 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene are not clearly separated by the analytical protocol used in this study; thus, they are reported together. The sum of these pollutants was found above its analytical quantification limit in two of twelve samples from five plants. The detected concentrations were 0.117 mg/l and 0.113 mg/l in the spent electrolyte wastewater sample. Both of these values are above the concentration considered achievable by identified technology. However, since the third sampling day at the plant showed a "not detected" value, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene are not considered for limitation because they are believed to be unique to that particular plant and are not expected to be common pollutants in spent electrolyte wastewater.

1,1-dichloroethylene was found in concentrations above its analytical quantification limit in two of ten samples from four plants. The values were 0.038 mg/l and 0.667 mg/l. Only one of these samples had a concentration above the 0.1 mg/l concentration considered achievable by identified treatment technology. Because it was found above a treatable concentration in only one sample, 1,1-dichloroethylene is not considered for limitation.

1,2-trans-dichloroethylene was found in concentrations above its analytical quantification limit in three of ten samples from four plants, with values ranging from 0.012 mg/l to 0.157 mg/l. Only one of the three samples had a concentration above the 0.1 mg/l concentration considered achievable by identified treatment technology. Because it was found above a treatable concentration in only one sample, 1,2-trans-dichloroethylene is not considered for limitation.

Fluoranthene was found above its analytical quantification limit in two of twelve samples from five plants. The detected concentrations were 0.069 mg/l and 0.258 mg/l in the spent electrolyte wastewater sample. One of these values is above the concentration considered achievable by identified technology. However, since the third sampling day at the plant showed a "not detected" value, fluoranthene is not considered for limitation because it is believed to be unique to that particular plant and is not expected to be a common pollutant in spent electrolyte wastewater.

Methylene chloride was found above its analytical quantification limit in two of ten samples from four plants. The detected concentrations were 0.64 mg/l and 0.58 mg/l. Since it was found above the concentration considered achievable by identified technology in only two samples, methylene chloride is not considered for limitation.

Bis(2-ethylhexyl) phthalate was found above its analytical quantification limit in 11 of 12 samples from five plants. The concentrations observed ranged from 0.019 to 0.4 mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary copper subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Therefore, bis(2-ethylhexyl) phthalate is not considered for limitation.

Butyl benzyl phthalate was found above its analytical quantification limit in two of 12 samples from five plants. The concentrations ranged from 0.011 to one mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary copper subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Therefore, butyl benzyl phthalate is not considered for limitation.

Di-n-butyl phthalate was found above its analytical quantification limit in six of 12 samples from five plants. The concentrations observed ranged from 0.012 to 0.4 mg/l. Three of the six samples showed concentrations above the 0.025 mg/l treatability concentration. The presence of this pollutant is not attributable to materials or processes associated with the secondary copper subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Therefore, di-n-butyl phthalate is not considered for limitation.

Di-n-octyl phthalate was found above its analytical quantification limit in one of 12 samples from five plants. The concentration observed was 0.067 mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary copper subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Therefore, di-n-octyl phthalate is not considered for limitation.

Diethyl phthalate was found above its analytical quantification limit in two of 12 samples from five plants. The concentrations observed were 0.042 mg/l and 0.083 mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary copper subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Therefore, diethyl phthalate is not considered for limitation.

Chrysene was detected above its analytical quantification limit in just one of 12 samples from five plants. Since it was found in only one sample, chrysene is not considered for limitation.

The toxic pollutants anthracene and phenanthrene are not clearly separated by the analytical protocol used in this study; thus, they are reported together. The sum of these pollutants was measured at a concentration greater than the analytical quantification limit in one of 12 samples from five plants. The detected concentration was 0.1 mg/l, which is greater than the concentration considered attainable by identified technology. Because they were found at a treatable concentration in only one sample, anthracene and phenanthrene are not considered for limitation.

Pyrene was found above its analytical quantification limit in two of 12 samples from five plants. The detected concentrations were 0.159 mg/l and 0.204 mg/l in the spent electrolyte wastewater sample. Both of these values are above the concentration considered achievable by identified technology. However, since the third sampling day at the plant showed a "not detected"

value, pyrene is not considered for limitation because it is believed to be unique to that particular plant and is not expected to be a common pollutant in spent electrolyte wastewater.

Tetrachloroethylene was found above its analytical quantification limit in one of 10 samples from four plants. The detected concentration was 0.072 mg/l, which is greater than the concentration considered attainable by identified technology. Because it was found at a treatable concentration in only one sample, tetrachloroethylene is not considered for limitation.

Arsenic was found above its analytical quantification limit in seven of 13 samples taken from five plants. Concentrations ranged from 0.01 to one mg/l. Only one sample contained a concentration above the 0.34 mg/l considered attainable by identified technology. Because it was found at a treatable concentration in only one sample, arsenic is not considered for limitation.

Selenium was found above its analytical quantification limit in seven of 10 samples taken from four plants. Concentrations ranged from 0.005 to 0.5 mg/l. Only two samples contained a concentration above the 0.20 mg/l considered attainable by identified technology. Because it was found at a treatable concentration in only two samples, selenium is not considered for limitation.

#### TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION FOR LIMITATION

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

- 55. naphthalene
- 77. acenaphthylene
- 87. trichlorethylene
- 118. cadmium
- 119. chromium
- 120. copper
- 122. lead
- 124. nickel
- 128. zinc

Naphthalene was found above its analytical quantification limit in three of 12 samples from five plants. The concentrations measured in the spent electrolyte were 0.042 mg/l, 5.0 mg/l, and 1.6 mg/l. Two of those values are above the 0.05 mg/l concentration attainable by identified treatment technology. Because it

is present at treatable concentrations in this spent electrolyte stream, naphthalene is selected for further consideration for regulation.

Acenaphthylene was found above its analytical quantification limit in three of 12 samples from five plants. The concentrations measured in the spent electrolyte were 0.042 mg/l, 0.117 mg/l, and 0.113 mg/l. All of these values are above the 0.01 mg/l concentration available by identified treatment technology. Because it is present at treatable concentrations in this spent electrolyte stream, acenaphthylene is selected for further consideration for regulation.

Trichloroethylene was found above its analytical quantification limit in four of 10 samples from four plants. The concentrations measured in the residue concentration wastewater were 0.023 mg/l and 0.058 mg/l. Both of those values are above the 0.01 mg/l concentration attainable by identified treatment technology. Because it is present at treatable concentrations in this residue concentration stream, trichloroethylene is selected for further consideration for regulation.

Cadmium was measured above its analytical quantification limit in 10 of 13 samples, taken from five plants, with concentrations ranging from 0.006 to 2.0 mg/l. Seven samples were above the 0.049 mg/l concentration attainable by identified treatment technology. Therefore, cadmium is selected for further consideration for limitation.

Chromium was found above its analytical quantification limit in 11 of 13 samples, taken from five plants, with concentrations ranging from 0.008 to 5.0 mg/l. Eleven samples were above the 0.07 mg/l concentration attainable by identified treatment technology. Therefore, chromium is selected for further consideration for limitation.

Copper was measured above its analytical quantification limit in all 13 samples, taken from five plants, with concentrations ranging from 0.3 to 3,630 mg/l. Twelve samples were above the 0.39 mg/l concentration attainable by identified treatment technology. Therefore, copper is selected for further consideration for limitation.

Lead was found in concentrations above its analytical quantification limit in all 13 samples taken from five plants, with concentrations ranging from 0.2 to 40 mg/l. All 13 samples were above the 0.08 mg/l concentration attainable by identified treatment technology. Therefore, lead is selected for further consideration for limitation.

Nickel was measured above its analytical quantification limit in all 13 samples, taken from five plants, with concentrations ranging from 0.007 to 530 mg/l. Since nine samples were also above the 0.22 mg/l concentration attainable by identified treatment technology, nickel is selected for further consideration for limitation.

Zinc was measured above its analytical quantification concentration in all 12 samples taken from five plants, with concentrations ranging from 0.7 to 300 mg/l. All 12 samples were above the 0.23 mg/l concentration attainable by the identified treatment technology. Therefore, zinc is selected for further consideration for limitation.

Table VI-1  
FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY COPPER  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
1. acenaphthene	0.010	0.010	5	12	10			2
2. acrolein	0.010	0.100	4	10	10			
3. acrylonitrile	0.010	0.01	4	10	10			
4. benzene	0.010	0.05 - 0.10	4	10	7	2	1	
5. benzidine	0.010	0.01	5	12	12			
6. carbon tetrachloride	0.010	0.05	4	10	9			1
7. chlorobenzene	0.010	0.025	4	10	10			
8. 1,2,4-trichlorobenzene	0.010	0.01	5	12	12			
9. hexachlorobenzene	0.010	0.01	5	12	12			
10. 1,2-dichloroethane	0.010	0.1	4	10	7	1	2	
11. 1,1,1-trichloroethane	0.010	0.01	4	10	10			
12. hexachloroethane	0.010	0.01	5	12	12			
13. 1,1-dichloroethane	0.010	0.01	4	10	10			
14. 1,1,2-trichloroethane	0.010	0.1	4	10	10			
15. 1,1,2,2-tetrachloroethane	0.010	0.05	4	10	8	2		
16. chloroethane	0.010	0.01	4	10	10			
17. bis(chloromethyl) ether	0.010	0.01	4	10	10			
18. bis(2-chloroethyl) ether	0.010	0.01	5	12	12			
19. 2-chloroethyl vinyl ether	0.010	0.01	4	10	10			
20. 2-chloronaphthalene	0.010	0.01	5	12	12			1
21. 2,4,6-trichlorophenol	Not Analyzed							
22. parachlorometa cresol	Not Analyzed							
23. chloroform	0.010	0.1	4	10			5	5
24. 2-chlorophenol	Not Analyzed							
25. 1,2-dichlorobenzene (c)	0.010	0.01	5	12	10			2
26. 1,3-dichlorobenzene (c)	0.010	0.01	5	12	10			2
27. 1,4-dichlorobenzene (c)	0.010	0.01	5	12	10			2
28. 3,3'-dichlorobenzidine	0.010	0.01	5	12	12			
29. 1,1-dichloroethylene	0.010	0.1	4	10	8		1	1
30. 1,2-trans-dichloroethylene	0.010	0.1	4	10	7		2	1
31. 2,4-dichlorophenol	Not Analyzed							
32. 1,2-dichloropropane	0.010	0.01	4	10	10			
33. 1,3-dichloropropylene	0.010	0.01	4	10	10			
34. 2,4-dimethylphenol	Not Analyzed							
35. 2,4-dinitrotoluene	0.010	0.05	5	12	12			
36. 2,6-dinitrotoluene	0.010	0.05	5	12	12			
37. 1,2-diphenylhydrazine	0.010	0.05	5	12	12			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY COPPER  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentra- tion (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
38. ethylbenzene	0.010	0.05	4	10	10			
39. fluoranthene	0.010	0.01	5	12	7			
40. 4-chlorophenyl phenyl ether	0.010	0.01	5	12	12	3		2
41. 4-bromophenyl phenyl ether	0.010	0.01	5	12	12			
42. bis(2-chloroisopropyl) ether	0.010	0.01	5	12	12			
43. bis(2-chloroethoxy) methane	0.010	0.01	5	12	12			
44. methylene chloride	0.010	0.10	4	10	8			2
45. methyl chloride	0.010	0.01	4	10	10			
46. methyl bromide	0.010	0.01	4	10	10			
47. bromoform	0.010	0.05	4	10	10			
48. dichlorobromomethane	0.010	0.10	4	10	10			
49. trichlorofluoromethane	0.010	0.01	4	10	10			
50. dichlorodifluoromethane	0.010	0.01	4	10	10			
51. chlorodibromomethane	0.010	0.10	4	10	10			
52. hexachlorobutadiene	0.010	0.01	5	12	12			
53. hexachlorocyclopentadiene	0.010	0.01	5	12	12			
54. isophorone	0.010	0.05	5	12	12			
55. naphthalene	0.010	0.05	5	12	9		1	2
56. nitrobenzene	0.010	0.05	5	12	12			
57. 2-nitrophenol	Not Analyzed							
58. 4-nitrophenol	Not Analyzed							
59. 2,4-dinitrophenol	Not Analyzed							
60. 4,6-dinitro-o-cresol	Not Analyzed							
61. N-nitrosodimethylamine	0.010	0.01	5	12	12			
62. N-nitrosodiphenylamine	0.010	0.01	5	12	12			
63. N-nitrosodi-n-propylamine	0.010	0.01	5	12	12			
64. pentachlorophenol	Not Analyzed							
65. phenol	Not Analyzed							0
66. bis(2-ethylhexyl) phthalate	0.010	0.01	5	12	1		1	1
67. butyl benzyl phthalate	0.010	0.001 - 0.01	5	12	8			2
68. di-n-butyl phthalate	0.010	0.025	5	12	3	3	3	3
69. di-n-octyl phthalate	0.010	0.01	5	12	8	3		1
70. diethyl phthalate	0.010	0.025	5	12	8	2		2
71. dimethyl phthalate	0.010	0.025	5	12	9	3		
72. benzo(a)anthracene	0.010	0.01	5	12	12			
73. benzo(a)pyrene	0.010	0.01	5	12	12			
74. 3,4-benzofluoranthene (d)	0.010	0.01	5	12	11	1		



Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY COPPER  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
75. benzo(k)fluoranthene (d)	0.010	0.01	5	12	11	1		
76. chrysene	0.010	0.001	5	12	10	1		1
77. acenaphthylene	0.010	0.01	5	12	9			3
78. anthracene (e)	0.010	0.01	5	12	7	4		1
79. benzo(ghi)perylene	0.010	0.01	5	12	12			
80. fluorene	0.010	0.01	5	12	12			
81. phenanthrene (e)	0.010	0.01	5	12	7	3		1
82. dibenzo(a,h)anthracene	0.010	0.01	5	12	12			
83. indeno(1,2,3-cd)pyrene	0.010	0.01	5	12	12			
84. pyrene	0.010	0.001 - 0.01	5	12	7	3		2
85. tetrachloroethylene	0.010	0.05	4	10	5	4		1
86. toluene	0.010	0.05	4	10	8		2	
87. trichloroethylene	0.010	0.01	4	10	5	1		4
88. vinyl chloride	0.010	0.01	4	10	10			
89. aldrin	0.005	0.001	5	10	10			
90. dieldrin	0.005	0.01	5	10	10			
91. chlordane	0.005	0.01	5	10	10			
92. 4,4'-DDT	0.005	0.01	5	10	10			
93. 4,4'-DDE	0.005	0.01	5	10	10			
94. 4,4'-DDD	0.005	0.01	5	10	10			
95. alpha-endosulfan	0.005	0.001	5	10	10			
96. beta-endosulfan	0.005	0.01	5	10	10			
97. endosulfan sulfate	0.005	0.01	5	10	10			
98. endrin	0.005	0.01	5	10	10			
99. endrin aldehyde	0.005	0.01	5	10	10			
100. heptachlor	0.005	0.01	5	10	10			
101. heptachlor epoxide	0.005	0.01	5	10	10			
102. alpha-BHC	0.005	0.01	5	10	10			
103. beta-BHC	0.005	0.01	5	10	10			
104. gamma-BHC	0.005	0.01	5	10	10			
105. delta-BHC	0.005	0.01	5	10	10			
106. PCB-1242 (f)	0.005	0.001	5	10	10			
107. PCB-1254 (f)	0.005		5	10	10			
108. PCB-1221 (f)	0.005		5	10	10			
109. PCB-1232 (g)	0.005	0.001	5	10	8	2		
110. PCB-1248 (g)	0.005		5	10	8	2		
111. PCB-1260 (g)	0.005		5	10	8	2		
112. PCB-1016 (g)	0.005		5	10	8	2		

Table VI-1 (Continued)  
 FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
 SECONDARY COPPER  
 RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
113. toxaphene	0.005	0.01	5	10	10			
114. antimony	0.100	0.47	5	13	10		3	
115. arsenic	0.010	0.34	5	13	6		6	1
116. asbestos	10 MFL	10 MFL	1	1		1		
117. beryllium	0.010	0.20	5	13	2		8	
118. cadmium	0.002	0.049	5	13	3		3	7
119. chromium	0.005	0.07	5	13	2			11
120. copper	0.009	0.39	5	13			1	12
121. cyanide	0.02(f)	0.047	4	11	5		6	
122. lead	0.020	0.08	5	13				13
123. mercury	0.0001	0.036	5	13			13	
124. nickel	0.005	0.22	5	13			4	9
125. selenium	0.01	0.20	4	10	3		5	2
126. silver	0.02	0.07	4	10	7		3	
127. thallium	0.100	0.34	4	10	10			
128. zinc	0.050	0.23	5	12				12
129. 2,3,7,8-tetrachlorodibenzo- p-dioxin (TCDD)	Not analyzed							

(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), (f), (g) Reported together.

(h) 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.

## SECONDARY COPPER SUBCATEGORY

### SECTION VII

#### CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the wastewater sources, flows, and characteristics of the wastewaters from secondary copper plants. This section summarizes the description of these wastewaters and indicates the treatment technologies which are currently practiced by the secondary copper subcategory for each waste stream.

#### TECHNICAL BASIS OF PROMULGATED BPT

EPA promulgated BPT effluent limitations for the secondary copper subcategory on February 27, 1975 under Subpart F of 40 CFR Part 421. These effluent limitations prohibit the discharge of process wastewater pollutants into navigable waters, and are based on control technologies for specific waste streams. The best practicable control technology for process wastewater generated during the contact cooling of copper ingots, anodes, billets, or shot is the elimination of this discharge through recycle and reuse of all contact cooling water. With the reuse and recycle of casting contact cooling water, the needs for solids and oil removal would be dictated by plant operational procedures. Removal of solids such as charcoal used to cover copper alloy ingots and the oxide scale and mold wash from anode casting requires sedimentation and filtration before the water is reused. The pond used for sedimentation will also provide cooling. Alternately, a cooling tower can provide settling and cooling capacity.

The best practicable control technology for process wastewater generated from the quenching and granulation of copper-rich slags is the elimination of this discharge by the recycle and reuse of all slag granulation wastewater. Suspended solids are removed by sedimentation and filtration prior to recycle and reuse. Alternately, the molten slag may be air cooled after it has been cast into slag pots for subsequent metal recovery by dry methods. When quenching and granulating depleted (waste) slags, the best practicable control technology is the total recycle and reuse of this wastewater after treatment to reduce suspended solids by sedimentation and filtration.

The best practicable control technology for process wastewater generated during copper-rich slag milling and classifying (residue concentration) is the elimination of this discharge by either total recycle and reuse of this wastewater, or by melt-agglomerating the metal in a blast, cupola, or rotary furnace.

Prior to recycle and reuse, solids are removed by lime precipitation, if necessary, sedimentation, and filtration.

The best practicable control technology for process wastewater produced from furnace exhaust scrubbing is the elimination of wastewater discharge by recycling all of the furnace scrubber water. Before recycling, the scrubber water is treated by sedimentation and filtration or centrifugation. Another alternative to the elimination of this waste stream is conversion to dry air pollution control equipment.

The best practicable control technology for wastewater from electrolytic refining is the elimination of this wastewater discharge by treating the bleed stream from electrolytic cell operations, so that it is suitable for reuse in other plant processes. The treatment consists of removal of copper by cementation with iron metal, lime precipitation, and sand filtering this stream to remove solids. The resulting water is then discharged to a combined process wastewater reservoir serving other plant water needs.

The BPT effluent limitations contain a catastrophic stormwater allowance. This stormwater exemption states that a volume of process wastewater in excess of the 10-year, 24-hour storm event falling on a wastewater impoundment may be discharged. This discharge is not subject to effluent limitations.

The BPT effluent limitations also contain a net precipitation exemption. This exemption allows facilities to discharge once per month, subject to concentration-based effluent limitations, a volume of water equal to the difference between precipitation and evaporation falling on an impoundment in that month.

#### CURRENT CONTROL AND TREATMENT PRACTICES

Control and treatment technologies are also discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability to wastewater similar to that found in this subcategory are presented there. This section presents a summary of the control and treatment technologies that are currently applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary copper 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 specific sources as well as combined waste streams in Section V. Generally, these pollutants are present in each of the waste streams at treatable concentrations, so these waste streams are commonly combined for treatment to reduce the concentrations of these pollutants.

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.

Six plants in this subcategory treat combined wastewater. At three of these plants, combined waste streams are settled in one or more settling ponds and then completely recycled. One plant treats combined wastewater by screening, sedimentation in ponds, and filtration, and combined wastewater is neutralized with caustic prior to discharge at another plant. At the remaining plant, combined waste streams are treated by lime precipitation, sedimentation, and filtration prior to discharge.

#### RESIDUE CONCENTRATION

Residue concentration wastewater is generated when the copper value is recovered from reverberatory and rotary furnace slags, and other residues such as drosses, skimmings, spills, and sweepings, through wet milling and classifying. Seven plants generate this waste stream. Five of these plants achieve zero discharge of residue concentration wastewater through 100 percent recycle. One discharging plant does not recycle this waste stream and the other discharging plant did not report its recycle practices.

The residue concentration wastewater is treated by six of the seven plants prior to recycle or discharge. The treatment schemes include the following:

1. Preliminary treatment consisting of acid neutralization, polymer flocculation, and sedimentation for residue concentration wastewater only. Following preliminary treatment, the residue concentration wastewater is combined with other process wastewater and settled in lagoons, screened, filtered, and then completely recycled.
2. Sedimentation with lagoons, total recycle (combined treatment).
3. Filtration, total recycle (no combined treatment).
4. Sedimentation with classifiers and jigs, screening, sedimentation with lagoons, total recycle (no combined treatment).
5. Sedimentation in lagoons, discharge (no recycle, or combined treatment).

6. Grit removal for residue concentration wastewater, and combined treatment consisting of lime precipitation, sedimentation, and filtration, followed by discharge (recycle practices not reported).

The seventh plant recycles 100 percent of this waste stream, but did not report if the stream is treated prior to recycle.

Residue concentration wastewater is characterized by treatable concentrations of suspended solids, and dissolved toxic metal pollutants.

#### SLAG GRANULATION

This wastewater is generated when blast or cupola furnace slag is granulated with high pressure water jets, or in quench pits. Five plants generate a slag granulation waste stream. Four of these plants practice complete recycle, and the remaining plant evaporates its slag granulation wastewater. Prior to recycle, the slag granulation wastewater is treated by one or more of the following steps:

1. Screening,
2. Settling ponds or basins, and
3. Filtration.

At two of the total recycle plants, the slag granulation water is combined with other process wastewater when treated.

Slag granulation wastewater contains treatable concentrations of dissolved metals and suspended solids.

#### REVERBERATORY AND ROTARY FURNACE WET AIR POLLUTION CONTROL

Wet air pollution control devices are used by five secondary copper plants to contain metal oxide fumes and dust produced from rotary and reverberatory furnace operations. Three of the five plants completely recycle this waste stream, and one plant recycles 81 percent. The remaining plant does not recycle this waste stream. The control and treatment practices of the five plants are as follows:

1. Settling ponds, total recycle;
2. Settling ponds (combined with other process wastewater), total recycle;
3. Settling tanks, centrifuge, total recycle;
4. Holding tank, 81 percent recycle, settling tanks, discharge; and

5. Lime and caustic neutralization, flocculation with iron salts and polymers, clarification, and filtration followed by discharge.

As shown above, only one of the five plants combines its furnace wet air pollution control water with other process wastewater for treatment.

Reverberatory and rotary furnace wet air pollution control water is characterized by treatable concentrations of suspended solids and dissolved toxic metals.

#### SCRAP ANODE RINSING

This wastewater is generated when anodes are removed from electrolytic cells and rinsed before further processing. Two plants rinse scrap anodes. Both plants recycle or reuse 100 percent of their scrap anode rinse water. This wastewater is characterized by treatable concentrations of suspended solids and dissolved toxic metal pollutants.

#### SPENT ELECTROLYTE

Electrolyte is continuously circulated through thickeners and filters to remove anode mud slimes, and recycled back through the electrolytic cells. A bleed stream is necessary to prevent the build-up of nickel and copper in the electrolyte. Usually, nickel or copper is recovered from the electrolyte bleed before recycle or discharge. Copper is recovered from the electrolyte by cementation with iron. In this process, scrap iron is added to the spent electrolyte and the solution is heated to about 180°F, where copper precipitates from solution. An alternate method for recovering copper from solution is electrowinning. Nickel is recovered by evaporating the electrolyte bleed to produce nickel sulfate crystals and sulfuric acid. Six plants in the secondary copper subcategory have an electrolytic refining process. Two of those plants discharge spent electrolyte without treatment. One of those two plants contract hauls the spent electrolyte. At two plants, copper is cemented from an electrolytic bleed stream with iron, and the resulting solution is either discharged (at one plant) or contract hauled (at the other plant). The remaining two plants each achieve zero discharge of spent electrolyte through the following treatment schemes:

1. An electrolyte bleed stream is electrowinned to recover copper and evaporated to recover nickel sulfate crystals and sulfuric acid.
2. An electrolyte bleed stream is evaporated to recover nickel sulfate and sulfuric acid.

Spent electrolyte is acidic and contains treatable concentrations of dissolved metals (particularly copper).

#### CASTING CONTACT COOLING

Contact cooling water is used by 22 plants in the secondary copper subcategory. As discussed in Section III, there are a variety of methods for cooling the various types of castings. In the case of ingots, anodes, and billets, the molten metal is solidified by spray cooling, and then quenched in tanks. Finished refined copper shapes are usually prepared by cooling the molten metal by non-contact cooling techniques, and then quenching the solidified metal. Shot is manufactured by directing a small stream of molten copper directly into a quench pit.

Eleven of the 22 plants which produce casting contact cooling water achieve zero discharge through total recycle. One achieves zero discharge through dry well injection. There are a variety of control and treatment practices utilized by both zero discharge and discharging plants. These control and treatment practices are as follows:

1. No recycle, discharge without treatment (five plants);
2. Partial recycle, caustic neutralization, discharge (one plant);
3. Cooling pond, partial recycle, settling pond, discharge (one plant);
4. Partial recycle through cooling towers (two plants);
5. 99 percent recycle with a blowdown stream treated by lime precipitation, sedimentation, and filtration prior to discharge (one plant);
6. No treatment, total recycle (three plants);
7. Screening, total recycle (one plant);
8. Settling, total recycle (four plants);
9. Screening, settling, filtration, total recycle (one plant);
10. Settling pits, holding tanks, cooling tower, centrifuge, total recycle (one plant);
11. Neutralization with lime, flocculation with polymers, settling, total recycle (one plant); and
12. No recycle, dry well injection (one plant).



At five of the above plants, casting contact cooling water is combined with other process wastewater when treated.

Casting contact cooling water is characterized by treatable concentrations of lead, zinc, copper, and total suspended solids.

#### CASTING WET AIR POLLUTION CONTROL

Three plants control fumes from casting operations with wet air pollution control devices. One plant completely recycles casting scrubber water after neutralization with caustic and settling, and one plant contract hauls a casting scrubber water bleed stream. The remaining plant discharges a casting scrubber water bleed stream after neutralization with caustic.

#### CONTROL AND TREATMENT OPTIONS CONSIDERED

Based on an examination of the wastewater sampling data, three control and treatment options that effectively control the pollutants found in secondary copper wastewaters were selected for evaluation. These technology options are discussed below.

Reverse osmosis (Option F) is theoretically applicable to wastewaters generated in the secondary silver subcategory; however, it is not demonstrated in the nonferrous metals manufacturing category, nor is it clearly transferable. Activated alumina adsorption (Option D) and activated carbon adsorption (Option E) were not considered for secondary copper because pollutants (arsenic, fluoride and the toxic organics) generally treatable by these technologies are not present at treatable concentrations or in quantities warranting control.

#### OPTION A

Option A for the secondary copper subcategory is equivalent to the technology basis for the promulgated pretreatment standards for existing sources. The Option A treatment scheme consists of chemical precipitation and sedimentation (lime and settle) applied to combined waste streams. Chemical precipitation and sedimentation consists of lime addition to precipitate metals followed by gravity sedimentation for the removal of suspended solids, including the metal precipitates.

#### OPTION C

Option C for the secondary copper subcategory consists of all the requirements of Option A (chemical precipitation and sedimentation) plus multimedia filtration added to the end of the Option C 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 the gravity, mixed-media type, although other forms of filters such as rapid sand filters or pressure filters would perform satisfactorily.

#### OPTION G

Option G for the secondary copper subcategory is based on total recycle of all process wastewater through cooling towers and holding tanks with lime precipitation and sedimentation treatment. The water obtained from the above treatment is of sufficient quality for reuse in secondary copper operations.

## SECONDARY COPPER SUBCATEGORY

### SECTION VIII

#### COSTS, ENERGY AND NONWATER QUALITY ASPECTS

As discussed in Section VII, EPA considered three control and treatment technology options for the secondary copper subcategory. The Agency considered costs in regard to its review of the promulgated PSES. The first option, Option A, is equivalent to the technology basis used for the promulgated PSES. Option A is based on lime precipitation and sedimentation of combined process wastewater. The second option considered, Option C, includes lime precipitation and sedimentation followed by end-of-pipe polishing filtration. The third option considered, Option G, is equivalent to the technology basis used for the promulgated BPT and BAT.

There are no costs associated with Option A for indirect dischargers since these costs were included in development of the promulgated PSES. The costs associated with Option G, cooling towers and holding tanks to achieve zero discharge of wastewater pollutants were considered during the 1976 rulemaking. These costs are presented in, Supplemental for Pretreatment to the Interim Final Development Document for the Secondary Copper Segment of the Nonferrous Metals Manufacturing Point Source Category, U.S. EPA, EPA 440/1-77/081d. The Agency concluded at that time that the additional costs associated with cooling towers and holding tanks were not significant when compared to the costs of implementing lime precipitation and sedimentation.

Wastes generated by secondary copper can be regulated as hazardous. However, the Agency examined the solid wastes that would be generated at secondary copper 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. None of these wastes are listed specifically as hazardous. Nor are they likely to exhibit a characteristic of hazardous wastes. This judgment is made based on the recommended technology of lime precipitation, sedimentation and filtration. By the addition of excess 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 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), 47 FR 32274 (July 26, 1982).

Even if these wastes are not identified as hazardous, they still must be disposed of in compliance with 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. For more details, see Section VIII of the General Development Document.

The proposed PSES technology should not substantially increase the energy requirements of the existing PSES because of the additional pumping requirements for complete recycle. To achieve the proposed PSES, a typical indirect discharger will increase total energy consumption by less than 1 percent of the energy consumed for production purposes.

The Agency estimates that the NSPS and PSNS technology will, in general, require as much energy as the existing source limitations.

## SECONDARY COPPER SUBCATEGORY

### SECTION IX

#### BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

EPA promulgated BPT effluent limitations for the secondary copper subcategory on February 27, 1975 as Subpart F of 40 CFR Part 421. EPA is not proposing any modifications to these limitations. Under the BPT effluent limitations, existing point sources may not discharge process wastewater pollutants to U.S. waters. The zero discharge of process wastewater pollutants is achieved by the application of lime precipitation, sedimentation, and filtration technology followed by the total recycle and reuse of treated water. The BPT effluent limitations include net precipitation and catastrophic storm allowances. A process wastewater impoundment which is designed, constructed and operated so as to contain the precipitation from the 10-year, 24-hour rainfall event as established by the National Climatic Center, National Oceanic and Atmospheric Administration, for the area in which such impoundment is located may discharge that volume of process wastewater which is equivalent to the volume of precipitation that falls within the impoundment in excess of that attributable to the 10-year, 24-hour rainfall event, when such event occurs. Also, during any calendar month there may be discharged from a process wastewater impoundment either a volume of process wastewater equal to the difference between the precipitation for that month that falls within the impoundment and either the evaporation from the pond water surface area for that month, or a volume of process wastewater equal to the difference between the mean precipitation for that month that falls within the impoundment and the mean evaporation from the pond water surface area as established by the National Climatic Center, National Oceanic and Atmospheric Administration, for the area in which such impound is located (or as otherwise determined if no monthly data have been established by the National Climatic Center), whichever is greater.

Process wastewater discharge pursuant to the net precipitation allowance shall comply with the following concentration-based effluent limitations:

<u>Effluent Characteristic</u>	<u>Effluent Limitations</u>	
	<u>Maximum for Any One Day</u>	<u>Average of Daily Values for 30 Consecutive Days Shall Not Exceed-</u>
	Metric Units (mg/l)	
	English Units (ppm)	
Total Suspended Solids	50	25
Copper	0.5	0.25
Zinc	10	5
Oil and Grease	20	10
pH	Within the range of 6.0 to 9.0	

## SECONDARY COPPER SUBCATEGORY

### SECTION X

#### BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

EPA promulgated BAT effluent limitations for the secondary copper subcategory on February 27, 1975 as Subpart F of 40 CFR Part 421. These BAT effluent limitations prohibit the discharge of process wastewater pollutants into U.S. waters. The zero discharge of process wastewater pollutants is achieved by the application of lime precipitation, sedimentation, filtration technology followed by the total recycle and reuse of treated water. The BAT effluent limitations include the same net precipitation and catastrophic storm allowances as the existing BPT effluent limitations except the catastrophic storm is a 25-year, 24-hour rainfall event.

As discussed in Section IX of the General Development Document, the Agency is modifying its approach to stormwater. EPA is proposing to modify the existing BAT effluent limitations for the secondary copper subcategory to eliminate the existing net precipitation allowance. The impoundments used for cooling and settling process wastewater prior to recycle and reuse require much smaller surface areas than the settling evaporative impoundments for which the net precipitation discharge was allowed. Since cooling and settling impoundments have a much smaller surface area than evaporative impoundments, the net precipitation on these impoundments is small enough for secondary copper plants to accommodate. Cooling towers were costed for BAT in the 1975 rulemaking when a plant had insufficient existing cooling impoundment capacity or cooling impoundments were not feasible due to space limitations. Thus, EPA is requiring that net precipitation on cooling and settling impoundments be used in secondary copper processes instead of being discharged. The proposed BAT effluent limitations are, therefore, zero discharge of process wastewater pollutants to U.S. waters with allowances for the 25-year, 24-hour storm.

## SECONDARY COPPER SUBCATEGORY

### SECTION XI

#### NEW SOURCE PERFORMANCE STANDARDS

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

EPA is proposing that NSPS for the secondary copper subcategory be equal to zero discharge of process wastewater pollutants. EPA is also eliminating the allowance for catastrophic stormwater discharge provided at BAT. The Agency believes that new sources can be constructed with cooling towers exclusively, and that the cost of cooling towers instead of cooling impoundments is minimal. Some existing plants already use cooling towers rather than cooling impoundments. Therefore, EPA believes that NSPS, as defined, does not constitute a barrier to entry for new plants.



## SECONDARY COPPER SUBCATEGORY

### SECTION XII

#### PRETREATMENT STANDARDS

##### INTRODUCTION

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES), which must be achieved within three years of promulgation. 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 of 1977 requires pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives. Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time that it promulgates NSPS. 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 technology for removal of toxic pollutants.

EPA promulgated PSES for the secondary copper subcategory on December 15, 1976 as Subpart F of 40 CFR Part 421. The promulgated PSES allows a continuous discharge of process wastewater subject to specific limitations based on treatment with lime precipitation and sedimentation. Proposed BAT (and promulgated BPT) for this subcategory require the zero discharge of process wastewater pollutants to U.S. waters. EPA is proposing to modify PSES to eliminate the disparity between BAT and PSES. Accordingly, EPA is proposing that PSES for the secondary copper subcategory be zero discharge of process wastewater pollutants to POTW.

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the primary electrolytic copper refining subcategory. Pretreatment standards for regulated pollutants are presented based on the selected treatment technology.

##### TECHNICAL APPROACH TO PRETREATMENT

Before proposing pretreatment standards, the agency examines whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operations 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: (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 nor 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 EXISTING SOURCES

In summary form, the treatment technologies considered for secondary copper plants discharging to POTW are:

Option A is based on:

- o Lime precipitation and sedimentation

Option C is based on:

- o Lime precipitation and sedimentation
- o Multimedia filtration

Option G is based on:

- o Lime precipitation and sedimentation
- o Multimedia filtration
- o In-process flow reduction with cooling towers and holding tanks
- o Total recycle and reuse of treated water

These three technology options for PSES are discussed in greater detail below. The first option considered (Option A) is identical to the technology basis for the existing PSES. The remaining

two options provide additional pollutant removal beyond that achieved by Option A.

#### Option A

Option A for the secondary copper subcategory is lime precipitation and sedimentation (lime and settle). Lime precipitation and sedimentation removes metals and suspended solids from process wastewater by the addition of lime followed by sedimentation.

#### Option C

Option C for the secondary copper subcategory consists of multimedia filtration technology added to the end of the lime precipitation and sedimentation technology of Option A. 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.

#### Option G

Option G consists of the lime precipitation and sedimentation technology of Option A, followed by complete recycle and reuse of the treated water. In-process flow reduction measures consisting of the recycle of process wastewater through cooling towers or holding tanks is also added for Option G.

### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

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 on the following pages.

#### POLLUTANT REDUCTION BENEFITS

A complete description of the methodology used to calculate the estimated pollutant reduction, or benefit, achieved by the application of the various treatment options is presented in Section X of the General Development Document. In short, sampling data collected during the field sampling program were used to characterize the 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 copper subcategory. By multiplying the total subcategory production for a unit operation by the corresponding raw waste value, the mass of pollutant generated for that unit operation was estimated.

The volume of wastewater discharged after the application of each treatment option was estimated by multiplying the regulatory flow determined for each unit process by the total subcategory production. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed, referred to as the benefit, is simply 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 Agency varied this procedure slightly in computing estimated BPT discharge in a subcategory where there is an existing BPT limitation. In this case, EPA took the mass limits from the BPT limitations (for all pollutants limited at BPT) and multiplied these limits by the total subcategory production (from dcp). (The assumption is that plants are discharging a volume equal to their BPT allowance times their production). Where pollutants are not controlled by existing BPT, EPA used the achievable concentration for the associated technology proposed today, and multiplied these concentrations by the total end-of-pipe discharge of process wastewater for the subcategory (from dcp). The total of both these calculations represents estimated mass loadings for the subcategory. The pollutant reduction benefit estimates for the segment of the secondary copper subcategory discharging to POTW are shown in Table XII-1.

#### COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop uniformly-applicable cost curves, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied these curves on a per plant basis, a plant's costs--both capital, and operating and maintenance--being 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 cost, yielding the cost of compliance for the subcategory. These costs were used in assessing economic achievability. Option A represents no cost since it is the technology basis for the existing PSES. The costs for cooling towers and hold tanks were considered for the existing PSES rulemaking. At that time, EPA concluded that the additional cost was not significant. Thus, Option G represents no significant cost. Costs were not determined for Option C.

### PSES OPTION SELECTION

EPA has selected Option G as the basis for PSES. Option G consists of chemical precipitation and sedimentation, with cooling towers and holding tanks to achieve zero discharge of process wastewater pollutants. Implementation of Option G would remove an estimated 4,837 kg of toxic pollutants over estimated current discharge. EPA believes that the costs associated with installing cooling towers and holding tanks will be insignificant. In addition, costs for cooling towers and holding tanks were considered during the 1976 PSES rulemaking.

### PSNS OPTION SELECTION

The technology basis for proposed PSNS is identical to NSPS and BAT, which is zero discharge of all process wastewater pollutants (including no allowance for catastrophic stormwater discharges). PSNS does not increase costs compared to PSES or BAT, and EPA does not believe that PSNS will prevent the entry of new plants.

### WASTEWATER DISCHARGE RATES

Specific wastewater streams associated with the secondary copper subcategory are residue concentration wastewater, slag granulation, wastewater, reverberatory and rotary furnace wet air pollution control wastewater, spent electrolyte, scape anode rinsing wastewater, casting contact cooling wastewater and casting wet air pollution control wastewater. None of these wastewater streams will be allocated a discharge allowance for the proposed PSES. The zero discharge requirement will eliminate the disparity between the existing PSES and the promulgated and proposed BAT effluent limitations. Each wastewater stream is discussed individually below.

#### RESIDUE CONCENTRATION

No discharge allowance is provided for residue concentration for proposed PSES. Seven plants in the secondary copper subcategory generate residue concentration wastewater. The water use and discharge rates for residue concentration at these plants are shown in Table V-1. As shown in Table V-1, five of the seven plants practice total recycle and reuse of this waste stream, while only two plants discharge the residue concentration wastewater. The zero discharge of residue concentration wastewater is based on the five plants who do not discharge this wastewater.

#### SLAG GRANULATION

No discharge allowance is provided for slag granulation for proposed PSES. Five plants in the secondary copper subcategory generate this waste stream. The water use and discharge rates

for slag granulation at these plants are shown in Table V-2. As shown by Table V-2, all five plants practice total recycle and reuse of this waste stream. Accordingly, no discharge allowance is provided for slag granulation.

#### REVERBERATORY AND ROTARY FURNACE WET AIR POLLUTION CONTROL

No discharge allowance is provided for reverberatory and rotary furnace wet air pollution control for proposed PSES. Five plants in the secondary copper subcategory use wet air pollution control on their rotary and reverberatory furnaces. The production normalized water use and discharge rates for reverberatory and rotary furnace wet air pollution control of these plants are shown in Table V-3. Three of the five plants completely recycle and reuse this waste stream. In addition, 13 plants control reverberatory and rotary furnace fumes and dust with dry air pollution control devices. Therefore, based on total recycle or dry air pollution control, no discharge allowance is provided for reverberatory and rotary furnace wet air pollution control for proposed PSES.

#### SPENT ELECTROLYTE

No discharge allowance is provided for spent electrolyte for the proposed PSES. Six plants in the secondary copper subcategory have an electrolyte refining process. The production normalized electrolyte use and discharge rates at these plants are shown in Table V-4. Four plants achieve zero discharge of spent electrolyte by either complete recycle (two plants) or by contract hauling (two plants). EPA believes that spent electrolyte is suitable for reuse in other plant operations after treatment consisting of cementation with iron (for copper recovery), lime precipitation, and sedimentation. For this reason, and since four of the six plants already achieve zero discharge for spent electrolyte, a discharge allowance is not provided.

#### SCRAP ANODE RINSING

No discharge allowance is provided for scrap anode rinsing for proposed PSES. Two plants reported this waste stream. The water use and discharge rates for scrap anode rinsing at these plants are shown in Table V-5. Table V-5 shows that both of the plants with scrap anode rinsing practice 100 percent recycle. Accordingly, a discharge allowance is not provided for scrap anode rinsing.

#### CASTING CONTACT COOLING

No discharge allowance is provided for casting contact cooling water. Twenty-two plants use casting contact cooling water. The water use and discharge rates for casting contact cooling at

these plants is shown in Table V-6. As shown in Table V-6, 10 of the 22 plants achieve zero discharge of this wastewater. EPA believes that the 12 plants which discharge this wastewater can also achieve zero discharge through recycle and reuse with cooling towers and holding tanks. Therefore, no discharge allowance is provided for casting contact cooling water.

#### CASTING WET AIR POLLUTION CONTROL

No discharge allowance is provided for casting wet air pollution control. Three plants in the secondary copper subcategory use wet air pollution control devices to control fumes from casting melting furnaces or pouring. The water use and discharge rates for casting wet air pollution control are shown in Table V-7. Table V-7 shows that one of the three plants completely recycle and reuses this waste stream. In addition, five plants use dry air pollution control devices to control fumes from casting operations. Therefore, based on total recycle or dry air pollution control, no discharge allowance is provided for casting wet air pollution control.

#### STORMWATER AND PRECIPITATION ALLOWANCES

No discharge allowance is provided for catastrophic and net precipitation stormwater for the proposed PSES and PSNS. These standards are based on the use of cooling towers and holding tanks rather than cooling impoundments.

#### PRETREATMENT STANDARDS FOR EXISTING AND NEW SOURCES

EPA is proposing zero discharge of process wastewater pollutants (with no net precipitation and catastrophic storm allowances) for both PSES and PSNS for the secondary copper subcategory.

Table XII-1

## POLLUTANT REDUCTION BENEFITS FOR INDIRECT DISCHARGERS

Flow (l/yr)		33.374 x 10 <sup>6</sup>		33.374 x 10 <sup>6</sup>		0.0	
	Raw Waste	Option A	Option A	Option C	Option C	Option G	Option G
Pollutant	kg/yr	Removed	Discharged	Removed	Discharged	Removed	Discharged
		kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Chromium	19.7	17.0	2.7	17.4	2.3	19.7	0.0
Copper	1,793.7	1,774.4	19.4	1,780.7	13.0	1,793.7	0.0
Lead	904.3	900.3	4.0	901.6	2.7	904.3	0.0
Nickel	887.0	868.0	19.0	879.7	7.3	887.0	0.0
Zinc	1,233.0	1,223.0	10.0	1,225.4	7.7	1,233.0	0.0
Oil & Grease	1,292.7	825.4	467.2	958.9	333.7	1,292.7	0.0
TSS	4,698.3	4,297.8	400.5	4,611.6	86.8	4,698.3	0.0
Total Toxic Metals	4,837.8	4,782.7	55.1	4,804.8	33.0	4,837.8	0.0
Total Conventional	5,990.8	5,123.2	867.7	5,570.5	420.5	5,990.8	0.0
Total Pollutants	10,828.8	9,906.0	922.8	10,375.3	453.5	10,828.8	0.0

NOTE: Total Toxic Metals = Chromium + Copper + Lead + Nickel + Zinc  
 Total Conventional = TSS + Oil and Grease  
 Total Pollutants = Total Toxic Metals + Total Conventional

Option A - Chemical Precipitation and Sedimentation

Option C - Chemical Precipitation, Sedimentation, and Filtration

Option G - Chemical Precipitation, Sedimentation, and Total Recycle and Reuse of Treated Water



## SECONDARY COPPER SUBCATEGORY

### SECTION XIII

#### BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

The 1977 amendments to the Clean Water Act added Section 301(b)(2)(E), establishing "best conventional pollutant control technology" (BCT) for discharge of conventional pollutants from existing industrial point sources. Biochemical oxygen-demanding pollutants (BOD<sub>5</sub>), total suspended solids (TSS), fecal coliform, oil and grease (O&G), and pH have been designated as conventional pollutants (see 44 FR 44501).

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. In addition to the other factors specified in Section 304(b)(4)(B), the Act requires that limitations for conventional pollutants be assessed in light of a two-part cost-reasonableness test. On October 29, 1982, the Agency proposed a revised methodology for carrying out BCT analyses (47 FR 49176). The purpose of the proposal was to correct errors in the BCT methodology originally established in 1977.

Part 1 of the proposed BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be compared with the cost and level of reduction to remove the same type of pollutants by publicly-owned treatment works (POTW). The POTW comparison figure has been calculated by evaluating the change in costs and removals between secondary treatment (30 mg/l BOD and 30 mg/l TSS) and advanced secondary treatment (10 mg/l BOD and 10 mg/l TSS). The difference in cost is divided by the difference in pounds of conventional pollutants removed, resulting in an estimate of the "dollars per pound" of pollutant removed; that is used as a benchmark value. The proposed POTW test benchmark is \$0.30 per pound (1978 dollars).

Part 2 of the BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be evaluated internally to the industry. In order to develop a benchmark that assesses a reasonable relationship between cost and removal, EPA has developed an industry cost ratio which compares the dollar per pound of conventional pollutant removed in going from primary to secondary treatment levels with that of going from secondary to more advanced treatment levels. The basis of costs for the calculation of this ratio are the costs incurred by a POTW. EPA used these costs because: they reflect the treatment technologies most commonly used to remove conventional pollutants from wastewater; the treatment levels associated with them compare readily to the levels considered for industrial dischargers, and the costs are the most reliable for

the treatment levels under consideration. The proposed industry subcategory benchmark is 1.42. If the industry figure for a subcategory is lower than 1.43, the subcategory passes the BCT test.

The Agency usually considers two conventional pollutants in the cost test, TSS and an oxygen-demanding pollutant. Although both oil and grease and BOD<sub>5</sub> are considered to be oxygen-demanding substances by EPA (see 44 FR 50733), only one can be selected in the cost analysis to conform to procedures used to develop POTW costs. Oil and grease is used rather than BOD<sub>5</sub> in the cost analysis performed for nonferrous metals manufacturing waste streams due to the common use of oils in casting operations in this industry.

BPT is the base for evaluating limitations on conventional pollutants (i.e., it is assumed that BPT is already in place). The test evaluates the costs and removals associated with treatment and controls in addition to that specified as BPT.

If the conventional pollutant removal cost of the candidate BCT is less than the POTW cost, Part 1 of the cost-reasonableness test is passed and Part 2 (the internal industry test) of the cost-reasonableness test must be performed. If the internal industry test is passed, then a BCT limitation is promulgated equivalent to the candidate BCT level. If all candidate BCT technologies fail both parts of the cost-reasonableness test, the BCT requirements for conventional pollutants are equal to BPT.

BPT and BAT effluent limitations for secondary copper smelting are zero discharge of process wastewater pollutants. These effluent limitations control the discharge of toxic and non-conventional pollutants. Likewise, they incidentally provide adequate control of conventional pollutants. Consequently, EPA is not proposing BCT effluent limitations for secondary copper smelting.

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION I

#### SUMMARY AND CONCLUSIONS

On April 8, 1974, EPA promulgated technology-based effluent limitations guidelines and performance standards for the secondary aluminum smelting subcategory of the nonferrous metals manufacturing point source category. Those regulations included BPT, BAT, NSPS, and PSNS limitations. The main purpose of these effluent guidelines and standards was to limit the quantities of total suspended solids, chemical oxygen demand, fluoride, ammonia, aluminum, and copper, and the range of pH found in secondary aluminum smelting wastewater discharges. On December 15, 1976, EPA promulgated technology-based pretreatment standards for existing sources (PSES) in the secondary aluminum subcategory. The main purpose of these standards was to limit the quantities of ammonia, oil and grease, and the range of pH found in secondary aluminum smelting wastewater discharges.

Since 1974, implementation of the technology-based effluent limitations and standards has been guided by a series of settlement agreements into which EPA entered with several environmental groups, the latest of which occurred in 1979. NRDC v. Costle, 12 ERC 1833 (D.D.C. 1979), aff'd and remd'd, EDF v. Costle, 14 ERC 2161 (1980). Under the settlement agreements, EPA was required to develop BAT limitations and pretreatment and new source performance standards for 65 classes of pollutants discharged from specific industrial point source categories, including secondary aluminum smelting. The list of 65 classes was subsequently expanded to a list of 129 specific toxic pollutants, and now consists of 126 toxics.

Congress amended the Clean Water Act in 1977 to encompass many of the provisions of the earlier settlement agreements, including the list of 65 classes of pollutants. As a result of the settlement agreements and the Clean Water Act Amendments, EPA undertook an extensive effort to develop technology-based BAT limitations and pretreatment and new source performance standards for the toxic pollutants.

EPA is proposing modifications to BAT, NSPS, PSES and PSNS and the establishment of BCT for this subcategory pursuant to the provisions of the Settlement Agreement and Sections 301, 304, 306, and 307 of the Clean Water Act and its amendments. Consideration will be given to incorporation of limits on priority pollutant levels in discharges in these modified standards. This supplement provides a compilation and analysis of the background material used to develop these effluent guidelines.

The secondary aluminum subcategory is comprised of 55 plants. Of the 55 plants, eight discharge directly to rivers, lakes, or streams; 13 discharge to publicly owned treatment works (POTW); and 34 achieve zero discharge of process wastewater.

EPA first studied the secondary aluminum subcategory to determine whether differences in raw materials, final products, manufacturing processes, equipment, age and size of plants, water usage, required the development of separate effluent limitations and standards for different segments of the subcategory. This involved a detailed analysis of wastewater discharge and treated effluent characteristics, including (1) the sources and volume of water used, the processes used, and the sources of pollutants and wastewaters in the plant; and (2) the constituents of wastewaters, including toxic pollutants.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary aluminum subcategory. The Agency analyzed both historical and newly generated data on the performance of these technologies, including their nonwater quality environmental impacts (air quality impacts and 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 category. 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 Economic Impact Analysis of Proposed Effluent Limitations and Standards for the Nonferrous Smelting and Refining Industry.

Based on consideration of the above factors, EPA identified various control and treatment technologies which formed the basis for BPT and selected control and treatment appropriate for each set of standards and limitations. The mass limitations and standards for BPT, BAT, NSPS, PSES, PSNS, and BCT are presented in Section II.

For BAT, the Agency has built upon the BPT basis of lime precipitation and sedimentation by adding in-process control technologies, preliminary treatment of ammonia by steam stripping, and multimedia filtration. In-process control technologies include recycle or reuse of process water from wet air pollution control and metal contact cooling. Filtration is added as an effluent

polishing step to further reduce metals and suspended solids concentrations. To meet the BAT effluent limitations based on this technology, the secondary aluminum subcategory is estimated to incur a capital cost of \$1.6 million (1978 dollars) and an annual cost of \$1.35 million (1978 dollars).

The best demonstrated technology (BDT), which is the technical basis of NSPS, is equivalent to BAT. In modifying BDT, 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. Treatment of toxic metals is based upon lime precipitation, sedimentation, and filtration. Oil skimming is included for the control of oil and grease.

Pretreatment standards for existing sources are based on the same technology as BAT. The technology basis is in-process flow reduction, ammonia steam stripping preliminary treatment, lime precipitation, sedimentation, and multimedia filtration. To meet PSES, the secondary aluminum subcategory is estimated to incur a capital cost of \$2.4 million (1978 dollars) and an annual cost of \$1.6 million (1978 dollars). The Agency is proposing alternative concentration-based and mass-based PSES for this subcategory. Mass-based standards ensure that dilution is not used as a means of achieving effluent limitations. They are particularly important when a limitation is based on flow reduction since flow reduction must be measured as a reduction of mass discharged. However, in the secondary aluminum subcategory flow reduction over current discharge rates is minimal (0.2 percent).

For pretreatment standards for new sources, the technology basis of in-process flow reduction, preliminary treatment, and end-of-pipe technology is equivalent to NSPS. As such, PSNS are identical to NSPS for all waste streams. Alternative mass-based and concentration-based PSNS are not proposed, since PSNS includes significant flow reduction (90 percent flow reduction of direct chill casting wastewater).

The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. The technology basis of BCT is preliminary treatment of selected waste streams by ammonia steam stripping and oil skimming, and lime precipitation and sedimentation end-of-pipe technology.

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION II

#### RECOMMENDATIONS

1. EPA has divided the secondary aluminum subcategory into seven subdivisions for the purpose of effluent limitations and standards. These subdivisions are:
  - (a) Scrap drying wet air pollution control,
  - (b) Scrap screening and milling,
  - (c) Dross washing,
  - (d) Demagging wet air pollution control,
  - (e) Direct chill casting contact cooling,
  - (f) Stationary casting contact cooling, and
  - (g) Shot casting contact cooling.
2. EPA promulgated BPT effluent limitations for the secondary aluminum subcategory on April 8, 1974, as Subpart C of 40 CFR Part 421. At this time, EPA is not proposing any modifications to BPT effluent limitations. The BPT effluent limitations apply to discharges resulting from magnesium removal processes (demagging using either chlorine or aluminum fluoride) and wet residue processes. BPT was promulgated based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology. The following BPT effluent limitations were promulgated for existing sources:
  - (a) The following limitations establish the quantity or quality of pollutants or pollutant properties, which may be discharged by a point source subject to the provisions of this subpart and which uses water for metal cooling, after application of the best practicable control technology currently available: There shall be no discharge of process wastewater pollutants to navigable waters.
  - (b) The following limitations establish the quantity or quality of pollutants or pollutant properties which may be discharged by a point source subject to the provisions of this subpart and which uses aluminum fluoride in its magnesium removal process ("demagging process"), after application of the best practicable control technology currently available: There shall be no discharge of process wastewater pollutants to navigable waters.

- (c) The following limitations establish the quantity or quality of pollutants or pollutant properties controlled by this section, which may be discharged by a point source subject to the provisions of this subpart and which uses chlorine in its magnesium removal process, after application of the best practicable control technology currently available:

Effluent Characteristic	Effluent Limitations
	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 kg magnesium removed)
	English units (lbs per 1,000 lbs magnesium removed)
TSS	175
COD	6.5
pH	Within the range of 7.5 to 9.0

- (d) The following limitations establish the quantity or quality of pollutants or pollutant properties which may be discharged by a point source subject to the provisions of this subpart and which processes residues by wet methods, after application of the best practical control technology currently available:

Effluent Characteristic	Effluent Limitations
	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 kg magnesium removed)
	English units (lbs per 1,000 lbs magnesium removed)
TSS	1.5
Fluoride	0.4
Ammonia (as N)	0.01
Aluminum	1.0
Copper	0.003
COD	1.0
pH	Within the range of 7.5 to 9.0

3. EPA is proposing to modify BAT 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 proposed for existing sources:

(a) Scrap Drying Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap dried		
English Units - lbs/billion lbs of aluminum scrap dried		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

(b) Scrap Screening and Milling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap screened and milled		
English Units - lbs/billion lbs of aluminum scrap screened and milled		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

(c) Dross Washing  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of dross washed		
English Units - lbs/billion lbs of dross washed		
Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Aluminum	32,930.04	13,476.32
Ammonia (as N)	1,445,444.0	636,864.80



(d) Demagging Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Lead	80.0	72.0
Zinc	816.0	336.0
Aluminum	2,424.0	992.0
Ammonia (as N)	106,400.0	46,880.0

(e) Direct Chill Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum product from direct chill casting		
English Units - lbs/billion lbs of aluminum product from direct chill casting		
Lead	199.90	179.91
Zinc	2,038.98	839.58
Aluminum	6,056.97	2,478.76
Ammonia (as N)	265,867.0	117,141.40

(f) Stationary Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from stationary casting		
English Units - lbs/billion lbs of aluminum produced from stationary casting		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

(g) Shot Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from shot casting		
English Units - lbs/billion lbs of aluminum produced from shot casting		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

4. EPA is proposing to modify NSPS 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 and oil skimming for selected waste streams. The following effluent standards are proposed for new sources:

(a) Scrap Drying Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap dried		
English Units - lbs/billion lbs of aluminum scrap dried		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and Grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Scrap Screening and Milling NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap screened and milled		
English Units - lbs/billion lbs of aluminum scrap screened and milled		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and Grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Dross Washing NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of dross washed		
English Units - lbs/billion lbs of dross washed		
Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Aluminum	32,930.04	13,476.32
Ammonia (as N)	1,445,444.0	636,864.80
Oil and Grease	108,680.0	108,680.0
TSS	163,020.0	130,416.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Demagging Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Lead	80.0	72.0
Zinc	816.0	336.0
Aluminum	2,424.0	992.0
Ammonia (as N)	106,400.0	46,880.0
Oil and Grease	8,000.0	8,000.0
TSS	12,000.0	9,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Direct Chill Casting Contact Cooling NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of aluminum produced from  
direct chill casting

English Units - lbs/billion lbs of aluminum produced from  
direct chill casting

Lead	199.90	179.91
Zinc	2,038.98	839.58
Aluminum	6,056.97	2,478.76
Ammonia (as N)	265,867.0	117,141.40
Oil and Grease	19,990.0	19,990.0
TSS	29,985.0	23,988.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Stationary Casting Contact Cooling NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of aluminum produced from stationary  
casting

English Units - lbs/million lbs of aluminum produced from  
stationary casting

Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and Grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(g) Shot Casting Contact Cooling NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of aluminum produced from shot casting  
English Units - lbs/billion lbs of aluminum produced  
from shot casting

Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and Grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

5. EPA is proposing to modify PSES 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 mass-based pretreatment standards are proposed for existing sources:

(a) Scrap Drying Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of aluminum scrap dried  
English Units - lbs/billion lbs of aluminum scrap dried

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(b) Scrap Screening and Milling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of aluminum scrap screened and milled  
English Units - lbs/billion lbs of aluminum scrap screened  
and milled

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(c) Dross Washing PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of dross washed		
English Units - lbs/billion lbs of dross washed		
Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Ammonia (as N)	1,445,444.0	636,864.80

(d) Demagging Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Lead	80.0	72.0
Zinc	816.0	336.0
Ammonia (as N)	106,400.0	46,880.0

(e) Direct Chill Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from direct chill casting		
English Units - lbs/billion lbs of aluminum produced from direct chill casting		
Lead	199.90	179.91
Zinc	2,038.98	839.58
Ammonia (as N)	265,867.0	117,141.40

(f) Stationary Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from stationary casting		
English Units - lbs/billion lbs of aluminum produced from stationary casting		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(g) Shot Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/kg of aluminum produced from shot casting  
English Units - lbs/billion lbs of aluminum produced from  
shot casting

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

6. Alternatively, concentration-based standards are proposed for the modifications to PSES based on the same end-of-pipe technologies used for the proposed mass-based standards. The concentrations presented below apply to all process wastewater streams for which allowances were given under the mass-based standards proposed above. The following concentration-based pretreatment standards are proposed for existing sources:

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
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Metric Units - mg/l  
English Units - ppm

Lead	0.10	0.09
Zinc	1.02	0.42
Ammonia (as N)	133	58.6

7. EPA is proposing to modify PSNS 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 mass-based pretreatment standards are proposed for new sources:

(a) Scrap Drying Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/l		
English Units - ppm		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(b) Scrap Screening and Milling PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap screened and milled		
English Units - lbs/billion lbs of aluminum scrap screened and milled		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(c) Dross Washing PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of dross washed		
English Units - lbs/billion lbs of dross washed		
Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Ammonia (as N)	1,445,444.0	636,864.80

(d) Demagging Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Lead	80.0	72.0
Zinc	816.0	336.0
Ammonia (as N)	106,400.0	46,880.0



(e) Direct Chill Casting Contact Cooling PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from direct chill casting		
English Units - lbs/billion lbs of aluminum produced from direct chill casting		
Lead	199.90	179.91
Zinc	2,038.98	839.58
Ammonia (as N)	265,867.0	117,141.40

(f) Stationary Casting Contact Cooling PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from stationary casting		
English Units - lbs/billion lbs of aluminum produced from stationary casting		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(g) Shot Casting Contact Cooling PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from shot casting		
English Units - lbs/billion lbs of aluminum produced from shot casting		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

8. BCT is proposed 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 and oil skimming for selected waste streams. The following BCT limitations are proposed for existing direct dischargers:

(a) Scrap Drying Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap dried		
English Units - lbs/billion lbs of aluminum scrap dried		
Oil and Grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Scrap Screening and Milling  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap screened and milled		
English Units - lbs/billion lbs of aluminum scrap screened and milled		
Oil and Grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Dross Washing  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of dross washed		
English Units - lbs/billion lbs of dross washed		
Oil and Grease	217,360.0	130,416.0
TSS	445,588.0	217,360.0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Demagging Wet Air Pollution control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Oil and Grease	16,000.0	9,600.0
TSS	32,800.0	16,000.0
pH	Within the range of 7.5 to 10.0 at all times	

(e) Direct Chill Casting Contact Cooling  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from direct chill casting		
English Units - lbs/billion lbs of aluminum produced from direct chill casting		
Oil and Grease	39,980.0	23,988.0
TSS	81,959.0	39,980.0
pH	Within the range of 7.5 to 10.0 at all times	

(f) Stationary Casting Contact Cooling  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from stationary casting		
English Units - lbs/billion lbs of aluminum produced from stationary casting		
Oil and Grease	0	0
TSS	0	0
pH	0	0
	Within the range of 7.5 to 10.0 at all times	

(g) Shot Casting Contact Cooling  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for</u>	
	<u>Any One Day</u>	<u>Monthly Average</u>
Metric Units - mg/kg of aluminum produced from shot casting		
English Units - lbs/billion lbs of aluminum produced from shot casting		
Oil and Grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION III

#### INDUSTRY PROFILE

This section of the Secondary Aluminum Supplement describes the raw materials and processes used in reducing recycling aluminum and presents a profile of the secondary aluminum plants identified in this study. For a discussion of the purpose, authority, and methodology for this study and a general description of the nonferrous metals manufacturing category, refer to Section III of the General Development Document.

#### DESCRIPTION OF SECONDARY ALUMINUM PRODUCTION

Secondary aluminum production involves two basic process steps: pretreatment and smelting and refining. A pretreatment step is required before smelting and refining operations can be undertaken because this industry uses essentially scraps (much of which is contaminated) for its raw material. The two processes, their components, and variations are discussed below. Figure III-1 represents a general flow diagram of the two process steps.

#### RAW MATERIALS

The secondary aluminum subcategory uses aluminum-bearing scrap to produce metallic aluminum and aluminum alloys. Much of the scrap used is purchased from scrap dealers of industrial plants. There are five primary classifications of scrap processed: old sheet and castings, new clippings and forgings, borings and turnings, residues, and high iron.

New scrap is produced during the manufacture of a finished product and originates from the aircraft industry, aluminum formers, and other manufacturing plants. Old scrap (sheet and castings) is comprised of worn out, damaged or obsolete articles and includes automobile parts, household items, and airplane parts. Borings and turnings are by-products of the machining of castings, rods, and forgings by the aircraft and automobile industry. Residues consist of drosses, skimmings, and slags which are obtained from primary reduction plants, secondary smelting plants, casting plants, and foundries. Foil from discarded packaging constitutes a minor source of raw material for this industry. High iron aluminum scraps which are to be reused in the secondary aluminum subcategory require more extensive treatment before smelting than other sources of scrap aluminum.

#### PRETREATMENT

Scrap pretreatment involves preparing the material for further processing and removing contaminants. As Figure III-1 indicates,

the scrap pretreatment process varies depending on the source and type of raw material being handled. There is also variation in the degree to which scrap is pretreated among facilities. There are three general methods of pretreating: mechanical, hydrometallurgical, and pyrometallurgical, with the method used being dependent on the type of scrap. The mechanical method involves shredding and classifying, baling, and milling and screening. Hydrometallurgical treatment involves leaching with water, and pyrometallurgical processing involves burning and drying and sweating. Depending on the type of raw material, pretreatment may consist of a combination of these methods before smelting and refining is effected.

Old sheet, castings, and clippings preparation is a dry process that can vary from no pretreatment to crushing and screening that compacts the scrap. New clippings and forgings usually require little preparation other than sorting; however, they may be contaminated with cutting oils, and may require crushing and drying to remove the oils. Cable, which is not considered a major source for the secondary aluminum subcategory, requires shredding and classifying to remove the insulation and ferrous portions from the aluminum. The borings and burnings are also often contaminated by cutting oils and require burning or drying to remove that contaminant. The entire procedure consists of (1) crushing the borings and turnings to compact the scrap, (2) heating the scrap in an oil or gas-fired rotary dryer to remove organic material and water, (3) screening to remove aluminum fines, and (4) magnetically removing the tramp iron.

Residues, such as drosses, skimmings, and slags, contain 10 to 30 percent aluminum, as well as oxides, carbides, nitrides, fluxing salts, and other contaminants. Metallic aluminum can be liberated from the impurities using either dry or wet processes. The dry process consists of milling, screening, and magnetic separation for iron removal. The wet process involves milling and leaching with water to remove the contaminants. The washed material is then screened, dried, and passed through a magnetic separator. Heavy metallic skims, a minor source of aluminum, require little pretreatment.

Foil, which is another minor source of raw material for the subcategory, is usually pretreated by roasting to remove paper or wax backings. High iron content scrap often is subjected to sweating treatment to remove impurities. This process involves placing the iron-contaminated aluminum in a sweating furnace. This furnace has sloped sides and the molten aluminum flows down the slope, leaving the higher melting point materials such as iron behind. Alternately, the high iron scrap also can be purified by crushing it and removing the iron magnetically.

## SMELTING AND REFINING

The second step of the manufacturing process for the secondary aluminum subcategory is smelting and refining. This step actually consists of five substeps: charging scrap to the furnace; addition of fluxing agents; addition of alloying agents; demagging or degassing; and skimming.

Charging of scrap into the furnace can be a batch process or a continuous process. Each cycle, called a "heat", will vary in length depending on the process. Charging wells are often designed to permit the introduction of chips and scrap below the surface of a previously melted charge called a "heel." This design not only minimizes oxidation, but provides for more efficient application of pollution control systems.

The next step is fluxing the molten charge. There are two general types of fluxes: cover fluxes that are used to reduce oxidation of the melt by air, and solvent fluxes that react with contaminants such as nonmetallics, residues from burned coatings, and dirt to form insolubles which float on the surface of the melt as slag.

Next, alloying agents are added to the melt in varying amounts according to production specifications. Copper, silicon, manganese, or zinc are typical alloys added. Mixing the furnace contents is necessary to assure uniform composition. Nitrogen or other inert gases may be injected to aid in the mixing. Magnesium is another alloying agent used. However, scrap aluminum, received by the secondary aluminum smelters averages about 0.3 to 0.5 percent magnesium, while the product line of alloys produced averages about 0.1 percent. Therefore, after the furnace is fully charged and the melt brought up to the desired chemical specification, it is usually necessary to remove the excess magnesium (known as "demagging").

Demagging is accomplished with chlorine or chlorinating agents, such as anhydrous aluminum chloride or chlorinated organics, or with aluminum fluoride. Magnesium chloride or magnesium fluoride is formed and collected in the fluxing agents on top of the molten melt. As the magnesium is depleted, chlorine will consume aluminum and the excess aluminum chloride or aluminum fluoride present volatilizes into the surrounding air and is a source of air pollution.

Magnesium is the only metal removable from the alloy in this manner. Other metal alloy levels must be adjusted by the addition of either more aluminum (dilution) or more of the metal.

Chlorination is performed at temperatures between 760 and 815°C. As a rule of thumb, the reaction requires 3.5 kilograms of

chlorine per kilogram of magnesium removed. Elemental chlorine gas is fed under pressure through tubes or lances to the bottom of the melt. As it bubbles through the melt, it reacts with magnesium and aluminum to form chlorides, which float to the melt surface where they combine with the fluxing agents and are skimmed off. Because magnesium is above aluminum in the electromotive series, aluminum chloride will be reduced by any available magnesium in the melt. At the beginning of the demagging cycle, the principal reaction product is magnesium chloride. As magnesium is removed and there is less available for reaction with chlorine, the reaction of chlorine with aluminum becomes more significant, the reduction of the aluminum chloride by magnesium becomes less likely, and the production of aluminum chloride, a volatile compound, becomes significant. The aluminum chloride escapes and considerable fuming results from the chlorination, making ventilation and air pollution equipment necessary. Control of fumes is frequently accomplished by wet scrubbing and, thus, is a source of water contamination.

Aluminum fluoride as a demagging agent reacts with the magnesium to form magnesium fluoride, which in turn combines with the flux on top of the melt, where it is skimmed off. In practice, about 4.3 kilograms of aluminum fluoride are required per kilogram of magnesium removed. The air contaminants exist as gaseous fluorides or as fluoride dusts and are a source of air pollution. The fluorides are controlled by either dry or wet methods. When dry scrubbing is used, a solid waste is generated. When wet scrubbing is used, both water pollution and solid waste are generated.

Some facilities in the secondary aluminum subcategory are not limited by a magnesium content in their product, particularly the deoxidant manufacturers, and they make no attempt to remove magnesium. Therefore, these plants do not contend with the magnitude of fumes produced by demagging, and as a result, do not require extensive air pollution control equipment and related water usage.

In the skimming step, the dross or slag, with its associated impurities, is skimmed from the molten aluminum. The cooled slag is stored for shipment to a residue processor, recycled, or discarded.

The product line(s) of each smelter can be categorized as specification alloy ingots, billets, hot metal, notched bar, shot, and hardeners. Specification alloy ingots, used by foundries for casting, are the most important products of the secondary aluminum subcategory. Cooling can be done with either contact or noncontact cooling water, and air cooling is also used.



Plants using contact cooling water recycle systems generate intermittent discharges (accompanied with sludge removal). Billets, manufactured for use in extrusion plants, are cooled with noncontact water that is recycled. Sometimes the molten metal is poured directly into preheated crucibles, then shipped while still in a molten form. No water is used. Notched bar molds may be air or water cooled with either contact or noncontact water.

Direct chill casting is characterized by continuous solidification of the metal while it is being poured. The length of an ingot cast using this method is determined by the vertical distance it is allowed to drop rather than by mold dimensions. Molten aluminum is tapped from the melting furnace and flows through a distributor channel into a shallow mold. Noncontact cooling water circulates within this mold, causing solidification of the aluminum. The base of the mold is attached to a hydraulic cylinder which is gradually lowered as pouring continues. As the solidified aluminum leaves the mold, it is sprayed with contact cooling water to reduce the temperature of the forming ingot. The cylinder continues to descend into a tank of water, causing further cooling of the ingot as it is immersed. When the cylinder has reached its lowest position, pouring stops and the ingot is lifted from the pit. The hydraulic cylinder is then raised and positioned for another casting cycle.

Aluminum shot is also used as a deoxidant in the steel industry. Molten metal is poured into a vibrating feeder, where droplets of molten metal are formed through perforated openings. The droplets are cooled in a quench tank. Water is generally recycled, and periodic sludge removal is required.

#### PROCESS WASTEWATER SOURCES

The primary areas of water use and wastewater production in the secondary aluminum subcategory are as follows:

1. Scrap drying wet air pollution control,
2. Scrap screening and milling,
3. Dross washing,
4. Demagging wet air pollution control, and
5. Direct chill casting contact cooling water,
6. Stationary casting contact cooling water,
7. Shot casting contact cooling water.

#### OTHER WASTEWATER SOURCES

There are other waste streams associated with the production of secondary aluminum. These waste streams include but are not limited to:

1. Maintenance and cleanup water, and
2. Stormwater runoff.

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

#### AGE, PRODUCTION, AND PROCESS PROFILE

Figure III-2 shows the location of 55 secondary aluminum reduction plants. Most of the plants are located in the eastern United States, and most are in urban areas near raw materials and markets. The notations within the states indicated the type of discharge the facilities use, direct (D), indirect (I), or zero (Z).

The data in Table III-1 indicate that the majority of facilities (30) are less than 25 years old, reflecting relative recent development of this industry.

In addition, most facilities practice zero discharge with only 15 percent (eight facilities) discharging directly.

The data in Table III-2 indicate that the majority of facilities produce between 5,000 and 20,000 tons per year of secondary aluminum. Table III-3 provides a summary of the plants having the various secondary aluminum processes; the number of plants generating wastewater from the processes is also shown.

Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS  
IN THE SECONDARY ALUMINUM SUBCATEGORY BY DISCHARGE TYPE

Type of Plant Discharge	1978- 1973 <u>0-5</u>	1972- 1968 <u>6-10</u>	1967- 1958 <u>11-20</u>	1957- 1948 <u>21-30</u>	1947- 1938 <u>31-40</u>	1937- 1928 <u>41-50</u>	1927- 1918 <u>51-60</u>	1917- 1903 <u>61-75</u>	Before 1903 <u>75+</u>	Insuff. Data	Total
Direct	0	4	0	3	1	0	0	0	0	0	8
Indirect	0	4	3	1	1	1	2	1	0	0	13
Zero	<u>7</u>	<u>4</u>	<u>8</u>	<u>8</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>3</u>	<u>34</u>
Total	7	12	11	12	3	2	3	2	0	3	55

Table III-2

PRODUCTION RANGES FOR SMELTERS AND REFINERS  
OF THE SECONDARY ALUMINUM SUBCATEGORY

<u>Production Ranges for 1976 (Tons/Year)</u>	<u>Number of Plants</u>
0 - 2,500	5
2,501 - 5,000	8
5,001 - 10,000	19
10,001 - 20,000	13
20,001 - 30,000	4
30,000 +	4
No Data	<u>2</u>
Total Number of Plants in Survey	55

Table III-3

## SUMMARY OF SUBCATEGORY PROCESSES AND ASSOCIATED WASTE STREAMS

<u>Process</u>	<u>Number of Plants With Process</u>	<u>Number of Plants Reporting Generating Wastewater</u>
Scrap Drying Air Pollution Control	28	3
Scrap Screening and Milling	21	2
Dross Classification	5	4
Dust Air Pollution Control	16	0
Demagging Air Pollution Control	34	19
Casting	54	38

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

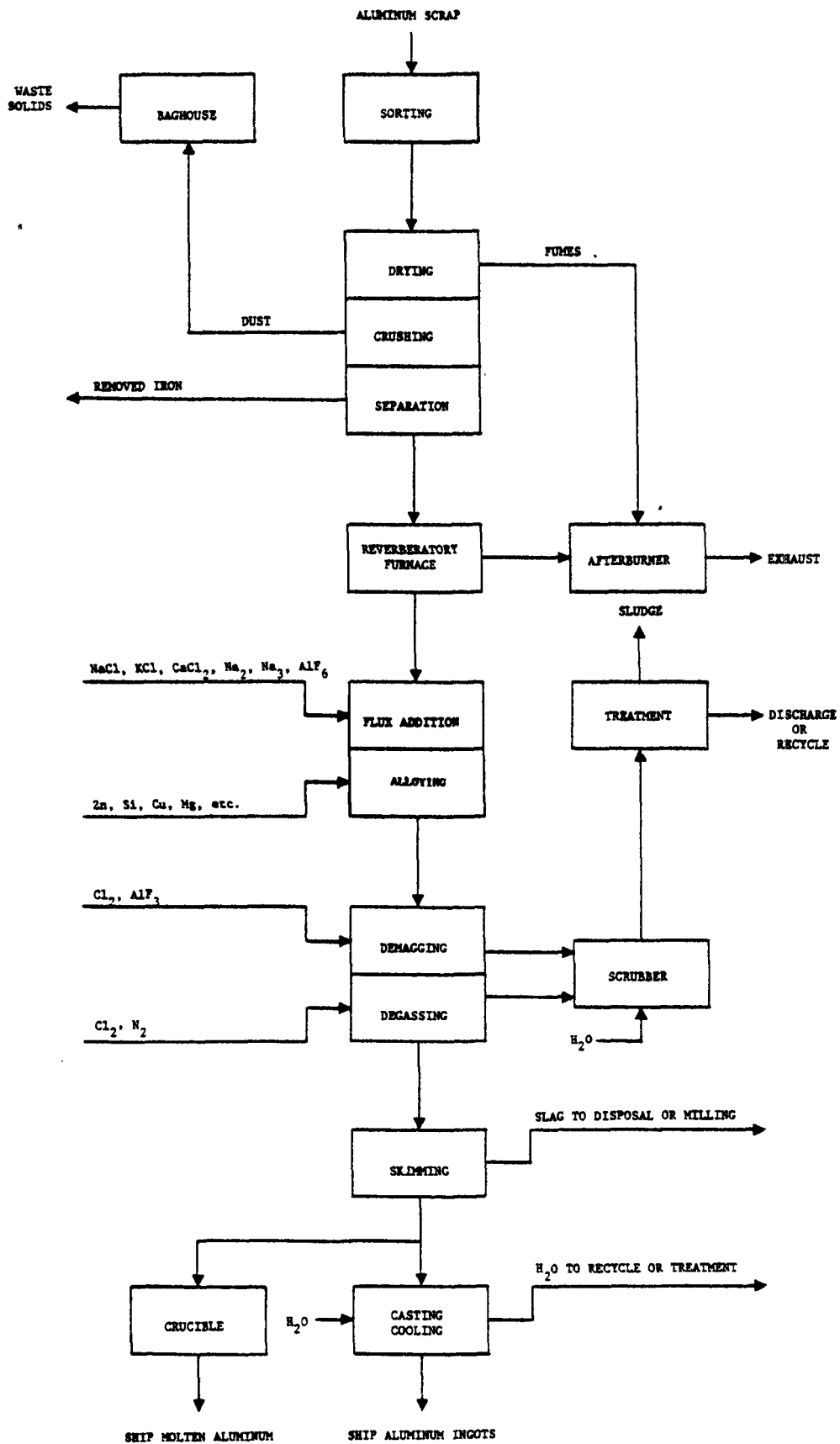


Figure III-1  
SECONDARY ALUMINUM SMELTING PROCESS

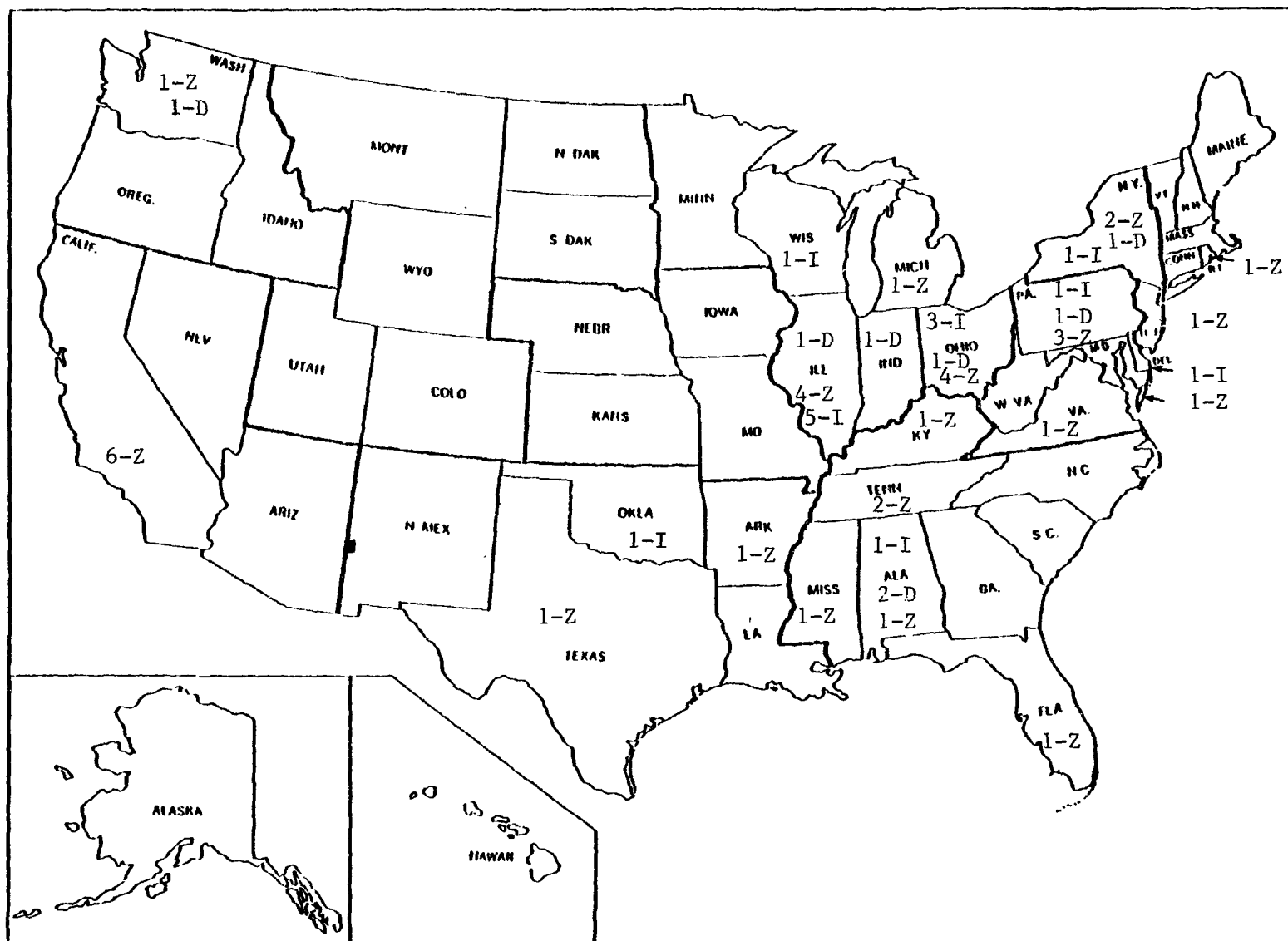


Figure III-2

GEOGRAPHIC LOCATIONS OF THE SECONDARY  
ALUMINUM SUBCATEGORY PLANTS

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION IV

#### SUBCATEGORIZATION

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

#### FACTORS CONSIDERED IN SUBCATEGORIZATION

The following factors were evaluated for use in determining appropriate subcategories for the nonferrous metals subcategory:

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

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

In Section IV of the General Development Document, each of these factors is described, and the rationale for selecting metal product, manufacturing processes, and raw materials as the principal factors used for subcategorization is discussed. On this basis, the nonferrous metals manufacturing category (phase I) was divided into 12 subcategories, one of them being secondary aluminum.



Secondary aluminum was identified as a subcategory in a final regulation promulgated in 1974 and BPT, BAT, NSPS, and PSNS effluent limitations and standards were established for the secondary aluminum subcategory. The purpose of this study is to support proposed modifications to the BAT, NSPS, and PSNS regulations.

#### FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY ALUMINUM SUBCATEGORY

The factors listed above were each evaluated when establishing the secondary aluminum subcategory and its subdivisions. In the discussion that follows, the factors will be described as they pertain to this particular subcategory. Subcategorization of the entire nonferrous metals industry and evaluation of the factors used in this process are discussed in Section IV of the General Development Document.

The rationale for subdividing the secondary aluminum subcategory considers the diversity in source of raw materials, the use of certain manufacturing processes by only a few facilities, and the differences in available technologies for final product processing (i.e., contact cooling water, air cooling, and noncontact cooling water).

The raw materials used by secondary aluminum plants are either solid scraps (clippings and forgings, borings and turnings, and old sheet and castings) or residues from aluminum reduction and smelting. Since all secondary smelters use the various types of scraps at one time or another, the type of scrap cannot be used as a basis for subcategorization. However, many plants have scrap drying operations. Most of these plants use air pollution control devices in this process. A few plants use wet scrubbers which produce wastewater. Some facilities also use water in scrap screening and milling, generating wastewater. Therefore, scrap drying wet air pollution control and scrap screening and milling should be considered subdivisions.

Furnace residue processing to recover aluminum can produce a wastewater stream with treatable pollutant concentrations. Five facilities process furnace residues, and four of these use water for the processing. Since this process produces a potentially contaminated waste stream it has been identified as a subdivision.

Plants practicing magnesium removal (demagging), use either a chlorine or aluminum fluoride process. The demagging process requires air pollution control devices to minimize fuming. Wet scrubbing can be practiced with both types of demagging and the resulting scrubber water is usually treated by pH adjustment and settling.

Thirty-four plants demag, 19 generate wastewater from fume scrubbing. Because the demagging process can produce a contaminated wastewater, it has been identified as a subdivision within the secondary aluminum subcategory.

The final secondary aluminum process step is casting. The technique for cooling the aluminum into various shapes varies within the subcategory and with the product. Air cooling, water contact cooling, and water noncontact cooling are all used. When water contact cooling is used, the cooling water is frequently recycled. However, a blowdown stream may be necessary to dissipate the buildup of dissolved solids. This blowdown stream may have, in addition to treatable dissolved solids, oil and grease and phenolics, depending on whether lubricants are used in casting. This manufacturing process with has also been considered for subdivision within the secondary aluminum subcategory.

Within the secondary aluminum subcategory the processes that produce the wastewaters discussed previously, residue processing wastewater, demagging fume scrubber liquors, and contact cooling water, are not all present at all facilities. Some facilities may have one, others combinations of two, and still others all three. The building block approach used in this regulation accommodates these differences by establishing limitations and standards for each waste stream.

Limitations will be based on specific flow allowances for the following subdivisions:

1. Scrap drying wet air pollution control,
2. Scrap screening and milling,
3. Dross washing,
4. Demagging wet air pollution control,
5. Direct chill casting contact cooling,
6. Stationary casting contact cooling, and
7. Shot casting contact cooling.

#### Other Factors

The other factors considered in this evaluation either supported the establishment of the secondary aluminum subcategory and its subdivisions or were shown to be inappropriate bases for subcategorization. Air pollution control methods, treatment costs, nonwater quality aspects, and total energy requirements were each shown to be functions of the selected subcategorization factors--metal product, raw materials, and production processes. As such, they support the method of subcategorization which has been applied. 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 as bases for subcategorization of nonferrous metal plants.

## PRODUCTION NORMALIZING PARAMETERS

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, the production normalizing parameter (PNP), is developed in conjunction with subcategorization.

In general, the amount of aluminum produced by the respective manufacturing process is used as the PNP. The PNP's for the seven secondary aluminum subdivisions are:

<u>Subdivision</u>	<u>PNP</u>
1. Scrap drying wet air pollution control	kkg of aluminum scrap dried
2. Scrap screening and milling	kkg of scrap screened or milled
3. Dross washing	kkg of dross washed
4. Demagging wet air pollution control	kkg of aluminum demagged
5. Direct chill casting contact cooling	kkg of aluminum cast
6. Stationary casting contact cooling	kkg of aluminum cast
7. Shot casting contact cooling	kkg of aluminum cast

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION V

#### WATER USE AND WASTEWATER CHARACTERISTICS

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

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

In order to quantify the pollutant discharge from secondary aluminum 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. Wastewater samples were collected in two phases: screening and verification. The first phase, screen sampling, was to identify which toxic pollutants were present in the wastewaters from production of the various metals. Screening samples were analyzed for 128 of the 129 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. There is no reason to expect that TCDD would be present in secondary aluminum wastewater.) A total of 10 plants were selected for screening sampling in the nonferrous metals manufacturing category, one of those being a secondary aluminum plant. In general, the samples were analyzed for three classes of pollutants: toxic organic pollutants, toxic metal pollutants, and criteria pollutants (which includes conventional and nonconventional pollutants).

As described in Section IV of this supplement, secondary aluminum plants have been categorized into seven subdivisions. 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.

## WASTEWATER SOURCES, DISCHARGE RATES, AND CHARACTERISTICS

The wastewater data presented in this section were evaluated in light of production process information compiled during this study. As a result, it was possible to identify the principal wastewater sources in the secondary aluminum subcategory. The result of this analysis is summarized in the following discussion.

Sources of process wastewater within the secondary aluminum subcategory include:

1. Scrap drying wet air pollution control,
2. Scrap screening and milling,
3. Dross washing,
4. Demagging wet air pollution control,
5. Direct chill casting contact cooling water,
6. Stationary casting contact cooling, and
7. Shot casting contact cooling.

Data supplied by data collection portfolio 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 or other fluid (e.g., emulsions, lubricants) required for a given process per mass of aluminum 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 used) 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 aluminum produced. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carryover on the product. The production values in calculation correspond to the production normalizing parameter, PNP, assigned to each stream, as outlined in Section IV. The production normalized flows were compiled by stream type. 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 X, XI, and XII, where representative BAT, BDT, and pretreatment discharge flows are selected for use in calculating the effluent limitations and standards. As an example, casting cooling water wastewater flow is related to the casting production. As such, the discharge rate is expressed in liters of cooling water per metric ton of casting production (gallons of cooling water wastewater per ton of aluminum reduction production).

In order to quantify the concentrations of pollutants present in wastewater from secondary aluminum plants, wastewater samples were collected at five plants. Diagrams indicating the sampling sites and contributing production processes are shown in Figures V-1 to V-5.

The reported water use and discharge rates for the seven identified secondary aluminum wet operations are given in Tables V-1, 2, 3, 5, 7, and 8. The raw wastewater sampling data for the facilities sampled are presented in Tables V-4, V-6, and V-9. Table V-10 shows combined raw wastewater data from demagging scrubbing and casting contact cooling.

The treated wastewater data are shown in Tables V-11 through V-14. The locations and stream codes of the samples taken are identified on the process flow diagrams in Figures V-1 through V-5. Where no data is listed for a specific day of sampling, the wastewater samples for the stream were not collected. If the analysis did not detect a pollutant in a waste stream, the pollutant was omitted from the table.

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

These detection limits shown on the data tables are not the same as 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. Data reported as an asterisk are considered as detected but below quantifiable concentrations, and a value of zero is used for averaging. Toxic 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 excluded in

calculating the average. Finally, toxic metal values reported as less than a certain value were considered as not detected, and a value of zero is used in the calculation of the average. For example, three samples reported as ND, \*, and 0.021 mg/l have an average value of 0.010 mg/l.

In the following discussion, water use and field sampling data are presented for each operation. Appropriate tubing or background blank and source water concentrations are presented with the summaries of the sampling data. Figures V-1 through V-5 show the location of wastewater sampling sites at each facility. The method by which each sample was collected is indicated by number, as follows:

- 1 one-time grab
- 2 24-hour manual composite
- 3 24-hour automatic composite
- 4 48-hour manual composite
- 5 48-hour automatic composite
- 6 72-hour manual composite
- 7 72-hour automatic composite

In the data collection portfolios, plants were asked to specify the presence or absence of any of the toxic pollutants in their effluent. All of the plants that responded to this portion of the questionnaire indicated that they believed the toxic organic pollutants to be absent. One exception, hexachloroethane, was reported believed to be present by two plants. This compound was not detected in any sample taken in the subcategory.

Although most of the plants indicated that the toxic metals were believed absent from their effluent, some plants did report that specific pollutants were known present or believed present. The responses for the toxic metals are shown below.

<u>Pollutant</u>	<u>Known Present</u>	<u>Believed Present</u>	<u>Believed Absent</u>	<u>Known Absent</u>
Antimony	-	-	23	-
Arsenic	-	1	22	-
Beryllium	1	-	22	-
Cadmium	5	1	17	-
Chromium	11	5	7	-
Copper	1	-	21	1
Lead	7	6	10	-
Mercury	2	2	18	1
Nickel	5	2	16	-
Selenium	-	-	22	1
Thallium	-	-	22	1
Zinc	9	6	8	-

## SCRAP DRYING WET AIR POLLUTION CONTROL

Some scrap may require drying to remove cutting oils and water. The scrap drying procedure consists of crushing the scrap and heating in an oil or gas-fired rotary drier. Twenty-nine secondary aluminum plants control air emissions from scrap drying operations. Three use scrubbers, while 26 use baghouses. Scrap drying wet air pollution control water use and discharge rates are shown in Table V-1 in liters per metric ton (gal/ton) of aluminum scrap dried.

The Agency did not sample raw wastewater from scrap drying scrubbers, however, this wastewater should contain total suspended solids and treatable concentrations of aluminum. Toxic organic pollutants should not be present at measurable concentrations.

## SCRAP SCREENING AND MILLING

Only two plants reported using water in scrap screening and milling. The discharge rates from these plants is presented in Table V-2 in liters per metric ton of aluminum scrap screened or milled. The Agency did not sample scrap screening and milling wastewater but this waste stream should contain total suspended solids and treatable concentrations of aluminum, as well as toxic metals.

## DROSS WASHING WASTEWATER

Sources of aluminum for the secondary aluminum subcategory are residues such as drosses, skimmings, and slags. These residues must be pretreated before charging them into the smelters. Both wet and dry processes are available for this pretreatment. Of the facilities surveyed, four used the wet process to prepare their residues for smelting. The quantities of water used and discharged, expressed as a function of dross processed, are presented in Table V-3.

The data in Table V-4 indicate that this wastewater contains treatable concentrations of suspended solids (aluminum oxide and hydrated alumina), ammonia, and metals such as aluminum, copper, and lead.

## DEMAGGING WET AIR POLLUTION CONTROL

As discussed in Section III, demagging consists of injecting chlorine or aluminum fluoride into the molten aluminum to remove magnesium. During this process, heavy fuming can result. Of the 26 facilities supplying data, 17 use a wet process to control emissions from this process, while nine use a dry process. The flow rates used and discharged, expressed in liters/metric ton of aluminum demagged, for those plants with wet air pollution control are shown in Table V-5.



The wastewaters associated with this scrubbing operation may contain treatable concentrations of suspended solids and chlorides or fluorides, and of heavy metals. Table V-6 summarizes the wastewater sampling data associated with demagging scrubber wastes.

#### DIRECT CHILL CASTING CONTACT COOLING WATER

The usual final step in the secondary aluminum subcategory process is often the casting of molten aluminum into ingots, bars, billets, shot, etc. Air cooling, noncontact water cooling, and contact water cooling are used to cool the molten metal. The contact cooling water is often recycled, but a blowdown stream is often required. There is a trend in the secondary aluminum subcategory toward converting to direct chill casting. However, limited data were available for direct chill casting from the dcp survey. Wastewater use and discharge data were taken from both the aluminum forming and the primary aluminum subcategories because information does not indicate a significant difference in the amount of water required for direct chill casting cooling in a secondary aluminum, primary aluminum, and aluminum forming plant. Tables V-7 and V-8 present the production normalized water use and discharge rates expressed in liters per metric ton of aluminum cast. In all, 27 primary aluminum plants and 61 aluminum forming plants have direct chill casting operations. Recycle of the contact cooling water is practiced at 30 aluminum forming and 18 primary aluminum plants. Of these, 12 plants indicated that total recycle of this stream made it possible to avoid any discharge of wastewater; however, the majority of the plants discharge a bleed stream.

In direct chill casting, lubrication of the mold is required to ensure proper ingot quality. Lard or castor oil is usually applied before casting begins and may be reapplied during the drop. Much of the lubricant volatilizes on contact with the molten aluminum, but contamination of the contact cooling water with oil and oil residues does occur. Oil and grease, and chlorides are usually present, along with a measurable concentration of suspended solids. Table V-9 presents casting contact cooling water sampling data from a secondary aluminum plant. The type of casting operation sampled was not reported with the data. However, the types of casting considered in this subcategory will have similar wastewater pollutant characteristics because the raw material, aluminum, is the same in each operation.

#### STATIONARY CASTING COOLING

In the stationary casting method, molten aluminum is poured into cast iron molds and the generally allowed to air cool. The Agency is aware of the use of spray quenching to quickly cool the surface of the molten aluminum once it is cast into the molds;

however, this water evaporates on contact with the molten aluminum. This operation is similar throughout the secondary aluminum and primary aluminum subcategories, and the aluminum forming category, and no discharge of process water has been reported.

#### SHOT CASTING CONTACT COOLING

Contact cooling water is used for rapid quenching of molten metal in deoxidizer shot production. Specific casting methods used in the secondary aluminum subcategory were not differentiated in the data collection portfolios. Therefore, specific water use and wastewater characterization data were not available. However, the dcp survey showed that recycle and reuse of casting contact cooling water is widely practiced in the secondary aluminum subcategory. Thirty-five plants reported generating casting contact cooling water, 22 of those achieving zero discharge through complete recycle or evaporation. Suspended solids and aluminum should be present in this water.

Table V-1

WATER USE AND DISCHARGE RATES FOR SCRAP DRYING  
WET AIR POLLUTION CONTROL

(1/kg of aluminum scrap dried)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
00427	0	1,057	1,057
04102	100	5,111	0
00640	100	567.6	0

Table V-2

WATER USE AND DISCHARGE RATES FOR SCRAP SCREENING  
AND MILLING

(1/kg of aluminum scrap dried)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
00296	100	13,827	0
00301	100	NR	0

---

NR - Present, but data not reported in dcp.

Table V-3  
WATER USE AND DISCHARGE RATES FOR DROSS WASHING  
(1/kkg of dross washed)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
04104	67	32,933	10,868
04101	100	78,840	0
04102	100	58,408	0
04103	0*	NR	0

---

\*Wastewater is 100 percent evaporated.

NR - Present, but data not reported in dcp.

Table V-4

SECONDARY ALUMINUM SAMPLING DATA  
DROSS WASHING  
RAW WASTEWATER

		Concentrations (mg/l, except as noted)						
<u>Pollutant (a)</u>		<u>Stream Code</u>	<u>Sample Type +</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>								
23.	chloroform	70	2	0.022	0.061	0.057		0.059
30.	1,2-trans-dichloro-ethylene	70	2	ND	0.058	0.057		0.0575
39.	fluoranthene	70	3	*	0.02			0.02
66.	bis(2-ethylhexyl) phthalate	70	3	0.038	2.03			2.03
67.	butyl benzyl phthalate	7	3	ND	0.098			0.098
68.	di-n-butyl phthalate	70	3	*	0.022			0.022
69.	di-n-octyl phthalate	70	3	0.011	0.036			0.036
71.	dimethyl phthalate	70	3	ND	0.056			0.056
76.	chrysene	70	3	*	0.198			0.198
87.	trichloroethylene	70	2	0.022	<0.021	<0.015		<0.018
115.	arsenic	70	3	<0.01	0.02			0.02
117.	beryllium	70	3	<0.001	0.05			0.05

Table V-4 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
DROSS WASHING  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type + Source</u>	Concentrations (mg/l, except as noted)			
			<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
118. cadmium	70	3 0.02	0.40			0.4
119. chromium	70	3 0.009	2.0			2.0
120. copper	70	3 0.02	10.0			10.0
122. lead	70	3 <0.02	8.0			8.0
123. mercury	70	3 <0.0001	0.0006			0.0006
124. nickel	70	3 <0.005	1.0			1.0
126. silver	70	3 <0.02	0.07			0.07
127. thallium	70	3 <0.01	1.0			1.0
128. zinc	70	3 <0.06	8.0			8.0
<u>Nonconventionals</u>						
aluminum	70	3 0.05 2,000				2,000
ammonia	70	2	240	150		195.0
chemical oxygen demand (COD)	70	3	933			933
phenols (total; by 4-AAP method)	70	2	0.006	0.016		0.011
total organic carbon (TOC)	70	3	220			220.0

Table V-4 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
DROSS WASHING  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type + Source</u>	Concentrations (mg/l, except as noted)			
			<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>						
oil and grease	70	2	20.0	29.0		24.50
total suspended solids (TSS)	70	2	20,140			20,140
pH (standard units)	70	1		9.6		

(a) No samples were analyzed for the acid extractable toxic organic pollutants. One sample was analyzed for the pesticide fraction; none was detected above its analytical quantification limit. One sample was analyzed for PCBs; none was detected.

+Sample Type. Note: These numbers also apply to subsequent sampling data tables in this section.

- 1 - one-time grab
- 2 - 24-hour manual composite
- 3 - 24-hour automatic composite
- 4 - 48-hour manual composite
- 5 - 48-hour automatic composite
- 6 - 72-hour manual composite
- 7 - 72-hour automatic composite

\* Indicates less than or equal to 0.01 mg/l

\*\* Indicates less than or equal to 0.005 mg/l



Table V-5

WATER USE AND DISCHARGE RATES FOR DEMAGGING  
WET AIR POLLUTION CONTROL

(1/kg of aluminum demagged)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
4104	0	1,956.24	1,956.24
0332	0	1,867	1,867
0037	0	1,370.2	1,370.2
0427	0	476	476
0333	40	577	346
0048	0	339.6	339.6
0018	0	326.0	326.0
0628	0	283.5	283.5
0326	0	223.3	223.3
0313	0	NR	NR
0296	100	30,728	0
0301	NR	NR	NR
0319	100	NR	0
0320	100	553.7	0
0329	100	172.7	0
0330	100	169.7	0
0532	100	251	0
0625	100	130.8	0
4209	100	297.5	0

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NR - Present, but data not reported in dcp.

Table V-6

SECONDARY ALUMINUM SAMPLING DATA  
DEMAGGING SCRUBBER LIQUOR  
RAW WASTEWATER

				Concentrations (mg/l, except as noted)			
<u>Pollutant (a)</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
4. benzene	3 68	2 2	0.017	0.136 *	<0.013 *	<0.018 *	0.045 *
23. chloroform	3 68	2 2	0.022	0.41 0.019	0.041 0.071	0.064 0.019	0.17 0.36
29. 1,1-dichloro-ethylene	3 68	2 2	ND	0.099 ND	ND ND	ND ND	0.099
30. 1,2-trans-dichloro-ethylene	3 68	2 2	ND	ND 0.07	ND 0.03	* 0.019	* 0.4
44. methylene chloride	3 68	2 2	ND	0.37 ND	ND ND	ND ND	0.37
48. dichlorobromo-methane	3 68	2 2	ND	ND ND	ND 0.019	ND ND	0.019
66. bis(2-ethylhexyl) phthalate	3 68	7 7	0.038	ND 0.228			0.228
85. tetrachloroethylene	3 68	2 2	ND	0.378 *	ND *	* *	0.189 *
87. trichloroethylene	3 68	2 2	0.022	0.787 <0.03	ND <0.030	<0.089 <0.031	<0.39 <0.030

Table V-6 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
 DEMAGGING SCRUBBER LIQUOR  
 RAW WASTEWATER

Concentrations (mg/l, except as noted)

	<u>Pollutant</u>	<u>(a)</u>	<u>Stream</u> <u>Code</u>	<u>Sample</u> <u>Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
106.	PCB-1242	(b)	3	7		<0.020			<0.02
107.	PCB-1254	(b)	68	7	**	**			**
108.	PCB-1221	(b)							
109.	PCB-1232	(c)	3	7		<0.025			<0.025
110.	PCB-1248	(c)	68	7	**	**			**
111.	PCB-1260	(c)							
112.	PCB-1016	(c)							
113.	toxaphene		3	7		<0.011			<0.011
			68	7	ND	ND			
114.	antimony		3	7		0.3			0.3
			68	7	<0.1	<0.1			<0.1
115.	arsenic		3	7		4			4
			68	7	<0.01	<0.01			<0.01
117.	beryllium		68	7	<0.001	0.2			0.2
118.	cadmium		68	7	0.02	0.5			0.5
119.	chromium		68	7	0.009	<0.05			<0.05
120.	copper		68	7	0.02	0.2			0.2
121.	cyanide		3	7		<0.001	<0.001	<0.001	<0.001
			68	7			0.003		0.003

Table V-6 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
DEMAGGING SCRUBBER LIQUOR  
RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	Concentrations (mg/l, except as noted)			
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
122. lead	68	7	<0.02	2			2
123. mercury	3	7		0.0064			0.0064
	68	7	<0.0001	0.001			0.001
124. nickel	68	7	<0.005	<0.05			<0.05
125. selenium	3	7		0.2			0.2
	68	7	<0.01	<0.01			<0.01
128. zinc	68	7	<0.06	3			3
<u>Nonconventionals</u>							
aluminum	3	2			ND	ND	
	68	2	0.05	0.05			0.05
ammonia	3	1		<0.1	<0.1	<0.1	<0.1
	68	2		0.84	0.42		0.63
chemical oxygen demand (COD)	3	2		48			48
	68	2		50			50
chloride	3	2		6,000			6,000
	68	2		3,241			3,241
phenols (total by 4-AAP method)	3	2		0.021	0.023	0.032	0.025
	68	2				0.007	0.007
total organic carbon (TOC)	3	2		3			3
	68	2		9			9

Table V-6 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
DEMAGGING SCRUBBER LIQUOR  
RAW WASTEWATER

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>							
oil and grease	3 68	2 2		121	16	157 7	98 7
total suspended solids (TSS)	3 68	2 2		89 2,082			89 2,082
pH (standard units)	3 68	1 1		2.8 6	3.6 6.4	2.5 6.1	

(a) One sample from one stream was analyzed for the acid extractable toxic organic pollutants; none was detected.

(b), (c) Reported together.

Table V-7

WASTER USE AND DISCHARGE RATES FOR  
DIRECT CHILL CASTING CONTACT COOLING  
(ALUMINUM FORMING CATEGORY)

(1/kg of aluminum cast)

<u>Plant Code*</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
1	100	NR	0
2	100	NR	0
3	50	2,743	0
4	97	NR	0
5	100	NR	0
6	100	NR	0
7	100	NR	0
8	100	NR	0
9	100	8.339	0
10	99	82,050	0.2989
11	99	105,000	0.3252
12	100	86,430	0.4169
13	99	82,640	0.4169
14	0	908.9	120.9
15	98	30,670	150.1
16	97	37,530	250.2
17	99	31,340	313.4
18	0	392.8	392.8
19	NR	NR	496.2
20	NR	NR	514.5
21	97	73,800	612.9
22	98	31,440	629.6
23	0	3,819	779.7
24	93	14,090	963.1
25	94	35,320	1,113
26	97	36,980	1,167
27	99	177,900	1,483
28	96	70,880	1,534
29	96	62,960	1,955
30	94	72,130	2,397
31	92	43,360	2,753
32	0	3,394	3,002
33	NR	NR	4,003
34	0	5,041	5,041
35	NR	NR	5,337
36	0	9,089	9,089
37	0	9,506	9,506

Table V-7 (Continued)

WATER USE AND DISCHARGE RATES FOR  
DIRECT CHILL CASTING CONTACT COOLING  
(ALUMINUM FORMING CATEGORY)

(l/kg of aluminum cast)

<u>Plant Code*</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
38	0	23,060	16,590
39	0	28,390	28,390
40	0	35,500	35,500
41	0	52,540	52,540
42	0	58,370	58,370
43	0	91,310	91,310
44	98	NR	NR
45	96	NR	NR
46	NR	NR	NR
47	NR	NR	NR
48	0	NR	NR
49	0	NR	NR
50	NR	NR	NR
51	0	NR	NR
52	NR	NR	NR
53	0	NR	NR
54	NR	NR	NR
55	NR	NR	NR
56	100	50,030	NR
57	NR	NR	NR
58	NR	NR	NR
59	0	NR	NR
60	90	NR	NR
61	NR	NR	NR

---

NR - Present, but data not reported in dcp.

\*Some plants use more than one type of direct chill casting process.

Table V-8

WATER USE AND DISCHARGE RATES FOR  
DIRECT CHILL CASTING CONTACT COOLING WATER  
(PRIMARY ALUMINUM SUBCATEGORY)

(l/kg of aluminum cast)

<u>Plant Code*</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
368	100	NR	0
348	100	NR	0
346	100	NR	0
355	97	1,113	33.36
362	99	54,790	125.1
367	0	254.3	254.3
355	99	34,120	437.8
345	82	2,535	446.1
357	98	24,350	487.8
363	95	28,440	1,422
350	98	142,700	2,218
353	94	46,910	3,040
340	98	138,300	3,319
371	0	6,504	6,504
366	1	7,088	7,021
342	93	117,000	8,118
365	53	18,260	8,635
349	0	10,330	10,320
370	0	12,080	12,080
348	0	12,180	12,180
369	0	12,530	12,530
365	53	30,440	14,360
352	20	20,580	16,470
360	0	20,700	20,700
347	0	31,700	31,700
370	0	52,490	52,490
343	2	60,460	52,290

---

NR - Present, but data not reported in dcp.

\*Some plants have more than one type of direct chill casting process.



Table V-9

SECONDARY ALUMINUM SAMPLING DATA  
CASTING CONTACT COOLING WATER  
RAW WASTEWATER

<u>Pollutant (a)</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	Concentrations (mg/l, except as noted)			
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
23. chloroform	80	2	*	0.051			0.051
27. 1,4-dichlorobenzene	80	2	ND	0.026			0.026
66. bis(2-ethylhexyl) phthalate	80	2	*	0.075			0.075
67. butyl benzyl phthalate	80	2	*	0.014			0.014
68. di-n-butyl phthalate	80	2	*	0.045			0.045
77. acenaphthylene	80	2	ND	0.017			0.017
84. pyrene	80	2	*	0.024			0.024
121. cyanide	80	2		0.005			0.005
<u>Nonconventionals</u>							
phenols (total; by 4-AAP method)	80	2		0.007			0.007
<u>Conventionals</u>							
oil and grease	80	2		16			16

(a) This sample was not analyzed for the acid extractable toxic pollutants. The pesticide fraction was analyzed for; none was detected above its analytical quantification limit. PCBs were analyzed for and detected below the quantification limit in one sample.

Table V-10

SECONDARY ALUMINUM SAMPLING DATA  
 DEMAGGING WET AIR POLLUTION CONTROL AND CASTING CONTACT COOLING  
 COMBINED RAW WASTEWATER

<u>Pollutant (a)</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	Concentrations (mg/l, except as noted)			
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
23. chloroform	84	2	0.017	0.024	*	0.015	0.013
73. benzo(a)pyrene	84	3	ND		ND	0.012	0.012
117. beryllium	84	3			0.004	0.010	0.007
118. cadmium	84	3			0.02	0.05	0.035
120. copper	84	3			0.070	0.070	0.070
121. cyanide	84	3		0.003	0.002	0.007	0.004
122. lead	84	3			0.06	0.07	0.065
123. mercury	84	3			0.0002	0.0002	0.0002
128. zinc	84	3			2.0	2.0	2.0
<u>Nonconventionals</u>							
aluminum	84	3			70	90	80
chemical oxygen demand (COD)	84	3	<5		11	16	14
phenols (total; by 4-AAP method)	84	2		9.0	<0.001	<0.001	3.0

Table V-10 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
 DEMAGGING WET AIR POLLUTION CONTROL AND CASTING CONTACT COOLING  
 COMBINED RAW WASTEWATER

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	Concentrations (mg/l, except as noted)			
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
total organic carbon (TOC)	84	3	5		6	9	7.5
<u>Conventionals</u>							
Oil and grease	84	1		7	5	13	8.3
total suspended solids (TSS)	84	3	4		60	74	67
pH (standard units)	84	1		6.8	6.6	6.5	

- (a) No samples were analyzed for the acid extractable toxic organic pollutants. Two samples were analyzed for the pesticide fraction; none was reported present above its analytical quantification limit. PCBs were analyzed for and detected below the quantification limit in two samples.

Table V-11

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT A

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
23. chloroform	81	1	*	ND	*	0.025	0.125
47. bromoform	81	1	*	ND	0.011	*	0.0055
66. bis(2-ethylhexyl phthalate)	81	7	*	0.012			0.012
114. antimony	81	7	<0.1	1.1			1.1
115. arsenic	81	7	<0.01	0.07			0.07
121. cyanide	81	7		0.009	<0.001	<0.001	0.003
<u>Nonconventionals</u>							
chemical oxygen demand (COD)	81	7		1.4			1.4
phenols (total; by 4-AAP method)	81	1		0.008	0.007	0.004	0.006
total organic carbon (TOC)	81	7		6			6

Table V-11 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT A

Concentrations (mg/l, except as noted)

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventionals</u>							
oil and grease	81	1		3	28	ND	16
total suspended solids (TSS)	81	1		212			212
pH (standard units)	81	1		1.4	0.9	1.5	

Table V-12

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT B

		Concentrations (mg/l, except as noted)					
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
23. chloroform	69	2	0.022	0.132	0.037		0.095
	133	1	0.022	ND			
30. 1,2-trans-dichloroethylene	69	2	ND	0.088	0.028		0.058
	133	1	ND	*			
48. dichlorobromomethane	69	2	ND	0.014	ND		0.014
	133	1	ND	ND			
66. bis(2-ethylhexyl) phthalate	69	3	0.038	1.259			1.259
	133	1	0.038	0.036			
68. di-n-butyl phthalate	69	3	*	*			*
	133	1	*	0.012			
115. arsenic	69	3	<0.01	<0.01			<0.01
	133	1	<0.01	0.01			
117. beryllium	69	3	<0.001	0.02			0.02
	133	1	<0.001	0.05			
118. cadmium	69	3	0.02	<0.02			<0.02
	133	1	0.02	0.3			
119. chromium	69	3	0.009	<0.05			<0.05
	133	1	0.009	0.09			

Table V-12 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT B

		Concentrations (mg/l, except as noted)						
	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
776	120. copper	69	3	0.02	<0.06			<0.01
		133	1	0.02	2			0.01
	121. cyanide	69	3			0.004		0.004
		133	1		0.002			0.002
	122. lead	69	3	<0.02	<0.02			<0.02
		133	1	<0.02	2			2
	123. mercury	69	3	<0.0001	0.0002			0.0002
		133	1	<0.0001	0.0006			0.0006
	124. nickel	69	3	<0.005	<0.05			<0.05
		133	1	<0.005	0.2			0.2
	128. zinc	69	3	<0.06	<0.06			<0.06
		133	1	<0.06	4			4
<u>Nonconventionals</u>								
	aluminum	69	2	0.05	23.1			23.1
		133	1	0.05	200			200
	ammonia	69	2		4.7	21		13

Table V-12 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT B

<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, except as noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
chemical oxygen demand (COD)	69	2		54			54
	133	1		67			67
chloride	69	2		5500			5500
	133	1		3691			3691
total organic carbon (TOC)	69	2		9			9
	133	1		20			20
phenols (total; by 4-AAP method)	69	2			0.02		0.02
	133	1		0.006			0.006
<u>Conventionals</u>							
oil and grease	69	2			13		13
	133	1		11			11
total suspended solids (TSS)	69	2		240			240
	133	1		1132			1132
pH (standard units)	69	1		6	5.4		



Table V-13

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT D

		Concentrations (mg/l, except as noted)						
	<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>								
23.	chloroform	99	3	0.033	0.222	0.216	0.126	0.188
48.	dichlorobromo-methane	99	3	ND	0.0255	0.018	0.018	0.021
51.	chlorodibromo-methane	99	3	ND	<0.025	ND	0.029	0.0145
66.	bis(2-ethylhexyl) phthalate	99	3	0.071	*	0.021	0.746	0.26
68.	di-n-butyl phthalate	99	3	*	*	0.055	0.033	0.029
69.	di-n-octyl phthalate	99	3	ND	*	*	0.101	0.0337
118.	cadmium	99	3	0.004	0.008	0.3	0.04	0.12
119.	chromium	99	3	0.01	0.4	0.6	0.5	0.5
120.	copper	99	3	<0.006	0.02	0.08	<0.06	0.033
121.	cyanide	99	3		0.003	<0.001	<0.001	0.001
122.	lead	99	3	<0.02	<0.02	0.9	0.3	0.4
123.	mercury	99	3	<0.0001	0.004	0.0061	0.0042	0.0048

Table V-13 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT D

			Concentrations (mg/l, except as noted)				
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
124. nickel	99	3	<0.005	0.03	0.08	0.4	0.17
127. thallium	99	3	<0.1	<0.1	<0.1	0.1	0.033
128. zinc	99	3	<0.06	0.1	<0.6	<0.6	0.033
<u>Nonconventionals</u>							
aluminum	99	3	<0.05	2	3	1	2
chemical oxygen demand (COD)	99	3		10	6	<5	5
chloride	99	3		2510	2270	2170	2317
phenols (total; by 4-AAP method)	99	1		0.022	<0.001	<0.001	0.0073
total organic carbon (TOC)	99	3		6	6	6	6
<u>Conventionals</u>							
oil and grease	99	1		4	8	5	6
total suspended solids (TSS)	99	3		9	9	13	10

Table V-14

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT E

				Concentrations (mg/l, except as noted)			
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
4. benzene	4	2		0.018	<0.018	<0.014	0.06
10. 1,2-dichloroethane	4	2		0.047	ND	0.124	0.086
11. 1,1,1-trichloroethane	4	2		ND	ND	0.016	0.016
15. 1,1,2,2-tetrachloroethane	4	2		ND	ND	<0.011	<0.011
23. chloroform	4	2		0.386	0.056	0.085	0.18
29. 1,1-dichloroethylene	4	2		0.109	ND	ND	0.109
44. methylene chloride	4	2		0.473	ND	ND	0.473
51. chlorodibromomethane	4	2		ND	0.012	ND	0.012
85. tetrachloroethylene	4	2		0.025	ND	<0.011	0.012
87. trichloroethylene	4	2		0.098	<0.098	<0.074	0.033
114. antimony	4	2		0.06			0.06

Table V-14 (Continued)

SECONDARY ALUMINUM SAMPLING DATA  
TREATMENT PLANT SAMPLES  
PLANT E

		Concentrations (mg/l, except as noted)					
<u>Pollutant</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
121. cyanide	4	2		<0.001	<0.001	0.001	0.0003
123. mercury	4	2		0.0035			0.0035
125. selenium	4	2		0.02			0.02
<u>Nonconventionals</u>							
ammonia	4	2		<0.1	>0.1	<0.1	<0.1
chemical oxygen demand (COD)	4	2		40			40
chloride	4	2		4140			4140
phenols (total; by 4-AAP method)	4	2		0.012	0.005	0.017	0.011
total organic carbon (TOC)	4	2		122			122
<u>Conventionals</u>							
oil and grease	4	1		7	7	8	7
total suspended solids (TSS)	4	2		1950			1950
pH (standard units)	4	1		7.0	7.8	6.8	



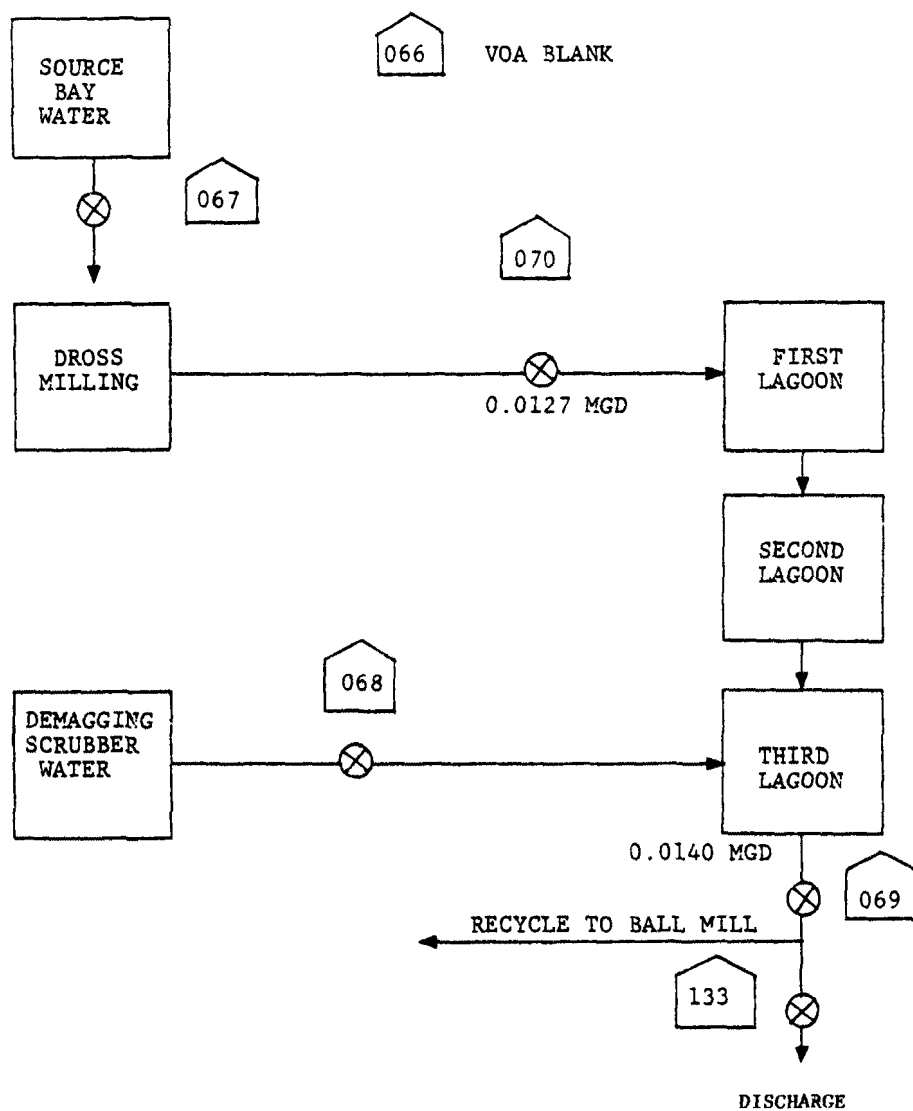


Figure V-2  
SAMPLING SITES AT SECONDARY ALUMINUM PLANT B

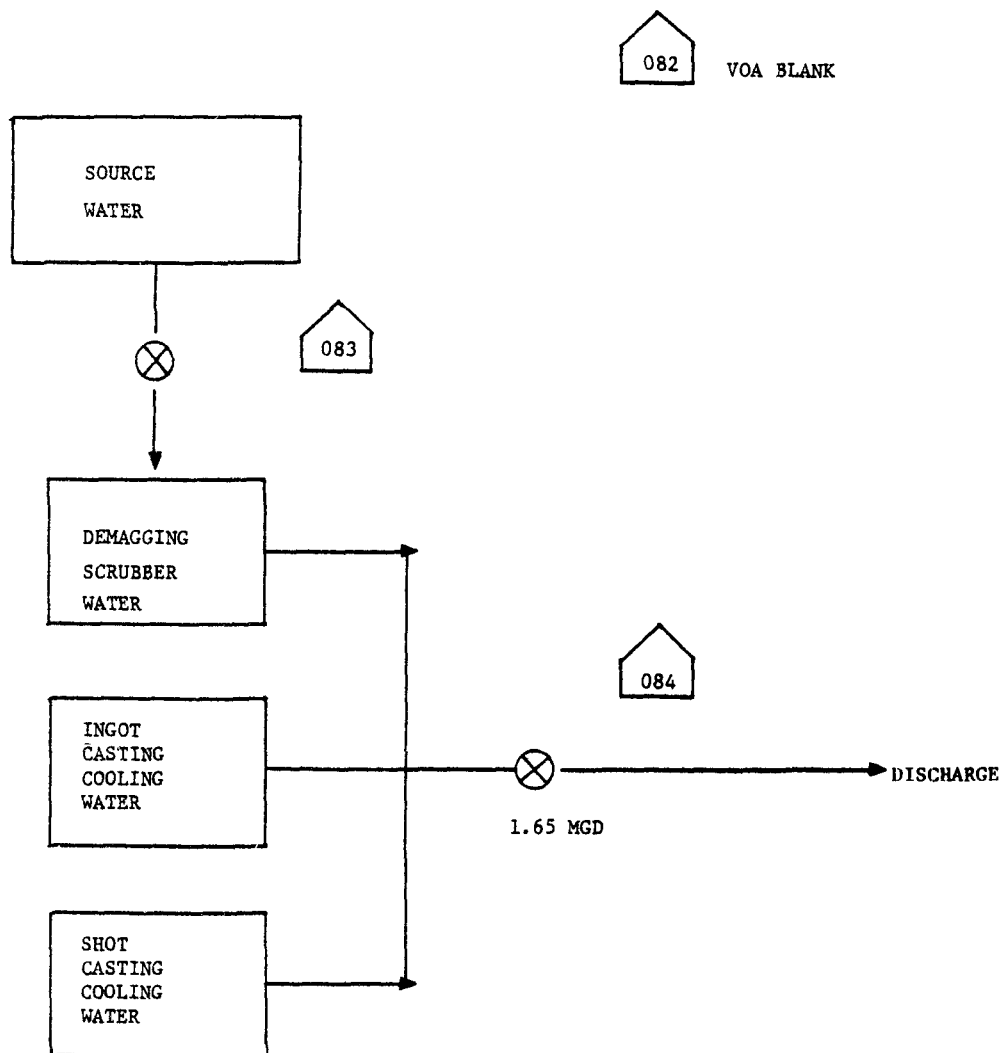


Figure V-3  
SAMPLING SITES AT SECONDARY ALUMINUM PLANT C

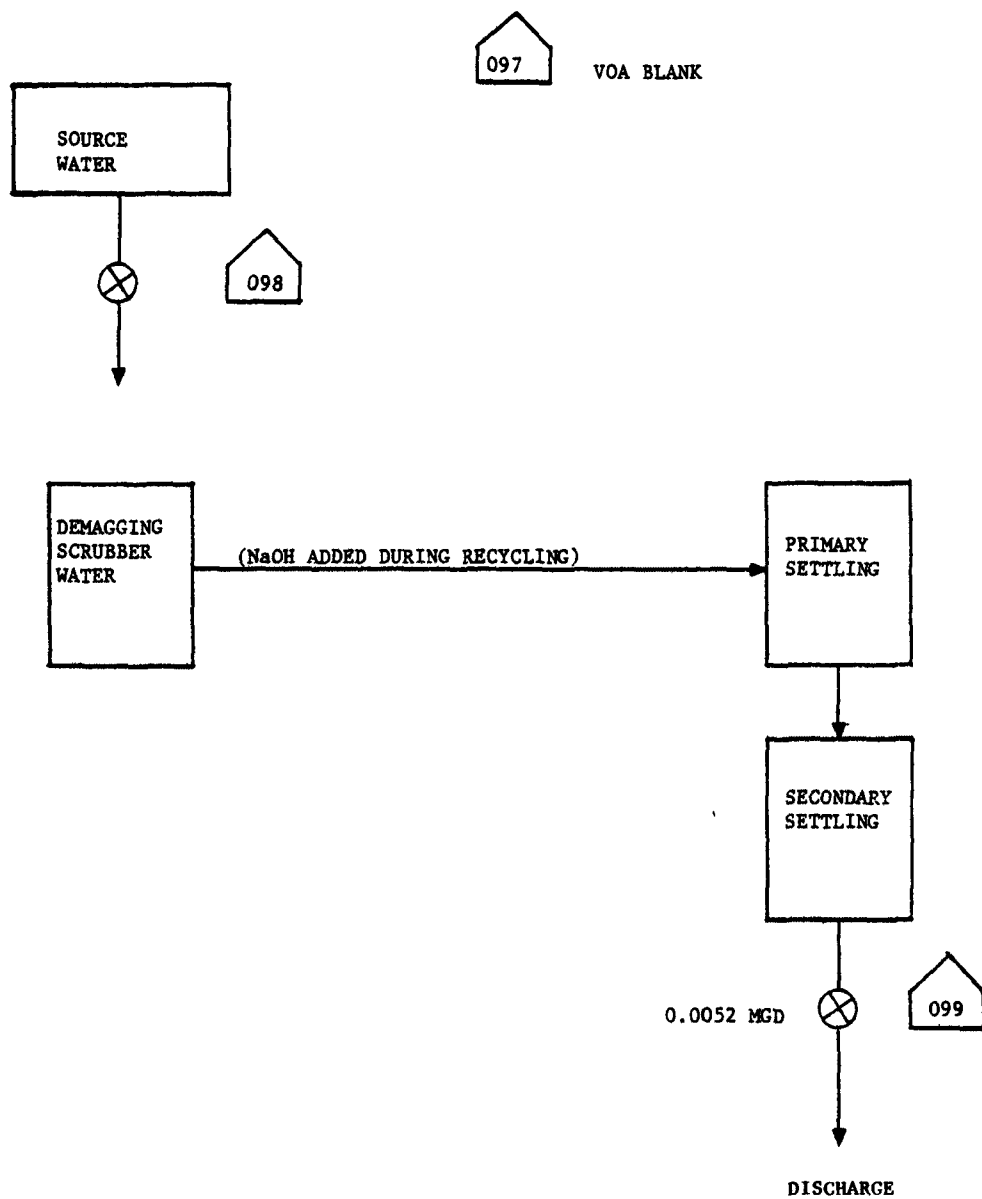


Figure V-4  
SAMPLING SITES AT SECONDARY ALUMINUM PLANT D



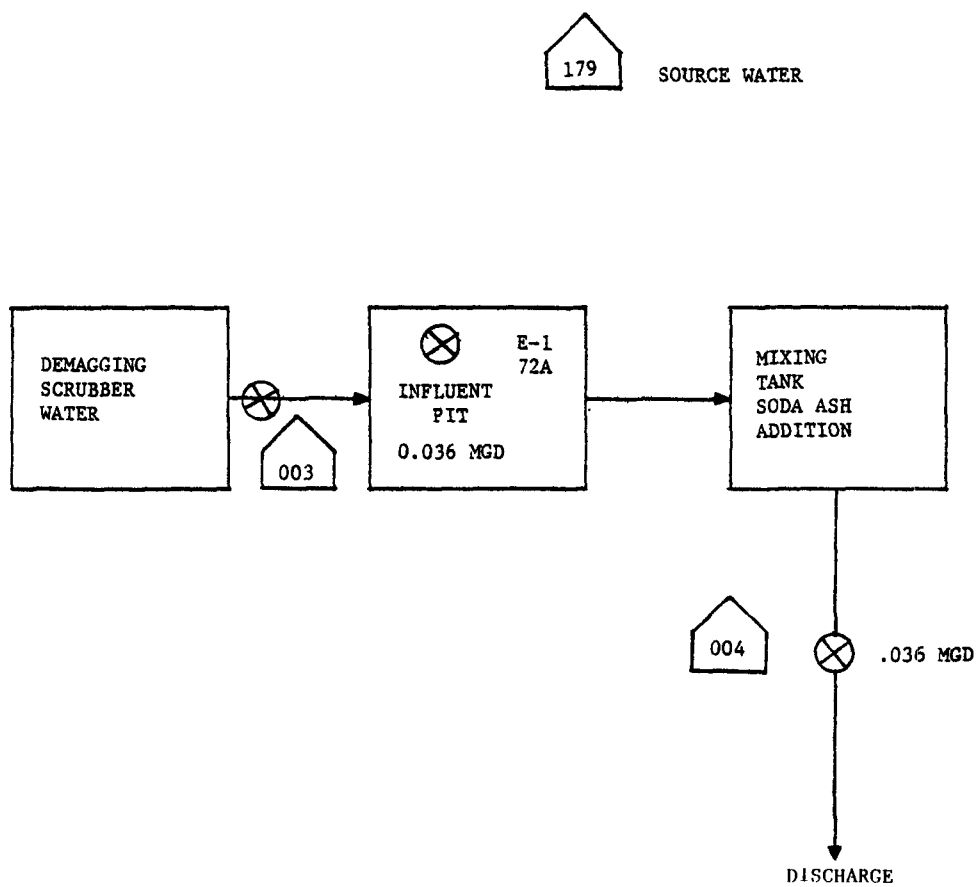


Figure V-5  
SAMPLING SITES AT SECONDARY ALUMINUM PLANT E

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION VI

#### SELECTION OF POLLUTANTS

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

Each pollutant selected for potential limitation is discussed in Section VI of the General Development Document. That discussion provides information about where the pollutant originates (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 pollutants for limitation in this subcategory.

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

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS

This study examined samples from the secondary aluminum subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and seven nonconventional pollutant parameters (ammonia, chemical oxygen demand, chloride, fluoride, aluminum, total organic carbon, and total phenols).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

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

aluminum  
ammonia  
total suspended solids (TSS)  
oil and grease  
pH

Aluminum was found above the 0.74 mg/l concentration attainable by identified treatment technology in three of six samples in two plants. Because it is the major product of plants in this subcategory and was found at treatable concentrations, aluminum is selected for consideration for limitation.

Ammonia was measured at three sites at two plants. The concentration of ammonia in these samples varied widely, depending on the stage and type of manufacturing process. Those plants that produce treatable concentrations of ammonia will be considered for limitation for that pollutant.

Total suspended solids ranged from 60 to 20,140 mg/l in six samples. All of the measured concentrations are well above the concentration achievable by identified treatment technology. Furthermore, most of the technologies 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 also ensures that sedimentation to remove precipitated toxic metals has been effective. For these reasons, total suspended solids is considered for limitation in this subcategory.

Oil and grease was found above treatability (10 mg/l) in six of seven samples with concentrations ranging from 16 to 157 mg/l. Many secondary aluminum plants have converted to direct chill casting processes since the sampling data was collected. Sampling data from direct chill casting raw wastewater taken at aluminum forming plants show oil and grease present at treatable concentrations in 15 of 23 samples. The treatable concentrations range from 15 to 226 mg/l. (For a further discussion, refer to Section V of the Development Document for Proposed Effluent Limitations Guidelines and Standards for the Aluminum Forming Point Source Category). Therefore, oil and grease is selected for consideration for limitation.

The pH of a wastewater measures its relative acidity or alkalinity. In this study, the pH values observed in raw wastewater ranged from 2.8 to 9.6. Effective removal of toxic metals by precipitation requires careful control at pH. Therefore, pH is considered for limitation in this subcategory.

## TOXIC POLLUTANTS

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-1. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater data from streams 3, 68, 70, 80, and 84 (see Section V). Treatment plant sampling data were not considered in the frequency count.

### TOXIC POLLUTANTS NEVER DETECTED

Paragraph 8(a)(iii) of the Revised Settlement Agreement allows the Administrator to exclude from regulation those toxic pollutants not detectable by Section 304(h) analytical methods or other state-of-the-art methods. The toxic pollutants listed below were not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidine
6. carbon tetrachloride
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. DELETED
18. bis(2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
20. chloronaphthalene
21. 2,4,6-trichlorophenol
22. parachlorometa cresol
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
28. 3,3'-dichlorobenzidine
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene

- 34. 2,4-dimethylphenol
- 35. 2,4-dinitrotoluene
- 36. 2,6-dinitrotoluene
- 37. 1,2-diphenylhydrazine
- 38. ethylbenzene
- 40. 4-chlorophenyl phenyl ether
- 41. 4-bromophenyl phenyl ether
- 42. bis(2-chloroisopropyl) ether
- 43. bis(2-chloroethoxy) methane
- 45. methyl chloride
- 46. methyl bromide
- 47. bromoform
- 49. DELETED
- 50. DELETED
- 51. chlorodibromomethane
- 52. hexachlorobutadiene
- 53. hexachlorocyclopentadiene
- 54. isophorone
- 55. naphthalene
- 56. nitrobenzene
- 57. 2-nitrophenol
- 58. 4-nitrophenol
- 59. 2,4-dinitrophenol
- 60. 4,6-dinitro-o-cresol
- 61. N-nitrosodimethylamine
- 62. N-nitrosodiphenylamine
- 63. N-nitrosodi-n-propylamine
- 64. pentachlorophenol
- 65. phenol
- 70. diethyl phthalate
- 72. benzo(a)anthracene
- 74. 3,4-benzofluoranthene
- 75. benzo(k)fluoranthene
- 78. anthracene (a)
- 79. benzo(ghi)perylene
- 80. fluorene
- 81. phenanthrene (a)
- 82. dibenzo(a,h)anthracene
- 83. indeno (1,2,3-cd)pyrene
- 86. toluene
- 88. vinyl chloride
- 89. aldrin
- 90. dieldrin
- 94. 4,4'-DDD
- 95. alpha-endosulfan
- 96. beta-endosulfan
- 97. endosulfan sulfate
- 105. delta-BHC
- 116. asbestos
- 129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

(a) Reported together

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LIMIT

The provision of Paragraph 8(a)(iii) of the Revised Settlement Agreement excluding from regulation those toxic pollutants which are not detectable includes those pollutants whose concentrations fall below EPA's nominal detection limit. The toxic pollutants listed below were never found above their analytical quantification level in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

- 91. chlordane
- 92. 4,4'-DDT
- 93. 4,4'-DDE
- 98. endrin
- 99. endrin aldehyde
- 100. heptachlor
- 101. heptachlor epoxide
- 102. alpha-BHC
- 103. beta-BHC
- 104. gamma-BHC
- 106. PCB-1242 (a)
- 107. PCB-1254 (a)
- 108. PCB-1221 (a)
- 109. PCB-1232 (b)
- 110. PCB-1248 (b)
- 111. PCB-1260 (b)
- 112. PCB-1016 (b)
- 113. toxaphene
- 121. cyanide

(a),(b) Reported together.

TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

Paragraph 8(a)(iii) of the Revised Settlement Agreement also allows the exclusion of toxic pollutants which were detected in quantities too small to be effectively reduced by technologies known to the Administrator. The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies. These pollutants are discussed individually following the list.

- 29. 1,1-dichloroethylene
- 30. 1,2-trans-dichloroethylene
- 48. dichlorobromomethane
- 114. antimony

- 117. beryllium
- 123. mercury
- 125. selenium
- 126. silver

1,1-Dichloroethylene was found above its analytical quantification limit in one of 12 samples, at 0.099 mg/l. The measured concentration is below the treatable concentration of 0.1 mg/l. Therefore, 1,1-dichloroethylene is not considered for limitation.

1,2-trans-Dichloroethylene was found above its analytical quantification limit in five of 12 samples, with values ranging from 0.019 to 0.070 mg/l. All of the values are below the treatable concentration of 0.1 mg/l. Therefore, 1,2-trans-dichloroethylene is not considered for limitation.

Dichlorobromomethane was found above its analytical quantification limit in one of 12 samples. The measured value was 0.019 mg/l, which is below 0.1 mg/l, the concentration achievable by identified treatment technology. Therefore, dichlorobromomethane is not considered for specific limitation.

Antimony was found above its analytical quantification limit in one of six samples collected at four plants. The concentration found was 0.3 mg/l, which is below that achievable by identified technology. Therefore, antimony is not considered for limitation.

Beryllium was found above its analytical quantification limit in three of four samples. The maximum concentration measured was 0.20 mg/l. The concentration achievable by identified treatment technology is 0.20 mg/l. Therefore, beryllium is not considered for limitation.

Mercury was detected above its analytical quantification limit in all five samples of this subcategory, ranging from 0.0002 to 0.0064 mg/l. All of the values are below the 0.036 mg/l concentration achievable by identified treatment technology. Therefore, mercury is not considered for limitation.

Selenium was found above its quantification concentration in one of three samples collected at three plants. The concentration found was 0.20 mg/l, which is the concentration achievable by identified treatment technology. Therefore, selenium is not considered for limitation.

Silver was found above its analytical quantification limit in one of three samples with a value of 0.07 mg/l. This concentration is equal to that achievable by identified treatment technology. Therefore, silver is not considered for limitation.

## TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant if it is detectable in the effluent from only a small number of sources within the subcategory and it is uniquely related to only those sources. The following pollutants were not selected for consideration for limitation on this basis.

- 4. benzene
- 23. chloroform
- 27. 1,4-dichlorobenzene
- 39. fluoranthene
- 44. methylene chloride
- 66. bis(2-ethylhexyl) phthalate
- 67. butyl benzyl phthalate
- 68. di-n-butyl phthalate
- 69. di-n-octyl phthalate
- 71. dimethyl phthalate
- 73. benzo(a)pyrene
- 76. chrysene
- 77. acenaphthylene
- 84. pyrene
- 85. tetrachloroethylene
- 87. trichloroethylene
- 115. arsenic
- 119. chromium
- 120. copper
- 124. nickel
- 127. thallium

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

Benzene was found above its analytical quantification limit in one of 12 samples collected at four plants. The concentration of 0.136 mg/l is above the concentration achievable by identified treatment technology. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Because it was found above a treatable concentration at only one plant, benzene is not considered for limitation.

Chloroform was found above its analytical quantification limit in 11 of 12 samples collected at four plants. The 11 samples ranged from values of 0.019 to 0.410 mg/l; however, 10 of the 11 samples were at concentrations below that achievable by treatment. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Because the possibility of sample contamination is likely, chloroform is not considered for limitation.



1,4-Dichlorobenzene was found above its analytical quantification concentration in only one of six samples collected from three plants with a concentration of 0.026 mg/l, which is treatable by identified technology. However, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Since it was detected in only one plant, 1,4-dichlorobenzene is not considered for limitation.

Fluoranthene was detected above its analytical quantification limit in only one of six samples collected at three plants. The reported fluoranthene concentration, 0.020 mg/l, is above the concentration achievable by available treatment. However, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Because it was found at only one plant, indicating the pollutant is site-specific, fluoranthene is not considered for limitation.

Methylene chloride was found above its analytical quantification limit in one of 12 samples. The measurable concentration was 0.370 mg/l. This pollutant is not attributable to specific materials or processes associated with the secondary aluminum subcategory; however, it is a common solvent used in analytical laboratories. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Since the possibility of sample contamination is likely, methylene chloride is not considered for limitation.

Bis(2-ethylhexyl) phthalate was found above its analytical quantification limit in three of six samples. The concentrations measured were 0.075, 0.28, and 2.03 mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary aluminum subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Therefore, bis(2-ethylhexyl) phthalate is not considered for limitation.

Butyl benzyl phthalate was found above its analytical quantification limit in two of six samples collected from three plants. The measured values were 0.014 and 0.098 mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary aluminum subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Also, all secondary aluminum plants indicated in

the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. For these reasons, butyl benzyl phthalate is not considered for limitation.

Di-n-butyl phthalate was found above its analytical quantification limit in two of six samples, with concentrations of 0.022 and 0.045 mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary aluminum subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Therefore, di-n-butyl phthalate is not considered for limitation.

Di-n-octyl phthalate was found above its analytical quantification limit in only one of six samples collected at three plants, at a concentration of 0.036 mg/l. The presence of this pollutant is not attributable to materials or processes associated with the secondary aluminum subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. For these reasons, di-n-octyl phthalate is not considered for limitation.

Dimethyl phthalate was detected at a concentration greater than its analytical quantification limit in only one of six samples collected at three plants. The measured concentration of this toxic pollutant was 0.056 mg/l. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Because it was found at just one plant, dimethyl phthalate is not considered for limitation.

Benzo(a)pyrene was detected at a concentration above its analytical quantification limit in only one of six samples collected at three plants. The 0.012 mg/l concentration measured is above the concentration achievable by identified treatment technology. However, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Because it was found at only one plant, benzo(a)pyrene is not considered for limitation.

Chrysene was detected at a concentration above its analytical quantification limit in only one of six samples collected at three plants. The 0.017 mg/l concentration measured is above the concentration achievable by identified treatment technology. However, all secondary aluminum plants indicated in the dcp that

this pollutant was known to be absent or believed to be absent from their wastewater. Because it was found only at one plant, chrysene is not considered for limitation.

Acenaphthylene was detected at a concentration above its analytical quantification limit in only one of six samples collected at three plants. The 0.017 mg/l concentration measured is above the concentration achievable by identified treatment technology. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Because it was found at only one plant, acenaphthylene is not considered for limitation.

Pyrene was measured at a concentration greater than its analytical quantification limit in only one of six samples collected at three plants. The concentration of this toxic pollutant was 0.024 mg/l. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Because it was found at just one plant, pyrene is not considered for limitation.

Tetrachloroethylene was found above its analytical quantification limit and above the concentration attainable by available treatment in only one of 12 samples collected from four plants, indicating the pollutant is site-specific. The measured concentration was 0.378 mg/l. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Therefore, tetrachloroethylene is not considered for limitation.

Trichloroethylene was found above its analytical quantification limit and treatable concentration in one of 12 samples collected from four plants. The sample concentration was 0.787 mg/l. Also, all secondary aluminum plants indicated in the dcp that this pollutant was known to be absent or believed to be absent from their wastewater. Since this pollutant was found at only one plant, trichloroethylene is not considered for limitation.

Arsenic was found above its treatable concentration in one of three samples collected at four plants. The concentration of arsenic was 4.0 mg/l. Since it was found at a treatable concentration only one plant, arsenic is not considered for limitation.

Chromium was found above its treatable concentration in one of three samples collected at two plants. This sample contained 2.0 mg/l of chromium. Since a treatable concentration of chromium was collected at only one plant, chromium is not considered for limitation.

Copper was found above its treatable concentration in one of four samples, with a value of 10.0 mg/l. Since copper was found at only one plant, it is considered specific to that site and is not considered for limitation.

Nickel was detected above its treatable concentration in one of three samples (1.0 mg/l). Since it was found in only one plant, nickel is not considered for limitation.

Thallium was detected above its treatable concentration in one of three samples collected at three plants. Because it was found at only one plant, thallium is not considered for limitation.

#### TOXIC POLLUTANTS SELECTED FOR CONSIDERATION FOR ESTABLISHING LIMITATIONS

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

- 118. cadmium
- 122. lead
- 128. zinc

Cadmium was detected above its analytical quantification limit in four samples collected at two plants. The values ranged from 0.020 to 0.500 mg/l. Three of the concentrations are above the concentration of 0.049 mg/l, which is achievable by identified treatment technology. Therefore, cadmium is selected for consideration for limitation.

Lead was detected present above its analytical quantification limit in all four samples collected at two plants. The reported lead concentrations ranged from 0.060 to 8.0 mg/l. A lead concentration of 0.08 mg/l is achievable by identified treatment technology. Therefore, lead is selected for consideration for limitation.

Zinc was detected above its analytical quantification limit in all four samples collected at two plants. The concentrations of zinc reported ranged from 2.0 to 8.0 mg/l. The concentration of zinc achievable by identified treatment technology is 0.23 mg/l. Therefore, zinc is selected for consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY ALUMINUM  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
1. acenaphthene	0.010	0.010	5	6	6			
2. acrolein	0.010	0.100	5	12	12			
3. acrylonitrile	0.010	0.01	5	12	12			
4. benzene	0.010	0.05 - 0.10	5	12	6	5		1
5. benzidine	0.010	0.01	5	6	6			
6. carbon tetrachloride	0.010	0.05	5	12	12			
7. chlorobenzene	0.010	0.025	5	12	12			
8. 1,2,4-trichlorobenzene	0.010	0.01	5	6	6			
9. hexachlorobenzene	0.010	0.01	5	6	6			
10. 1,2-dichloroethane	0.010	0.1	5	12	12			
11. 1,1,1-trichloroethane	0.010	0.01	5	12	12			
12. hexachloroethane	0.010	0.01	5	6	6			
13. 1,1-dichloroethane	0.010	0.01	5	12	12			
14. 1,1,2-trichloroethane	0.010	0.1	5	12	12			
15. 1,1,2,2-tetrachloroethane	0.010	0.05	5	12	12			
16. chloroethane	0.010	0.01	5	12	12			
17. bis(chloromethyl) ether	0.010	0.01	5	12	12			
18. bis(2-chloroethyl) ether	0.010	0.01	5	6	6			
19. 2-chloroethyl vinyl ether	0.010	0.01	5	12	12			
20. 2-chloronaphthalene	0.010	0.01	5	6	6			
21. 2,4,6-trichlorophenol	0.010	0.025	2	2	2			
22. parachlorometa cresol	0.010	0.05	2	2	2			
23. chloroform	0.010	0.1	5	12		1	10	1
24. 2-chlorophenol	0.010	0.05	2	2	2			
25. 1,2-dichlorobenzene	0.010	0.05	5	6	6			
26. 1,3-dichlorobenzene	0.010	0.01	5	6	6			
27. 1,4-dichlorobenzene	0.010	0.01	5	6	5			1
28. 3,3'-dichlorobenzidine	0.010	0.01	5	6	6			
29. 1,1-dichloroethylene	0.010	0.1	5	12	11		1	
30. 1,2-trans-dichloroethylene	0.010	0.1	5	12	6	1	5	
31. 2,4-dichlorophenol	0.010	0.01	2	2	2	1		
32. 1,2-dichloropropane	0.010	0.01	5	12	12			
33. 1,3-dichloropropylene	0.010	0.01	5	12	12			
34. 2,4-dimethylphenol	0.010	0.05	2	2	2			
35. 2,4-dinitrotoluene	0.010	0.05	5	6	6			
36. 2,6-dinitrotoluene	0.010	0.05	5	6	6			
37. 1,2-diphenylhydrazine	0.010	0.05	5	6	6			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY ALUMINUM  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
38. ethylbenzene	0.010	0.05	5	12	12			
39. fluoranthene	0.010	0.01	5	6	5			1
40. 4-chlorophenyl phenyl ether	0.010	0.01	5	6	6			
41. 4-bromophenyl phenyl ether	0.010	0.01	5	6	6			
42. bis(2-chloroisopropyl) ether	0.010	0.01	5	6	6			
43. bis(2-chloroethoxy) methane	0.010	0.01	5	6	6			
44. methylene chloride	0.010	0.10	5	12	11			1
45. methyl chloride	0.010	0.01	5	12	12			
46. methyl bromide	0.010	0.01	5	12	12			
47. bromoform	0.010	0.05	5	12	12			
48. dichlorobromomethane	0.010	0.10	5	12	11		1	
49. trichlorofluoromethane	0.010	0.01	5	12	12			
50. dichlorodifluoromethane	0.010	0.01	5	12	12			
51. chlorodibromomethane	0.010	0.10	5	12	12			
52. hexachlorobutadiene	0.010	0.01	5	6	6			
53. hexachlorocyclopentadiene	0.010	0.01	5	6	6			
54. isophorone	0.010	0.05	5	6	6			
55. naphthalene	0.010	0.05	5	6	6			
56. nitrobenzene	0.010	0.05	5	6	6			
57. 2-nitrophenol	0.010	0.01	2	2	2			
58. 4-nitrophenol	0.010	0.05	2	2	2			
59. 2,4-dinitrophenol	0.010	0.025	2	2	2			
60. 4,6-dinitro-o-cresol	0.010	0.025	2	2	2			
61. N-nitrosodimethylamine	0.010	0.01	5	6	6			
62. N-nitrosodiphenylamine	0.010	0.01	5	6	6			
63. N-nitrosodi-n-propylamine	0.010	0.01	5	6	6			
64. pentachlorophenol	0.010	0.01	2	2	2			
65. phenol	0.010	0.05	2	2	2			
66. bis(2-ethylhexyl) phthalate	0.010	0.01	5	6	3			3
67. butyl benzyl phthalate	0.010	0.001 - 0.01	5	6	4			2
68. di-n-butyl phthalate	0.010	0.025	5	6	4		1	1
69. di-n-octyl phthalate	0.010	0.01	5	6	5			1
70. diethyl phthalate	0.010	0.025	5	6	6			
71. dimethyl phthalate	0.010	0.025	5	6	5			1
72. benzo(a)anthracene	0.010	0.01	5	6	6			
73. benzo(a)pyrene	0.010	0.01	5	6	5			1
74. 3,4-benzofluoranthene	0.010	0.01	5	6	6			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY ALUMINUM  
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
75. benzo(k)fluoranthene	0.010	0.01	5	6	6			
76. chrysene	0.010	0.001	5	6	5			1
77. acenaphthylene	0.010	0.01	5	6	5			1
78. anthracene (c)	0.010	0.01	5	6	6			
79. benzo(ghi)perylene	0.010	0.01	5	6	6			
80. fluorene	0.010	0.01	5	6	6			
81. phenanthrene (c)	0.010	0.01	5	6	6			
82. dibenzo(a,h)anthracene	0.010	0.01	5	6	6			
83. indeno(1,2,3-cd)pyrene	0.010	0.01	5	6	6			
84. pyrene	0.010	0.001 - 0.01	5	6	5			1
85. tetrachloroethylene	0.010	0.05	5	12	7	4		1
86. toluene	0.010	0.05	5	12	12			
87. trichloroethylene	0.010	0.01	5	12	5	6		1
88. vinyl chloride	0.010	0.01	5	12	12			
89. aldrin	0.005	0.001	5	6	6			
90. dieldrin	0.005	0.01	5	6	6			
91. chlordane	0.005	0.01	5	6	2	4		
92. 4,4'-DDT	0.005	0.01	5	6	2	4		
93. 4,4'-DDE	0.005	0.01	5	6	3	3		
94. 4,4'-DDD	0.005	0.01	5	6	6			
95. alpha-endosulfan	0.005	0.001	5	6	6			
96. beta-endosulfan	0.005	0.01	5	6	6			
97. endosulfan sulfate	0.005	0.01	5	6	6			
98. endrin	0.005	0.01	5	6	5	1		
99. endrin aldehyde	0.005	0.01	5	6	4	2		
100. heptachlor	0.005	0.01	5	6	2	4		
101. heptachlor epoxide	0.005	0.01	5	6	4	2		
102. alpha-BHC	0.005	0.01	5	6	4	2		
103. beta-BHC	0.005	0.01	5	6	2	4		
104. gamma-BHC	0.005	0.01	5	6	3	3		
105. delta-BHC	0.005	0.01	5	6	6			
106. PCB-1242 (d)	0.005	0.001	5	6	1	5		
107. PCB-1254 (d)	0.005							
108. PCB-1221 (d)	0.005							
109. PCB-1232 (e)	0.005	0.001	5	6	1	5		
110. PCB-1248 (e)	0.005							
111. PCB-1260 (e)	0.005							
112. PCB-1016 (e)	0.005							

Table VI-1 (Continued)  
 FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
 SECONDARY ALUMINUM  
 RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l) (a)	Treatable Concentra- tion (mg/l) (b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treat- able Concen- tration	Detected Above Treat- able Concen- tration
113. toxaphene	0.005	0.01	5	6	5	1		
114. antimony	0.100	0.47	3	3	2		1	
115. arsenic	0.010	0.34	3	3	1	1		1
116. asbestos	10 MFL	10 MFL	1	1	1			
117. beryllium	0.010	0.20	3	4		1	3	
118. cadmium	0.002	0.049	3	4			1	3
119. chromium	0.005	0.07	3	4		3		1
120. copper	0.009	0.39	3	4			3	1
121. cyanide (f)	0.02	0.047	5	10		9	1	
122. lead	0.020	0.08	3	4			2	2
123. mercury	0.0001	0.036	4	5			5	
124. nickel	0.005	0.22	3	3		2		1
125. selenium	0.01	0.20	3	3	2		1	
126. silver	0.02	0.07	3	3	2		1	
127. thallium	0.100	0.34	3	3	2			1
128. zinc	0.050	0.23	3	4				4
129. 2,3,7,8-tetrachlorodibenzo- p-dioxin (TCDD)	Not Analyzed							

(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.



## SECONDARY ALUMINUM SUBCATEGORY

### SECTION VII

#### CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the wastewater sources, flows, and characteristics of the wastewaters from secondary aluminum plants. This section summarizes the description of these wastewaters and indicates the level of treatment which is currently practiced by in secondary aluminum subcategory for each waste stream.

#### TECHNICAL BASIS OF BPT

As mentioned in Section III, EPA promulgated BPT effluent limitations guidelines for the secondary aluminum smelting subcategory on April 8, 1974. In order to put the treatment practices currently in place and the technologies selected for BAT options into the proper perspective, it is necessary to describe the technologies selected by EPA for BPT. The BPT regulations established by EPA limited the discharge of aluminum, copper, ammonia, chemical oxygen demand, fluoride, and total suspended solids and required the control of pH (refer to Section IX).

Control and treatment technologies are also discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability to wastewater similar to that found in this subcategory are presented there. This section presents a summary of the control and treatment technologies that are currently being applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary aluminum subcategory is characterized by the presence of the toxic metal pollutants and suspended solids. The raw (untreated) wastewater data are 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, so these waste streams are commonly combined for treatment to reduce the concentrations of these pollutants. 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 lime precipitation and sedimentation, and no plants have lime precipitation, sedimentation and filtration. As such, three options have been selected for consideration for BAT, BDT, BCT, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

## CURRENT CONTROL AND TREATMENT PRACTICES

Control and treatment technologies are discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability to wastewater similar to that found in this industry are presented there. 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 and then identifies three options which are considered as the basis for BAT, BDT, and pretreatment for existing and new sources.

### SCRAP DRYING WET AIR POLLUTION CONTROL

Wet and dry control devices are used to control air emissions from scrap drying operations. Three plants use scrubbers; 26 plants use baghouses. Two plants practice 100 percent recycle, resulting in zero discharge. One plant discharges this wastewater, which may contain suspended solids and aluminum.

Alkali addition and sedimentation can be used to remove suspended solids and some metals. The one plant producing this wastewater reported no treatment before discharging to a municipal sewer system.

### SCRAP SCREENING AND MILLING WASTEWATER

Two plants use scrubbers to control air emissions from scrap screening and milling operations. Both plants practice 100 percent recycle of this wastewater, which may contain total suspended solids, toxic metals, and aluminum at treatable concentrations. Alkali addition and sedimentation may be used to reduce suspended solids and some metals.

### DROSS WASHING WASTEWATER

Of the four plants that practice wet dross processing, two practice 100 percent recycle and one attains zero discharge by solar evaporation. One plant recycles 67 percent of this wastewater, which contains organics, toxic metals, aluminum, ammonia, phenolics, and suspended solids.

The only currently practiced reduction of primary aluminum residues and secondary aluminum slags uses wet milling with a countercurrent flow process to reduce or possibly eliminate salt impregnation of runoff and ground water from discarded solid waste. Such salt recovery installations are operating in England and Switzerland, and the salts recovered assist in paying for the

operation since they are reusable as fluxing salts in the secondary aluminum subcategory. By using a countercurrent milling and washing approach, two advantages are realized. The final recovered metal is washed with clean water, providing a low-salt feed to the melting furnaces. The wastewater, with the insolubles removed, would be of a concentration suitable for economical salt recovery by evaporation and crystallization. Heat for evaporation could be supplied by the waste heat from the furnaces. The process would have to contend with the ultimate disposal of dirt, trace metals, and insoluble salts not removed from the dross during milling. Sedimentation with recycle is the treatment method currently used at the one discharging facility.

#### DEMAGGING WET AIR POLLUTION CONTROL

During the smelting process it is often necessary to remove magnesium from the molten aluminum. This process of demagging can be performed with chlorine or aluminum fluoride. Most facilities (25 of the 37 that demag) use chlorine to accomplish the demagging. Aluminum fluoride is more expensive than chlorine and is not regarded as effective in removing magnesium. In addition, the furnace refractory lining life is shorter when aluminum fluoride is used since residues resulting from its use in the demagging process are more corrosive than chlorine generated residues.

However, demagging with chlorine complicates emissions control because of the formation of hydrochloric acid in the smelting emissions, due to the hydrolysis of aluminum and magnesium chloride when wet scrubbing is used. Emissions from aluminum fluoride demagging are usually controlled with dry processes.

Demagging scrubbing wastewater contains organics, toxic metals, cyanide, aluminum, ammonia, chloride, phenolics, total suspended solids, and oil and grease.

Of the 55 facilities surveyed, 20 use some form of wet process control of demagging air emissions. Seven of the 20 practice 100 percent recycle, while two others use a closed system incorporating evaporation ponds. Four of the facilities discharge (either directly or to a POTW) with no prior treatment, and one facility only settles the waste stream before discharging it. The six facilities that treat this waste stream all neutralize the stream (often with soda ash) before discharge. This neutralization step is usually followed by a settling procedure since pH adjustment to 5.0 to 7.0 will precipitate most of the aluminum and magnesium.

## CASTING CONTACT COOLING

Different product cooling techniques are used in the secondary aluminum subcategory depending on the product being produced. Air cooling, contact water cooling, and noncontact water cooling are all used. Also, there is a trend toward converting to direct chill casting in the secondary aluminum subcategory (refer to Section V, p.754 ). The use of contact water itself varies with the type of product being manufactured. Ingot molds are often sprayed with water to cool them, whereas the production of deoxidizer shot involves allowing molten aluminum to flow through the mesh of a screen and fall (forming a spherical shot product) into a quenching tank.

Oil and grease, used to lubricate mold conveyor systems, is washed from the equipment as the product is sprayed with water. The quantity of this form of wastewater can be reduced by recycle or the adoption of systems that allow total evaporation through regulated flow.

Casting contact cooling water contains treatable concentrations of aluminum, oil and grease, and suspended solids.

Of the 55 facilities surveyed, 35 produced a wastewater associated with cooling water. Twenty-two of the 35 facilities utilize recycle or evaporation to the extent that no discharge of contact cooling water occurs. Eleven of the facilities discharge (either directly or indirectly) with no treatment other than some volume reduction due to evaporation or partial recycle. Two facilities treat the wastewater before discharge. One uses flotation to remove oil and grease followed by grit removal before discharge. The other facility uses equalization and neutralization before discharge.

## CONTROL AND TREATMENT OPTIONS CONSIDERED

Based on an examination of the wastewater sampling data, three treatment technologies that effectively control the pollutants found in secondary aluminum wastewaters were selected for evaluation. These technology options are discussed below. Other treatment technologies included additional in-process flow reduction (Option B), activated alumina adsorption (Option D), and activated carbon adsorption (Option E). These technologies were not selected for evaluation because they are not applicable to the secondary aluminum subcategory. Option B does not apply since in-process wastewater flow reduction is part of the Option A technology. EPA believes that no additional in-process wastewater flow reduction is achievable by this subcategory. Since arsenic was not selected for consideration for limitation in the secondary aluminum subcategory, activated alumina technology (Option D) was not selected for evaluation because it is not

applicable. (For pollutant selection, refer to Section VI, p. 787 ). Since no toxic organic pollutants were selected for consideration for limitation in this subcategory, activated carbon technology (Option E) also is not applicable.

#### OPTION A

Option A for the secondary aluminum subcategory is equivalent to BPT treatment. Option A requires control and treatment technologies to reduce the discharge of wastewater volume and pollutant mass. Recycle of casting contact cooling water is the control mechanism for flow reduction.

The Option A treatment scheme consists of ammonia stream stripping preliminary treatment applied to the dross washing wastewater stream, preliminary treatment of casting cooling water with oil skimming, and lime and settle technology (chemical precipitation and sedimentation) applied to the combined stream of steam stripper effluent, demagging air pollution scrubbing wastewater, and casting contact cooling wastewater. Chemical precipitation is used to remove metals and fluoride by the addition of lime followed by gravity sedimentation. Suspended solids are also removed from the process.

#### OPTION C

Option C for the secondary aluminum subcategory consists of preliminary treatment with ammonia steam stripping and oil skimming in-process flow reduction, and the chemical precipitation and sedimentation technology considered in Option A plus multimedia filtration end-of-pipe technology. 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 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 in which there are rapid increases in flows or loadings of pollutants to the treatment scheme.

#### OPTION F

Option F for the secondary aluminum subcategory consists of preliminary treatment with ammonia steam stripping and oil skimming in-process flow reduction, chemical precipitation, sedimentation, and multimedia filtration technology considered in Option C with the addition of reverse osmosis and evaporation end-of-pipe technology. Option F is used for complete recycle of the treated water by controlling the concentration of dissolved solids. Multiple-effect evaporation is used to dewater the brines rejected from reverse osmosis.

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION VIII

#### COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section describes the method used to develop the costs associated with the control and treatment technologies discussed in Section VII for wastewaters from secondary aluminum plants. The energy requirements of the considered options, as well as solid waste and air pollution aspects, are also discussed in this section. Section VIII of the General Development Document provides background on the capital and annual costs for each of the technologies discussed herein.

The wastewater streams associated with the secondary aluminum subcategory are combined into three groups for the purposes of this section. These three groups have been selected because the combinations of waste streams is representative of the processing that occurs in secondary aluminum plants. The three groups are as follows:

1. Dross washing, scrap drying wet air pollution control, and scrap screening and milling wastewaters;
2. Demagging wet air pollution control wastewater; and
3. Direct chill casting contact cooling.

These three groups are found in existing plants in the five different combinations shown below. These five combinations are selected for the purpose of cost estimation because they represent the wastewater combinations that occur most frequently in plants in the secondary aluminum subcategory.

<u>Combination</u>	<u>Dross Washing, Scrap Drying Wet Air Pollution Control and Scrap Screening and Milling</u>	<u>Demagging Wet Air Pollution Control</u>	<u>Direct Chill Casting Contact Cooling</u>
1	X	X	
2		X	X
3			X
4	X		
5		X	

The wastewater of combination 4 is so similar to that of combination 1 that they are considered together for the cost estimates. Similarly, combination 5 is considered with combination 2. Thus, three combinations of wastewater are considered for the purpose of cost estimates.

Section VI indicated that significant pollutants and pollutant parameters in the secondary aluminum subcategory are cadmium, lead, zinc, aluminum, ammonia, oil and grease, total suspended solids, and pH. As explained in Section VII of the General Development Document, metals are most economically removed by lime precipitation, sedimentation, and filtration technology. Reverse osmosis, in conjunction with multiple-effect evaporation, is a technology used for the removal of organics and dissolved metals. Ammonia is removed from streams in which it is present in treatable concentrations by preliminary steam stripping treatment, and oil and grease is removed by oil skimming.

#### TREATMENT OPTIONS COSTED FOR EXISTING SOURCES

As discussed in Section VII, three control and treatment options are considered for treating wastewater from the secondary aluminum subcategory. Cost estimates, in the form of annual cost curves, have been developed for each of these control and treatment options. The control and treatment options are presented schematically in Figures X-1 through X-3 and summarized below.

##### OPTION A

Option A for the secondary aluminum subcategory requires control and treatment technologies to reduce the discharge of wastewater volume and pollutant mass. The recycle of direct chill casting contact cooling water through cooling towers and the total recycle of scrap drying scrubber water through holding tanks are the control mechanisms for flow reduction. The Option A treatment technology consists of ammonia steam stripping preliminary treatment applied to the dross washing wastewater stream, and oil skimming preliminary treatment applied to the direct chill casting contact cooling water stream; preliminary treatment is followed by lime precipitation and sedimentation applied to the combined stream of steam stripper effluent, scrap screening and milling wastewater, demagging scrubber water, and direct chill casting contact cooling water. The annual cost curves developed for the various options for wastewater combinations 1 and 4 are based on ammonia steam stripping preliminary treatment for 85 percent of the wastewater stream, while the curves developed for combinations 2, 3, and 5 do not consider ammonia steam stripping preliminary treatment since these combinations do not contain dross washing wastewater. The annual cost curves developed for Option A do not consider the recycle of direct chill casting contact cooling water through cooling towers or the recycle of scrap drying scrubber water through holding tanks. Therefore, separate cost curves have been developed to estimate holding tank and cooling tower costs. The total cost of Option A is determined by adding the holding tank and cooling tower costs to the cost determined from the appropriate Option A cost curve.

## OPTION C

Option C for the secondary aluminum subcategory consists of all the control and treatment technologies of Option A (in-process flow reduction through holding tanks and cooling towers, ammonia steam stripping and oil skimming preliminary treatment, and lime precipitation and sedimentation end-of-pipe treatment) with the addition of multimedia filtration to the end-of-pipe treatment scheme. The cost curves for Option C do not consider the recycle of direct chill casting contact cooling water through cooling towers or the recycle of scrap drying scrubber water through holding tanks. Therefore, the total cost of Option C is determined by adding the cooling tower and holding tank costs to the cost determined from the appropriate Option C cost curve.

## OPTION F

Option F for the secondary aluminum subcategory consists of all the control and treatment technologies of Option C (in-process flow reduction through holding tanks and cooling towers, ammonia steam stripping and oil skimming preliminary treatment, and lime precipitation, sedimentation, and multimedia filtration end-of-pipe treatment) with the addition of reverse osmosis and multiple-effect evaporation technology, followed by total recycle to the end-of-pipe treatment scheme. The cost curves developed for the five wastewater combinations do not consider the recycle of direct chill casting contact cooling water through cooling towers or the recycle of scrap drying scrubber water through holding tanks. Therefore, the total cost of Option F is determined by adding the cooling tower and holding tank costs to the cost determined from the appropriate Option F cost curve.

The cost curves for the options summarized above are presented in the figures listed below. The respective options which the curves are based on are also shown.

<u>Combination</u>	<u>Figure VIII-</u>	<u>Options Costed</u>
1 & 4	1 - 3	A, C, F
2 & 5	4 - 6	A, C, F
3	7 - 9	A, C, F

The cooling tower and holding tank cost curves are shown in Figures VIII-10 and VIII-11, respectively.

## 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 aluminum 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. Briefly, the energy usage of the various options is determined for secondary aluminum using the median plant wastewater flow. The energy usage of the options is then compared to the energy usage of the median secondary aluminum energy consumption plant. As shown in Table VIII-1, the most energy intensive option is reverse osmosis, which increases the median secondary aluminum energy consumption by 0.065 percent. The remaining two options would increase the median energy consumption by less than 0.065 percent.

#### SOLID WASTE

Sludges associated with the secondary aluminum subcategory will necessarily contain toxic quantities (and concentrations) 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. None of these wastes is 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, sedimentation and filtration. By the addition of excess 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 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 non-ferrous 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), 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. For more details, see Section VIII of the General Development Document.

#### AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of ammonia steam stripping, oil skimming, chemical precipitation, sedimentation, multimedia filtration, and reverse osmosis. These technologies transfer pollutants to solid waste and do not involve air stripping or any other physical process likely to transfer pollutants to air. Water vapor containing some particulate matter will be released in the drift from the cooling tower systems which are used as the basis for flow reduction in the secondary aluminum subcategory. However, the Agency does not consider this impact to be significant.

Table VIII-1  
ENERGY REQUIREMENTS

Median of Total Plant Energy Consumption (Btu/year)	Median Size Plant by Flow (gal/day)	ENERGY USAGE (Btu/year) AND PERCENT OF MEDIAN PLANT ENERGY CONSUMPTION					
		Option A		Option C		Option F	
		Usage	%	Usage	%	Usage	%
$2.785 \times 10^{11}$	4,280	$1.25 \times 10^8$	0.045	$1.25 \times 10^8$	0.045	$1.82 \times 10^8$	0.065

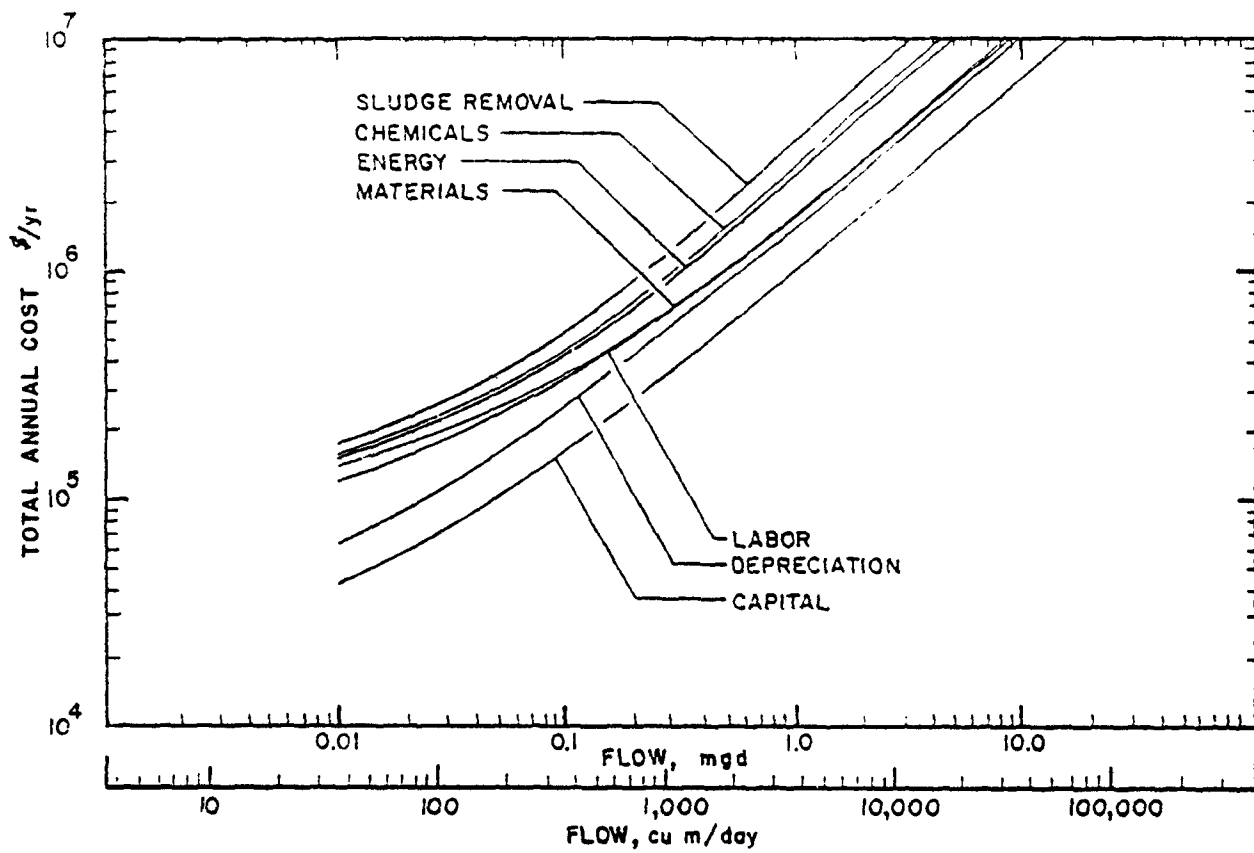


Figure VIII-1

SECONDARY ALUMINUM COMBINATIONS 1&4, OPTION A

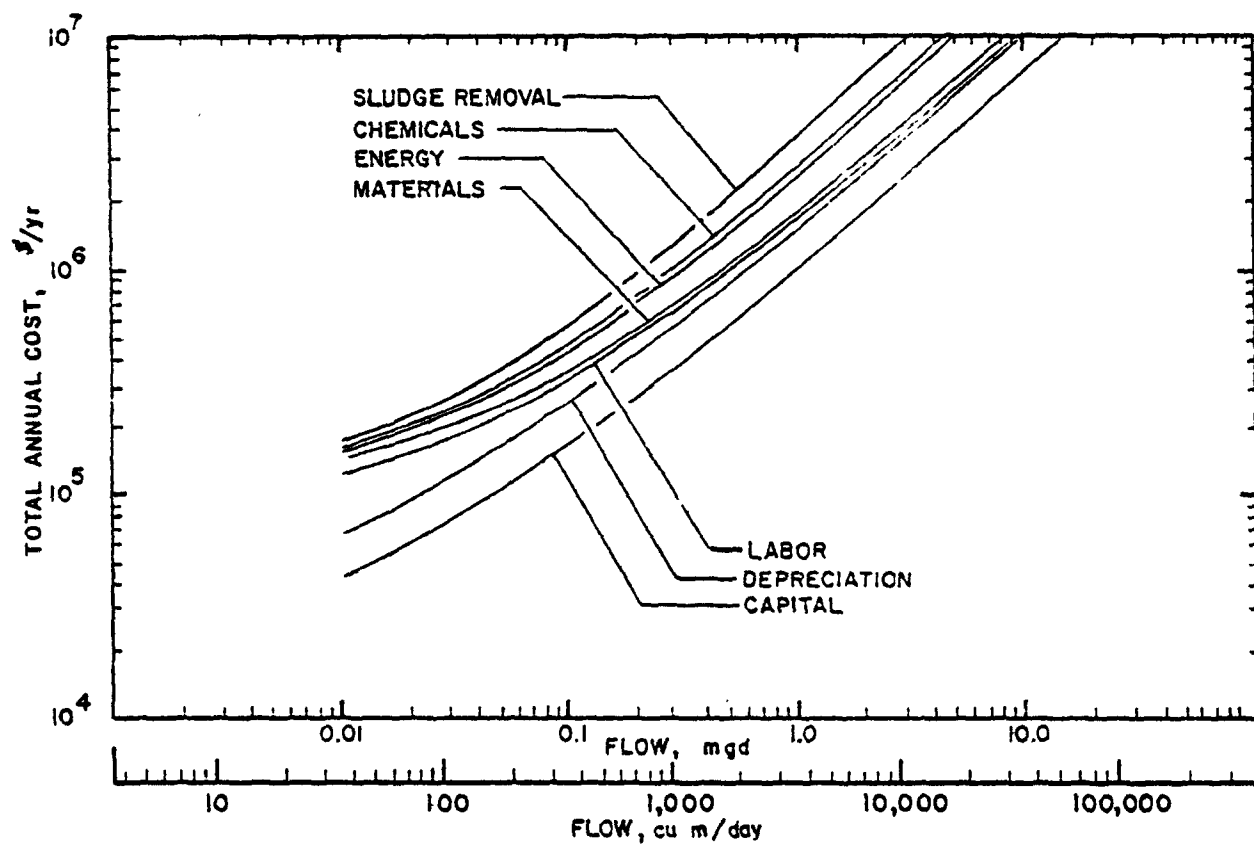


Figure VIII-2

SECONDARY ALUMINUM COMBINATIONS 1&4, OPTION C

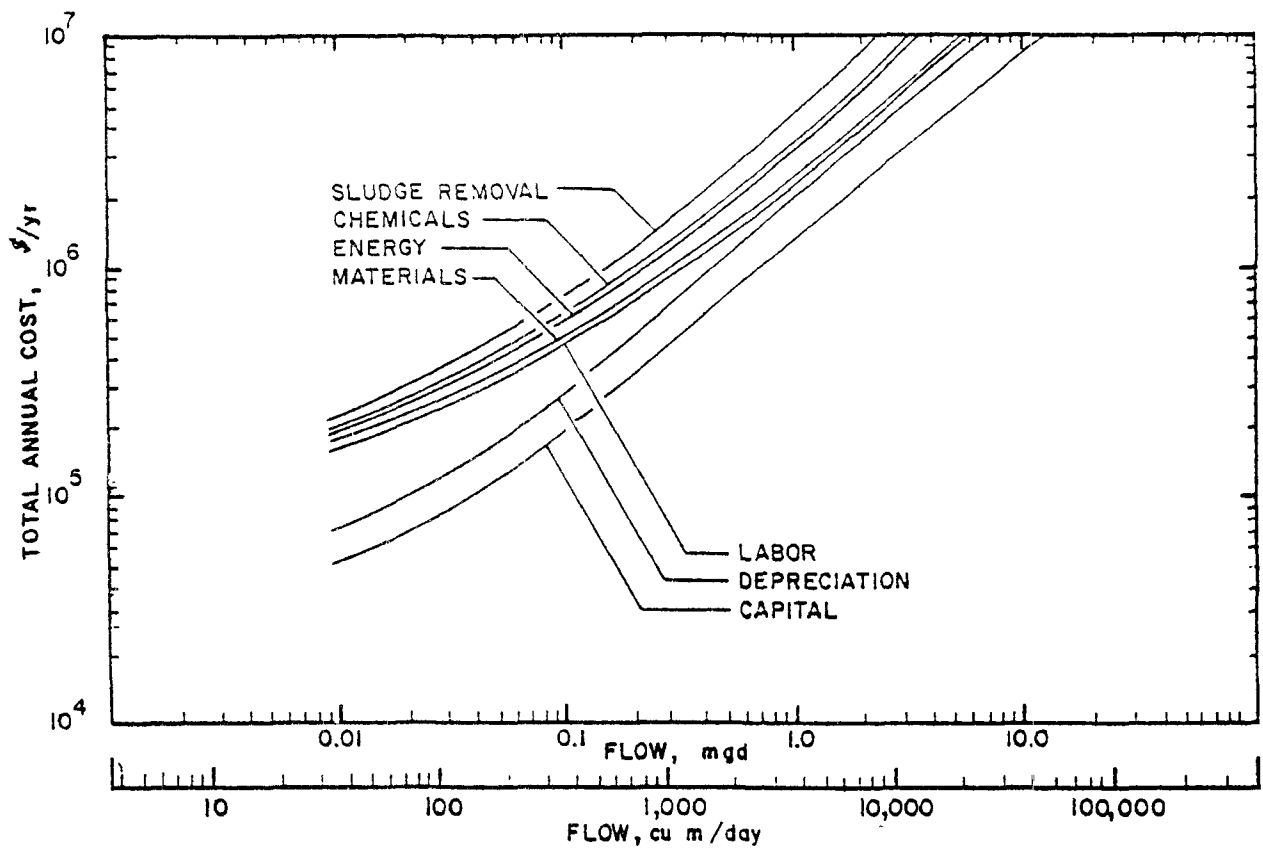


Figure VIII-3

SECONDARY ALUMINUM COMBINATIONS 1&4, OPTION F

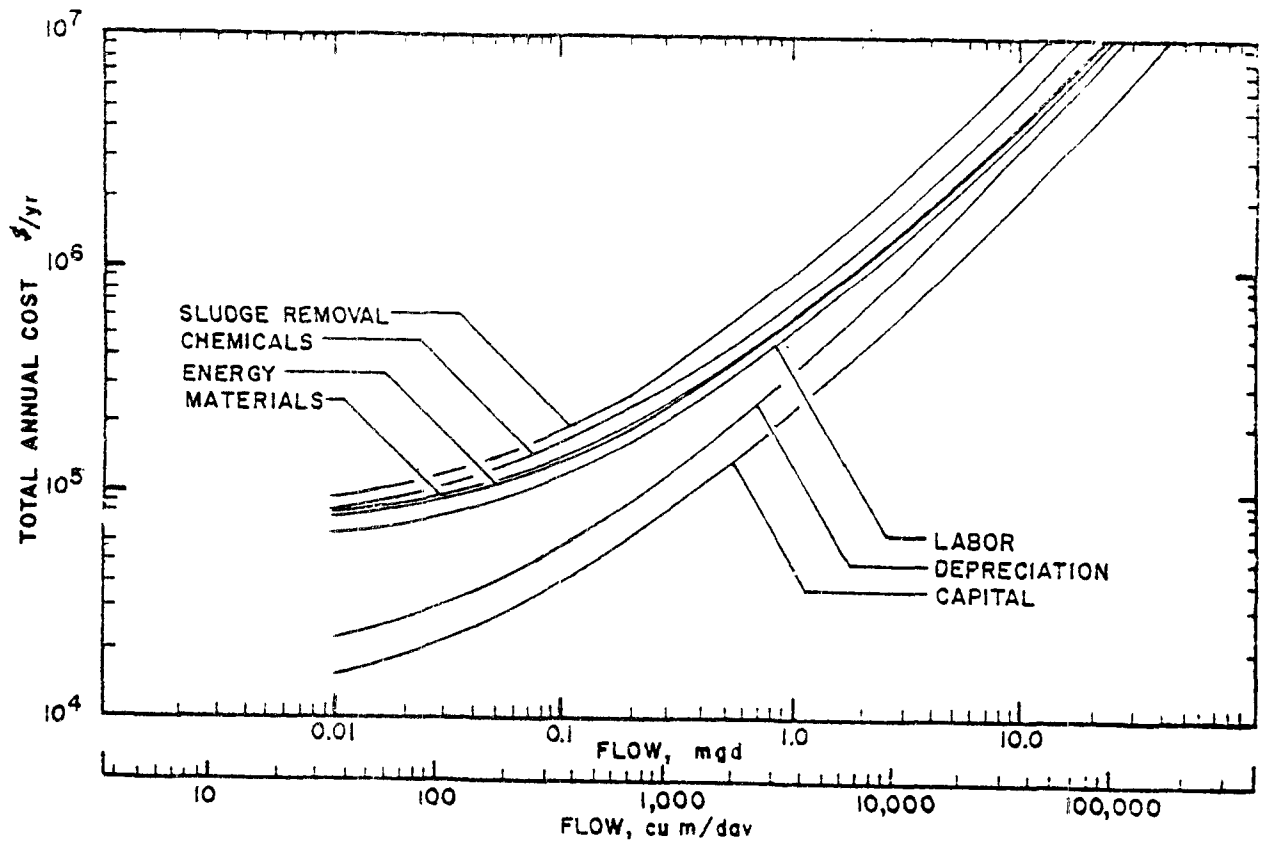


Figure VIII-4

SECONDARY ALUMINUM COMBINATIONS 2&5, OPTION A

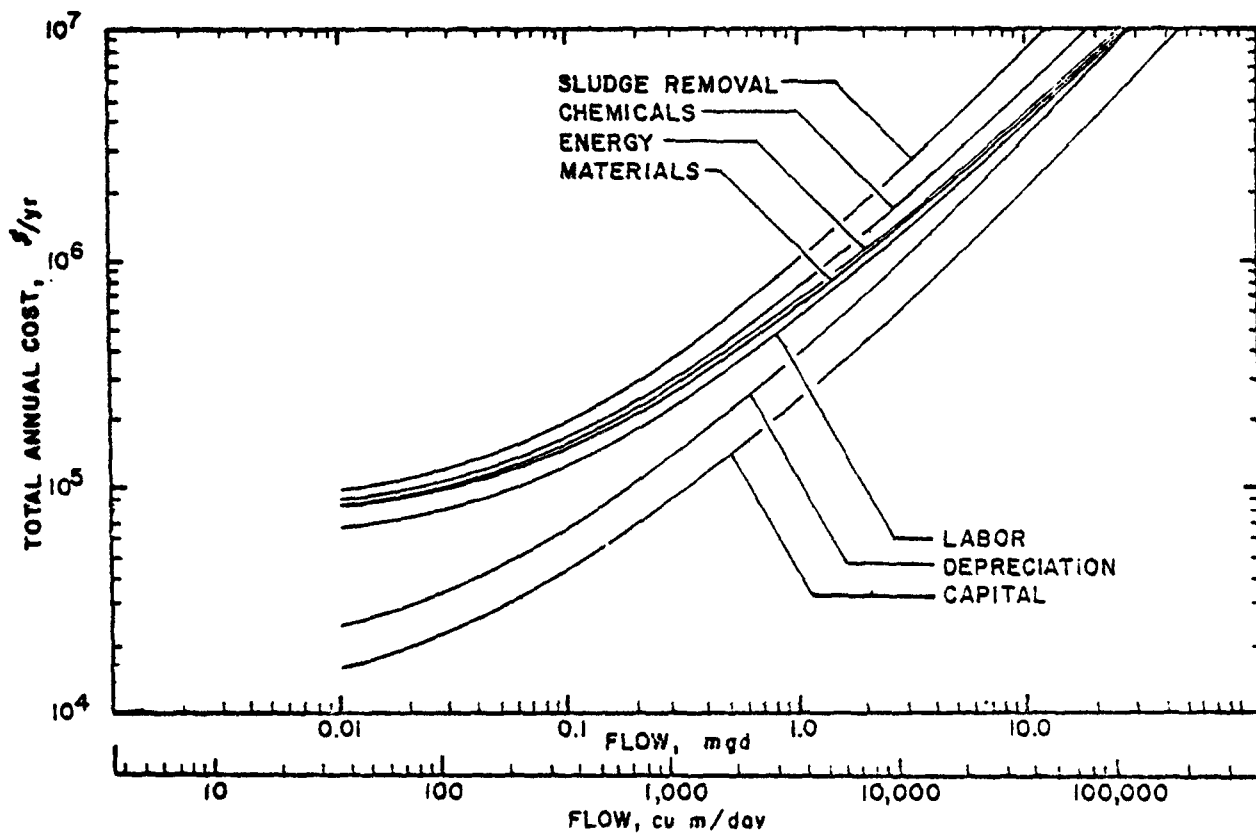


Figure VIII-5

SECONDARY ALUMINUM COMBINATIONS 2&5, OPTION C

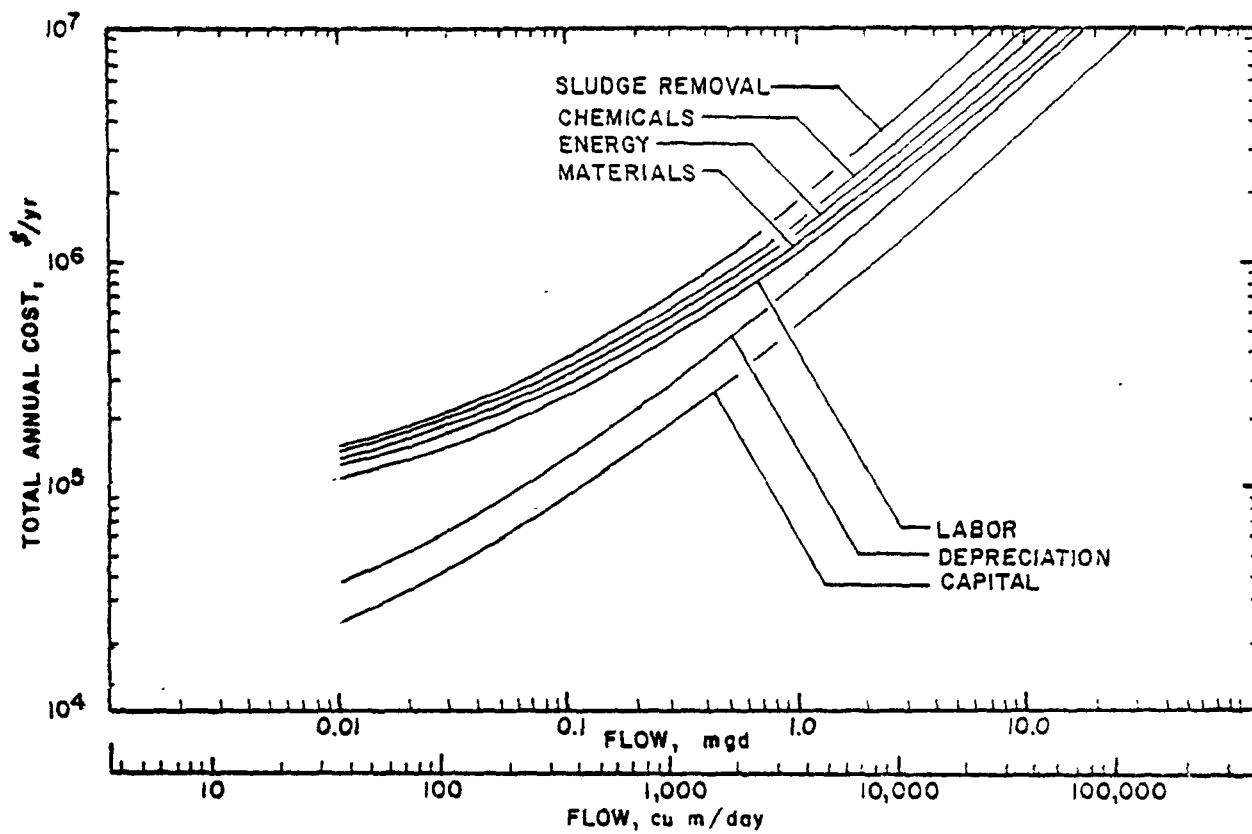


Figure VIII-6

SECONDARY ALUMINUM COMBINATIONS 2&5, OPTION F

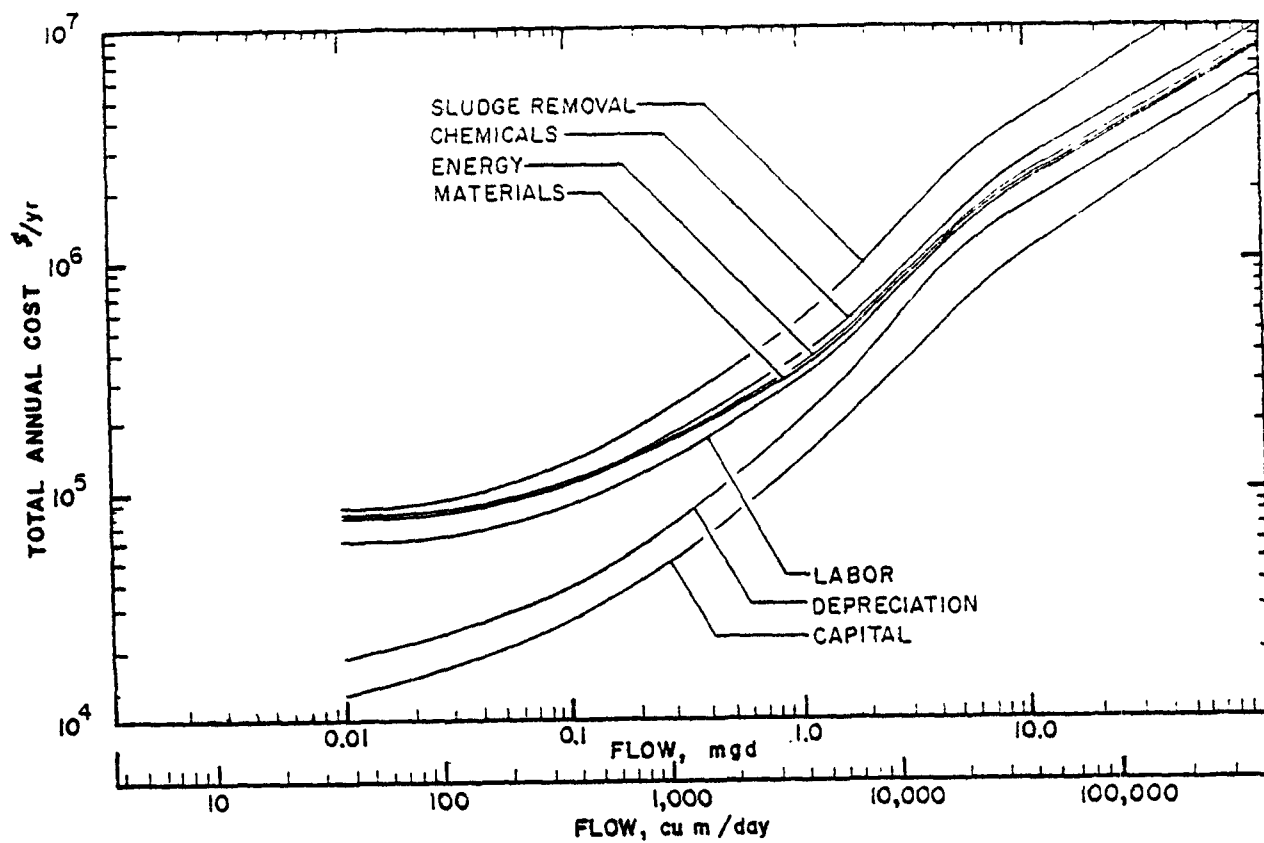


Figure VIII-7

SECONDARY ALUMINUM COMBINATION 3, OPTION A

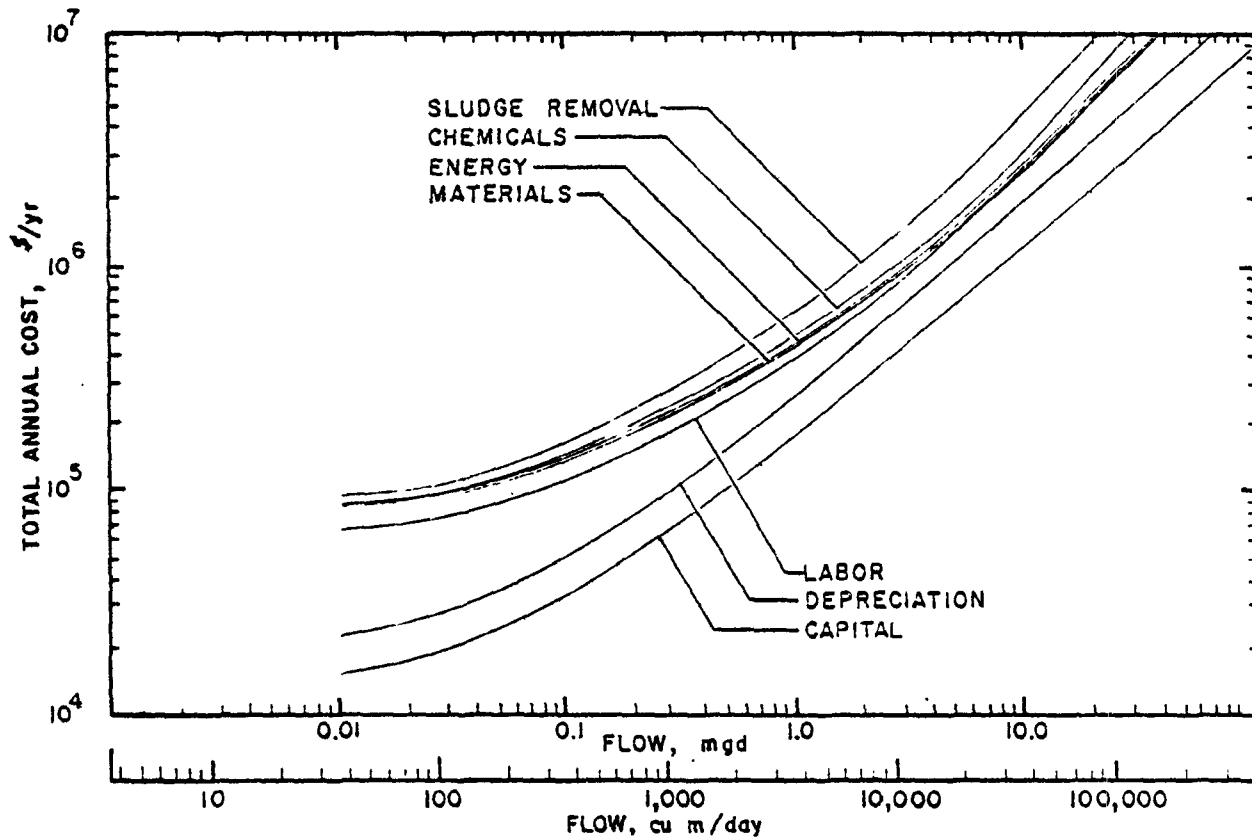


Figure VIII-8

SECONDARY ALUMINUM COMBINATION 3, OPTION C

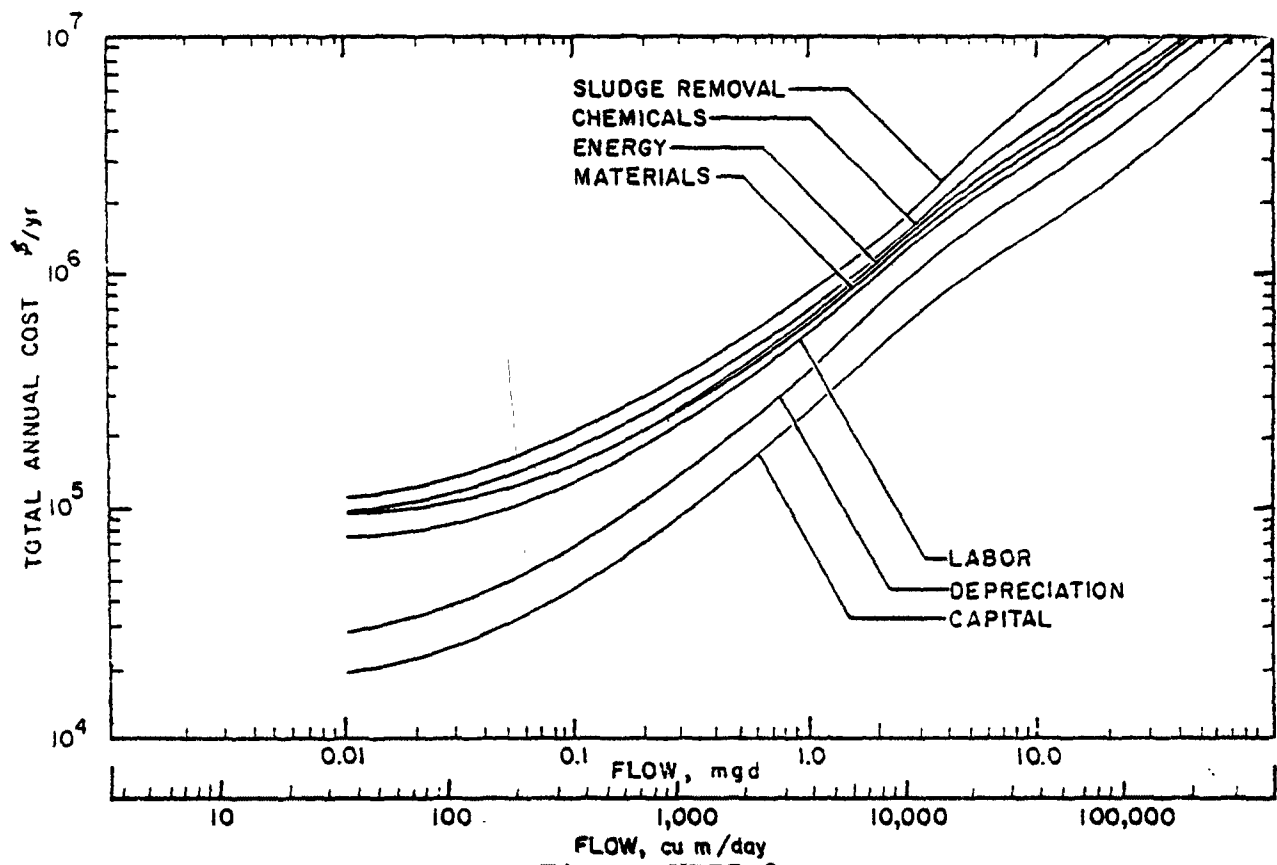


Figure VIII-9

SECONDARY ALUMINUM COMBINATION 3, OPTION F

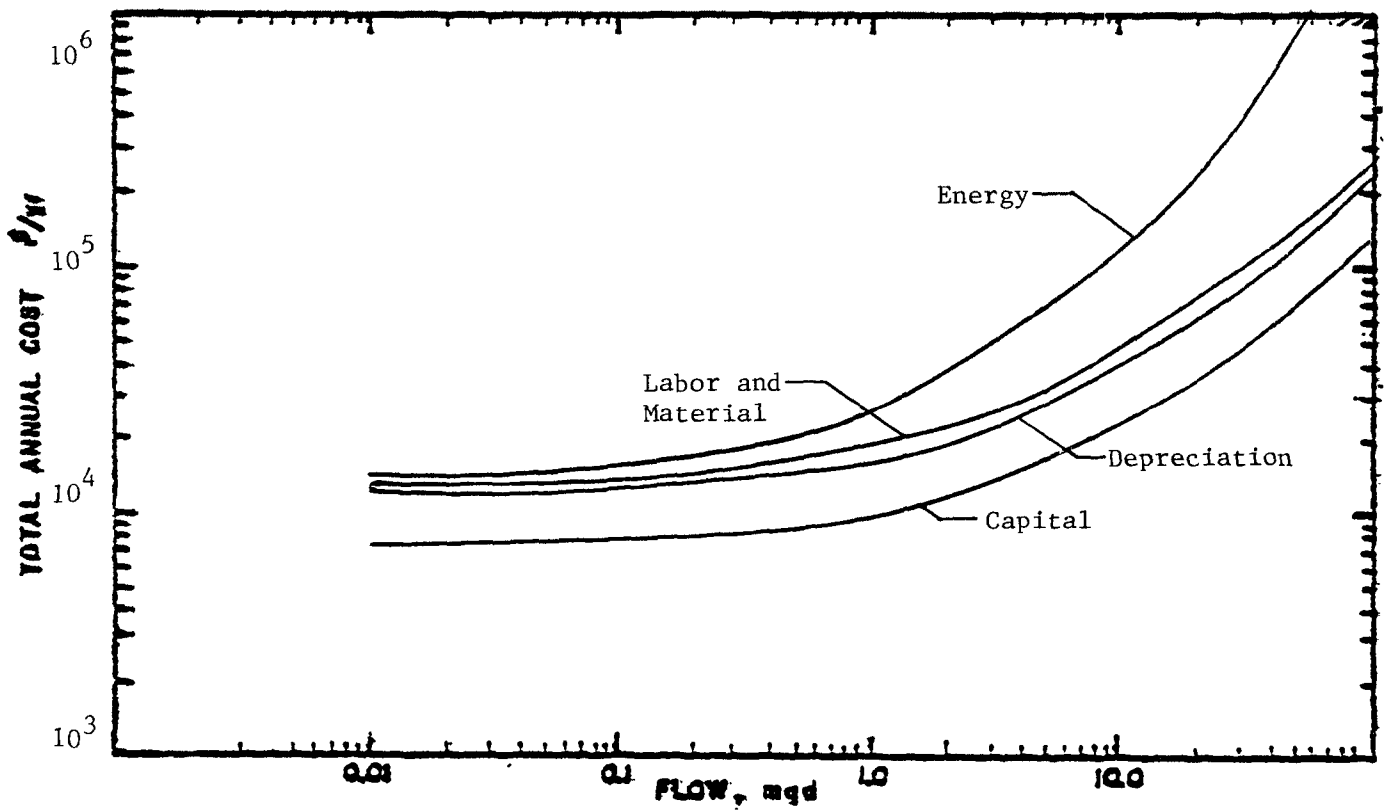


Figure VIII-10

COOLING TOWER COSTS (CASTING CONTACT COOLING)



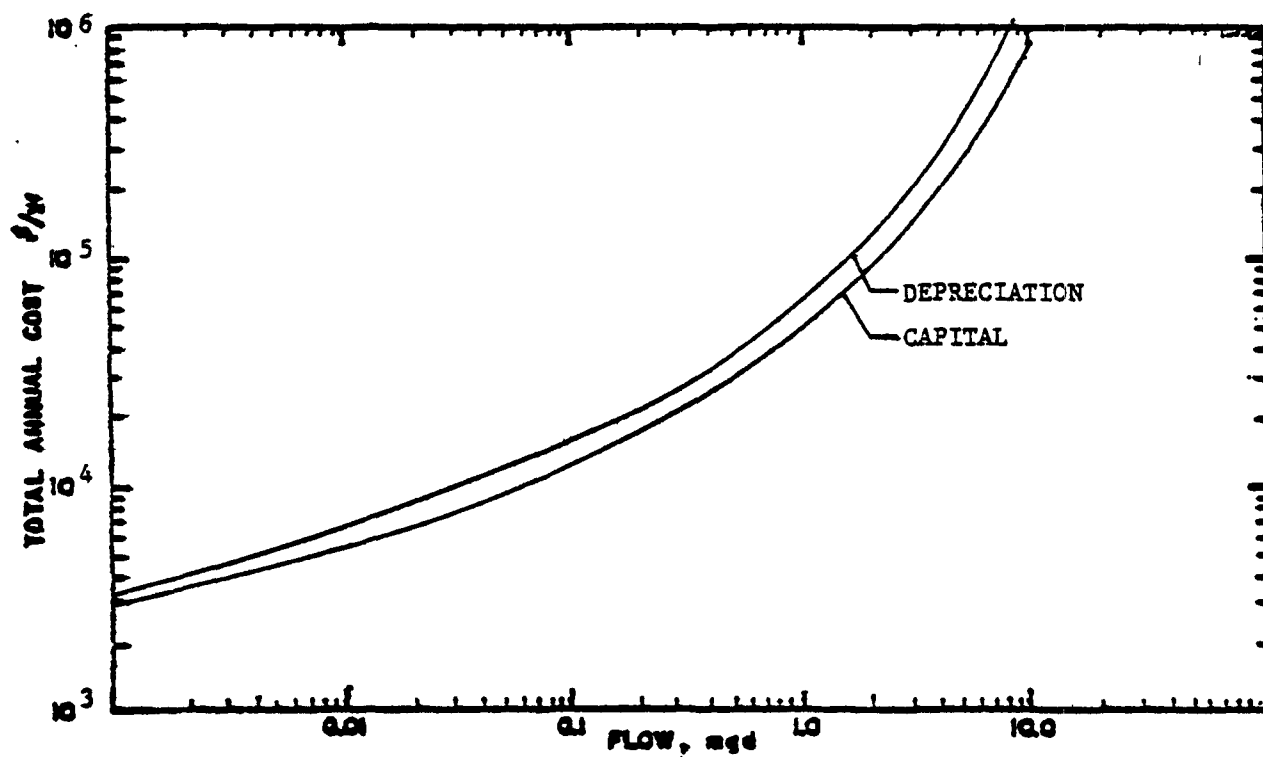


Figure VIII-11  
HOLDING TANK COSTS

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION IX

#### BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

EPA promulgated best practicable control technology currently available (BPT) effluent limitations standards for the secondary aluminum industry on April 8, 1974 as Subpart C of 40 CFR Part 421. Pollutants regulated by these standards are aluminum, copper, chemical oxygen demand, ammonia, fluoride, TSS, and pH. Unlike the current rulemaking, the BPT standards were developed on the basis of two subdivisions of the secondary aluminum process, not on the basis of individual wastewater streams. BPT standards were established for magnesium removal processes (demagging using either chlorine or aluminum fluoride) and wet residue processes. The effluent limitations established by the BPT standards are as listed below:

- (a) The following limitations establish the quantity or quality of pollutants or pollutant properties, which may be discharged by a point source subject to the provisions of this subpart and which uses water for metal cooling, after application of the best practicable control technology currently available: There shall be no discharge of process wastewater pollutants to navigable waters.
- (b) The following limitations establish the quantity or quality of pollutants or pollutant properties which may be discharged by a point source subject to the provisions of this subpart and which uses aluminum fluoride in its magnesium removal process ("demagging process"), after application of the best practicable control technology currently available: There shall be no discharge of process wastewater pollutants to navigable waters.
- (c) The following limitations establish the quantity or quality of pollutants or pollutant properties controlled by this section, which may be discharged by a point source subject to the provisions of this subpart and which uses chlorine in its magnesium removal process, after application of the best practicable control technology currently available:

Effluent Characteristic	Effluent Limitations
	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 kg magnesium removed)
	English units (lbs per 1,000 lbs magnesium removed)
TSS	175
COD	6.5
pH	Within the range of 7.5 to 9.0

- (d) The following limitations establish the quantity or quality of pollutants or pollutant properties which may be discharged by a point source subject to the provisions of this subpart and which processes residues by wet methods, after application of the best practical control technology currently available:

Effluent Characteristic	Effluent Limitations
	Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 kg magnesium removed)
	English units (lbs per 1,000 lbs magnesium removed)
TSS	1.5
Fluoride	0.4
Ammonia (as N)	0.01
Aluminum	1.0
Copper	0.003
COD	1.0
pH	Within the range of 7.5 to 9.0

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION X

#### BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

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

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

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

#### TECHNICAL APPROACH TO BAT

In pursuing this second round of effluent regulations, EPA 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 three technology alternatives which could be applied to the secondary aluminum subcategory as BAT options.

In summary, the treatment technologies considered for BAT are presented below:

Option A (Figure X-1) is based on

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation

Option C (Figure X-2) is based on

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation
- o Multimedia filtration

Option F (Figure X-3) is based on

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation
- o Multimedia filtration
- o Reverse osmosis and multiple-effect evaporation for complete recycle of treated water

The three options for BAT are discussed in greater detail below. The first option considered is the same at the BPT treatment and control technology.

#### OPTION A

Option A for the secondary aluminum subcategory is equivalent to BPT treatment. Option A requires control and treatment technologies to reduce the discharge of wastewater volume and pollutant mass. These measures include in-process changes, resulting in the elimination of some wastewater streams and the concentration of pollutants in other effluents. As explained in Section VII of the General Development Document, treatment of a more concentrated effluent allows achievement of a greater net pollutant

removal and introduces the possible economic benefits associated with treating a lower volume of wastewater. Methods used in Option A to reduce process wastewater generation or discharge rates include the following:

#### Recycle of Casting Contact Cooling Water Through Cooling Towers

The cooling and recycle of contact cooling water is practiced by 25 of the 38 plants reporting this wastewater. The function of casting contact cooling water is to quickly remove heat from the newly formed ingot or bar. Therefore, the principal requirements of the water are that it be cool and not contain dissolved solids at a concentration that would cause water marks or other surface imperfections. There is sufficient category experience with casting contact cooling wastewaters to assure the success of this technology using cooling towers or heat exchangers (refer to Section VII of the General Development Document). Although 22 plants have reported that they do not discharge any quench water by reason of 100 percent recycle, a blowdown or periodic cleaning is likely to be needed to prevent a buildup of dissolved and suspended solids. (EPA has determined that a blowdown of 10 percent of the water applied in a process is adequate.)

#### Recycle of Water Used in Wet Air Pollution Control

There are two wastewater sources associated with wet air pollution control which are regulated under these effluent limitations:

1. Scrap drying, and
2. Demagging.

Table X-1 presents the number of plants reporting wastewater use with these sources, the number of plants practicing recycle of scrubber liquor, and the range of recycle values being used.

The Option A treatment scheme includes in-process flow reduction, steam stripping preliminary treatment of wastewaters containing ammonia at treatable concentrations and oil skimming, where required. Preliminary treatment is followed by chemical precipitation and sedimentation (see Figure X-1). Although oil and grease is a conventional pollutant limited under best conventional technology (BCT), oil skimming is needed for BAT to ensure proper metals removal. Oil and grease interferes with the chemical addition and mixing required for chemical precipitation treatment. Chemical precipitation is used to remove metals by the addition of lime followed by gravity sedimentation. Suspended solids are also removed from the process.

## OPTION C

Option C for the secondary aluminum subcategory builds upon the Option A control and treatment technology of in-process flow reduction, oil skimming (where required), ammonia steam stripping, chemical precipitation, and sedimentation by adding multimedia filtration technology at the end of the Option A treatment scheme (see Figure X-2). 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.

## OPTION F

Option F for the secondary aluminum subcategory builds upon the Option C control and treatment technology of in-process flow reduction, oil skimming (where required), ammonia steam stripping, chemical precipitation, sedimentation, and multimedia filtration with the addition of reverse osmosis and evaporation technology at the end of the Option C treatment train (see Figure X-3). Option F is used for complete recycle of the treated wastewater by controlling the concentration of dissolved solids. Multiple-effect evaporation is used to dewater brines rejected from reverse osmosis.

Other treatment technologies included additional in-process flow reduction (Option B), activated alumina adsorption (Option D), and activated carbon adsorption (Option E). These technologies were not considered because they are not applicable to the secondary aluminum subcategory. Option B does not apply since in-process wastewater flow reduction is part of the Option A technology. EPA believes that no additional in-process wastewater flow reduction is achievable for this subcategory. Since arsenic was not selected for consideration for limitation in the secondary aluminum subcategory, activated alumina technology (Option D) was not considered because it is not applicable. (For pollutant selection refer to Section VI, p. 787.) Since no toxic organic pollutants were selected for consideration for limitation in this subcategory, activated carbon technology (Option E) also is not applicable.

## INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

As a 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 REDUCTION BENEFITS

A complete description of the methodology used to calculate the estimated pollutant reduction, or benefit, achieved by the application of the various treatment options is presented in Section X of the General Development Document. In short, sampling data collected during the field sampling program were used to characterize the 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 aluminum subcategory. By multiplying the total subcategory production for a unit operation by the corresponding raw waste value, the mass of pollutant generated for that unit operation was estimated.

The volume of wastewater discharged after the application of each treatment option was estimated by multiplying the regulatory flow determined for each unit process by the total subcategory production. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed, referred to as the benefit, is simply 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 Agency varied this procedure slightly in computing estimated BPT discharge in a subcategory where there is an existing BPT limitation. In this case, EPA took the mass limits from the BPT limitations (for all pollutants limited at BPT) and multiplied these limits by the total subcategory production (from dcp). (The assumption is that plants are discharging a volume equal to their BPT allowance times their production.) Where pollutants are not controlled by existing BPT, EPA used the achievable concentration for the associated technology proposed in this document, and multiplied these concentrations by the total end-of-pipe discharge of process wastewater for the subcategory (from dcp). The total of both these calculations represents estimated mass loadings for the subcategory. The pollutant reduction benefit estimates for direct dischargers in the secondary aluminum subcategory are presented in Table X-2.

## COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop uniformly-applicable cost curves, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied these curves on a per plant basis, a plant's



costs (both capital, and operating and maintenance) being 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-3). These costs were used in assessing economic achievability.

#### BAT OPTION SELECTION

EPA has selected Option C as the basis of BAT in this subcategory. The BAT treatment scheme proposed consists of flow reduction, oil skimming (where required), preliminary treatment of ammonia steam stripping, lime precipitation, sedimentation, and filtration for control of toxic metals. The selected option increases the removal of toxic pollutants from raw wastewater by approximately 903 kg/yr and nonconventional pollutants by approximately 541 kg/yr. This option also removes approximately 17 kg/yr of toxic pollutants and 46 kg/yr of nonconventional pollutants over the estimated BPT discharge. The estimated capital cost of proposed BAT is \$1.6 million (1978 dollars) and the annual cost is \$1.35 million (1978 dollars).

Ammonia steam stripping is demonstrated in the nonferrous metals manufacturing category. One plant in the secondary aluminum subcategory, one plant in the secondary lead subcategory, two plants in the primary columbium-tantalum subcategory, and four plants in the primary tungsten subcategory reported steam stripping in place.

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 (treated 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.

stewater samples from the coke facility concentrations of 599, 226, 819, 502, 984, and 797 wstewater samples from the secondary aluminum an ammonia concentration of 195 mg/l.

oves additional toxic and nonconventional conomically achievable, it is included as part of proposed BAT. Filtration also adds to the treatment system reliability by making it less susceptible to operator error and to sudden changes in raw wastewater flows and concentrations.

Reverse osmosis (Option F) was considered for the purpose of achieving zero discharge of process wastewater pollutants; however, it was rejected because it is not adequately demonstrated in this subcategory nor is it clearly transferable from another category.

#### WASTEWATER DISCHARGE RATES

Specific wastewater streams associated with the secondary aluminum subcategory are generated from scrap drying air pollution control, scrap screening and milling, dross washing, demagging air pollution control, direct chill casting contact cooling, and shot casting contact cooling.

Table X-4 lists the production normalized wastewater discharge rates allocated at BAT for these wastewater streams. The values represent the best existing practices of the industry, as determined from the analysis of dcps. Individual discharge rates from the plants surveyed are presented in Section V of this supplement for each wastewater stream.

#### SCRAP DRYING WET AIR POLLUTION CONTROL WASTEWATER

No BAT wastewater discharge allowance is provided for scrap drying air pollution control. Only three of 29 plants use scrubbers to control emissions; the remaining 26 plants use baghouses. Two of the three plants with scrubbers achieve zero discharge by 100 percent recycle. One plant is a once-through discharger with a rate of 1,057 l/kg (253.5 gal/ton) of aluminum scrap produced. Wastewater rates are presented in Section V (Table V-1). The BAT allowance is zero discharge of wastewater pollutants based on the attainment of no discharge by 28 of 29 plants including two of the three operations using wet air pollution control.

#### SCRAP SCREENING AND MILLING

No BAT wastewater discharge rate is provided for scrap screening and milling. Both plants reporting this wastewater are zero

dischargers because of 100 percent recycle or reuse. Therefore, the Agency believes that zero discharge is possible for all secondary aluminum scrap screening and milling processes.

#### DROSS WASHING WASTEWATER

The BAT wastewater discharge rate is 10,868 l/kg (2,607 gal/ton) of dross processed. Four plants reported producing this wastewater. One plant discharges after 67 percent recycle and the BAT rate is the discharge from this plant. Two plants recycle 100 percent of the wastewater and the fourth plant evaporates 100 percent. EPA considers the zero discharge practices for this waste stream to be site-specific and not applicable on a nationwide basis. Wastewater rates for dross washing are presented in Section V (Table V-3).

#### DEMAGGING WET AIR POLLUTION CONTROL

The BAT wastewater discharge rate is 800 l/kg (192 gal/ton) of aluminum demagged. This rate is allocated only for plants practicing wet air pollution control of demagging operations. Of the 37 demagging operations reported, 19 use water for emissions control. Nine plants using water reported no wastewater discharge, achieved by recycle or reuse. Eight of the nine plants completely recycle the wastewater, while one plant did not report a recycle percentage. Another plant practices a partial recycle of 40 percent. Nine plants have once-through operations, eight of these discharging 223.3 to 1,956.24 l/kg (54.5 to 469.2 gal/ton). No flow data were provided by one of the discharging plants. A distribution of wastewater rates is presented in Table V-5. Industry comments on a draft of this document asserted that the use of recirculation systems using treated water reduces demagging scrubber efficiency. Therefore, recycle of scrubber liquor was not used as a basis for the BAT discharge rate for demagging wet air pollution control. The BAT discharge rate is based on the average of the nine discharging plants. Fifteen of the 19 plants with demagging wet air pollution control meet the BAT rate.

#### DIRECT CHILL CASTING CONTACT COOLING WATER

The BAT wastewater discharge rate for direct chill casting contact cooling water is 1,999 l/kg (479.4 gal/ton) of aluminum cast. There is a trend in the secondary aluminum subcategory toward converting to direct chill casting. Direct chill casting practices and the wastewater discharge from this operation are similar in aluminum forming, primary aluminum reduction and secondary aluminum plants. The information available does not indicate any significant difference in the amount of water required for direct chill casting in a primary aluminum, secondary aluminum and aluminum forming plants. For this reason,

available wastewater data from aluminum forming and primary aluminum plants were considered together in establishing BPT effluent limitations. No data for direct chill casting water use were provided by secondary aluminum plants

In all, 27 primary aluminum plants and 61 aluminum forming plants have direct chill casting operations. Recycle of the contact cooling water is practiced at 30 aluminum forming and 18 primary aluminum plants. Of these, 12 plants indicated that total recycle of this stream made it possible to avoid any discharge of wastewater; however, the majority of the plants discharge a bleed stream. The discharge flow for this operation is based on the average of the best, which is the average normalized discharge flow of the 29 plants that practice recycle.

#### STATIONARY CASTING CONTACT COOLING WATER

No BAT wastewater discharge allowance is provided for stationary casting cooling. In the stationary casting method, molten aluminum is poured into cast iron molds and then generally allowed to air cool. The Agency is aware of the use of spray quenching to quickly cool the surface of the molten aluminum once it is cast into the molds; however, this water evaporates on contact with the molten aluminum. As such, the Agency believes that there is no basis for a pollutant discharge allowance.

#### SHOT CASTING CONTACT COOLING WATER

No BAT wastewater discharge allowance is provided for shot casting contact cooling. In the secondary aluminum dcp summary, 22 of 35 plants reporting casting contact cooling water achieve zero discharge through complete recycle or evaporation. EPA believes zero discharge is feasible for all secondary aluminum shot casting processes.

#### REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C. §1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutants and pollutant parameters for consideration for limitation. This examination and evaluation, presented in Section VI, concluded that eight pollutants and pollutant parameters are present in secondary aluminum wastewaters at concentrations that can be effectively reduced by identified treatment technologies. (Refer to Section VI, p. 797).

However, 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 proposing effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant reduction benefit analysis. The pollutants selected for specific limitation are listed below:

- 122. lead
- 128. zinc
- aluminum
- ammonia

By establishing limitations and standards for certain toxic metal pollutants, dischargers will attain the same degree of control over toxic 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 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 lime 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 secondary aluminum subcategory to control the discharges of toxic metal pollutants are lead and zinc. Ammonia is also selected for limitation since the methods used to control lead and zinc are not effective in the control of ammonia.

The following toxic pollutant is excluded from limitation on the basis that it is effectively controlled by the limitations developed for lead and zinc:

- 118. cadmium

The conventional pollutant parameters oil and grease, TSS, and pH will be limited by the best conventional technology (BCT) effluent limitations. These effluent limitations and a discussion of BCT are presented in Section XIII of this supplement.

#### EFFLUENT LIMITATIONS

The treatable concentrations achievable by application of the BAT treatment are discussed in Section VII of the General Development

Document and summarized there in Table VII-19. The treatable concentrations (both one day maximum and monthly average values) are multiplied by the BAT normalized discharge flows summarized in Table X-4 to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per metric ton of product represent the BAT effluent limitations and are presented in Table X-5 for each waste stream.

Table X-1

CURRENT RECYCLE PRACTICES WITHIN THE SECONDARY ALUMINUM  
SUBCATEGORY

<u>Waste Stream</u>	<u>Number of Plants With Wastewater</u>	<u>Number of Plants Practicing Recycle</u>	<u>Range of Recycle Values (%)</u>
Scrap Drying Wet Air Pollution Control	3	2	100
Demagging Wet Air Pollution Control	19	9	40 - 100

Table X-2

POLLUTANT REDUCTION BENEFITS  
FOR  
DIRECT DISCHARGERS

Flow (1/yr)		123.0 x 10 <sup>6</sup>		123.0 x 10 <sup>6</sup>		0.0	
	Raw Waste	Option A	Option A	Option C	Option C	Option F	Option F
Pollutant	kg/yr	Removed	Discharged	Removed	Discharged	Removed	Discharged
		kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Cadmium	78.9	69.2	9.7	72.9	6.0	78.9	0.0
Lead	339.3	324.6	14.8	329.5	9.8	339.3	0.0
Zinc	546.4	509.5	36.9	518.1	28.3	546.4	0.0
TSS	214,829.5	213,353.1	1,476.4	214,509.6	319.9	214,829.5	0.0
Aluminum	677.2	540.6	136.6	586.2	91.0	677.2	0.0
Ammonia	48.2	0.0	48.2	0.0	48.2	48.2	0.0
Total Toxic Metals	964.6	903.3	61.4	920.5	44.1	964.6	0.0
Total Conventionals	214,829.5	213,353.1	1,476.4	214,509.6	319.9	214,829.5	0.0
Total Nonconventionals	725.4	540.6	184.8	586.2	139.2	725.4	0.0
Total Pollutants	216,519.5	214,797.0	1,722.6	216,016.3	503.2	216,519.5	0.0

NOTE: Total Toxic Metals = Cadmium + Lead + Zinc  
 Total Conventionals = TSS  
 Total Nonconventionals = Aluminum + Ammonia  
 Total Pollutants = Total Toxic Metals + Total Nonconventionals + Total Conventionals

Ammonia steam stripping is not included in this analysis.

Option A = Chemical precipitation, sedimentation, and oil skimming.  
 Option C = Option A plus multimedia filtration.  
 Option F = Option C plus reverse osmosis.



Table X-3

COST OF COMPLIANCE FOR THE SECONDARY ALUMINUM SUBCATEGORY  
DIRECT DISCHARGERS

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	1,510,000	1,310,000
C	1,600,000	1,350,000
F	1,900,000	1,500,000

Table X-4

## BAT WASTEWATER DISCHARGE RATES FOR THE SECONDARY ALUMINUM SUBCATEGORY

<u>Waste Stream</u>	BAT Normalized Discharge Rate		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Scrap Drying Wet Air Pollution Control	0	0	kgg of aluminum scrap dried
Scrap Screening and Milling	0	0	kgg of aluminum scrap screened and milled
Dross Washing	10,868	2,607	kgg of dross washed
Demagging Wet Air Pollution Control	800	192	kgg of aluminum demagged
Direct Chill Casting Contact Cooling	1,999	479.4	kgg of aluminum cast
Stationary Casting Contact Cooling	0	0	kgg of aluminum cast
Shot Casting Contact Cooling	0	0	kgg of aluminum cast

Table X-5

## BAT EFFLUENT LIMITATIONS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Scrap Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap dried		
English Units - lbs/billion lbs of aluminum scrap dried		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

Scrap Screening and Milling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap screened and milled		
English Units - lbs/billion lbs of aluminum scrap screened and milled		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

Dross Washing

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of dross washed		
English Units - lbs/billion lbs of dross washed		
Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Aluminum	32,930.04	13,476.32
Ammonia (as N)	1,445,444.0	636,864.80

Table X-5 (Continued)

## BAT EFFLUENT LIMITATIONS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Demagging Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Lead	80.0	72.0
Zinc	816.0	336.0
Aluminum	2,424.0	992.0
Ammonia (as N)	106,400.0	46,880.0

Direct Chill Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of aluminum product from direct chill casting		
English Units - lbs/billion lbs of aluminum product from direct chill casting		
Lead	199.90	179.91
Zinc	2,038.98	839.58
Aluminum	6,056.97	2,478.76
Ammonia (as N)	265,867.0	117,141.40

Stationary Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of aluminum produced from stationary casting		
English Units - lbs/billion lbs of aluminum produced from stationary casting		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Shot Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum produced from shot casting

English Units - lbs/billion lbs of aluminum produced from  
shot casting

Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0

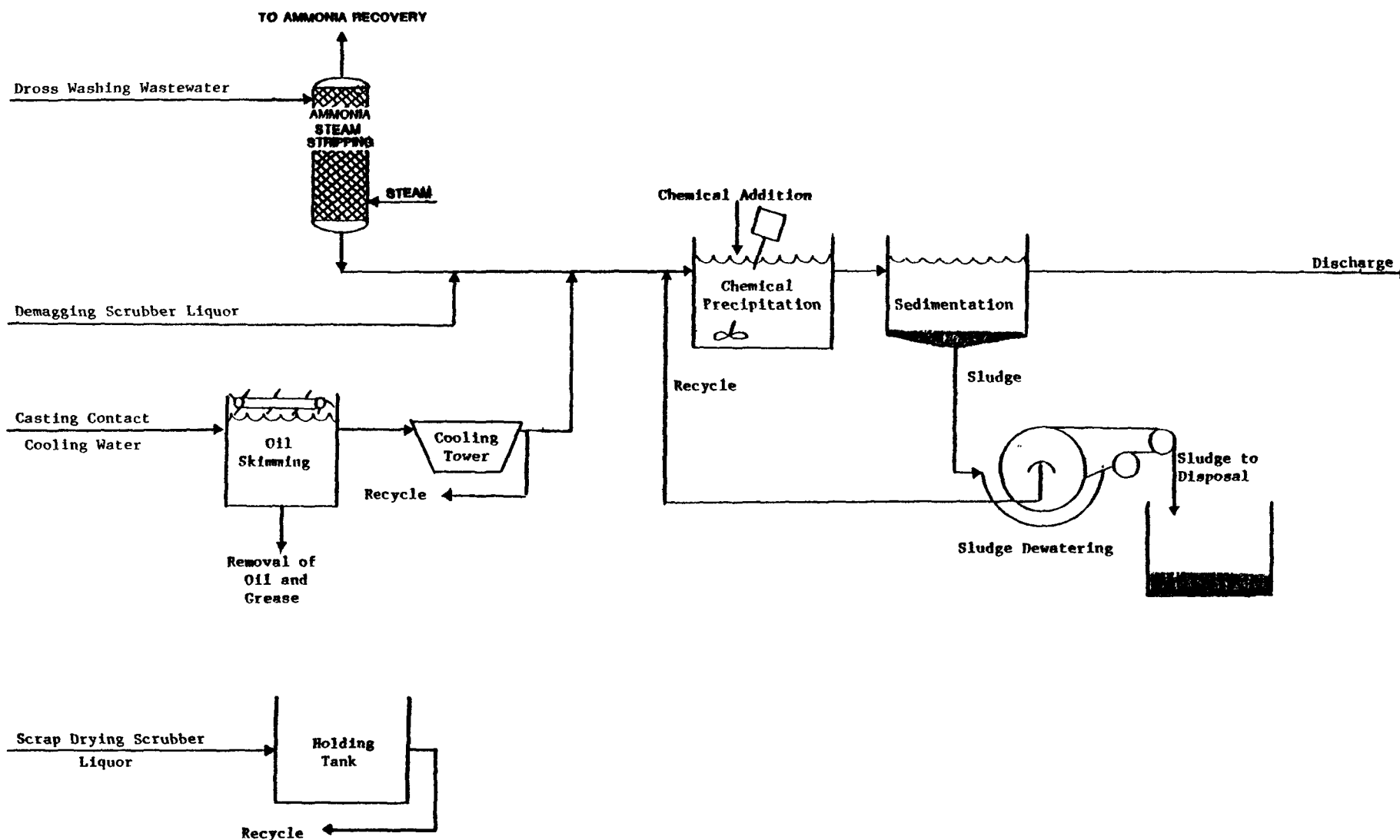


Figure X-1  
BAT TREATMENT SCHEME FOR OPTION A

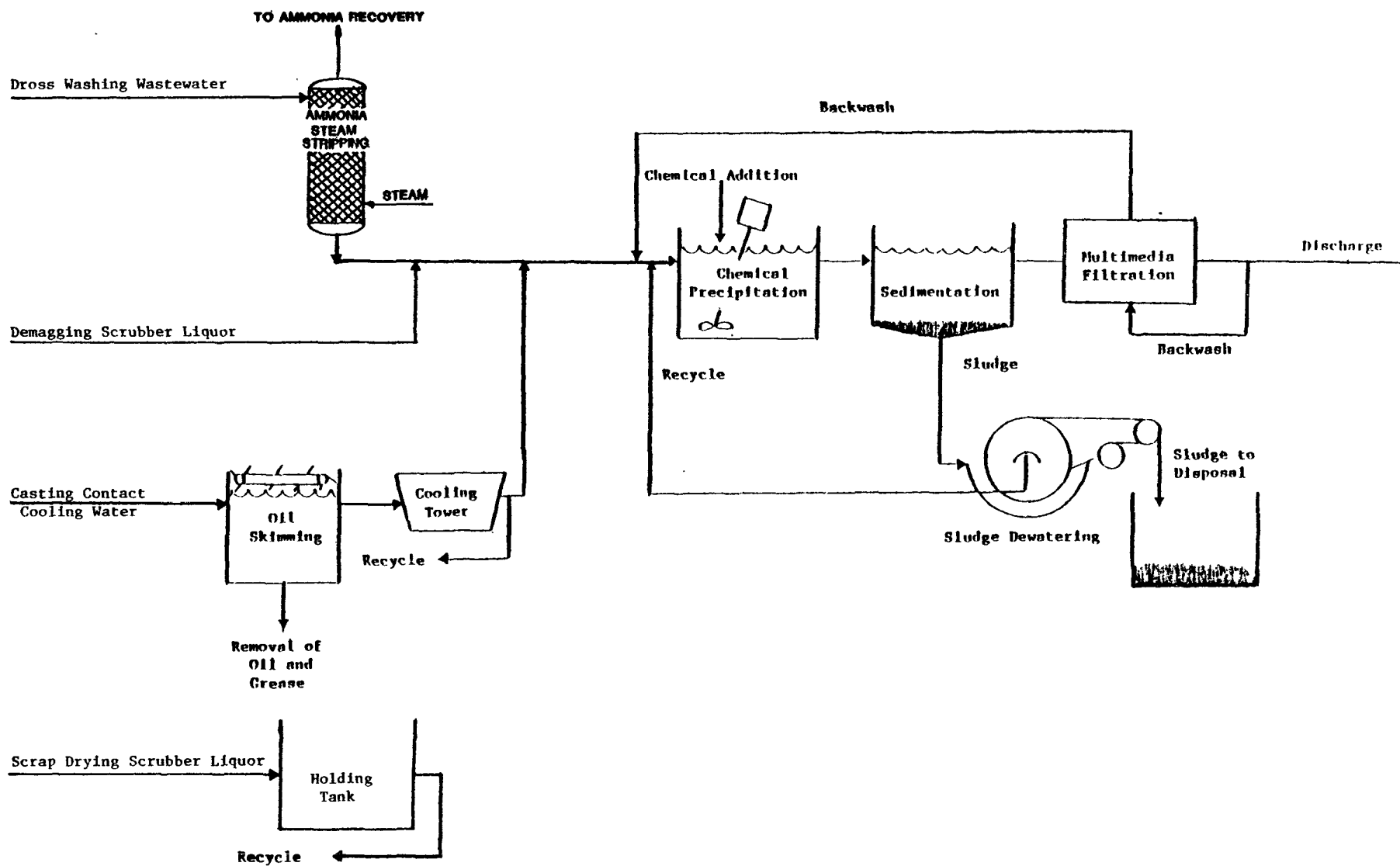


Figure X-2

BAT TREATMENT SCHEME FOR OPTION C

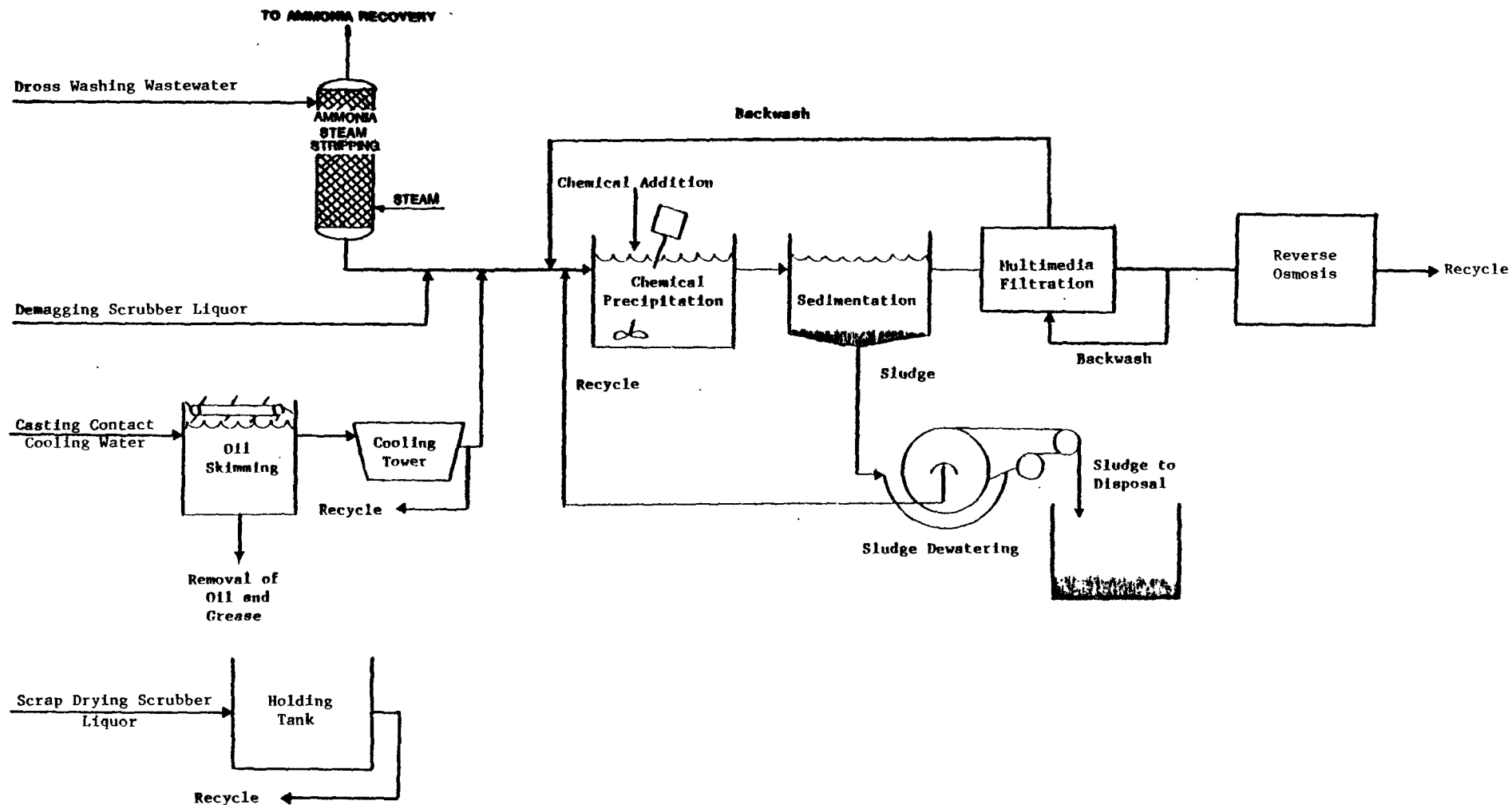


Figure X-3  
BAT TREATMENT SCHEME FOR OPTION F



## SECONDARY ALUMINUM SUBCATEGORY

### SECTION XI

#### NEW SOURCE PERFORMANCE STANDARDS

##### INTRODUCTION

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

This section describes the control technology for treatment of wastewater from new sources and presents mass discharge limitations of regulatory pollutants for NSPS in the secondary aluminum subcategory, based on the described control technology.

##### TECHNICAL APPROACH TO BDT

As discussed in the General Development Document, all of the treatment technology options applicable to a new source were previously considered for the BAT options. For this reason, three options were considered for BDT, all identical to the BAT options discussed in Section X. The treatment technologies used for the three BDT options are:

##### OPTION A

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation

##### OPTION C

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation
- o Multimedia filtration

## OPTION F

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation
- o Multimedia filtration
- o Reverse osmosis and multiple-effect evaporation for complete recycle of treated water

Partial or complete reuse and recycle of wastewater is an essential part of each option. Reuse and recycle can precede or follow end-of-pipe treatment. A more detailed discussion of these treatment options is presented in Section X.

## BDT OPTION SELECTION

EPA promulgated the best available demonstrated technology for the secondary aluminum subcategory on April 8, 1974 as Subpart C of 40 CFR Part 421. The promulgated NSPS prohibits the discharge of process wastewater except for an allowance, if determined to be necessary, which allows the discharge of process wastewater from chlorine demagging. In this respect, promulgated NSPS was less stringent than promulgated BAT. The Agency did this recognizing that NSPS became effective on the date of promulgation and did not believe that the dry chlorine demagging processes were immediately available. The Agency believes that they were appropriate for BAT with its compliance date being 10 years later.

EPA is proposing to modify the promulgated NSPS to allow for a discharge from chlorine demagging and direct chill casting. The discharge allowances are identical to those proposed for BAT. The technology basis is also identical to that of the proposed BAT treatment consisting of in-process flow reduction, preliminary treatment by oil skimming and ammonia steam stripping, lime precipitation, sedimentation and filtration (Option C).

Reverse osmosis is not demonstrated and is not clearly transferable to nonferrous metals manufacturing wastewater. The Agency also does not believe that new plants could achieve any additional flow reduction for chlorine demagging and direct chill casting beyond that proposed for BAT.

## 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, oil and grease, 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 all the BAT options and are presented in Table XI-1. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the appropriate achievable treatment concentration by the production normalized wastewater discharge flows (1/kkg). The treatable concentrations are listed in Tables VII-19 of the General Development Document. New source performance standards for the secondary aluminum subcategory waste streams are presented in Table XI-2.

Table XI-1

## NSPS WASTEWATER DISCHARGE RATES FOR THE SECONDARY ALUMINUM SUBCATEGORY

<u>Waste Stream</u>	NSPS Normalized Discharge Rate		Production Normalizing Parameter
	<u>l/kg</u>	<u>gal/ton</u>	
Scrap Drying Wet Air Pollution Control	0	0	kg of aluminum scrap dried
Scrap Screening and Milling	0	0	kg of aluminum scrap screened and milled
Dross Washing	10,868	2,607	kg of dross washed
Demagging Wet Air Pollution Control	800	192	kg of aluminum demagged
Direct Chill Casting Contact Cooling	1,999	479.4	kg of aluminum cast
Stationary Casting Contact Cooling	0	0	kg of aluminum cast
Shot Casting Contact Cooling	0	0	kg of aluminum cast

Table XI-2

## NSPS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Scrap Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap dried		
English Units - lbs/billion lbs of aluminum scrap dried		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and grease	0	0
TSS	0	0
pH	Within the range 7.5 to 10.0 at all times	

Scrap Screening and Milling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum scrap screened and milled		
English Units - lbs/billion lbs of aluminum scrap screened and milled		
Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Dross Washing

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of dross washed		
English Units - lbs/billion lbs of dross washed		
Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Aluminum	32,930.04	13,476.32
Ammonia (as N)	1,445,444.0	636,864.80
Oil and grease	108,680.0	108,680.0
TSS	163,020.0	130,416.0
pH	Within the range of 7.5 to 10.0 at all times	

Demagging Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Lead	80.0	72.0
Zinc	816.0	336.0
Aluminum	2,424.0	992.0
Ammonia (as N)	106,400.0	46,880.0
Oil and grease	8,000.0	8,000.0
TSS	12,000.0	9,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Direct Chill Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum produced from  
direct chill casting

English Units - lbs/billion lbs of aluminum produced from  
direct chill casting

Lead	199.90	179.91
Zinc	2,038.98	839.58
Aluminum	6,056.97	2,478.76
Ammonia (as N)	265,867.0	117,141.40
Oil and grease	19,990.0	19,990.0
TSS	29,985.0	23,988.0
pH	Within the range of 7.5 to 10.0 at all times	

Stationary Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum produced from stationary  
casting

English Units - lbs/billion lbs of aluminum produced from  
stationary casting

Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Shot Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum produced from stationary casting

English Units - lbs/billion lbs of aluminum produced from stationary casting

Lead	0	0
Zinc	0	0
Aluminum	0	0
Ammonia (as N)	0	0
Oil and grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 at all times	



## SECONDARY ALUMINUM SUBCATEGORY

### SECTION XII

#### PRETREATMENT STANDARDS

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES), which must be achieved within three years of promulgation. 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 of 1977 requires pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives. Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time that it promulgates NSPS. 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 technology for removal of toxic pollutants.

This section describes the control technology for pretreatment of process wastewaters from existing sources and new sources in the secondary aluminum subcategory. Pretreatment standards for regulated pollutants are presented based on the described control technology.

#### TECHNICAL APPROACH TO PRETREATMENT

Before proposing pretreatment standards, the Agency examines whether the pollutants discharged by the subcategory 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: (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 nor 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 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. Although oil and grease is a conventional pollutant compatible with treatment provided by POTW, oil skimming is needed for the PSNS treatment technology to ensure proper removal. Oil and grease interferes with the chemical addition and mixing required for chemical precipitation and treatment.

A description of each option is presented in Section X, while a more detailed discussion, including pollutants controlled by each treatment process and achievable treatment concentrations is presented in Section VII of the General Development Document.

Treatment technology options for the PSES and PSNS are:

##### OPTION A

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation

##### OPTION C

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation
- o Multimedia filtration

## OPTION F

- o Preliminary treatment with oil skimming (where required)
- o Preliminary treatment of dross washing wastewater with ammonia steam stripping
- o In-process flow reduction of direct chill casting contact cooling water and scrubber liquor resulting from scrap drying wet air pollution control
- o Chemical precipitation and sedimentation
- o Multimedia filtration
- o Reverse osmosis and multiple-effect evaporation for complete recycle of treated water

## INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

The industry cost and environmental benefits of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant reduction benefits and plant compliance costs is discussed in Section X.

Table XII-1 shows the estimated pollutant reduction benefits for indirect dischargers. Compliance costs are presented in Table XII-2.

## PSES AND PSNS OPTION SELECTION

The technology basis for proposed PSES and PSNS is identical to BAT (Option C). The treatment scheme consists of in-process flow reduction, preliminary treatment with ammonia steam stripping and oil skimming (where required), followed by lime precipitation, sedimentation, and filtration. EPA knows of no demonstrated technology that provides more efficient pollutant removal than BAT technology. No additional flow reduction for new sources is feasible because the only other available flow reduction technology, reverse osmosis (Option F) is not adequately demonstrated nor is it clearly transferable for this subcategory.

Since the proposed PSNS does not increase costs compared to PSES of BAT, it is not expected to prevent the entry of new plants into the subcategory. The selected option for proposed PSES increases the removal of approximately 1,214 kg/yr of toxic pollutants over the estimated raw discharge. The estimated capital cost of proposed PSES is \$2.4 million (1978 dollars) and the annual cost is \$1.6 million (1978 dollars).

## REGULATED POLLUTANT PARAMETERS

Pollutants selected for regulation under PSES and PSNS are identical to those selected for regulation for BAT. The conventional pollutants oil and grease, TSS, and pH are not limited under PSES and PSNS because they are effectively controlled by

POTW. PSES and PSNS prevent the pass-through of lead, zinc, and ammonia. Aluminum is not limited because in its hydroxide form it is used by POTW as a flocculant aid in the settling and removal of suspended solids. As such, aluminum in limited quantities does not pass through or interfere with POTW; rather it is a necessary aid to its operation.

#### PRETREATMENT STANDARDS

In proposing PSES and PSNS, the Agency considered whether to propose exclusively mass-based standards, or to allow a POTW the alternative of concentration or mass-based standards. Mass-based standards ensure that limitations are achieved by means of pollutant removal rather than by dilution. They are particularly important when a limitation is based upon flow reduction because pollutant limitations associated with the flow reduction cannot be measured any way but as a reduction of mass discharged. Mass-based standards, however, are harder to implement because a POTW faces increased difficulties in monitoring. A POTW also must develop specific limits for each plant based on the unit operations present and the production occurring in each operation.

EPA resolved these competing considerations by proposing mass-based standards exclusively where the PSES and PSNS treatment options include significant flow reductions or where significant pollutant removals are attributable to flow reductions. Flow reduction over current discharge rates is minimal (0.2 percent) in the secondary aluminum subcategory. For secondary aluminum, EPA has concluded that the proposed PSES should provide alternative mass-based and concentration-based standards.

The Agency is not proposing alternative mass- and concentration-based PSNS for the secondary aluminum subcategory, since PSNS include significant flow reduction (90 percent flow reduction of direct chill casting).

The PSES and PSNS discharge flows for mass-based standards are identical to the BAT discharge flows for all processes. These discharge flows are listed in Table XII-3. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the achievable treatment concentration (mg/l) by the normalized wastewater discharge flow (1/kg). The achievable treatment concentrations are presented in Table VII-19 of the General Development Document. Concentration-based PSES are identical to the achievable treatment concentrations. Mass and concentration-based PSES are presented in Tables XII-4 and XII-5, respectively. PSNS are shown in Table XII-6.

Table XII-1

POLLUTANT REDUCTION BENEFITS  
FOR  
INDIRECT DISCHARGERS

Flow (l/yr)		213.5 x 10 <sup>6</sup>		213.5 x 10 <sup>6</sup>		0.0	
	Raw Waste	Option A	Option A	Option C	Option C	Option F	Option F
Pollutant	kg/yr	Removed	Discharged	Removed	Discharged	Removed	Discharged
		kg/yr	kg/yr	kg/yr	kg/yr	kg/yr	kg/yr
Cadmium	98.8	82.9	15.9	88.9	9.9	98.8	0.0
Lead	445.5	421.3	24.2	429.3	16.1	445.5	0.0
Zinc	742.2	681.7	60.5	695.8	46.4	742.2	0.0
TSS	305,508.3	303,088.0	2,420.2	304,983.9	524.4	305,508.3	0.0
Aluminum	1,395.0	1,171.1	223.9	1,245.7	149.2	1,395.0	0.0
Ammonia	60.3	0.0	60.3	0.0	60.3	60.3	0.0
Total Toxic Metals	1,286.5	1,185.9	100.6	1,214.0	72.4	1,286.5	0.0
Total Conventional	305,508.3	303,088.0	2,420.2	304,983.9	524.4	305,508.3	0.0
Total Nonconven- tionals	1,455.3	1,171.1	284.2	1,245.7	209.5	1,455.3	0.0
Total Pollutants	308,250.1	305,445.0	2,805.0	307,443.6	806.3	308,250.1	0.0

NOTE: Total Toxic Metals = Cadmium + Lead + Zinc  
 Total Conventional = TSS  
 Total Nonconventional = Aluminum + Ammonia  
 Total Pollutants = Total Toxic Metals + Total Nonconventional + Total Conventional

Ammonia steam stripping is not considered in this analysis.

Option A = Lime precipitation, sedimentation, and oil skimming.  
 Option C = Option A plus multimedia filtration.  
 Option F = Option C plus reverse osmosis.

Table XII-2

COST OF COMPLIANCE FOR THE SECONDARY ALUMINUM SUBCATEGORY  
INDIRECT DISCHARGERS

<u>Option</u>	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	2,200,000	1,500,000
C	2,400,000	1,600,000
F	3,080,000	1,900,000

Table XII-3

## PSES AND PSNS WASTEWATER DISCHARGE RATES FOR THE SECONDARY ALUMINUM SUBCATEGORY

<u>Waste Stream</u>	PSES and PSNS Normalized Discharge Rate		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Scrap Drying Wet Air Pollution Control	0	0	kg of aluminum scrap dried
Scrap Screening and Milling	0	0	kg of aluminum scrap screened and milled
Dross Washing	10,868	2,607	kg of dross washed
Demagging Wet Air Pollution Control	800	192	kg of aluminum demagged
Direct Chill Casting Contact Cooling	1,999	479.4	kg of aluminum cast
Stationary Casting Contact Cooling	0	0	kg of aluminum cast
Shot Casting Contact Cooling	0	0	kg of aluminum cast

Table XII-4

PSES FOR THE SECONDARY ALUMINUM SUBCATEGORY  
(MASS-BASED)

Scrap Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum scrap dried  
English Units - lbs/billion lbs of aluminum scrap dried

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Scrap Screening and Milling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum scrap screened and milled  
English Units - lbs/billion lbs of aluminum scrap screened  
and milled

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Dross Washing

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of dross washed  
English Units - lbs/billion lbs of dross washed

Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Ammonia (as N)	1,445,444.0	636,864.80



Table XII-4 (Continued)

PSES FOR THE SECONDARY ALUMINUM SUBCATEGORY  
(MASS-BASED)

Demagging Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Lead	80.0	72.0
Zinc	816.0	336.0
Ammonia (as N)	106,400.0	46,880.0

Direct Chill Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from direct chill casting		
English Units - lbs/billion lbs of aluminum produced from direct chill casting		
Lead	199.90	179.91
Zinc	2,038.98	839.58
Ammonia (as N)	265,867.0	117,141.40

Stationary Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from stationary casting		
English Units - lbs/billion lbs of aluminum produced from stationary casting		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-4 (Continued)

PSES FOR THE SECONDARY ALUMINUM SUBCATEGORY  
(MASS-BASED)

Shot Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from shot casting		
English Units - lbs/billion lbs of aluminum produced from shot casting		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-5

PSES FOR THE SECONDARY ALUMINUM SUBCATEGORY  
(CONCENTRATION-BASED)

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/l		
English Units -. ppm		
Lead	0.10	0.09
Zinc	1.02	0.42
Ammonia (as N)	133	58.6

Table XII-6

## PSNS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Scrap Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum scrap dried  
 English Units - lbs/billion lbs of aluminum scrap dried

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Scrap Screening and Milling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum scrap screened and milled  
 English Units - lbs/billion lbs of aluminum scrap screened  
 and milled

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Dross Washing

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of dross washed  
 English Units - lbs/billion lbs of dross washed

Lead	1,086.80	978.12
Zinc	11,085.36	4,564.56
Ammonia (as N)	1,445,444.0	636,864.80

Table XII-6 (Continued)

## PSNS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Demagging Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum demagged  
 English Units - lbs/billion lbs of aluminum demagged

Lead	80.0	72.0
Zinc	816.0	336.0
Ammonia (as N)	106,400.0	46,880.0

Direct Chill Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum produced from  
 direct chill casting  
 English Units - lbs/billion lbs of aluminum produced from  
 direct chill casting

Lead	199.90	179.91
Zinc	2,038.98	839.58
Ammonia (as N)	265,867.0	117,141.40

Stationary Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of aluminum produced from stationary  
 casting  
 English Units - lbs/billion lbs of aluminum produced from  
 stationary casting

Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-6 (Continued)

PSNS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Shot Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from shot casting		
English Units - lbs/billion lbs of aluminum produced from shot casting		
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

## SECONDARY ALUMINUM SUBCATEGORY

### SECTION XIII

#### BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

The 1977 amendments to the Clean Water Act added Section 301(b)(2)(E), establishing "best conventional pollutant control technology" (BCT) for discharge of conventional pollutants from existing industrial point sources. Biochemical oxygen-demanding pollutants (BOD<sub>5</sub>), total suspended solids (TSS), fecal coliform, oil and grease (O&G), and pH have been designated as conventional pollutants (see 44 FR 44501).

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. In addition to the other factors specified in Section 304(b)(4)(B), the Act requires that limitations for conventional pollutants be assessed in light of a two-part cost-reasonableness test. On October 29, 1982, the Agency proposed a revised methodology for carrying out BCT analyses (47 FR 49176). The purpose of the proposal was to correct errors in the BCT methodology originally established in 1977.

Part 1 of the proposed BCT test requires that the cost and level of reduction of conventional pollutants by industrial discharges be compared with the cost and level of reduction to remove the same type of pollutants by publicly-owned treatment works (POTW). The POTW comparison figure has been calculated by evaluating the change in costs and removals between secondary treatment (30 mg/l BOD and 30 mg/l TSS) and advanced secondary treatment (10 mg/l BOD and 10 mg/l TSS). The difference in cost is divided by the difference in pounds of conventional pollutants removed, resulting in an estimate of the "dollars per pound" of pollutant removed, that is used as a benchmark value. The proposed POTW test benchmark is \$0.30 per pound (1978 dollars).

Part 2 of the BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be evaluated internally to the industry. In order to develop a benchmark that assesses a reasonable relationship between cost and removal, EPA has developed an industry cost ratio which compares the dollar per pound of conventional pollutant removed in going from primary to secondary treatment levels with that of going from primary to secondary treatment levels with that of going from secondary to more advanced treatment levels. The basis of costs for the calculation of this ratio are the costs incurred by a POTW. EPA used these costs because: they reflect the treatment technologies most commonly used to remove conventional pollutants from wastewater; the treatment levels associated with them compare readily to the levels considered for

industrial dischargers; and the costs are the most reliable for the treatment levels under consideration. The proposed industry subcategory benchmark is 1.42. If the industry figure for a subcategory is lower than 1.43, the subcategory passes the BCT test.

The Agency usually considers two conventional pollutants in the cost test, TSS and an oxygen-demanding pollutant. Although both oil and grease and BOD<sub>5</sub> are considered to be oxygen-demanding substances by EPA (see 44 FR 50733), only one can be selected in the cost analysis to conform to procedures used to develop POTW costs. Oil and grease is used rather than BOD<sub>5</sub> in the cost analysis performed for nonferrous metals manufacturing waste streams due to the common use of oils in casting operations in this industry.

BPT is the base for evaluating limitations on conventional pollutants (i.e., it is assumed that BPT is already in place). The test evaluates the cost and removals associated with treatment and controls in addition to that specified as BPT.

If the conventional pollutant removal cost of the candidate BCT is less than the POTW cost, Part 1 of the cost-reasonableness test is passed and Part 2 (the internal industry test) of the cost-reasonableness test must be performed. If the internal industry test is passed, then a BCT limitation is promulgated equivalent to the candidate BCT level. If all candidate BCT technologies fail both parts of the cost-reasonableness test, the BCT requirements for conventional pollutants are equal to BPT.

The BCT test was performed for the proposed BAT basis of lime precipitation, sedimentation, in-process flow reduction, and multimedia filtration. The secondary aluminum subcategory failed Part 1 of the test with a calculated cost of \$15.68 per pound (1978 dollars) of removal of conventional pollutants using BAT technology.



Table XIII-1

## BCT EFFLUENT LIMITATIONS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Scrap Drying Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of aluminum scrap dried		
English Units - lbs/billion lbs of aluminum scrap dried		
Oil and grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 all times	

Scrap Screening and Milling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of aluminum scrap screened and milled		
English Units - lbs/billion lbs of aluminum scrap screened and milled		
Oil and grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 all times	

Dross Washing

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of dross washed		
English Units - lbs/billion lbs of dross washed		
Oil and grease	217,360.0	130,416.0
TSS	445,588.0	217,360.0
pH	Within the range of 7.5 to 10.0 all times	

Table XIII-1 (Continued)

## BCT EFFLUENT LIMITATIONS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Demagging Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum demagged		
English Units - lbs/billion lbs of aluminum demagged		
Oil and grease	16,000.0	9,600.0
TSS	32,800.0	16,000.0
pH	Within the range of 7.5 to 10.0 all times	

Direct Chill Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from direct chill casting		
English Units - lbs/billion lbs of aluminum produced from direct chill casting		
Oil and grease	39,980.0	23,988.0
TSS	81,959.0	39,980.0
pH	Within the range of 7.5 to 10.0 all times	

Stationary Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from stationary casting		
English Units - lbs/billion lbs of aluminum produced from stationary casting		
Oil and grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 all times	

Table XIII-1 (Continued)

BCT EFFLUENT LIMITATIONS FOR THE SECONDARY ALUMINUM SUBCATEGORY

Shot Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of aluminum produced from shot casting		
English Units - lbs/billion lbs of aluminum produced from shot casting		
Oil and grease	0	0
TSS	0	0
pH	Within the range of 7.5 to 10.0 all times	

## SECONDARY LEAD SUBCATEGORY

### SECTION I

#### SUMMARY AND CONCLUSIONS

On April 8, 1974, EPA promulgated technology-based effluent limitations guidelines and performance standards for several subcategories of the Nonferrous Metals Manufacturing Point Source Category. These regulations included BPT, BAT, NSPS, and PSNS limitations. The main purpose of these effluent guidelines and standards was to limit the quantities of total suspended solids, arsenic, zinc, selenium, copper, cadmium, and oil and grease. The allowable pH ranges for discharges was also limited.

Since 1974, implementation of the technology-based effluent limitations and standards has been guided by a series of settlement agreements into which EPA entered with several environmental groups, the latest of which occurred in 1979. NRDC v. Costle, 12 ERC 1833 (D.D.C. 1979), aff'd and remd'd, EDF v. Costle, 14 ERC 2161 (1980). Under the settlement agreements, EPA was required to develop BAT limitations and pretreatment and new source performance standards for 65 classes of pollutants discharged from specific industrial point source categories. The list of 65 classes was subsequently expanded to a list of 129 specific toxic pollutants, and now consists of 126 toxics.

Congress amended the Clean Water Act in 1977 to encompass many of the provisions of the earlier settlement agreements, including the list of 65 classes of pollutants. As a result of the settlement agreements and the Clean Water Act Amendments, EPA undertook an extensive effort to develop technology-based BAT limitations and pretreatment and new source performance standards for the toxic pollutants.

The purpose of this proposed rulemaking is to create the secondary lead subcategory and establish BPT, BAT, and BCT effluent limitations and NSPS, and pretreatment standards for this subcategory. This is done pursuant to the provisions of the Settlement Agreement and Sections 301, 304, 306, and 307 of the Clean Water Act and its amendments. This supplement provides a compilation and analysis of the background material used to develop these effluent limitations and standards.

The secondary lead subcategory is comprised of 69 plants. Of the 69 plants, seven discharge directly to rivers, lakes, or streams; 16 discharge to publicly owned treatment works (POTW); and 46 do not discharge process wastewater.

EPA first studied the secondary lead 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 (1) the processes used (2) the sources and volume of water used, (3) the sources of pollutants and wastewaters in the plant; and (4) the constituents (including toxic pollutants) and volume of wastewaters.

EPA also identified several distinct control and treatment technologies (both in-plant and end-of-pipe) applicable to the secondary lead 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 category. 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 Economic Impact Analysis of Proposed Effluent Standards and Limitations for the Nonferrous Smelting and Refining Industry.

Based on consideration of the above factors, EPA identified various control and treatment technologies which formed the basis for BPT and selected control and treatment appropriate for each set of standards and limitations. The mass limitations and standards for BPT, BAT, NSPS, PSES, PSNS, and BCT are presented in Section II.

After examining the various treatment technologies, the Agency has identified BPT to represent the average of the best existing technology. Metals removal based on lime precipitation and sedimentation is the basis for the BPT limitations. Wastewater discharge rates used in developing BPT effluent limitations represent the average of the subcategory discharge and usage for process wastewater. To meet the BPT effluent limitations based on this technology, the secondary lead subcategory is estimated to incur a capital cost of \$0.470 million (1978 dollars) and an annual cost of \$0.228 million (1978 dollars).

Due to current adverse structural economic changes that are not reflected in EPA's current economic analysis, the Agency has identified alternative technologies as a basis for BAT effluent limitations. For Alternative A, the Agency has built upon the BPT basis of lime precipitation and sedimentation for metals removed by adding in-process control technologies which include recycle of process water from air pollution control and metal contact cooling waste streams. To meet the Alternative A BAT effluent limitations, the secondary lead subcategory will incur an estimated capital cost of \$0.470 million (1978 dollars) and an annual cost of \$0.228 million (1978 dollars). For Alternative B, filtration is added as an effluent polishing step to the in-process flow reduction, lime precipitation, and sedimentation technology considered in Alternative A. To meet the Alternative B BAT effluent limitations, the secondary lead subcategory will incur an estimated capital cost of \$2.12 million (1978 dollars) and an annual cost of \$1.36 million (1978 dollars).

The best demonstrated technology, BDT, which is the technical basis of NSPS, is equivalent to BAT. In selected BDT, 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 because no additional process modifications or treatment technologies have been identified that substantially improve BAT performance.

The Agency selected the same alternative technologies as BAT for PSES. To meet the Alternative A pretreatment standards for existing sources, the secondary lead subcategory will incur an estimated capital cost of \$1.49 million (1978 dollars) and an annual cost of \$0.559 million (1978 dollars).

Alternative B pretreatment standards for existing sources are estimated to result in a capital cost of \$3.04 million (1978 dollars) and an annual cost of \$1.94 million (1978 dollars). For pretreatment standards for new sources (PSNS), the Agency selected end-of-pipe treatment and in-process flow reduction control techniques equivalent to BDT. As such, the PSNS are identical to the NSPS for all waste streams.

The Agency is also proposing BCT effluent limitations at this time. The best conventional technology (BCT) replaces BAT for the control of conventional pollutants. The technology basis of BCT is the BPT treatment of lime precipitation and sedimentation.

## SECONDARY LEAD SUBCATEGORY

### SECTION II

#### RECOMMENDATIONS

1. EPA has divided the secondary lead subcategory into four subdivisions for the purpose of effluent limitations and standards. These subdivisions are:

- (a) Battery Cracking,
- (b) Blast and Reverberatory Furnace Wet Air Pollution Control,
- (c) Kettle Wet Air Pollution Control, and
- (d) Casting Contact Cooling.

2. BPT is proposed based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology. The following BPT effluent limitations are proposed:

- (a) Battery Cracking  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	2,697.80	1,193.80
Arsenic	1,964.60	808.40
Lead	141.0	122.20
Zinc	1,250.20	526.40
Ammonia (as N)	0.0	0.0
Total Suspended Solids	38,540.0	18,800.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Blast and Reverberatory Furnace Wet Air Pollution  
Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	9,700.60	4,292.60
Arsenic	7,064.20	2,906.80
Lead	507.0	439.40
Zinc	4,495.40	1,892.80
Ammonia (as N)	0.0	0.0
Total Suspended Solids	138,580.0	67,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Kettle Wet Air Pollution Control  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	



(d) Casting Contact Cooling  
BPT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	634.84	280.92
Arsenic	462.31	190.23
Lead	33.18	28.76
Zinc	294.20	123.87
Ammonia (as N)	0.0	0.0
Total Suspended Solids	9,069.20	4,424.0
pH	Within the range of 7.5 to 10.0 at all times	

3. EPA is proposing two technology alternatives for BAT for the secondary lead subcategory.

BAT Alternative A is proposed based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods. The following BAT effluent limitations are proposed for existing sources:

(a) Battery Cracking  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,931.51	854.71
Arsenic	1,406.57	578.78
Lead	100.95	87.49
Zinc	895.09	376.88
Ammonia (as N)	0.0	0.0

(b) Blast and Reverberatory Furnace Wet Air Pollution  
Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	7,490.7	3,314.7
Arsenic	5,454.9	2,244.6
Lead	391.5	339.3
Zinc	3,471.30	1,461.6
Ammonia (as N)	0.0	0.0

(c) Kettle Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(d) Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	63.43	28.07
Arsenic	46.19	19.01
Lead	3.32	2.87
Zinc	29.39	12.38
Ammonia (as N)	0.0	0.0

BAT Alternative B is proposed based on the performance achievable by the application of chemical precipitation sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods. The following BAT effluent limitations are proposed for existing sources:

(a) Battery Cracking  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0

(b) Blast and Reverberatory Furnace Wet Air  
Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	5,037.30	2,244.60
Arsenic	3,627.90	1,487.70
Lead	261.0	234.90
Zinc	2,662.20	1,096.20
Ammonia (as N)	0.0	0.0

(c) Kettle Wet Air Pollution Control  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(d) Casting Contact Cooling  
BAT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0

4. NSPS are proposed based on the performance achievable by the application of chemical precipitation, sedimentation and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods. The following effluent standards are proposed for new sources:

(a) Battery Cracking NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0
Total Suspended Solids	10,095.0	8,076.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Blast and Reverberatory Furnace Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	5,037.30	2,244.60
Arsenic	3,627.90	1,487.70
Lead	261.0	234.90
Zinc	2,662.0	1,096.20
Ammonia (as N)	0	0
Total Suspended Solids	39,150.0	31,320.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Kettle Wet Air Pollution Control NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Casting Contact Cooling NSPS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0
Total Suspended Solids	331.50	265.20
pH	Within the range of 7.5 to 10.0 at all times	

5. EPA is proposing two technology alternatives for PSES for the secondary lead subcategory.

PSES Alternative A is proposed based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods. The following pretreatment standards are proposed:

(a) Battery Cracking PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,931.51	854.71
Arsenic	1,406.57	578.78
Lead	100.95	87.49
Zinc	895.09	376.88
Ammonia (as N)	0.0	0.0

(b) Blast and Reverberatory Furnace Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	7,490.7	3,314.7
Arsenic	5,454.9	2,244.6
Lead	391.5	339.3
Zinc	3,471.30	1,461.6
Ammonia (as N)	0.0	0.0

(c) Kettle Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(d) Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of lead cast  
English Units - lbs/billion lbs of lead cast

Antimony	63.43	28.07
Arsenic	46.19	19.01
Lead	3.32	2.87
Zinc	29.39	12.38
Ammonia (as N)	0.0	0.0

PSES Alternative B is proposed based on the performance achievable by the application of chemical precipitation, sedimentation, and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods. The following pretreatment standards are proposed:

(a) Battery Cracking PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of lead scrap produced  
English Units - lbs/billion lbs of lead scrap produced

Antimony	1,298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0

(b) Blast and Reverberatory Furnace Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of lead produced from smelting  
English Units - lbs/billion lbs of lead produced from smelting

Antimony	5,037.30	2,244.60
Arsenic	3,627.90	1,487.70
Lead	261.0	234.90
Zinc	2,662.20	1,096.20
Ammonia (as N)	0.0	0.0

(c) Kettle Wet Air Pollution Control PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of lead produced from kettle furnaces  
English Units - lbs/billion lbs of lead produced from kettle furnaces

Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(d) Casting Contact Cooling PSES

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of lead cast  
English Units - lbs/billion lbs of lead cast

Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0

6. PSNS are proposed based on the performance achievable by the application of chemical precipitation, sedimentation and multimedia filtration (lime, settle, and filter) technology and in-process flow reduction control methods. The following pretreatment standards are proposed:

(a) Battery Cracking PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
--	------------------------------------	--

Metric Units - mg/kg of lead scrap produced  
English Units - lbs/billion lbs of lead scrap produced

Antimony	1,298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0



(b) Blast and Reverberatory Furnace Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	5,037.3	2,244.6
Arsenic	3,627.9	1,487.7
Lead	261.0	234.9
Zinc	2,662.2	1,096.2
Ammonia (as N)	0	0

(c) Kettle Wet Air Pollution Control PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

(d) Casting Contact Cooling PSNS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0

7. BCT is proposed based on the performance achievable by the application of chemical precipitation and sedimentation (lime and settle) technology. BCT is not an additional set of effluent limitations, but replaces BAT in the control of conventional pollutants. The following BCT effluent limitations are proposed:

(a) Battery Cracking  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Total Suspended Solids	38,540.0	18,800.0
pH	Within the range of 7.5 to 10.0 at all times	

(b) Blast and Reverberatory Furnace Wet Air Pollution  
Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Total Suspended Solids	138,580.0	67,600.0
pH	Within the range of 7.5 to 10.0 at all times	

(c) Kettle Wet Air Pollution Control  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

(d) Casting Contact Cooling  
BCT EFFLUENT LIMITATIONS

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Total Suspended Solids	9,069.20	4,424.0
pH	Within the range of 7.5 to 10.0 at all times	

## SECONDARY LEAD SUBCATEGORY

### SECTION III

#### INDUSTRY PROFILE

This section of the secondary lead supplement describes the raw materials and processes used in converting lead-bearing scrap to metallic lead and lead-based alloys and presents a profile of the secondary lead plants identified in this study. For a discussion of the purpose, authority, and methodology for this study and a general description of the nonferrous metals manufacturing category, refer to Section III of the General Development Document.

#### DESCRIPTION OF SECONDARY LEAD PRODUCTION

There are three major phases involved in the secondary lead subcategory scrap pretreatment, smelting, and refining and casting. Figure III-1 is a block flow diagram depicting the various process steps involved in secondary lead manufacture. The following discussion summarizes the raw materials used and the processes with emphasis on the steps where water may be used. It should be pointed out that not all secondary lead plants perform all of the process steps described.

#### RAW MATERIALS

The principal raw materials used in the secondary lead subcategory are battery storage plates and other scrap reclaimed from discarded products containing lead. Minor amounts of solder, babbitt, cable coverings, type metal, soft lead, and antimonial lead, as well as drosses and residues generated as a result of operations within the secondary lead plant, are also utilized.

#### SCRAP PRETREATMENT

The scrap pretreatment phase may involve crushing or cutting used batteries to allow separation of the lead from the battery case, crushing of drosses and oversize scrap, and sweating of lead scrap containing other metals. The general crushing operations reduce the larger pieces of scrap to a suitable size using machinery such as jaw crushers. Sweating involves charging scrap to a furnace where the lead value is separated by selective melting. The molten lead is collected and cast and the residue is removed from the furnace. Reverberatory furnaces are used for this operation. Particulate emissions can be controlled with a baghouse, a scrubber, or both.

There are a number of different approaches used in battery breaking. Each method of battery breaking is described below.

### Battery Breaking by Shear or Saw

Many smelters dismantle batteries in a hand operation in which employees (1) separate plastic and rubber batteries, (2) cut the top of the battery off, and (3) empty the contents of the battery onto a pile. Typically, front-end loaders then move the battery parts to storage and disposal.

### Hammer-Mill Battery-Breaking

In order to speed up the process, remove employees from exposure and utilize plastic battery cases for fuel or resale, some plants use hammer mills to break batteries. Unfortunately, this approach continues to require hand separation of plastic and rubber cased batteries and manual handling of rubber cased batteries.

### Flotation-Type Separators

A number of flotation-type battery-breakers are currently used in today's smelters. The technique uses a combination of shears, saws, and hammer mills to reduce battery scrap to small pieces. The separator produces output streams of hard lead (grids and posts), oxide and sulfate sludge, plastic, and rubber. The advantages of this system are (1) positive control of furnace feed enables use of more sophisticated furnaces, e.g., rotary, and (2) separate recycling of plastic case material.

### Low-Energy Shredders

At least five secondary smelters have (or, have had) low-energy shredders installed for breaking batteries. This system uses a low-rpm, low-energy shredding device to slowly shred batteries into chargeable or separable pieces.

### Whole Battery Charging

This technique, developed by the Bergsoe smelter in Denmark, purposely utilizes as little battery breaking as possible (only about 20 percent of the battery mass needs to be broken). The acid is drained from the battery before charging. The unbroken batteries are mixed with other charge materials on concrete beds using a rubber-tired front end loader. After the charge is prepared, it is loaded into the furnace with a front-end loader.

The battery cracking operation may be performed either on- or off-site. Spent electrolyte, along with saw or shredder cooling water and wash water, constitutes a major source of wastewater at plants where battery cracking is performed.

## SMELTING OPERATIONS

The smelting operation takes place in either a reverberatory or a blast furnace. In the reverberatory furnace, heat is radiated from the burner flame and the furnace roof and walls onto the melt. It is usually one of the least expensive furnaces to operate because the flame and hot combustion products come in direct contact with the melt.

Reverberatory smelting partially purifies and compacts lead scrap. The charge to the furnace can be untreated scrap (where the sweating and smelting operations are combined), treated scrap, or a mixture of both. The process steps for this operation are: (1) charging the scrap to the furnace, (2) melting the scrap, (3) allowing the slag to rise to the surface of the metal, (4) tapping the slag as feed for the blast furnace, and (5) tapping the molten lead. The product lead can then be sent either to the refining and casting operation, cast into semisoft or hard lead ingots, or converted to various forms of lead oxide using kettle (Barton pot) or reverberatory oxidation methods.

The secondary lead blast furnace is a refractory-lined steel cylinder with air ports known as tuyeres located at the bottom, through which air is supplied by a blower. Coke, used as fuel, is placed in the shaft in alternating layers along with scrap, slag, and limestone (a flux). One of the most important control variables is the addition rate of combustion air through the tuyeres. Preheating the combustion air may increase the efficiency of the furnace.

The product of the blast furnace is semisoft or hard (antimonial) lead produced from pretreated scrap, reverberatory slag, and recycled blast furnace slag (rerun slag). A typical charge for the blast furnace is composed of 4.5 percent rerun slag, 4.5 percent scrap cast iron, 3.0 percent limestone, 5.5 percent coke, which serves both as a fuel and as a reducing agent, and 82.5 percent lead oxides, drosses, scrap, and reverberatory slags obtained from other smelting and refining operations.

Emissions from reverberatory and blast furnaces are usually controlled with baghouses, although wet scrubbers may be used. Most secondary lead plants which practice wet scrubbing of furnace emissions utilize some degree of recycle of the scrubbing liquor.

## REFINING AND CASTING

Softening, alloying, and refining processes take place in kettle furnaces which are larger versions of pot furnaces. Kettles may be cylindrical or rectangular in shape and are normally used to melt metals with melting points below 760°C. They are usually

poured by tilting, dipping, or pumping. These large pot or kettle furnaces may have many small burners along all sides. They are usually natural gas or oil fired.

The product of the kettle softening and refining process is soft, high purity lead. The process steps involved are (a) charging the preheated kettle furnace with an intermediate semisoft or hard lead obtained from the smelting operation, (b) melting the charge, (c) fluxing and agitating the molten charge, (d) skimming the slag, and (e) pouring and casting the soft lead into ingots.

Fluxes which may be used include sodium hydroxide, sodium nitrate, aluminum, aluminum chloride, sawdust, sulfur, and air. Sodium hydroxide, sodium nitrate, or air may be used to reduce the antimony content. Aluminum reacts preferentially with antimony, copper, and nickel to form drosses, as does sulfur with copper. Adding sawdust to the molten metal forms carbon which produces elemental lead by the reduction of lead oxide. This process is known as dry drossing.

The operating temperatures of refining kettles range between 371° to 482°C. Emissions are normally collected by using a hood over the kettle and are usually sent to a baghouse, although wet scrubbing also may be used. Solid wastes, consisting of drosses and skimmings along with baghouse dust, are generally recycled to the blast furnace.

The alloying and refining process utilizes the same type furnace as the kettle softening and refining operation and involves treatment and adjustment of the composition of the lead to produce the desired alloy. Antimony, arsenic, copper, silver, and tin are commonly used for lead alloys.

Cooling of lead or lead alloy castings is usually done with indirect (noncontact) cooling water in closed loop recirculating systems. Contact cooling may also produce a small volume discharge stream.

#### PROCESS WASTEWATER SOURCES

In summary, the principal uses of wastewater in secondary lead production are:

- (1). Battery cracking,
- (2). Wet air pollution control of blast and reverberatory furnaces,
- (3). Wet air pollution control of refining (kettle) furnaces, and
- (4). Casting contact cooling water.

## OTHER WASTEWATER SOURCES

There are other waste streams associated with the production of secondary lead. The principal wastewater source is maintenance and cleanup water.

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

## AGE, PRODUCTION, AND PROCESS PROFILE

Figure III-2 shows the location of the 69 secondary lead plants operating in the United States. These plants are predominantly located in or near major urban centers where most of the raw materials are readily available. Of the 69 secondary plants shown, 21 plants (30 percent) are located west of the Mississippi River. The remaining 48 plants are located in two bands east of the Mississippi, around the Great Lakes and in the South.

As seen from Figure III-2, plants discharging indirectly to POTW (indirect dischargers) and zero discharge plants (zero dischargers) are found in all areas, while plants discharging directly to receiving waters are found in the East and South.

Table III-1 shows that the median age of secondary lead plants is within a span of 25 to 44 years. Table III-2 shows that, for the 58 plants providing lead production data, only nine produced over 20,000 tons in 1976. Most secondary lead plants are relatively small operations; roughly two-thirds produced under 15,000 tons per year in 1976.

Table III-3 provides a summary of the number of plants in the secondary lead industry which utilize the various process operations discussed previously, and the number of plants which generate wastewater associated with each process. All plants practicing battery cracking generate wastewater. For the other processes, most plants avoid producing wastewater by utilizing dry air pollution control methods (e.g., baghouses) where controls are implemented.



Table III-1

INITIAL OPERATING YEAR (RANGE) SUMMARY OF PLANTS  
IN THE SECONDARY LEAD SUBCATEGORY BY DISCHARGE TYPE

Type of Plant Discharge	Plant Age Range (Years)									Insuff. Data	Total
	1982 to 1973 0-10	1972 to 1968 10-15	1967 to 1958 15-25	1957 to 1948 25-35	1947 to 1938 35-45	1937 to 1928 45-55	1927 to 1918 55-65	1917 to 1903 65-80	Before 1903 80+		
Direct	0	2	1	1	1	0	0	0	1	1	7
Indirect	3	1	2	0	1	2	2	2	0	3	16
Zero	<u>0</u>	<u>3</u>	<u>8</u>	<u>4</u>	<u>8</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>0</u>	<u>14</u>	<u>46</u>
Total	3	6	11	5	10	6	5	4	1	18	69

Table III-2

PRODUCTION RANGES FOR THE SECONDARY LEAD SUBCATEGORY

<u>Production Ranges for 1976 (Tons/Year)</u>	<u>Number of Plants</u>
0 - 2,500	16
2,501 - 5,000	4
5,001 - 10,000	8
10,001 - 15,000	11
15,001 - 20,000	10
20,001 - 30,000	5
30,001 +	4
Not Reported	<u>11</u>
Total Number of Plants in Survey	69

Table III-3  
SUMMARY OF SECONDARY LEAD SUBCATEGORY PROCESSES  
AND ASSOCIATED WASTE STREAMS

<u>Process</u>	<u>Number of Plants With Process</u>	<u>Number of Plants Generating Wastewater*</u>
Battery Cracking	32	32
Lead Dross Preparation	5	0
Smelting	47	6
Lead Oxide Production	12	1
Refining and Alloying	67	9
Casting	66	11

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

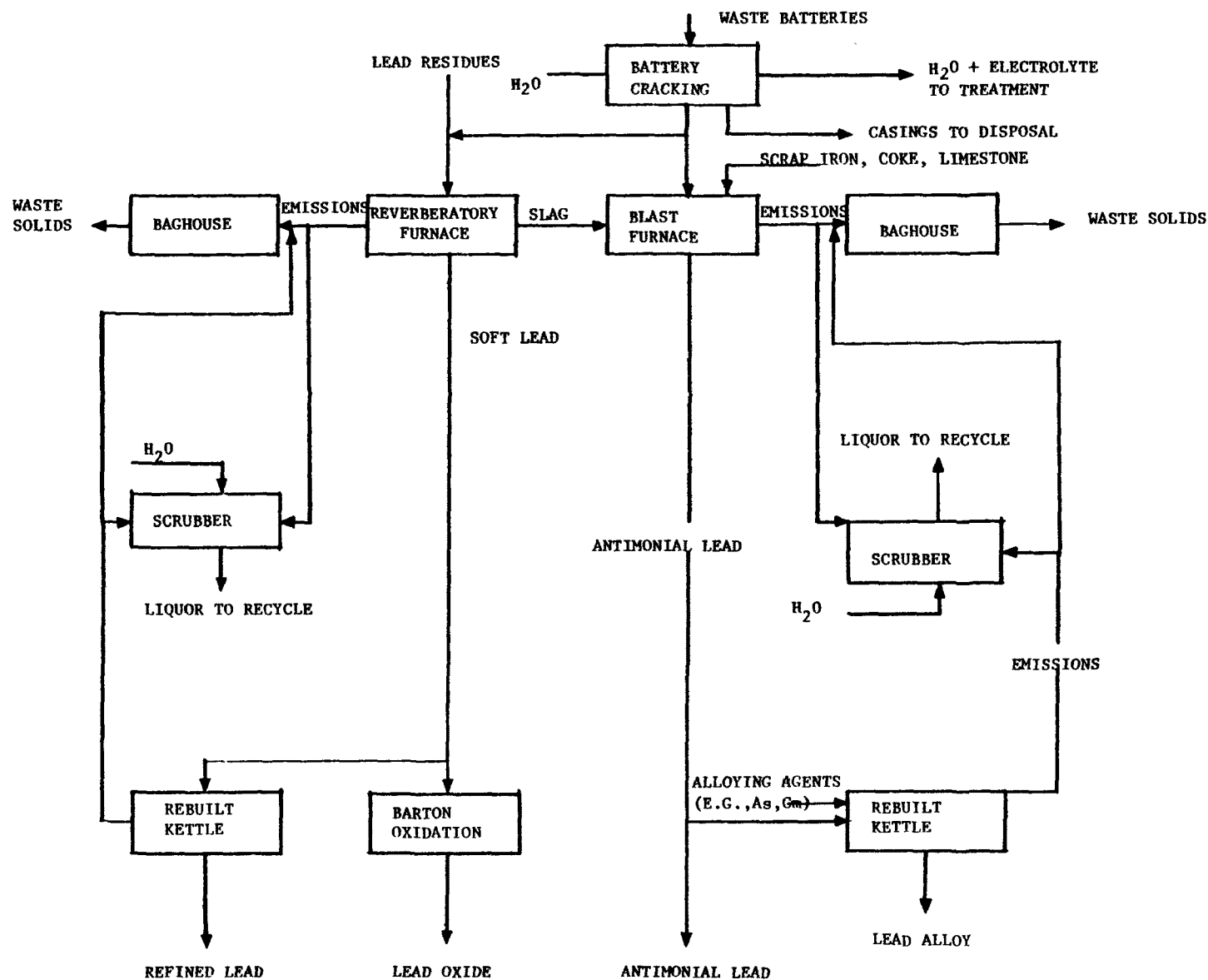


Figure III-1  
SECONDARY LEAD SMELTING PROCESS

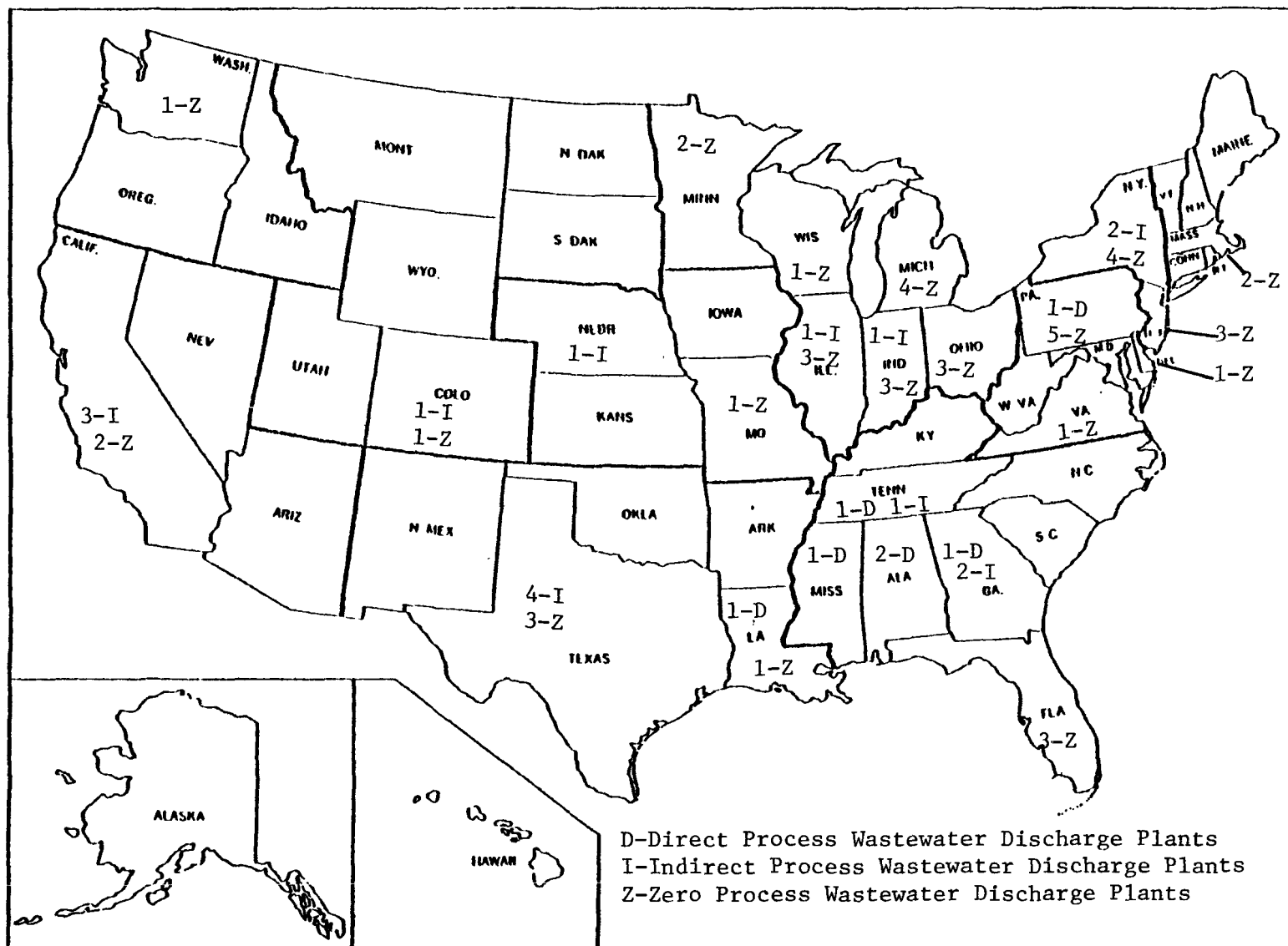


Figure III-2  
GEOGRAPHIC LOCATIONS OF THE SECONDARY LEAD SUBCATEGORY

## SECONDARY LEAD SUBCATEGORY

### SECTION IV

#### SUBCATEGORIZATION

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

#### FACTORS CONSIDERED IN SUBCATEGORIZATION

The following factors were evaluated for use in determining appropriate subcategories for the nonferrous metals industry:

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

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

In Section IV of the General Development Document, each of these factors is described, and the rationale for selecting metal products, manufacturing processes, and raw materials as the principal factors used for subcategorization is discussed. On the basis of these factors, the nonferrous metals manufacturing category (phase I) was divided into 12 subcategories, one of them being secondary lead.

The purpose of this rulemaking is to propose the creation of the secondary lead subcategory and the establishment of BPT and BAT effluent limitations, and NSPS, PSES, and PSNS for this subcategory.

#### FACTORS CONSIDERED IN SUBDIVIDING THE SECONDARY LEAD SUBCATEGORY

The factors listed previously were each evaluated when considering subdivision of the secondary lead 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 secondary lead subcategory is based primarily on the production process used. Within this subcategory, a number of different operations are performed, which may or may not have a water use or discharge, and which may require the establishment of separate effluent limitations and standards. While secondary lead production is still considered a single subcategory, a more thorough examination of the production processes, water use and discharge practices, and pollutant generation rates has illustrated the need for limitations and standards based on a specific set of waste streams, in accord with the building block approach adopted for all nonferrous metal subcategories. Limitations and standards will be based on specific flow allowances for the following subdivisions:

1. Battery cracking,
2. Blast and reverberatory furnace wet air pollution control,
3. Kettle wet air pollution control, and
4. Casting contact cooling.

#### OTHER FACTORS

The other factors considered in this evaluation either supported the establishment of the secondary lead subcategory and its subdivisions or were shown to be inappropriate bases for subcategorization. Air pollution control methods, treatment costs, nonwater quality aspects, and total energy requirements were each shown to be functions of the selected subcategorization factors--metal product, raw materials, and production processes. As such, they support the method of subcategorization which has been applied. As discussed in Section IV of the General Development Document, such other factors as plant age, plant size, and the number of employees were also evaluated and determined to be inappropriate for use as bases for subcategorization of nonferrous metal plants.

## PRODUCTION NORMALIZING PARAMETERS

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, the amount of lead produced by the respective manufacturing process is used as the PNP. This is based on the premise that the amount of water generated is proportional to the amount of product made. Variations in the association between the amount of water generated and the amount of product made are not felt to be significant enough to prevent the establishment of effluent limitations and standards. The PNP's for the secondary lead subdivision are as follows:

<u>Subdivision</u>	<u>PNP</u>
1. Battery cracking	kkg of lead scrap produced
2. Blast and reverberatory furnace wet air pollution control	kkg of lead produced from blast and reverberatory furnace smelting
3. Kettle wet air pollution control	kkg of lead produced from kettle furnaces
4. Casting contact cooling water	kkg of lead cast



## SECONDARY LEAD SUBCATEGORY

### SECTION V

#### WATER USE AND WASTEWATER CHARACTERISTICS

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

Section V of the General Development Document contains a detailed description of the data sources and methods of analysis used to characterize wastewater from the nonferrous metals category. To summarize this information briefly, two principle data sources were used: 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 secondary lead 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. Wastewater samples were collected in two phases: screening and verification. The first phase, screen sampling, was to identify which toxic pollutants were present in the wastewaters from production of the various metals. Screening samples were analyzed for 128 of the 129 toxic pollutants and other pollutants deemed appropriate. (Because the analytical standard for TCDD was judged to be too hazardous to be made generally available, samples were never analyzed for this pollutant. There is no reason to expect that TCDD would be present in nonferrous metals manufacturing wastewater.) A total of 10 plants were selected for screen sampling in the nonferrous metals manufacturing category, one of them being a secondary lead facility. 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).

As described in Section IV of this supplement, the secondary lead subcategory has been further categorized into four subdivisions, so that the proposed 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.

## WASTEWATER SOURCES, DISCHARGE RATES, AND CHARACTERISTICS

The wastewater data presented in this section were evaluated in light of production process information compiled during this analysis. From this information it was possible to identify the principal wastewater sources in the secondary lead subcategory. These are:

1. Battery cracking,
2. Blast and reverberatory furnace wet air pollution control,
3. Kettle wet air pollution control, and
4. Casting contact cooling water.

Data supplied by dcp responses were evaluated and two flow-to-production ratios were calculated for each stream. These two ratios, normalized water use and normalized wastewater discharge flow rate, differ by the water flow rates used in their calculation. Water use is defined as the volume of water or other fluid (e.g., battery electrolyte) required for or generated in a given process per mass of lead produced by the process and is therefore based on the sum of recycle and makeup flows to a given process. The production normalized discharge flow rate is defined as the volume of wastewater actually discharged from a given process for further treatment, disposal, or discharge per mass of lead produced. Differences between the water use and discharge flows associated with a given stream may result from combinations of recycle, evaporation, and carryover on the product. The production values used in calculating these ratios correspond to the production normalizing parameter (PNP) assigned to each stream, as discussed in Section IV of this supplement. The production normalized flows were compiled by stream type. An attempt was made to identify factors that could account for variations in the water use from plant to plant. This information is summarized in this section. A similar analysis of factors affecting the normalized wastewater flow rates is presented in Sections X, XI, and XII where representative BAT, BDT, and pretreatment discharge flows are selected for use in calculating effluent limitations.

In order to quantify the concentrations of pollutants present in wastewaters from secondary lead plants, wastewater samples were collected at six plants, representing 26 percent of the discharging secondary lead plants. Block diagrams indicating the locations of sampling points and the production processes involved for each of these six plants are given in Figures V-1 through V-6 (at the end of this section).

Raw wastewater sampling data for the secondary lead industry are presented in Tables V-2, V-4, V-6, and V-8 (at the end of this section). Treated wastewater sampling data are shown in Tables V-9 through V-13 (at the end of this section). The stream codes

displayed in the tables may be used to identify the location of each of the samples on the process flow diagrams in Figures V-1 through V-6. Where no data are listed for a specific day of sampling, the wastewater samples for the stream were not collected. If the analysis did not detect a pollutant in a waste stream, the pollutant was omitted from the table.

The data tables include some samples measured at concentrations considered not quantifiable. The base neutral extractables, acid extractables, and volatile organics 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 not considered quantifiable below concentrations of 0.005 mg/l. Nonquantifiable results are designated in the tables with an asterisk (double asterisk for pesticides).

These 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. Data reported as an asterisk are considered as detected but below quantifiable concentrations, and a value of zero is used for averaging. Toxic organic, nonconventional, and conventional 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 excluded in calculating the average. Finally, toxic metal values reported as less than a certain value were considered as not detected, and a value of zero was used in the calculation of the average. For example, three samples reported as ND, \*, and 0.021 mg/l have an average value of 0.010 mg/l. In selecting pollutants and pollutant parameters for specific regulation, individual samples were used rather than average values.

The method by which each sample was collected and composited is indicated on the data tables by a code number, as follows:

- 1 one-time grab
- 2 24-hour manual composite
- 3 24-hour automatic composite
- 4 48-hour manual composite
- 5 48-hour automatic composite
- 6 72-hour manual composite
- 7 72-hour automatic composite

In the data collection portfolios, the secondary lead plants which discharge were asked to specify the presence or absence of the toxic pollutants in their effluent. Of the 69 secondary lead plants, 22 responded to this portion of the questionnaire. All plants responding to the organic compounds portion reported that all toxic organic pollutants were known to be absent or believed to be absent from their wastewater.

The responses for the toxic metals are summarized below.

<u>Pollutant</u>	<u>Known Present</u>	<u>Believed Present</u>	<u>Believed Absent</u>	<u>Known Absent</u>
Antimony	13	5	4	-
Arsenic	9	7	6	-
Cadmium	7	6	6	3
Chromium	3	5	10	4
Copper	12	2	7	1
Lead	17	4	-	-
Mercury	2	4	13	3
Nickel	6	4	11	1
Silver	2	3	17	-
Thallium	1	6	18	3
Zinc	10	6	6	-

#### BATTERY CRACKING

Plants utilizing lead-acid batteries as a source of process raw materials produce a wastewater stream associated with the battery cracking operation. Battery cracking involves the breaking of battery cases by any of a number of methods described in Section III. Wastewater may be generated in the form of electrolyte drained from the battery cases, by the use of saw or breaker cooling water, and by area wash water. All 32 plants having battery cracking operations generate wastewater. Table V-1 summarizes the normalized electrolyte, blowdown, and ultimate discharge flows for these plants in terms of liters per metric ton of lead scrap produced (recovered) from battery cracking operations. Differences from plant to plant in the specific method and equipment used for battery cracking may be responsible for variations in these flow rates.

Table V-2 summarizes the field sampling data for the toxic, conventional, and nonconventional pollutants detected. This waste stream contains quantifiable concentrations of toxic organics. The metals antimony, arsenic, cadmium, copper, lead, and zinc are generally present in concentrations from 1 to 100 mg/l. Treatable concentrations of total suspended solids, and oil and grease, and low pH (less than 2) also characterize this stream.

#### BLAST AND REVERBERATORY FURNACE WET AIR POLLUTION CONTROL

Blast and reverberatory furnaces used in the smelting operation in secondary lead plants generally require some type of air pollution control to limit emissions, especially of particulates and sulfur oxide compounds. Out of 47 plants having smelting operations, six use wet air pollution control; 41 use dry air pollution control. Table V-3 summarizes the water use and discharge rates for these plants. Limited sampling and analytical data were obtained on furnace scrubbing liquor. As shown in Table V-4, treatable concentrations of lead and total suspended solids were found for the single sample analyzed.

#### KETTLE WET AIR POLLUTION CONTROL

Kettles used in the refining and alloying operations in secondary lead plants may also produce air pollutants, especially particulate matter, which may require control. Nine of the 67 plants reporting the use of refining and alloying kettles use wet air pollution control. Table V-5 shows the production normalized water use and discharge rates for these plants. Data obtained on the kettle scrubber liquor at one of these plants (presented in Table V-6) contained measurable concentrations of ammonia and treatable concentrations of total suspended solids, arsenic, and lead (50 to 380 mg/l) with measurable concentrations of other metals.

#### CASTING CONTACT COOLING WATER

Contact cooling water may be used in the casting operation. The cooling water is frequently recycled and may be totally evaporated, but a small stream may be blown down to limit the buildup of dissolved solids, which may cause surface imperfections on the cast metal. Eleven plants, of the 66 reporting the use of a casting operation, use direct contact cooling. The normalized water use and discharge data for these plants are summarized in Table V-7. No sampling data are available for secondary lead plant casting cooling water. It is expected that this operation may be similar to analogous operations in other nonferrous metals manufacturing subcategories. Organics, in the form of oil and grease, may be found when lubricants are used. Total suspended solids may also be present in treatable concentrations.

Table V-1

WATER USE AND DISCHARGE RATES FOR BATTERY CRACKING OPERATIONS  
(1/kg of lead scrap produced)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
222	0	139	139
224	0	834	834
223	0	775	775
225	0	763	763
227	0	384	384
234	0	437	437
236	0	142	142
239	0	154	154
244	0	306	306
246	0	315	315
248	0	1,618	1,618
249	0	442	442
250	0	1,984	1,984
254	0	796	796
263	0	1,046	1,046
264	0	1,647	1,647
265	0	1,084	1,084
266	0	4,669	4,669
271	0	81	81
272	0	5,086	5,086
273	0	286	286
392	0	369	369
391	0	922	922
428	0	244	244
652	0	429	429
655	0	905	905
4210	0	671	671
4211	0	377	377
9001	0	1,063	1,063
9002	0	638	638
26001	0	705	705
26003	0	600	600

Table V-2  
SECONDARY LEAD SAMPLING DATA  
BATTERY CRACKING  
RAW WASTEWATER

Pollutants (a)	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				Average
			Source	Day 1	Day 2	Day 3	
Toxic Pollutants							
23. chloroform	73	2		ND	0.014	0.026	0.02
	106	2		*	*	ND	*
	208	1		ND			
47. bromoform	73	2	ND	ND	ND		
	106	2		ND	ND	0.049	0.049
	208	1		ND			
66. bis(2-ethylhexyl) phthalate	73	7	0.575	0.575			0.575
	106	7		0.585			0.585
	152	3		*	0.2	*	0.067
	208	2		ND			
68. di-n-butyl phthalate	73	7	*	*			*
	106	7		0.028			0.028
	152	3		ND	*	ND	*
	208	2		ND			
69. di-n-octyl phthalate	73	7	*	*			*
	106	7		0.026			0.026
	208	2		ND			
71. dimethyl phthalate	73	7	ND	ND			
	106	7		0.013			0.013
	208	2		ND			
76. chrysene	73	7	ND	ND			
	106	7		0.545			0.545
	152	3		ND	ND	ND	
	208	2		ND			
77. acenaphthylene	73	7	*	ND			
	106	7		0.035			0.035
	208	2		ND			

Table V-2 (Continued)

SECONDARY LEAD SAMPLING DATA  
BATTERY CRACKING  
RAW WASTEWATER

Pollutants (a)	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
84. pyrene	73	7	*	ND			
	106	7		0.013			0.013
	208	2		ND			
114. antimony	73	7	<0.1	95			95
	106	7		77			77
	152			16	12	49	26
	208	2		18.41			18.41
115. arsenic	73	7	<0.01	8.5			8.5
	106	7		9.1			9.1
	152	3		1.2	3	8	4.1
117. beryllium	73	7	<0.001	0.002		0.03	0.016
	106	7		0.003			0.003
	152	3		0.006	0.007	0.002	0.005
118. cadmium	73	7	0.03	1		0.09	0.545
	106	7		3			3
	152	3		2.1	2.2	4.8	3
	208	2		3			3
119. chromium	73	7	<0.005	0.4		0.06	0.23
	106	7		1			1
	152			0.15	0.23	0.27	0.22
	208	2		0.43			0.43
120. copper	73	7	0.01	4		0.7	2.35
	106	7		6			6
	152	3		3.5	3.4	4.0	3.6
	208	2		1.8			1.8
121. cyanide	73	3		0.004	0.008	0.007	0.006
	106	7		3.0	4.0	6.0	4.3
	208	2		<0.01			<0.01
122. lead	73	7	0.05	80		1	40.5
	106	7		40			40
	152	3		11	4.6	4.7	6.8
	208	2		92.2			92.2



Table V-2 (Continued)  
SECONDARY LEAD SAMPLING DATA  
BATTERY CRACKING  
RAW WASTEWATER

Pollutants (a)	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
123. mercury	73	7	0.0001	0.0014		0.0061	0.00375
	106	7		0.0101			0.0101
	152	3		0.0004	0.0003	0.0005	0.0004
	208	2		<0.62			<0.62
124. nickel	73	7	<0.005	1		ND	
	106	7		2			2
	152	3		0.65	0.98	1.1	0.91
	208	2		0.94			0.94
126. silver	73	7	<0.02	0.32			0.32
	106	7		0.16			0.16
	152	3		0.34	0.03	0.03	0.31
127. thallium	73	7	<0.1	0.8			0.8
	106	7		1			1
	152	3		<0.001	<0.001	<0.001	<0.001
128. zinc	73	7	0.1	5		3	4
	106	7		10			10
	152	3		3.1	4.8	4.0	4
	208	2		7.6			7.6
<u>Nonconventional</u>							
ammonia	152	2		0.02	7.9	7.5	5.1
chemical oxygen demand (COD)	73	7		384			384
	106	7		174			174
phenols (total; by 4-AAP method)	73	2		0.001	0.003	0.017	0.007
	106	2		0.022	0.016	0.009	0.01567
	208	2		<0.004			<0.004
total organic carbon (TOC)	73	7		330			330
	106	7		69			69

Table V-2 (Continued)  
SECONDARY LEAD SAMPLING DATA  
BATTERY CRACKING  
RAW WASTEWATER

Pollutants (a)	Stream Code	Sample Type†	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Conventionals</u>							
oil and grease	73	1		65	56	56	59.0
	106	1		8	7	6	7.0
total suspended solids (TSS)	73	7		10,050			10,050
	106	7		1,447			1,447
	152	3		270	300	400	323
	208	5		0.2			0.2
pH (standard units)	73	1		2	2	2	
	106	1			1.1	0.6	
	152	1		1.9	1.7	1.0	
	208	1		0.6			

(a) No samples were analyzed for the acid extractables of toxic organic pollutants. Six samples were analyzed for the pesticide fraction; none was reported present above its analytical quantification limit.

†Sample type: Note: These numbers also apply to subsequent sampling data tables in this section.

- 1 One-time grab
- 2 24-hour manual composite
- 3 24-hour automatic composite
- 4 48-hour manual composite
- 5 48-hour automatic composite
- 6 72-hour manual composite
- 7 72-hour automatic composite

\* - Less than or equal to 0.01 mg/l.

\*\* - Less than or equal to 0.005 mg/l.

Table V-3

WATER USE AND DISCHARGE RATES FOR BLAST AND  
REVERBERATORY FURNACE WET AIR POLLUTION CONTROL  
(1/kkg of lead produced from smelting)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
266	0	3,252	3,252
26001	100	151,050	0
272	83.7	40,411	6,587
265 (a)	83.3	11,433	1,909
265	93.3	25,507	1,776
234	100	942	0
222	97.8	NR	NR

---

(a) Plant 265 controls air emissions on two furnaces with two different scrubbers.

NR = Present but data not reported in dcp.

Table V-4

SECONDARY LEAD SAMPLING DATA  
BLAST AND REVERBERATORY FURNACE SCRUBBER LIQUOR  
RAW WASTEWATER

<u>Pollutants(a)</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Toxic Pollutants</u>							
122. lead	176	1		23			23
<u>Conventional</u>							
total suspended solids (TSS)	176	1		28,000			28,000

(a) This sample was analyzed only for the two pollutants reported above.

Table V-5

WATER USE AND DISCHARGE RATES FOR KETTLE WET AIR  
POLLUTION CONTROL  
(1/kg of lead produced from kettle furnaces)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
26001	100	151,050	0
655	100	3,071	0
391	100	361	0
273	91.7	21,900	1,818
264	96	1,845	74
250	-	1,718	0*
225	100	11,373	0
224	100	5,724	0
223	100	7,089	0

---

\*100 percent of the wastewater is recycled to decasing washing.

Table V-6

SECONDARY LEAD SAMPLING DATA  
KETTLE SCRUBBER LIQUOR  
RAW WASTEWATER

Pollutants (a)	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
115. arsenic	151	3		40	60	50	50
117. beryllium	151	3		0.001	0.008	0.001	0.003
118. cadmium	151	3		1.2	0.43	0.41	0.68
119. chromium	151	3		0.003	0.002	0.001	0.002
120. copper	151	3		0.59	1.1	0.73	0.807
122. lead	151	3		75	95	29	66.3
123. mercury	151	3		0.0003	0.0025	0.0027	0.0018
124. nickel	151	3		0.37	0.32	0.54	0.41
126. silver	151	3		0.003	0.002	0.002	0.0023
128. zinc	151	3		0.17	0.17	0.15	0.16
<u>Nonconventional</u>							
ammonia	151	1		22	25	29	25.33
<u>Conventional</u>							
total suspended solids (TSS)	151	3		240	550	340	376.7
pH (standard units)	151	1		8.1	8.0	7.8	

(a) No samples were analyzed for either the acid or extractable volatile fractions of the toxic organic pollutants. Three samples were analyzed for the pesticide fraction; none was detected above its analytical quantification limit.

Table V-7

WATER USE AND DISCHARGE RATES FOR CASTING CONTACT COOLING  
(1/kg of lead cast)

<u>Plant Code</u>	<u>Percent Recycle</u>	<u>Production Normalized Water Use</u>	<u>Production Normalized Discharge Rate</u>
4211	100 (a)	171	0
26001	100	504	0
427	0	120	120
422	0	963	963
248	0	5	5
244	0	184	184
234	0	22	22
046	100	705	0
224	0	33	33
247	NR	(b)	(b)
252	NR	(b)	(b)

---

(a) 100 percent recycle or evaporation.

(b) Reported in dcp as "insignificant".

NR - Not reported in dcp.

Table V-8

SECONDARY LEAD SAMPLING DATA  
MISCELLANEOUS  
RAW WASTEWATER

Pollutants(a)	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				Average
			Source	Day 1	Day 2	Day 3	
Toxic Pollutants							
23. chloroform	20	1		0.024	0.012	0.018	0.018
	75	2		0.049	0.018	0.079	0.047
39. fluoranthene	75	6	*	0.027			0.027
44. methylene chloride	20	1		0.06	ND	ND	0.06
56. nitrobenzene	20	7		ND			
	108	2		0.016			0.016
66. bis(2-ethylhexyl) phthalate	20	7		0.027			0.027
	75	6	0.575	0.865			0.865
	108	2		0.031			0.031
67. butyl benzyl phthalate	75	6	*	0.089			0.089
68. di-n-butyl phthalate	20	7		0.031			0.031
	108	2		0.014			0.014
69. di-n-octyl phthalate	75	6	*	0.019			0.019
76. chrysene (b)	20	7		<0.04			<0.04
	75	6	ND	0.139			0.139
	108	2		ND			
78. anthracene (c)	20	7		<0.04			<0.04
81. phenanthrene (c)	108	2		*			*
84. pyrene	75	6	*	0.038			0.038
87. trichloroethylene	20	1		ND	*	<0.27	*
114. antimony	20	7		16			16
	75	6	<0.1	45			45
	76	1	<0.1	0.6			0.6
	77	1	<0.1	11			11
	108	2		83			83
115. arsenic	20	7		3			3
	75	6	<0.01	6.4			6.4
	76	1	<0.01	0.01			0.01
	77	1	<0.01	1.2			1.2
	108	2		16			16



Table V-8 (Continued)  
SECONDARY LEAD SAMPLING DATA  
MISCELLANEOUS  
RAW WASTEWATER

Pollutants(a)	Stream Code	Sample Type	Source	Concentrations (mg/l, Except as Noted)			Average
				Day 1	Day 2	Day 3	
120. copper	20	7		3			3
	75	6	0.01	3		<0.006	3
	108	2		10			10
121. cyanide	20	7		<0.001	<0.001	0.004	0.002
	75	6		0.007	0.006	0.013	0.0087
	108	2		0.006			0.006
122. lead	20	7		7			7
	75	6	0.05	80		<0.02	40
	108	2		7			7
	175	1		9.9			9
123. mercury	20	7		0.006			0.006
	75	6	0.0001	0.0007		<0.0001	0.0004
	108	2		0.0126			0.0126
124. nickel	20	7		1			1
	75	6	<0.005	<0.9		<0.005	<0.45
	108	2		2			2
126. silver	20	7		<0.25			<0.25
	75	6	<0.02	0.04			0.04
	76	1	<0.02	<0.02			<0.02
	77	1	<0.02	<0.02			<0.02
	108	2		0.07			0.07
127. thallium	20	7		<0.05			<0.05
	75	6	<0.1	0.3			0.3
	76	1	<0.1	<0.1			<0.1
	77	1	<0.1	<0.1			<0.1
	108	2		0.5			0.5
128. zinc	20	7		3			3
	75	6	0.1	4		0.6	2.3
	108	2		20			20
<u>Nonconventional</u>							
ammonia	20	1		4.86	25.08	6.42	12.12
chemical oxygen demand (COD)	20	7		65			65
	75	2		152			152
	108	2		144			144

Table V-8 (Continued)

SECONDARY LEAD SAMPLING DATA  
MISCELLANEOUS  
RAW WASTEWATER

Pollutants(a)	Stream Code	Sample Type	Source	Concentrations (mg/l, Except as Noted)			Average
				Day 1	Day 2	Day 3	
phenols (total; by 4-AAP method)	20	1		0.007	0.012	0.006	0.0083
	75	2		0.006	0.018	0.01	0.011
	108	2		0.01			0.01
total organic carbon (TOC)	20	7		4			4
	75	2		44			44
	108	2		70			70
<u>Conventional</u>							
oil and grease	20	1		76	23	22	40.3
	75	2		23	36	16	25
	108	1		7			7
total suspended solids (TSS)	20	7		428			428
	75	2		1,122			1,122
	108	2		836			836
	175	1		<1			<1
pH (standard units)	20	1		1.2	1.2	2.2	
	75	1		2	3	2	
	108	1		0.8			

- (a) One sample was analyzed for the acid extractable toxic organic pollutants, and eight samples were analyzed for the pesticide fraction; none of these pollutants was reported present above its analytical quantification limit.
- (b) Chrysene, in stream code 20 only, is reported with anthracene and phenanthrene.
- (c) Reported together.

Table V-9

SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT A

Pollutants	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				Average
			Source	Day 1	Day 2	Day 3	
<u>Toxic Pollutants</u>							
23. chloroform	74	2		0.017	0.015	0.037	0.023
66. bis(2-ethylhexyl) phthalate	74	6	0.575	0.021			0.021
67. butyl benzyl phthalate	74	6	*	ND	ND		
69. di-n-octyl phthalate	74	6	*	ND	ND		
114. antimony	74	6	<0.1	20			20
115. arsenic	74	6	<0.01	2.9			2.9
117. beryllium	74	6	<0.001	<0.01	<0.001		<0.0055
118. cadmium	74	6	0.03	0.4	<0.002		0.4
119. chromium	74	6	<0.005	0.2	0.03		0.12
120. copper	74	6	0.01	1	0.2		0.6
121. cyanide	74	6		<0.001	<0.001	<0.001	<0.001
122. lead	74	6	0.05	6	0.2		3.1
123. mercury	74	6	0.0001	0.0004	0.0004		0.0004
124. nickel	74	6	<0.005	0.6	<0.005		0.6
126. silver	74	6	<0.02	<0.02			<0.02
127. thallium	74	6	<0.1	0.2			0.2
128. zinc	74	6	0.1	3	0.7		1.85

Table V-9 (Continued)  
 SECONDARY LEAD SAMPLING DATA  
 TREATMENT PLANT SAMPLES - PLANT A

Pollutants	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				Average
			Source	Day 1	Day 2	Day 3	
<u>Nonconventional</u>							
chemical oxygen demand (COD)	74	2		32			32
chloride	74	2		309			309
phenols (total; by 4AAP method)	74	2		0.008	0.01	0.007	0.008
total organic carbon (TOC)	74	2		19			19
<u>Conventional</u>							
oil and grease	74	2		3	ND	28	15.5
total suspended solids (TSS)	74	2		351			351
pH (standard units)	74	1		2	3	4	

Table V-10

SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT B

Pollutants	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				Average
			Source	Day 1	Day 2	Day 3	
<u>Toxic Pollutants</u>							
114. antimony	206	2		1.22			1.22
	207	2		1.13			1.13
118. cadmium	206	2		0.03			0.03
	207	2		0.11			0.11
119. chromium	206	2		0.09			0.09
	207	2		0.09			0.09
120. copper	206	2		0.04			0.04
	207	2		0.16			0.16
122. lead	206	2		0.27			0.27
	207	2		11.7			11.7
123. mercury	206	2		<0.0002			<0.0002
	207	2		0.00066			0.00066
124. nickel	206	2		0.15			0.15
	207	2		0.14			0.14
128. zinc	206	2		0.06			0.06
	207	2		0.58			0.58
<u>Nonconventional</u>							
phenols (total; by 4-AAP method)	206	5		<0.004			<0.004
	207	5		<0.004			<0.004
<u>Conventional</u>							
total suspended solids (TSS)	206	5		0.01			0.01
	207	5		0.05			0.05
pH (standard units)	206	5		8.3			
	207	5		1.4			

Table V-11  
SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

Pollutants	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				
			Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>							
23. chloroform	107	2		0.028	0.03		0.03
30. 1,2-trans-dichloro-ethylene	107	2		0.026	0.013		0.0195
66. bis(2-ethylhexyl) phthalate	107	2		0.0199	0.022		0.0205
87. trichloroethylene	107	2		<0.02800	*		*
114. antimony	107	2		<0.1000	1.1		0.5
	109	1		0.7			0.7
118. cadmium	107	2		0.02	<0.002		0.02
119. chromium	107	2		0.07	0.04		0.055
120. copper	107	2		0.02	0.03		0.025
121. cyanide	107	2		0.001	<0.001		0.001
122. lead	107	2		0.2	0.2		0.2
123. mercury	107	2		<0.1	<0.1		<0.1
124. nickel	107	2		0.02	<0.005		0.01
127. thallium	107	2		<0.1	0.1		0.1
128. zinc	107	2		0.1	0.1		0.1
<u>Nonconventional</u>							
chemical oxygen demand (COD)	107	2		55	63		59
total organic carbon (TOC)	107	2		21	48		34.5
phenols (total: by 4-AAP method)	107	2		0.006	0.004		0.005

Table V-11 (Continued)

SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT C

<u>Pollutants</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Concentrations (mg/l, Except as Noted)</u>				
			<u>Source</u>	<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	<u>Average</u>
<u>Conventional</u>							
oil and grease	107	1		4	5		4.5
total suspended solids (TSS)	107	2		51	84		67.5
pH (standard units)	107	1		8.8			8.8

Table V-12

SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT D

Pollutants		Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				
				Source	Day 1	Day 2	Day 3	Average
<u>Toxic Pollutants</u>								
23.	chloroform	21	1		0.063	ND	*	0.0315
44.	methylene chloride	21	1		0.05	ND	ND	0.05
68.	di-n-butyl phthalate	21	7		0.044			0.04
114.	antimony	21	7		2			2
115.	arsenic	21	7		0.00025			0.00025
118.	cadmium	21	7		0.414			0.414
119.	chromium	21	7		0.032			0.032
120.	copper	21	7		1.25			1.25
121.	cyanide	21	7		0.002	0.001	0.002	0.0017
122.	lead	21	7		4.19			4.19
123.	mercury	21	7		0.0001			0.0001
124.	nickel	21	7		0.52			0.52
125.	selenium	21	7		0.005			0.005
126.	silver	21	7		<0.025			<0.025
128.	zinc	21	7		1.25			1.25
<u>Nonconventional</u>								
	ammonia	21	1		7,040	8,040	14,400	9,830
	chemical oxygen demand (COD)	21	1		28			28
	total organic carbon (TOC)	21	1		13			13
	phenols (total; by 4-AAP method)	21	1		0.007	0.01	0.047	0.021



Table V-12 (Continued)  
SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT D

<u>Pollutants</u>	<u>Stream Code</u>	<u>Sample Type</u>	<u>Source</u>	<u>Concentrations (mg/l, Except as Noted)</u>			<u>Average</u>
				<u>Day 1</u>	<u>Day 2</u>	<u>Day 3</u>	
<u>Conventional</u>							
oil and grease	21	1		6	6	4	5
total suspended solids (TSS)	21	1		177			177
pH (standard units)	21	1		8.5	8.6	6.8	

Table V-13

SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT E

Pollutants	Stream Code	Sample Type	Concentrations (mg/l, Except as Noted)				Average
			Source	Day 1	Day 2	Day 3	
<u>Toxic Pollutants</u>							
66. bis(2-ethylhexyl) phthalate	153	2		*	*		*
	154	1		*	0.02	*	0.0067
	155	1		0.02	*	*	0.067
	156	2		*	*	0.1	0.033
68. di-n-butyl phthalate	153	2		ND	ND		
	154	1		ND	ND	ND	
	155	1		*	ND	ND	*
	156	2		ND	ND	ND	ND
76. chrysene	155	1		*	ND	*	*
	156	2		ND	ND	ND	
78. anthracene (a)	155	1		*	*	*	*
81. phenanthrene (a)	156	2		ND	ND	ND	
114. antimony	153	2		0.2	0.3		0.25
	154	1		0.3	1.3	1.4	1
	156	2		9	1.5	0.5	3.7
115. arsenic	153	2		0.03	0.16		0.095
	155	1		200	160	88	149.3
	156	2		18	18	4	13.3
117. beryllium	153	2		0.03	<0.001		<0.03
	154	1		0.001	0.004	0.001	0.002
	155	1		<0.001	<0.001	0.001	0.0003
	156	2		0.002	0.002	0.001	0.017
118. cadmium	153	1		0.048	0.046		0.047
	154	1		0.04	0.08	0.12	0.08
	155	1		0.29	0.039	0.028	0.119
	156	2		1.8	2.4	1.7	2.0
119. chromium	153	2		0.02	0.035		0.28
	154	1		0.003	0.006	0.006	0.005
	155	1		0.002	0.001	0.001	0.0013
	156	2		0.2	0.19	0.21	0.2
120. copper	153	2		0.07	0.08		0.075
	154	1		0.07	0.17	0.25	0.163
	155	1		0.2	0.07	0.06	0.11
	156	2		4.5	4.9	3.6	4.3

Table V-13 (Continued)  
SECONDARY LEAD SAMPLING DATA  
TREATMENT PLANT SAMPLES - PLANT E

Pollutants	Stream Code	Sample Type	Source	Concentrations (mg/l, Except as Noted)			Average
				Day 1	Day 2	Day 3	
122. lead	153	3		1.7	0.72		1.21
	154	1		0.19	0.42	0.69	0.43
	155	1		40	39	36	38.3
	156	2		11	7.8	7.6	8.8
123. mercury	153	2		0.0003	0.0004		0.00035
	154	1		0.0004	0.0004	0.0003	0.00036
	155	1		0.0014	0.001	0.0006	0.001
	156	2		0.0009	0.0006	0.0008	0.0008
124. nickel	153	2		0.16	0.111		0.135
	154	1		0.13	0.12	0.13	0.1267
	155	1		0.11	0.07	0.001	0.0604
	156	2		0.92	0.9	1.1	0.973
126. silver	153	2		0.001	0.03		0.015
	154	1		0.008	0.002	0.002	0.004
	155	1		0.002	0.002	0.006	0.003
	156	2		0.004	0.009	0.014	0.009
127. thallium	155	1		<0.001	<0.001	<9.001	<0.001
	156	2		0.009	0.003	0.002	0.004
128. zinc	153	2		0.18	0.09		0.135
	154	1		0.08	0.17	0.3	0.183
	155	1		0.17	0.03	0.07	0.09
	156	2		5.2	5.5	3.4	4.7
<u>Nonconventional</u>							
ammonia	153	2		0.11	3.4		1.75
	154	1		0.01	2	1.9	1.3
	155	1		19	27	27	24
	156	2		0.02	3.2	2	1.7
<u>Conventional</u>							
total suspended solids (TSS)	153	2		730	180		455
	154	1		24	23	45	30.7
	155	1		72	98	120	97
	156	2		59	42	27	43
pH (standard units)	153	1		11	8.6		
	154	1		11	3.6	3.9	
	155	1		7.6	4.2	7.6	
	156	1		1.6	1.5	2.3	

(a) Reported together.

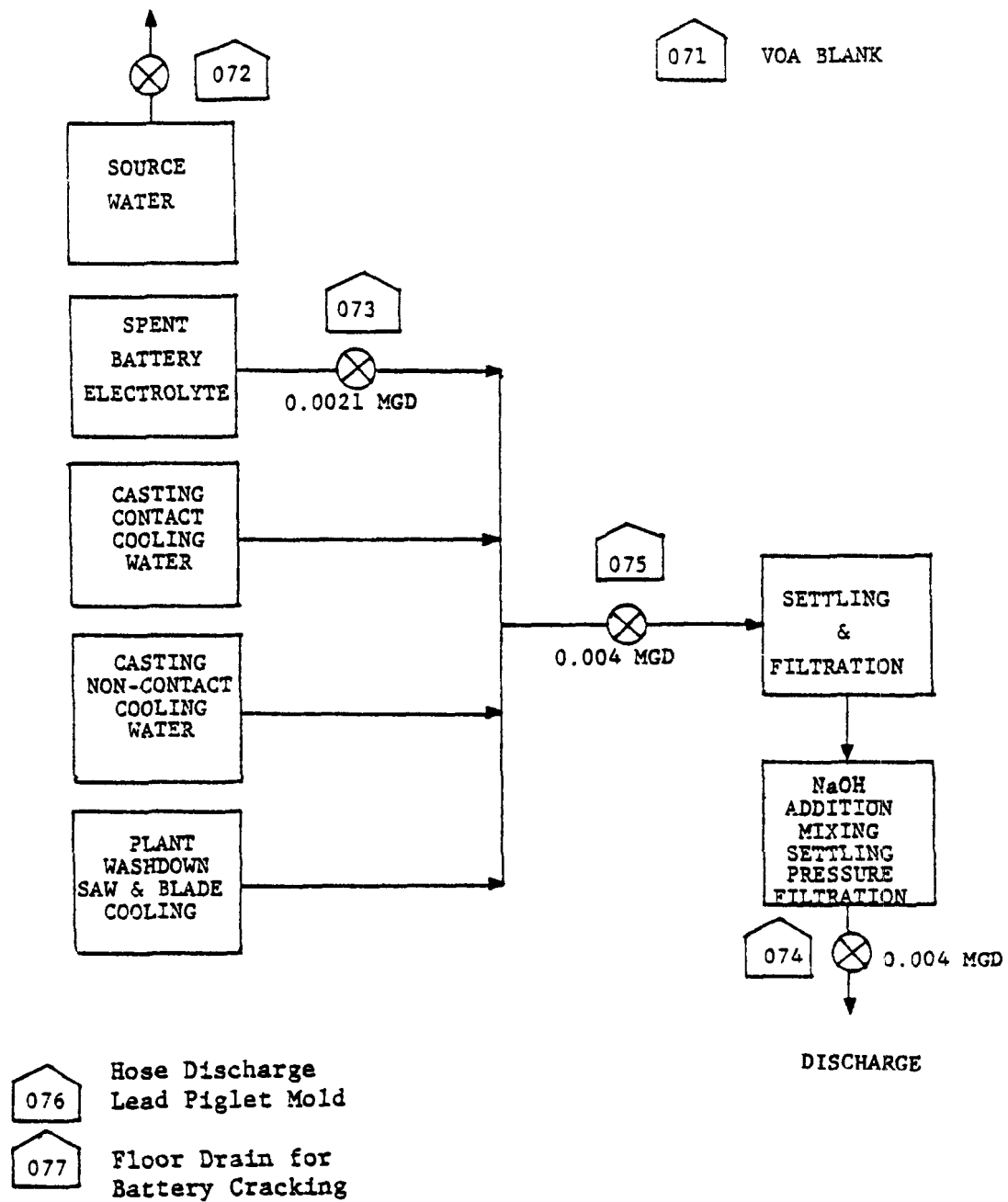


Figure V-1  
SAMPLING SITES AT SECONDARY LEAD PLANT A

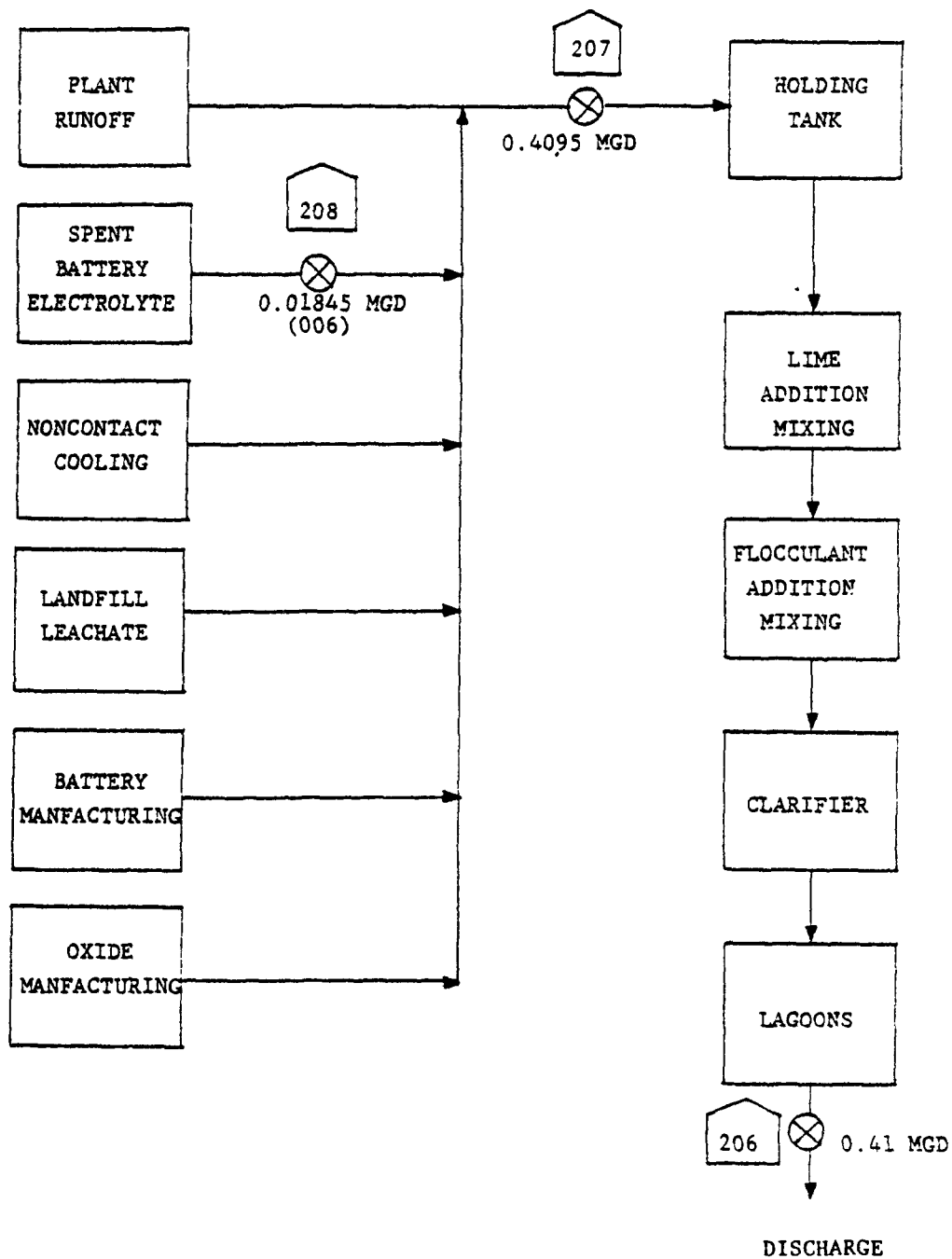


Figure V-2  
SAMPLING SITES AT SECONDARY LEAD PLANT B

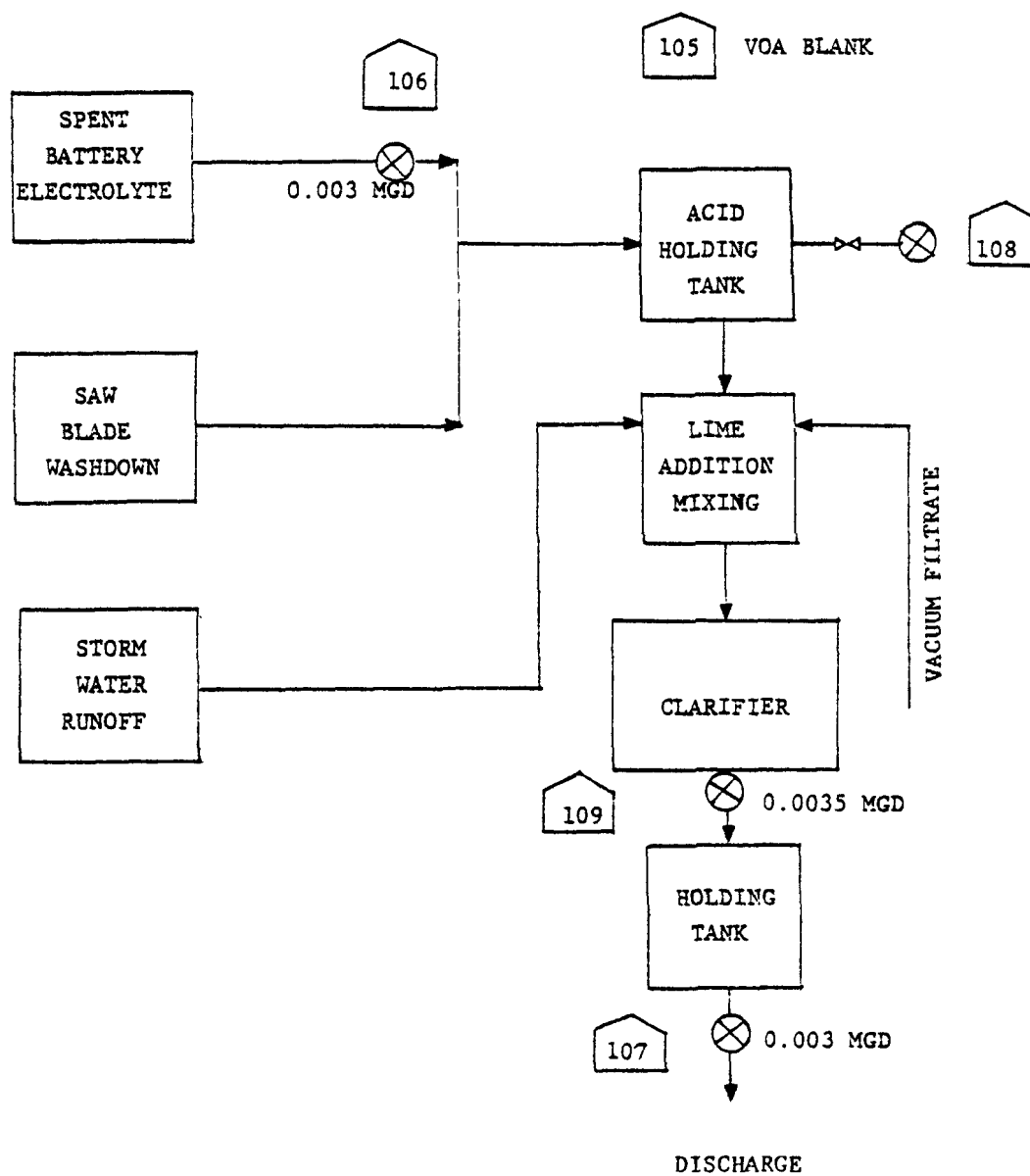


Figure V-3  
SAMPLING SITES AT SECONDARY LEAD PLANT C

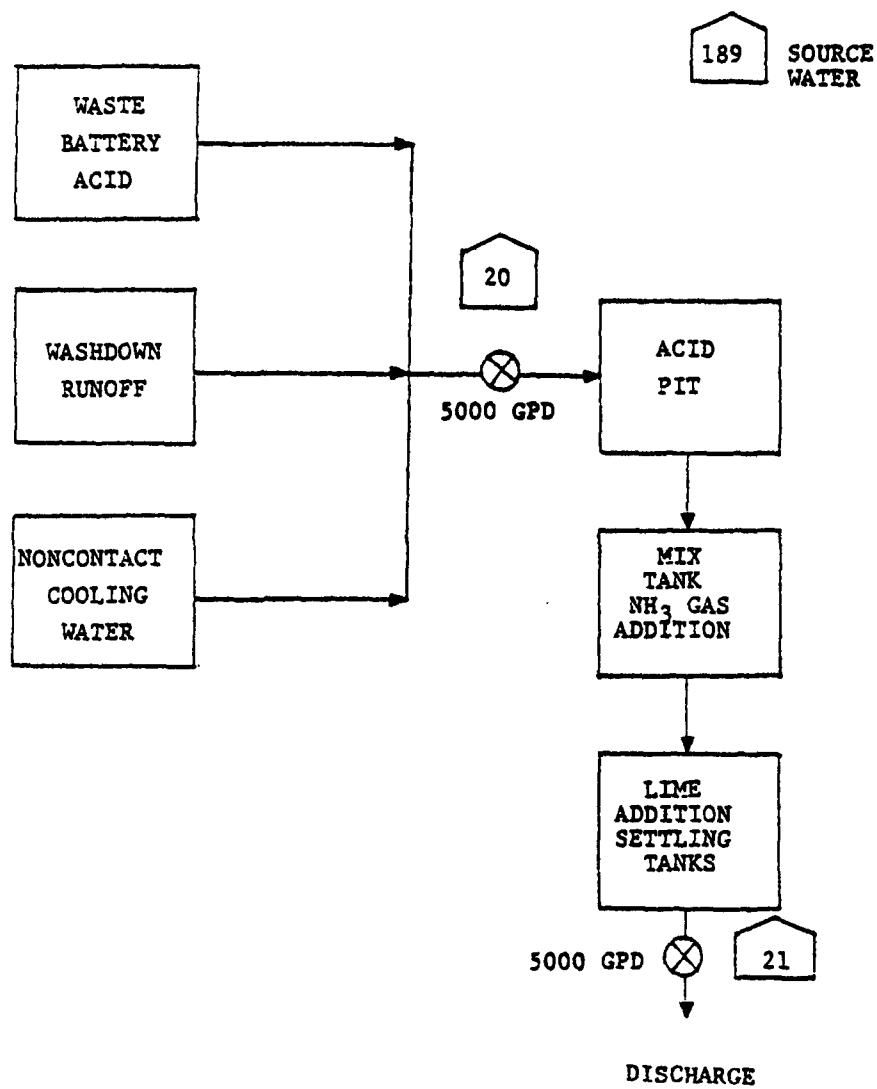


Figure V-4  
SAMPLING SITES AT SECONDARY LEAD PLANT D

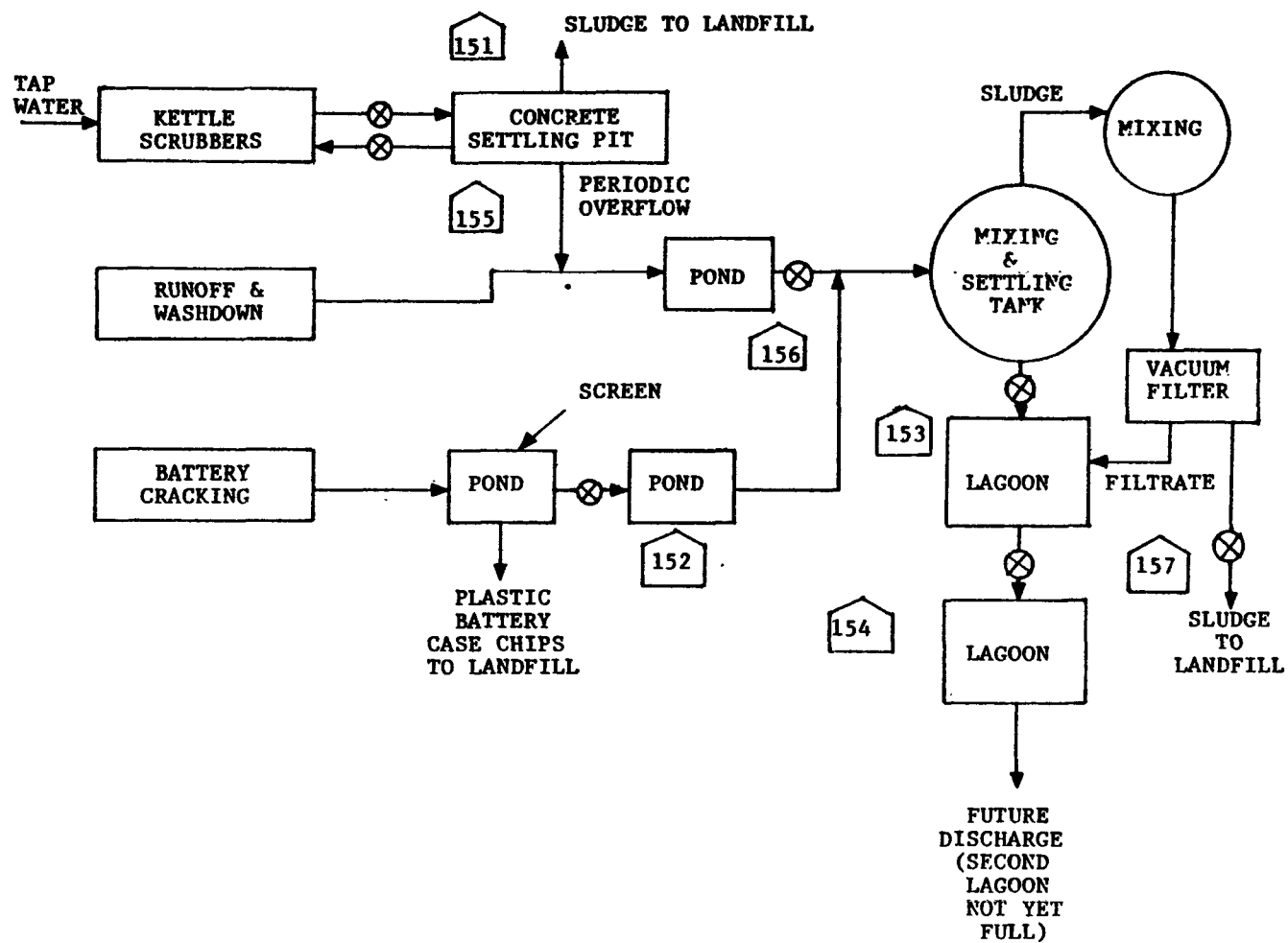


Figure V-5  
SAMPLING SITES AT SECONDARY LEAD PLANT E



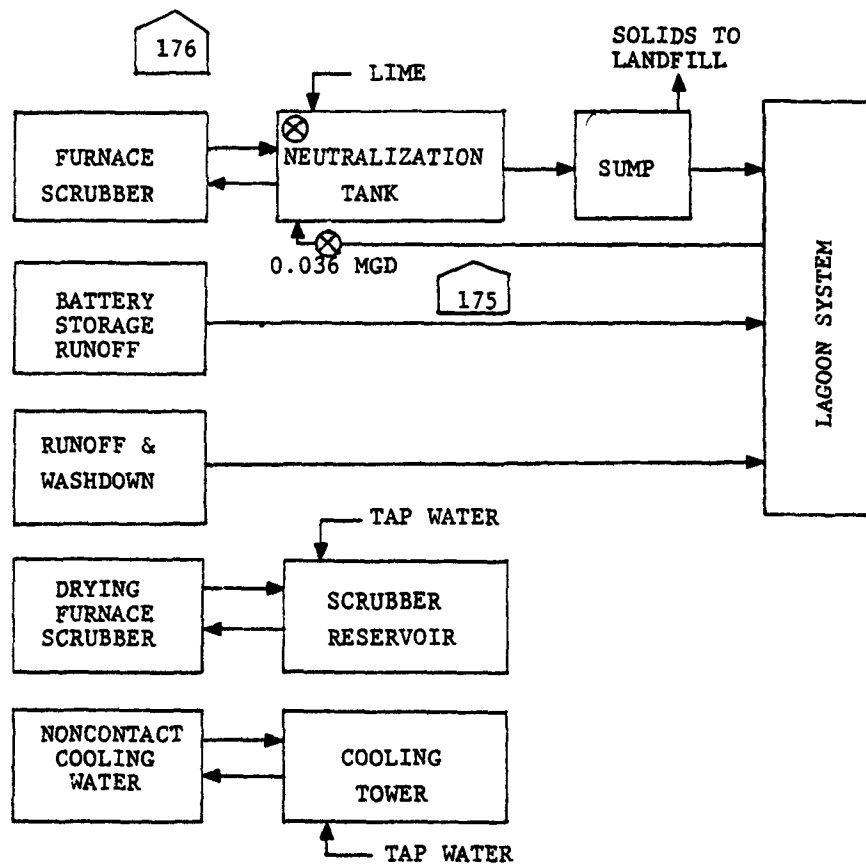


Figure V-6  
 SAMPLING SITES AT SECONDARY LEAD PLANT F  
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## SECONDARY LEAD SUBCATEGORY

### SECTION VI

#### SELECTION OF POLLUTANTS

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

Each pollutant selected for potential limitation is discussed in Section VI of the General Development Document. That discussion provides information about where the pollutant originates (i.e., whether it is a naturally occurring substance, process 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 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 concentrations used for the toxic metals were the long-term performance values achievable by lime precipitation, sedimentation, and filtration. The concentrations used for the toxic organics were the long-term performance values achievable by carbon adsorption (see Section VII of the General Development Document - Combined Metals Data Base).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANTS

This study examined samples from the secondary lead subcategory for three conventional pollutant parameters (oil and grease, total suspended solids, and pH) and four nonconventional pollutant parameters (ammonia, chemical oxygen demand, total organic carbon, and total phenols).

#### CONVENTIONAL AND NONCONVENTIONAL POLLUTANT PARAMETERS SELECTED

The following conventional pollutant parameters were selected for limitation in this subcategory:

- ammonia
- total suspended solids (TSS)
- pH

Ammonia was found in all six samples analyzed in concentrations ranging from 0.2 to 29 mg/l. The values recorded are not above the treatable concentration of 32 mg/l. Although none of the concentrations are above the 32 mg/l considered achievable with ammonia steam stripping, ammonia is selected for limitation. Only one kettle scrubber wastestream was sampled, and ammonia is known to be present in this stream with concentrations of 22, 25, and 29 mg/l. Ammonia is selected for limitation because it is known to be present in this wastestream and it may occur at treatable concentrations in this wastestream at other facilities.

Total suspended solids ranged from 240 to 28,000 mg/l in 14 samples. All but two of the observed concentrations are above that considered achievable by treatment. Further, most of the methods used to remove toxic metals do so by converting these metals to precipitates. Meeting a limitation on total suspended solids also helps ensure that removal of these precipitated toxic metals has been effective. For these reasons, total suspended solids is considered for limitation in this subcategory.

The pH of a wastewater measures its relative acidity or alkalinity. In this study, the pH values observed ranged from 0.6 to 8.1. Many harmful effects may be caused by extreme pH values or by rapid changes in pH. Therefore, pH is considered for limitation in this subcategory.

#### TOXIC POLLUTANTS

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-1. These data provide the basis for the selection or exclusion of specific pollutants, as discussed below. Table VI-1 is based on the raw wastewater data from streams 73, 75, 208, 106, 108, 151, 152, and 176 (see Section V). Treatment plant sampling data were not used in the frequency count.

#### TOXIC POLLUTANTS NEVER DETECTED

Paragraph 8(a)(iii) of the Revised Settlement Agreement allows the Administrator to exclude from regulation those toxic pollutants not detectable by Section 304(h) analytical methods or other state-of-the-art methods. The toxic pollutants listed below were not detected in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations:

1. acenaphthene
2. acrolein
3. acrylonitrile
4. benzene

5. benzidine
6. carbon tetrachloride
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
11. 1,1,1-trichloroethane
12. hexachlorethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane
17. 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-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
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-chloroethoxy) methane
44. methylene chloride
45. methyl chloride
46. methyl bromide
48. dichlorobromomethane
49. DELETED
50. DELETED
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-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
- 72. benzo(a)anthracene
- 73. benzo(a)pyrene
- 74. 3,4-benzofluoranthene
- 75. benzo(k)fluoranthene
- 79. benzo(ghi)perylene
- 80. fluorene
- 82. dibenzo(a,h)anthracene
- 83. indeno(1,2,3-cd)pyrene
- 85. tetrachloroethylene
- 86. toluene
- 87. trichloroethylene
- 88. vinyl chloride
- 89. aldrin
- 95. alpha-endosulfan
- 97. endosulfan sulfate
- 105. delta-BHC
- 113. toxaphene
- 116. asbestos
- 125. selenium
- 129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

TOXIC POLLUTANTS NEVER FOUND ABOVE THEIR ANALYTICAL QUANTIFICATION LIMIT

The provision of Paragraph 8(a)(iii) of the Revised Settlement Agreement excluding from regulation those toxic pollutants which are not detectable includes those pollutants whose concentrations fall below EPA's nominal detection limit. The toxic pollutants listed below were never found above their analytical quantification concentration in any wastewater samples from this subcategory; therefore, they are not selected for consideration in establishing limitations.

- 7. chlorobenzene
- 40. 4-chlorophenyl phenyl ether
- 70. diethyl phthalate
- 78. anthracene (a)
- 81. phenanthrene (a)
- 90. dieldrin
- 91. chlordane
- 92. 4,4'-DDT
- 93. 4,4'-DDE
- 94. 4,4'-DDD
- 96. beta-endosulfan
- 98. endrin
- 99. endrin aldehyde
- 100. heptachlor

- 101. heptachlor epoxide
- 102. alpha-BHC
- 103. beta-BHC
- 104. gamma-BHC
- 106. PCB-1242 (b)
- 107. PCB-1254 (b)
- 108. PCB 1221 (b)
- 109. PCB-1232 (c)
- 110. PCB-1248 (c)
- 111. PCB-1260 (c)
- 112. PCB-1016 (c)

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

#### TOXIC POLLUTANTS PRESENT BELOW CONCENTRATIONS ACHIEVABLE BY TREATMENT

Paragraph 8(a)(iii) of the Revised Settlement Agreement also allows the exclusion of toxic pollutants which were detected in quantities too small to be effectively reduced by technologies known to the Administrator. The pollutants listed below are not selected for consideration in establishing limitations because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or identified treatment technologies. These pollutants are discussed individually following the list.

- 23. chloroform
- 47. bromoform
- 56. nitrobenzene
- 71. dimethyl phthalate
- 117. beryllium
- 123. mercury

Chloroform was found above its analytical quantification limit in five of 10 samples analyzed, but the highest concentration reported was 0.026 mg/l, and identified treatment can reduce its concentration only to 0.1 mg/l. Chloroform is thus not selected for further consideration in establishing limitations.

Bromoform was detected in only one of 10 samples, and that one was below the concentration to which identified treatment can reduce its concentration (0.05 mg/l). Bromoform is thus not selected for consideration for limitation.

Nitrobenzene concentrations exceeded the analytical quantification limit in only one of eight samples, and that one was 0.016 mg/l. This value is below the 0.05 mg/l concentration achievable by treatment. Therefore, nitrobenzene is not selected for consideration for limitation.

Dimethyl phthalate was not detected in seven of eight samples. The one exception showed a concentration of 0.013 mg/l. This value is below the 0.05 mg/l concentration achievable by treatment. Dimethyl phenol is thus not selected for consideration for limitation.

Beryllium exceeded its analytical quantification limit in only one of 11 samples, with a concentration of 0.03 mg/l. This is below the concentration to which available treatment can reduce beryllium concentrations (0.20 mg/l), so beryllium is not selected for consideration for limitation.

Mercury was detected in 11 of 13 samples; with all of these values below the 0.036 mg/l concentration achievable by treatment. Therefore, mercury is not selected for consideration for limitation.

#### TOXIC POLLUTANTS DETECTED IN A SMALL NUMBER OF SOURCES

Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant if it is detectable in the effluent from only a small number of sources within the subcategory and it is uniquely related to only those sources. The following pollutants were not selected for limitation on this basis.

- 39. fluoranthene
- 66. bis(2-ethylhexyl) phthalate
- 68. di-n-butyl phthalate
- 69. di-n-octyl phthalate
- 76. chrysene
- 77. acenaphthylene
- 84. pyrene
- 121. cyanide

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

Fluoranthene was detected in one of five samples analyzed, with a concentration of 0.027 mg/l. The concentration to which treatment is effective is 0.01 mg/l. Since fluoranthene was found in only one waste stream, and since in the dcp all responding plants indicated that this pollutant was known to be absent or believed to be absent, it is not selected for consideration for limitation.

Bis(2-ethylhexyl) phthalate was found above both its analytical quantification limit and its treatable concentration (0.01 mg/l) in five of eight samples, with a maximum concentration of 0.585 mg/l. The presence of this pollutant is not attributable to

materials or processes associated with the secondary lead subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Also, in the dcp all responding plants indicated that this pollutant was known to be absent or believed to be absent. Therefore, bis(2-ethylhexyl) phthalate is not selected for consideration for limitation.

Two of eight samples analyzed for di-n-butyl phthalate were found to contain concentrations above its analytical quantification limit, one of these above the 0.025 mg/l concentration considered achievable with treatment. The presence of this pollutant is not attributable to materials or processes associated with the secondary lead subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Also, in the dcp all responding plants indicated that this pollutant was known to be absent or believed to be absent. It is thus not selected for consideration for limitation.

Di-n-octyl phthalate was found above its analytical quantification limit (0.01 mg/l) in two of eight samples. The presence of this pollutant is not attributable to materials or processes associated with the secondary lead subcategory. It is commonly used as a plasticizer in laboratory and field sampling equipment. EPA suspects sample contamination as the source of this pollutant. Also, in the dcp all responding plants indicated that this pollutant was known to be absent or believed to be absent. Therefore, di-n-octyl phthalate is not selected for consideration for limitation.

Chrysene was reported present above its analytical quantification limit in two of eight samples. The two reported concentrations of chrysene were 0.139 and 0.545 mg/l, which are above the 0.001 mg/l concentration considered attainable with treatment. The process waste stream that produced the 0.545 mg/l value, also produced five not detected values at two other facilities. Chrysene is not considered characteristic of the subcategory because it was found in only two samples from two different process wastestreams, Therefore, chrysene is not selected for consideration for limitation.

Acenaphthylene occurred above its treatable concentration (0.01 mg/l) in only one of eight samples, where it measured 0.035 mg/l. Two other samples of this waste stream at two different plants were reported as not detected. This site-specific result is not sufficient to characterize the whole subcategory, so acenaphthylene is not selected for consideration for limitations.



Pyrene exceeded its analytical quantification limit (0.01 mg/l) in only two of eight samples. The two reported concentrations of pyrene were 0.013 mg/l and 0.038 mg/l. These two values are from two different process wastestreams. This site-specific result is not sufficient to characterize the whole subcategory. Also, in the dcp all responding plants indicated that this pollutant was known to be absent or believed to be absent. Therefore, pyrene is not selected for consideration for limitation.

Cyanide was found at a treatable concentration in three of 11 samples, all at the same plant. All three concentrations (3.0, 4.0, and 6.0 mg/l) that were reported above the 0.047 mg/l concentration considered attainable are from the same plant. Because of the site-specificity of this result, cyanide not selected for consideration for limitation.

#### TOXIC POLLUTANTS SELECTED FOR FURTHER CONSIDERATION FOR LIMITATIONS

The toxic pollutants listed below were selected for establishing limitations and standards for this subcategory. The toxic pollutants selected are each discussed following the list.

- 114. antimony
- 115. arsenic
- 118. cadmium
- 119. chromium
- 120. copper
- 122. lead
- 124. nickel
- 126. silver
- 127. thallium
- 128. zinc

Eight of 11 samples analyzed for antimony exhibited concentrations over the treatable concentration (0.47 mg/l). Most of these were above 10 mg/l, with a maximum of 95 mg/l. Antimony is thus selected for further consideration for limitation.

Arsenic was found above its treatable concentration (0.34 mg/l) in all 10 samples analyzed. Treatable concentrations ranged from 0.6 to 16.0 mg/l. Arsenic is thus selected for further consideration for limitation.

Twelve of 13 samples analyzed for cadmium were found to have concentrations in excess of the treatable concentration (0.049 mg/l). Treatable concentrations ranged from 0.41 to 4.8 mg/l. Therefore, cadmium is selected for further consideration for limitation.

Chromium was found to exceed its treatable concentration (0.07 mg/l) in eight of 13 samples, with a maximum of 1 mg/l. Therefore, chromium is selected for further consideration for limitation.

Copper was found above its treatable concentration (0.39 mg/l) in 12 of 13 samples analyzed, with a maximum of 10 mg/l. Therefore, copper is selected for further consideration for limitation.

Lead was detected above its treatable concentration (0.08 mg/l) in 13 of 14 samples analyzed. Treatable concentrations ranged from 4.6 to 95.0 mg/l, with the majority above 10 mg/l. Lead is thus selected for further consideration for limitation.

Nine of 13 samples analyzed for nickel exhibited concentrations exceeding its treatable concentration (0.22 mg/l). Two samples had concentrations of 2 mg/l. Therefore, nickel is selected for further consideration for limitation.

Eleven samples were analyzed for silver. Reported results included concentrations of 0.16, 0.32, and 0.34 mg/l, all three above the 0.07 mg/l treatable concentration. Therefore, silver is selected for further consideration for limitation.

Thallium, for which treatment is effective above 0.34 mg/l, was found in three of 11 samples at 0.5, 0.8, and 1.0 mg/l. Therefore, thallium is selected for further consideration for limitation.

Zinc was found above its treatable concentration (0.23 mg/l) in 10 of 13 samples analyzed. Six of these were above 5 mg/l, with a high of 20 mg/l. Zinc is thus selected for further consideration for limitation.

Table VI-1

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY LEAD  
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 Treat- able Concen- tration	Detected Above Treat- able Concen- tration
1. acenaphthene	0.010	0.010	6	8	8			
2. acrolein	0.010	0.100	4	10	10			
3. acrylonitrile	0.010	0.01	4	10	10			
4. benzene	0.010	0.05 - 0.10	4	10	10			
5. benzdine	0.010	0.01	6	8	8			
6. carbon tetrachloride	0.010	0.05	4	10	10			
7. chlorobenzene	0.010	0.025	4	10	9	1		
8. 1,2,4-trichlorobenzene	0.010	0.01	6	8	8			
9. hexachlorobenzene	0.010	0.01	6	8	8			
10. 1,2-dichloroethane	0.010	0.1	4	10	10			
11. 1,1,1-trichloroethane	0.010	0.01	4	10	10			
12. hexachloroethane	0.010	0.01	6	8	8			
13. 1,1-dichloroethane	0.010	0.01	4	10	10			
14. 1,1,2-trichloroethane	0.010	0.1	4	10	10			
15. 1,1,2,2-tetrachloroethane	0.010	0.05	4	10	10			
16. chloroethane	0.010	0.01	4	10	10			
17. bis(chloromethyl) ether	0.010	0.01	4	10	10			
18. bis(2-chloroethyl) ether	0.010	0.01	6	8	8			
19. 2-chloroethyl vinyl ether	0.010	0.01	4	10	10			
20. 2-chloronaphthalene	0.010	0.01	6	8	8			
21. 2,4,6-trichlorophenol	0.010	0.025	1	1	1			
22. parachlorometa cresol	0.010	0.05	1	1	1			
23. chloroform	0.010	0.1	4	10	5		5	
24. 2-chlorophenol	0.010	0.05	1	1	1			
25. 1,2-dichlorobenzene	0.010	0.05	6	8	8			
26. 1,3-dichlorobenzene	0.010	0.01	6	8	8			
27. 1,4-dichlorobenzene	0.010	0.01	6	8	8			
28. 3,3'-dichlorobenzidine	0.010	0.01	6	8	8			
29. 1,1-dichloroethylene	0.010	0.1	4	10	10			
30. 1,2-trans-dichloroethylene	0.010	0.1	4	10	10			
31. 2,4-dichlorophenol	0.010	0.01	1	1	1			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY LEAD  
RAW WASTEWATER

<u>Pollutant</u>	<u>Analytical Quantification Concentration (mg/l) (a)</u>	<u>Treatable Concentration (mg/l) (b)</u>	<u>Number of Streams Analyzed</u>	<u>Number of Samples Analyzed</u>	<u>ND</u>	<u>Detected Below Quantification Concentration</u>	<u>Detected Below Treat- able Concen- tration</u>	<u>Detected Above Treat- able Concen- tration</u>
32. 1,2-dichloropropane	0.010	0.01	4	10	10			
33. 1,3-dichloropropylene	0.010	0.01	4	10	10			
34. 2,4-dimethylphenol	0.010	0.05	1	1	1			
35. 2,4-dinitrotoluene	0.010	0.05	6	8	8			
36. 2,6-dinitrotoluene	0.010	0.05	6	8	8			
37. 1,2-diphenylhydrazine	0.010	0.05	6	8	8			
38. ethylbenzene	0.010	0.05	4	10	10			
39. fluoranthene	0.010	0.01	6	8	7			1
40. 4-chlorophenyl phenyl ether	0.010	0.01	6	8	7	1		
41. 4-bromophenyl phenyl ether	0.010	0.01	6	8	8			
42. bis(2-chloroisopropyl) ether	0.010	0.01	6	8	8			
43. bis(2-chloroethoxy) methane	0.010	0.01	9	17	17			
44. methylene chloride	0.010	0.10	4	10	10			
45. methyl chloride	0.010	0.01	4	10	10			
46. methyl bromide	0.010	0.01	4	10	10			
47. bromoform	0.010	0.05	4	10	9		1	
48. dichlorobromomethane	0.010	0.10	4	10	10			
49. trichlorofluoromethane	0.010	0.01	4	10	10			
50. dichlorodifluoromethane	0.010	0.01	4	10	10			
51. chlorodibromomethane	0.010	0.10	4	10	10			
52. hexachlorobutadiene	0.010	0.01	6	8	8			
53. hexachlorocyclopentadiene	0.010	0.01	6	8	8			
54. isophorone	0.010	0.05	6	8	8			
55. naphthalene	0.010	0.05	6	8	8			
56. nitrobenzene	0.010	0.05	6	8	7		1	
57. 2-nitrophenol	0.010	0.01	1	1	1			
58. 4-nitrophenol	0.010	0.05	1	1	1			
59. 2,4-dinitrophenol	0.010	0.025	1	1	1			
60. 4,6-dinitro-o-cresol	0.010	0.025	1	1	1			
61. N-nitrosodimethylamine	0.010	0.01	6	8	8			

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY LEAD  
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 Treat- able Concen- tration	Detected Above Treat- able Concen- tration
62. N-nitrosodiphenylamine	0.010	0.01	6	8	8			
63. N-nitrosodi-n-propylamine	0.010	0.01	6	8	8			
64. pentachlorophenol	0.010	0.01	1	1	1			
65. phenol	0.010	0.05	1	1	1			
66. bis(2-ethylhexyl) phthalate	0.010	0.01	6	8	1	2		5
67. butyl benzyl phthalate	0.010	0.001 - 0.01	6	8	7			1
68. di-n-butyl phthalate	0.010	0.025	6	8	6	2	1	1
69. di-n-octyl phthalate	0.010	0.01	6	8	5	1		2
70. diethyl phthalate	0.010	0.025	6	8	8	8		
71. dimethyl phthalate	0.010	0.025	6	8	7		1	
72. benzo(a)anthracene	0.010	0.01	6	8	8			
73. benzo(a)pyrene	0.010	0.01	6	8	8			
74. 3,4-benzofluoranthene	0.010	0.01	6	8	8			
75. benzo(k)fluoranthene	0.010	0.01	6	8	8			
76. chrysene	0.010	0.001	6	8	6			2
77. acenaphthylene	0.010	0.01	6	8	7			1
78. anthracene (c)	0.010	0.01	6	8	7	1		
79. benzo(ghi)perylene	0.010	0.01	6	8	8			
80. fluorene	0.010	0.01	6	8	8			
81. phenanthrene (c)								
82. dibenzo(a,h)anthracene	0.010	0.01	6	8	8			
83. indeno(1,2,3-cd)pyrene	0.010	0.01	6	8	8			
84. pyrene	0.010	0.001 - 0.01	6	8	6			2
85. tetrachloroethylene	0.010	0.05	4	10	10			
86. toluene	0.010	0.05	4	10	10			
87. trichloroethylene	0.010	0.01	4	10	10			
88. vinyl chloride	0.010	0.01	4	10	10			
89. aldrin	0.005	0.001	5	8	8			
90. dieldrin	0.005	0.01	5	8	6	2		
91. chlordane	0.005	0.01	5	8	5	3		
92. 4,4'-DDT	0.005	0.01	5	8	6	2		
93. 4,4'-DDE	0.005	0.01	5	8	6	2		

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY LEAD  
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 Treat- able Concen- tration	Detected Above Treat- able Concen- tration
94. 4,4'-DDD	0.005	0.01	5	8	7	1		
95. alpha-endosulfan	0.005	0.001	5	8	8			
96. beta-endosulfan	0.005	0.01	5	8	7	1		
97. endosulfan sulfate	0.005	0.01	5	8	8			
98. endrin	0.005	0.01	5	8	7	1		
99. endrin aldehyde	0.005	0.01	5	8	7	1		
100. heptachlor	0.005	0.01	5	8	5	3		
101. heptachlor epoxide	0.005	0.01	5	8	6	2		
102. alpha-BHC	0.005	0.01	5	8	7	1		
103. beta-BHC	0.005	0.01	5	8	5	3		
104. gamma-BHC	0.005	0.01	5	8	5	3		
105. delta-BHC	0.005	0.01	5	8	8			
106. PCB-1242 (c) (d)	0.005	0.001	5	8	5	3		
107. PCB-1254 (c) (d)	0.005							
108. PCB-1221 (c) (d)	0.005							
109. PCB-1232 (c) (e)	0.005	0.001	5	8	5	3		
110. PCB-1248 (c) (e)	0.005							
111. PCB-1260 (c) (e)	0.005							
112. PCB-1016 (c) (e)	0.005							
113. toxaphene	0.005	0.01	5	8	8			
114. antimony	0.100	0.47	7	11	3			8
115. arsenic	0.10	0.34	6	10				10
116. asbestos	10 MFL	10 MFL	1	1	1			
117. beryllium	0.010	0.20	7	11		10	1	
118. cadmium	0.002	0.049	7	13	1			12
119. chromium	0.005	0.07	7	13		3	2	8
120. copper	0.009	0.39	7	13	1			12
121. cyanide (f)	0.02	0.20	5	11	1	4	3	3
122. lead	0.020	0.08	8	14	1			13

Table VI-1 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS  
SECONDARY LEAD  
RAW WASTEWATER

<u>Pollutant</u>	<u>Analytical Quantification Concentration (mg/l) (a)</u>	<u>Treatable Concentration (mg/l) (b)</u>	<u>Number of Streams Analyzed</u>	<u>Number of Samples Analyzed</u>	<u>ND</u>	<u>Detected Below Quantification Concentration</u>	<u>Detected Below Treat- able Concen- tration</u>	<u>Detected Above Treat- able Concen- tration</u>
123. mercury	0.0001	0.036	7	13	2		11	
124. nickel	0.005	0.22	7	13	4			9
125. selenium	0.01	0.007	7	11	11			
126. silver	0.02	0.07	7	11	1	3	4	3
127. thallium	0.100	0.34	7	11	7		1	3
128. zinc	0.050	0.23	7	13			3	10
129. 2,3,7,8-tetrachlorodibenzo- p-dioxin (TCDD)	Not Analyzed							

(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.

## SECONDARY LEAD SUBCATEGORY

### SECTION VII

#### CONTROL AND TREATMENT TECHNOLOGIES

The preceding sections of this supplement discussed the wastewater sources, flows, and characteristics of the wastewaters from secondary lead plants. This section summarizes the description of these wastewaters and indicates the level of treatment which is currently practiced by the secondary lead subcategory for each waste stream.

#### CURRENT CONTROL AND TREATMENT PRACTICES

Control and treatment technologies are discussed in general in Section VII of the General Development Document. The basic principles of these technologies and the applicability to wastewater similar to that found in this subcategory are presented there. This section presents a summary of the control and treatment technologies that are currently applied to each of the sources generating wastewater in this subcategory. As discussed in Section V, wastewater associated with the secondary lead 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, so these waste streams are commonly combined for treatment to reduce the concentrations of these pollutants. 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. Fourteen plants in this subcategory currently have combined wastewater treatment systems, 10 have lime precipitation and sedimentation, and seven have lime precipitation, sedimentation and filtration. As such, five options have been selected for consideration for BPT, BAT, BDT, BCT, and pretreatment in this subcategory, based on combined treatment of these compatible waste streams.

#### BATTERY CRACKING

Wastewater from the battery cracking operation may result from the following sources:

1. Waste battery electrolyte,
2. Saw or breaker cooling water, and
3. Area washdown.

The combined wastewater from these sources has the characteristics of the battery electrolyte; pollutant concentrations are



dependent on the amount of dilution from the other water sources. In general, this wastewater is characterized by treatable concentrations of suspended and dissolved solids, heavy metals, and arsenic. Of the 32 plants with battery cracking surveyed, four do not currently have any control on this stream; they either discharge it or use contract disposal. The majority neutralize the spent acid; 14 use ammonia, nine use lime, and two use caustic to raise the wastewater pH. Alkaline pH also favors the precipitation of heavy metal salts. Twenty plants provide for settling of these solids and other suspended solids in sedimentation equipment (e.g., clarifiers). Six plants filter the treated wastewater; in five of these plants the filtration step occurs after sedimentation and in the other filtration is used alone to remove suspended solids. Several plants add polymer to enhance the settling of this wastewater. One plant combines battery cracking wastewater with stormwater runoff, noncontact cooling water, water softener backflush and sanitary wastes after preliminary treatment, consisting of neutralization with ammonia and sedimentation. Approximately 20 percent of the combined wastewater is evaporated in a cooling tower and recycled to the plant process. Cooling tower blowdown is treated by ion exchange and then discharged. This allows the plant to effectively recycle or evaporate 90 percent of its wastewater. Treated water is recycled in four of the plants; others send it to ponds, or discharge, it either directly or to a POTW.

#### BLAST AND REVERBERATORY FURNACE WET AIR POLLUTION CONTROL

Air emissions from the blast and reverberatory furnaces may contain particulate matter which must be removed to meet air emissions standards. Either dry or wet methods may be used for particulate control; of the 47 plants surveyed which have blast reverberatory furnaces, 41 utilize baghouses or dry scrubbers, while six plants have wet scrubbers to control furnace emissions. The scrubbing solution contains treatable concentrations of suspended solids and lead. Five of the six plants with wet scrubbers recycle a portion of the scrubber water; the average recycle ratio is 93 percent. Two plants indicate they recycle 100 percent of the scrubber water. The four plants not using 100 percent recycle neutralize this wastewater using either ammonia (three plants) or caustic (one plant). Two follow this with sedimentation or filtration. The plant that does not recycle any of this stream combines it with wastewater from other streams and sends it to a pond. Treated wastewater is discharged to a POTW in the other plants not practicing total recycle.

#### KETTLE WET AIR POLLUTION CONTROL

Kettles used in the refining and alloying operation may produce a gaseous stream which may require control, primarily to reduce particulate emissions. Of the plants surveyed, 39 do not control

kettle emissions, 19 use dry controls (baghouses), and the remaining nine use wet scrubbers. Kettle scrubber effluent contains lead, arsenic, other alloying metals, and suspended solids at treatable concentrations. Eight of the nine plants with wet scrubbers recycle the scrubber water; the average recycle ratio is over 98 percent, with six plants reporting 100 percent recycle. The remaining plant utilizes the scrubber wastewater in the battery cracking operation. Of the two plants not using total recycle, one treats the blowdown using sodium carbonate, sedimentation and filtration, while the other does not treat the blowdown. Both plants discharge the blowdown to a POTW.

#### CASTING CONTACT COOLING WATER

Water may be used in the casting operation to accelerate the cooling of the cast metal. Of the plants surveyed, only 11 use direct contact cooling. Three plants use total recycle of the cooling water, four rely on evaporation to eliminate the wastewater, and the remainder discharge wastewater with no treatment.

#### CONTROL AND TREATMENT OPTIONS CONSIDERED

As the sampling and analytical data in Section V indicate, the wastewaters from the secondary lead subcategory contain various types of contaminants. The primary constituents of concern are dissolved metals, suspended solids, dissolved solids, and pH extremes or fluctuations. The Agency examined five control and treatment technology options that are applicable to the wastewaters from the secondary lead subcategory.

##### OPTION A

Option A for the secondary lead subcategory requires treatment technologies to reduce pollutant mass. The Option A treatment scheme consists of lime and settle treatment (chemical precipitation and sedimentation) applied to the combined streams of battery cracking wastewater, furnace smelting air pollution scrubbing wastewater, and casting contact cooling water. Chemical precipitation is used to remove metals by the addition of lime, followed by gravity sedimentation. Suspended solids are also removed in the process. This option also requires dry control methods to control air emissions from kettle refining or alternately, 100 percent recycle of kettle scrubber liquor.

##### OPTION B

Option B for the secondary lead subcategory requires control and treatment to reduce the discharge of wastewater volume and pollutant mass. Option B includes chemical precipitation and sedimen-

tation requirements, plus wastewater flow reduction to reduce the volume of wastewater discharged. Water recycle and reuse are the principal control mechanisms for flow reduction.

#### OPTION C

Option C for the secondary lead subcategory consists of Option B, (in-process flow reduction, lime precipitation, and sedimentation) with the addition of multimedia filtration at the end of Option B treatment. Multimedia filtration is used to remove suspended solids, including precipitated metals, below 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 for consistent removal during periods when there are rapid increases in flows or loadings of pollutants to the treatment system.

#### OPTION D

Option D for the secondary lead subcategory consists of Option C, (in-process flow reduction, lime precipitation, sedimentation, multimedia filtration) with the addition of activated alumina technology at the end of Option C treatment. The activated alumina process is used to remove dissolved arsenic which remains after lime precipitation.

#### OPTION F

Option F for the secondary lead subcategory consists of Option C, (in-process flow reduction, lime precipitation, sedimentation, multimedia filtration) with the addition of reverse osmosis and multiple-effect evaporation technology at the end of Option C treatment. Option F is used for complete recycle of the treated water by controlling the concentration of dissolved solids. Multiple-effect evaporation is used to dewater brines rejected from reverse osmosis.

In Section VI of this supplement, none of the toxic organic pollutants were selected for further consideration in establishing limitations for the secondary lead subcategory. Therefore, Option E, which includes activated carbon adsorption for organic removal, is not applicable to this subcategory.

## SECONDARY LEAD SUBCATEGORY

### SECTION VIII

#### COSTS, ENERGY, AND NONWATER QUALITY ASPECTS

This section describes the method used to develop the costs associated with the control and treatment technologies discussed in Section VII for wastewaters from secondary lead plants. The energy requirements of the considered options as well as solid waste and air pollution aspects are also discussed in this section. Section VIII of the General Development Document provides background on the capital and annual costs for each of the technologies discussed herein.

The wastewater streams associated with the secondary lead subcategory are combined into three groups for the purposes of this section. These three groups are as follows:

1. Battery cracking wastewater (electrolyte and saw water),
2. Smelting furnace and kettle wet air pollution control wastewaters, and
3. Casting contact cooling water.

These three groups are found in existing plants in the three combinations shown below. These three combinations are selected for the purpose of cost estimation because they represent the wastewater combinations that occur most frequently in plants in the secondary lead subcategory.

<u>Combination</u>	<u>Battery Cracking</u>	<u>Casting Contact Cooling</u>	<u>Casting Contact Cooling or Wet Air Pol- lution Control</u>
1	X		
2	X		X
3	X	X	

Since the wastewater characteristics of combinations 2 and 3 are similar, these two combinations are considered together in the cost estimates.

#### TREATMENT OPTIONS COSTED FOR EXISTING SOURCES

As discussed in Section VII, five control and treatment options are considered for treating wastewater from the secondary lead subcategory. Cost estimates, in the form of annual cost curves, have been developed for each of these control and treatment options. The control and treatment options are presented schematically in Figures X-1 through X-5, and summarized below.

#### OPTION A

Option A for the secondary lead subcategory consists of lime precipitation and sedimentation end-of-pipe technology. Total recycle of kettle wet air pollution control water is also required for Option A. The cost curves developed for Option A do not consider the cost for recycling kettle wet air pollution control water. Therefore, holding tank costs must be added to the cost obtained from the Option A cost curves to determine the total cost of Option A.

#### OPTION B

Option B for the secondary lead subcategory requires control and treatment technologies to reduce the discharge of wastewater volume and pollutant mass. The recycle of casting contact cooling water through cooling towers and the recycle of wet air pollution control water through holding tanks are the control mechanisms for flow reduction. The Option B end-of-pipe treatment technology consists of lime precipitation and sedimentation. The cost of Option B is determined by adding cooling tower and holding tank costs (the holding tanks costs for Option B are only for blast and reverberatory furnace scrubber water) to the cost of Option A.

#### OPTION C

Option C for the secondary lead subcategory consists of all the control and treatment technologies of Option B (in-process flow reduction through cooling towers and holding tanks; and lime precipitation and sedimentation end-of-pipe treatment) with the addition of multimedia filtration to the end-of-pipe treatment scheme. The cost curves developed for Option C do not include the cost of flow reduction. Therefore, the total cost of Option C is determined by adding cooling tower and holding tank costs to the costs obtained from the Option C cost curves.

#### OPTION D

Option D for the secondary lead subcategory consists of all the control and treatment technologies of Option C (in-process flow reduction through cooling towers and holding tanks; and lime precipitation, sedimentation, and multimedia filtration end-of-pipe treatment) with the addition of activated alumina adsorption to the end-of-pipe treatment scheme. Flow reduction is not included in the cost curves developed for Option D. Therefore, holding tank and cooling tower costs must be added to the costs obtained from the Option D cost curves to determine the total cost of Option D.

## OPTION F

Option F for the secondary lead subcategory consists of all the control and treatment technologies of Option C (in-process flow reduction through holding tanks and cooling towers; and lime precipitation, sedimentation, and multimedia filtration end-of-pipe treatment) with the addition of reverse osmosis and multiple-effect evaporation followed by complete recycle to the end-of-pipe treatment scheme. Flow reduction is not included in the cost curves developed for Option F. Therefore, holding tank and cooling tower costs must be added to the costs obtained from the Option F cost curves to determine the total cost of Option F.

The cost curves for the five options summarized above are presented in the figures listed below. The respective options which the curves are based on are also shown.

<u>Combination</u>	<u>Figure VIII-</u>	<u>Options Costed</u>
1	1 - 4	A, C, D, F
2 and 3	5 - 8	A, C, D, F

The holding tank and cooling tower cost curves used to determine flow reduction costs are presented in Figures VIII-9 and VIII-10, respectively.

## NONWATER QUALITY ASPECTS

A general discussion of nonwater quality aspects of the control and treatment alternatives considered for the nonferrous metals manufacturing category is contained in Section VIII of the General Development Document. Nonwater quality impacts specific to the secondary lead 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. Briefly, the energy usage of the options is determined using the median wastewater flow in the subcategory. The energy usage of the options is then compared to the energy usage of the median secondary lead energy consumption plant. As shown in Table VIII-1, the most energy intensive option is Option F with reverse osmosis and multiple-effect evaporation, which increases the median energy consumption by 0.27 percent.

## SOLID WASTE

Sludges associated with the secondary lead subcategory will necessarily contain additional quantities (and concentrations) 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 lead 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. None of these 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, sedimentation and filtration. By the addition of excess 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 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), 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. For more details, see Section VIII of the General Development Document.

#### AIR POLLUTION

There is no reason to believe that any substantial air pollution problems will result from implementation of chemical precipitation, sedimentation, multimedia filtration, activated alumina adsorption, and reverse osmosis. These technologies transfer pollutants to solid waste and do not involve air stripping or any other physical process likely to transfer pollutants to air. Water vapor containing some particulate matter will be released in the drift from cooling tower systems; however, the Agency does not consider this impact to be significant.



Table VIII-1  
ENERGY REQUIREMENTS

Median of Total Plant Energy Consumption (Btu/Yr)	Median Size Plant By Flow (gpd)	Energy Usage (Btu/yr) and Percent of Median Plant Energy Consumption									
		Option A		Option B		Option C		Option D		Option F	
		Usage	%	Usage	%	Usage	%	Usage	%	Usage	%
7.824x10 <sup>10</sup>	5,760	8.26x10 <sup>7</sup>	0.11	1.34x10 <sup>8</sup>	0.17	1.35x10 <sup>8</sup>	0.17	1.41x10 <sup>8</sup>	0.18	2.10x10 <sup>8</sup>	0.27

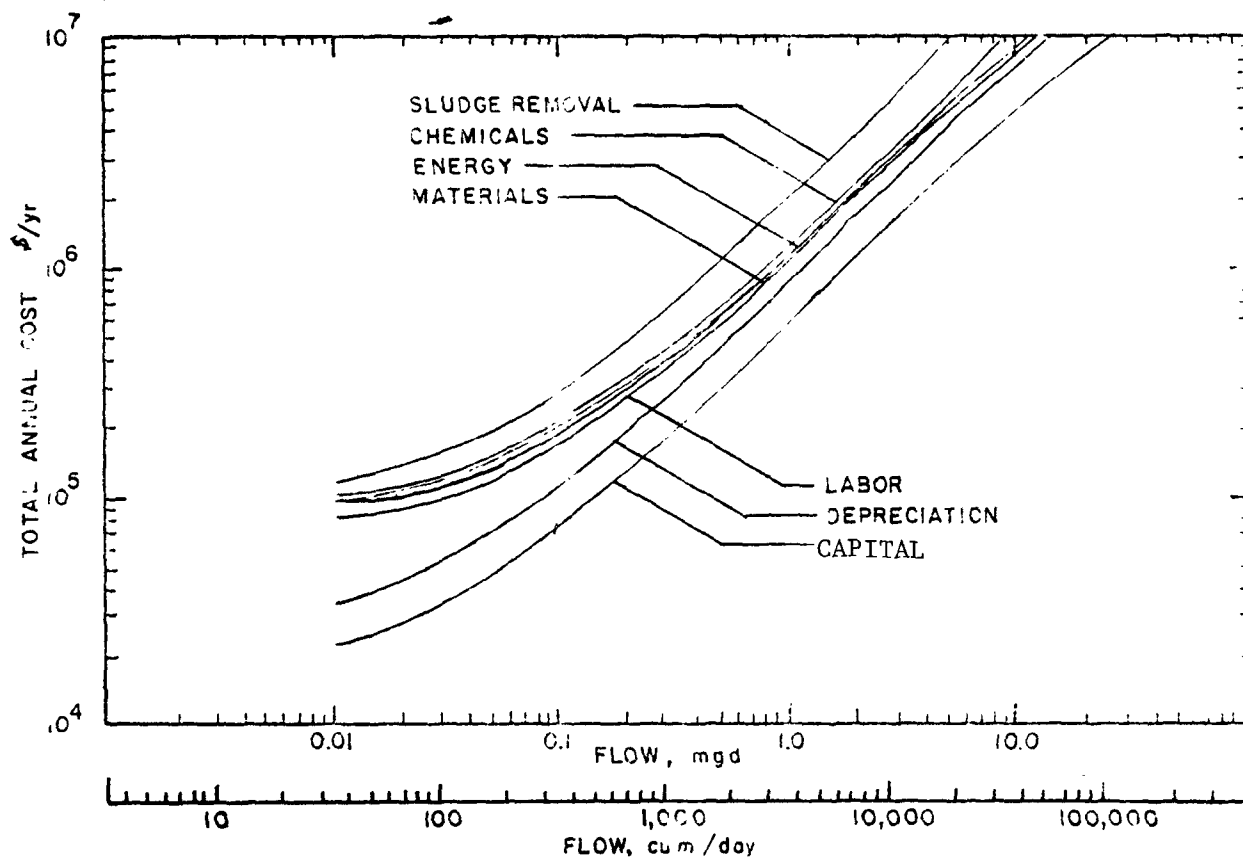


Figure VIII-1

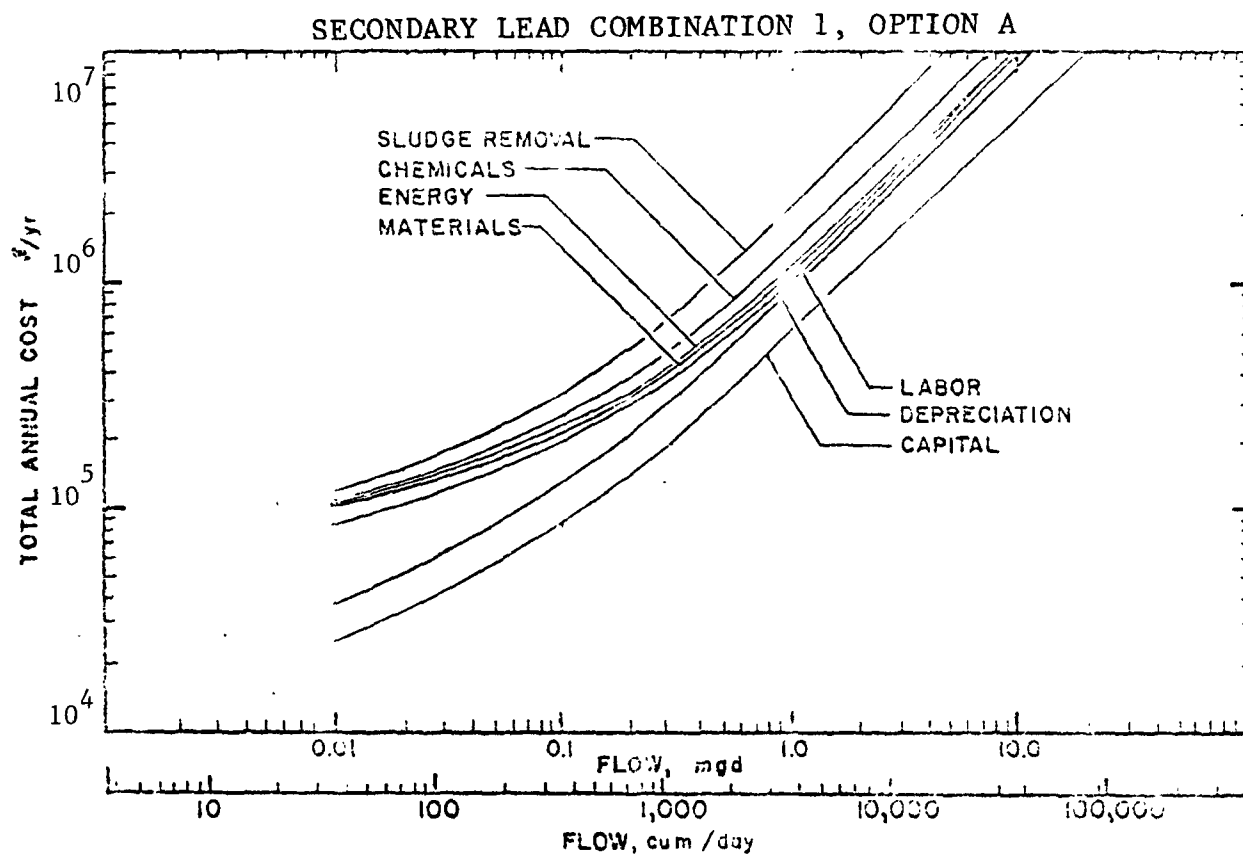


Figure VIII-2

SECONDARY LEAD COMBINATION 1, OPTION C

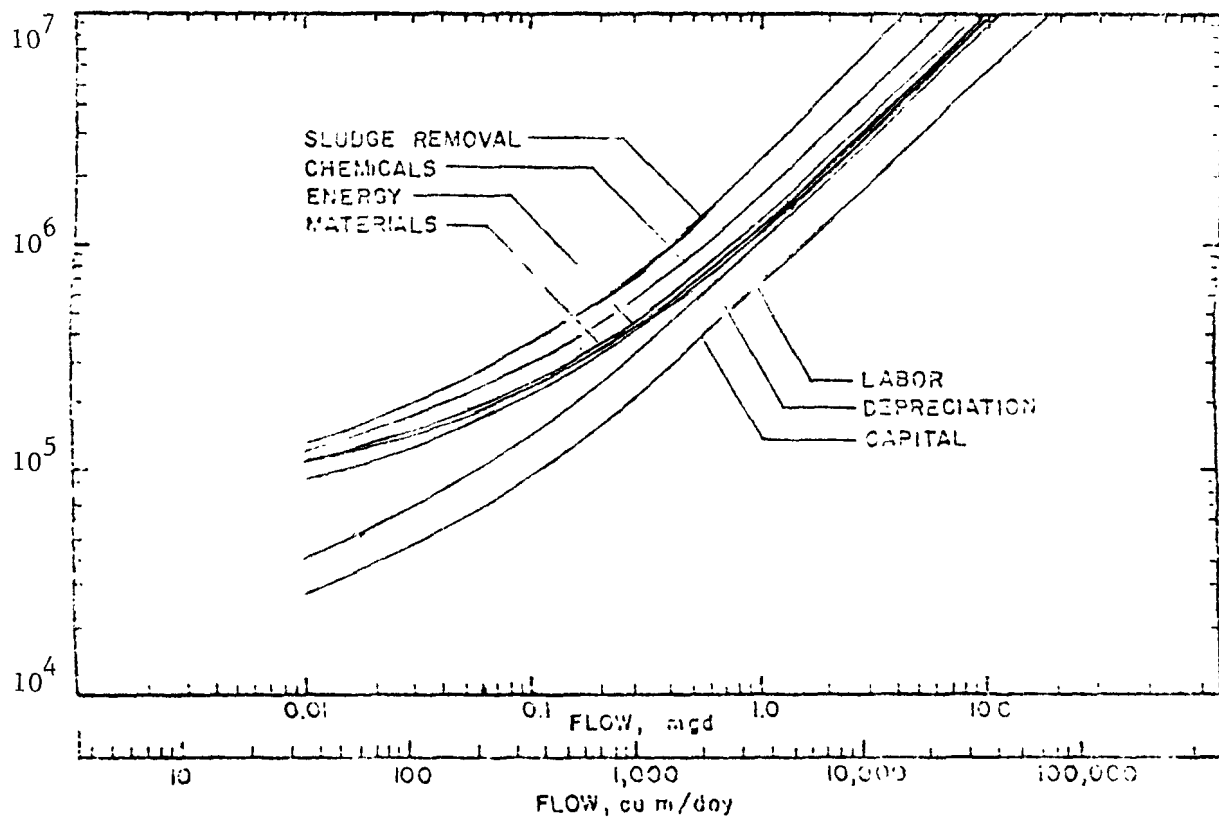


Figure VIII-3

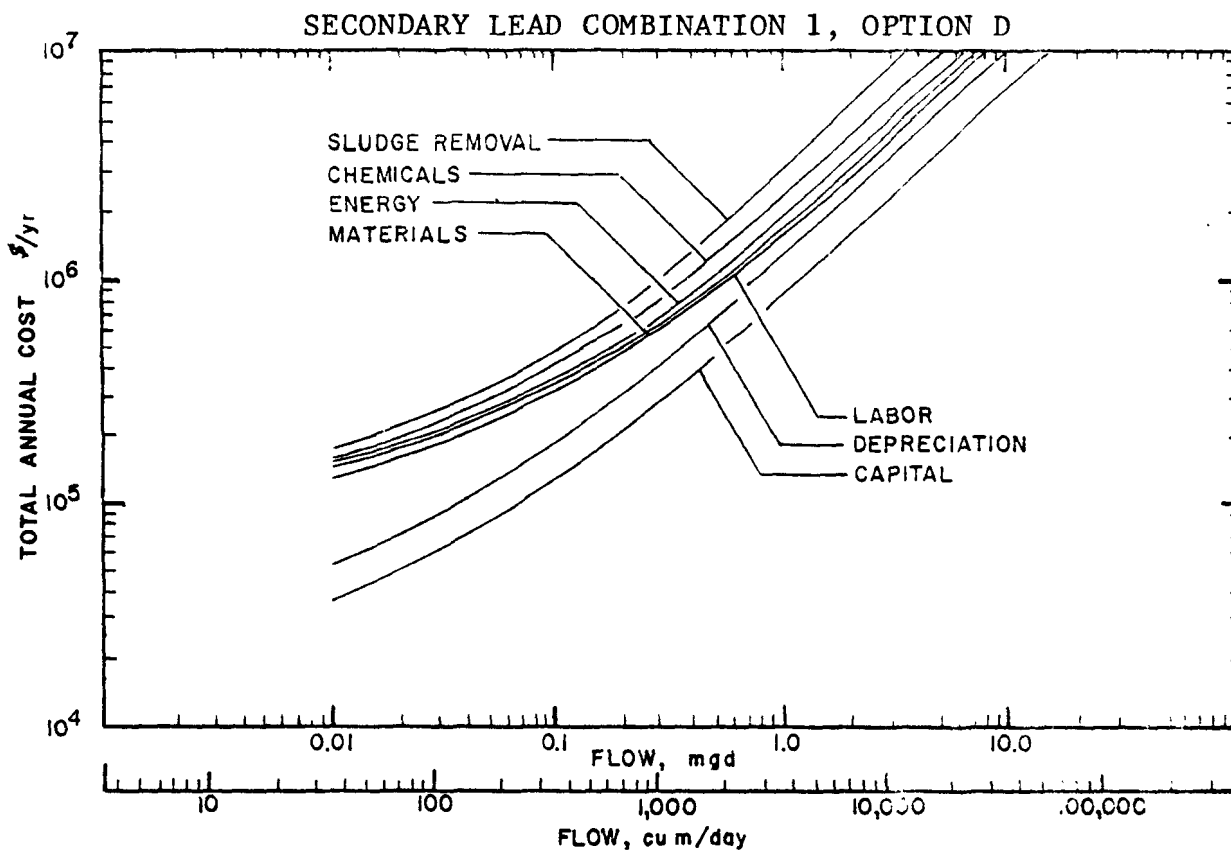
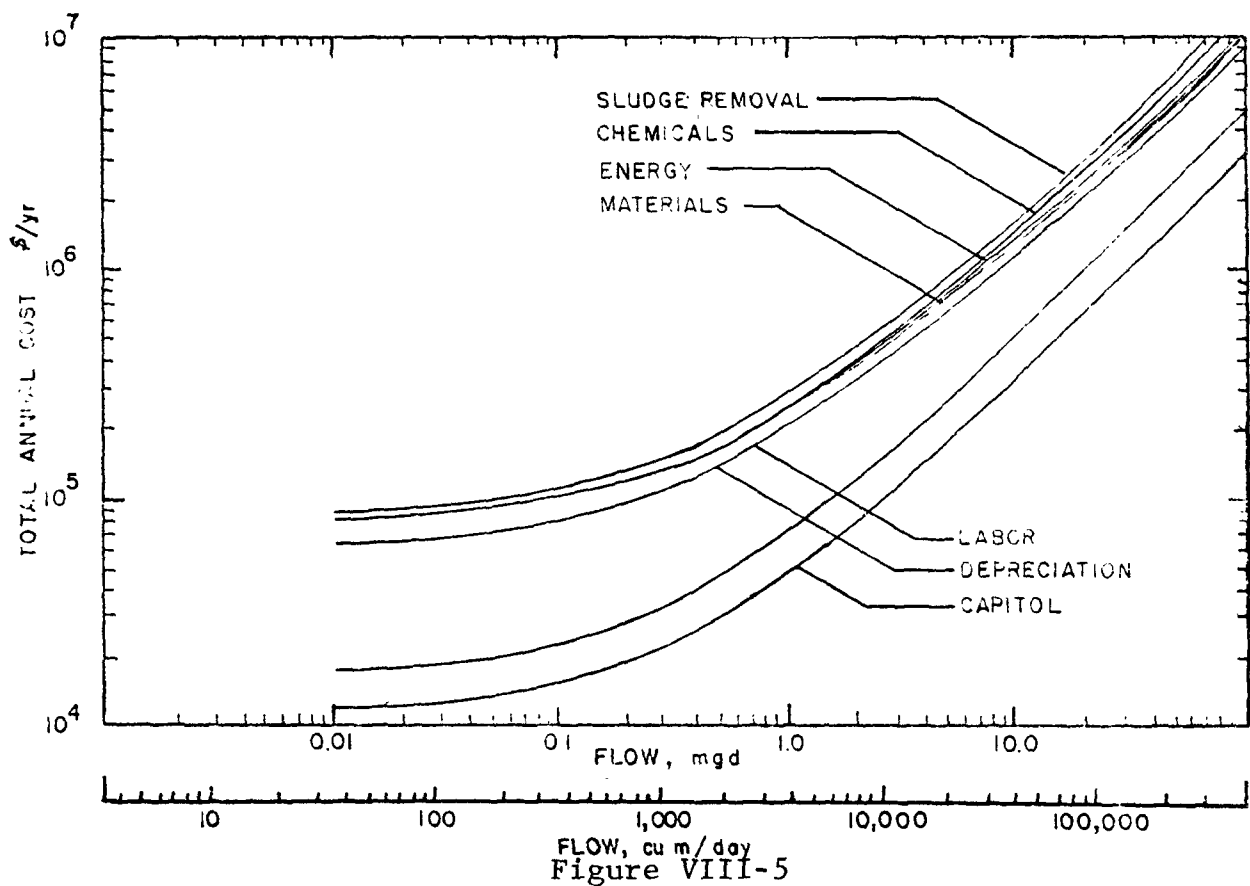
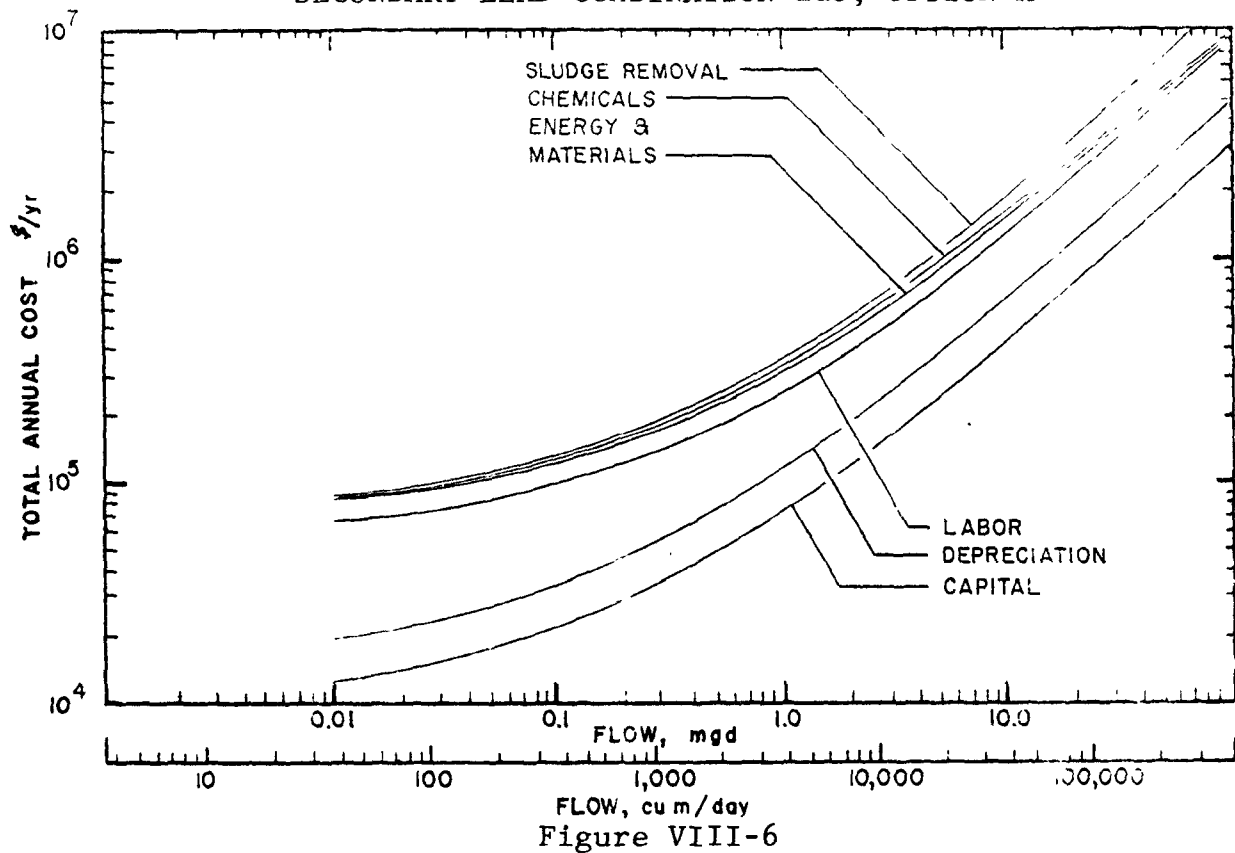


Figure VIII-4

SECONDARY LEAD COMBINATION 1, OPTION F



SECONDARY LEAD COMBINATION 2&3, OPTION A



SECONDARY LEAD COMBINATION 2&3, OPTION C

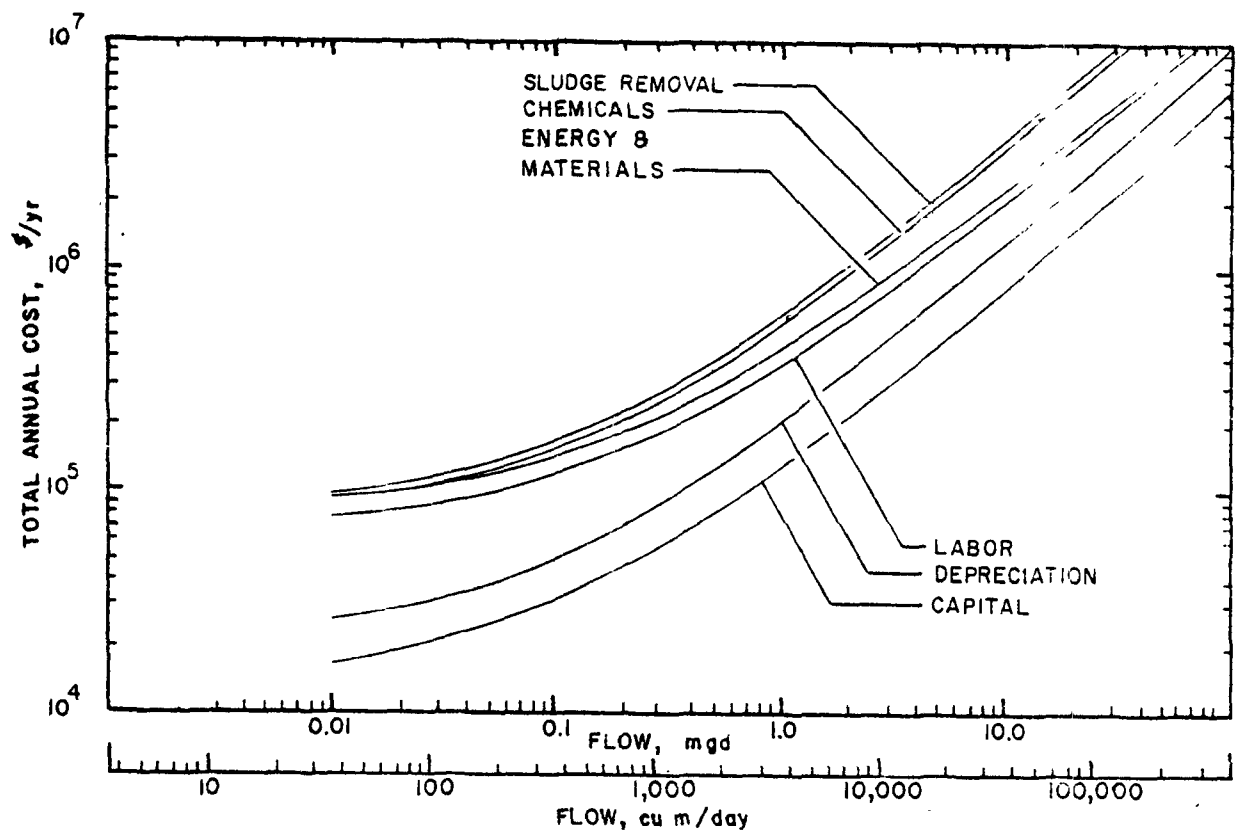


Figure VIII-7

SECONDARY LEAD COMBINATIONS 2&3, OPTION D

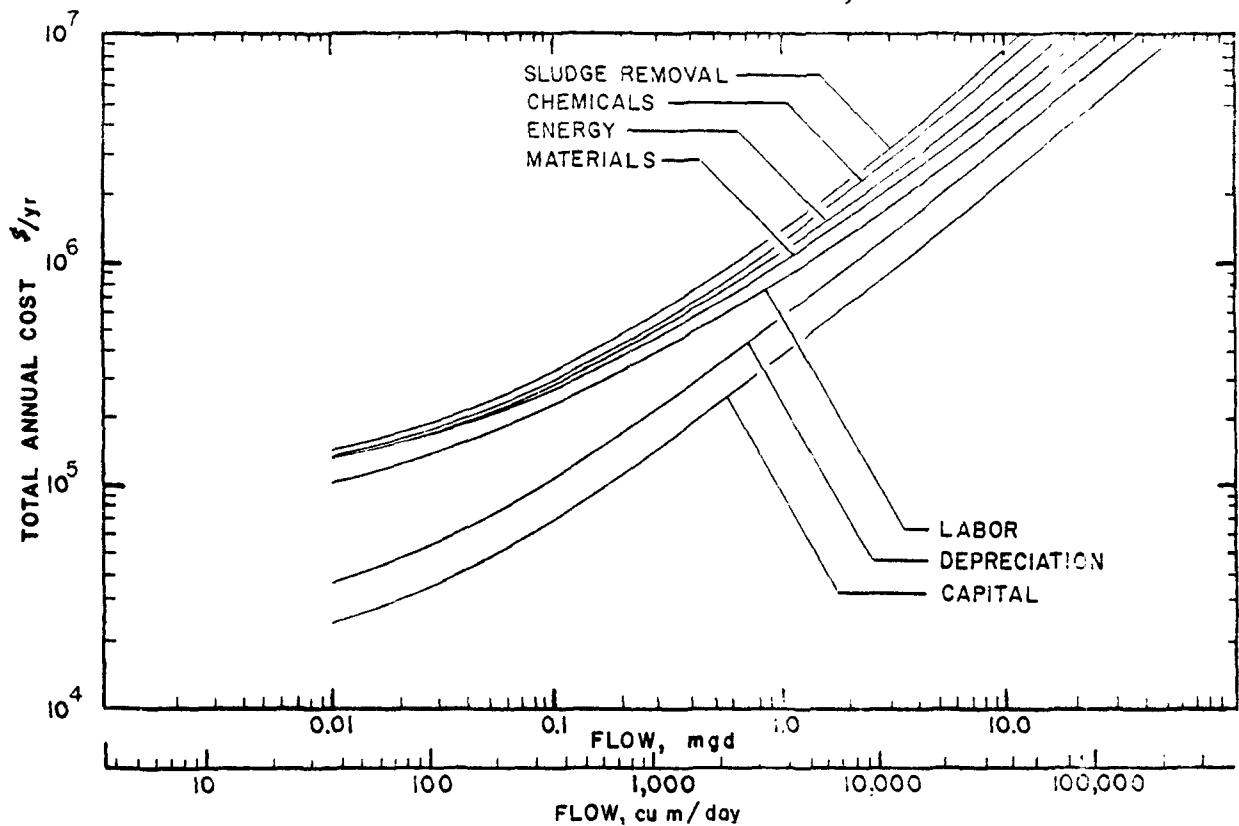


Figure VIII-8

SECONDARY LEAD COMBINATIONS 2&3, OPTION F

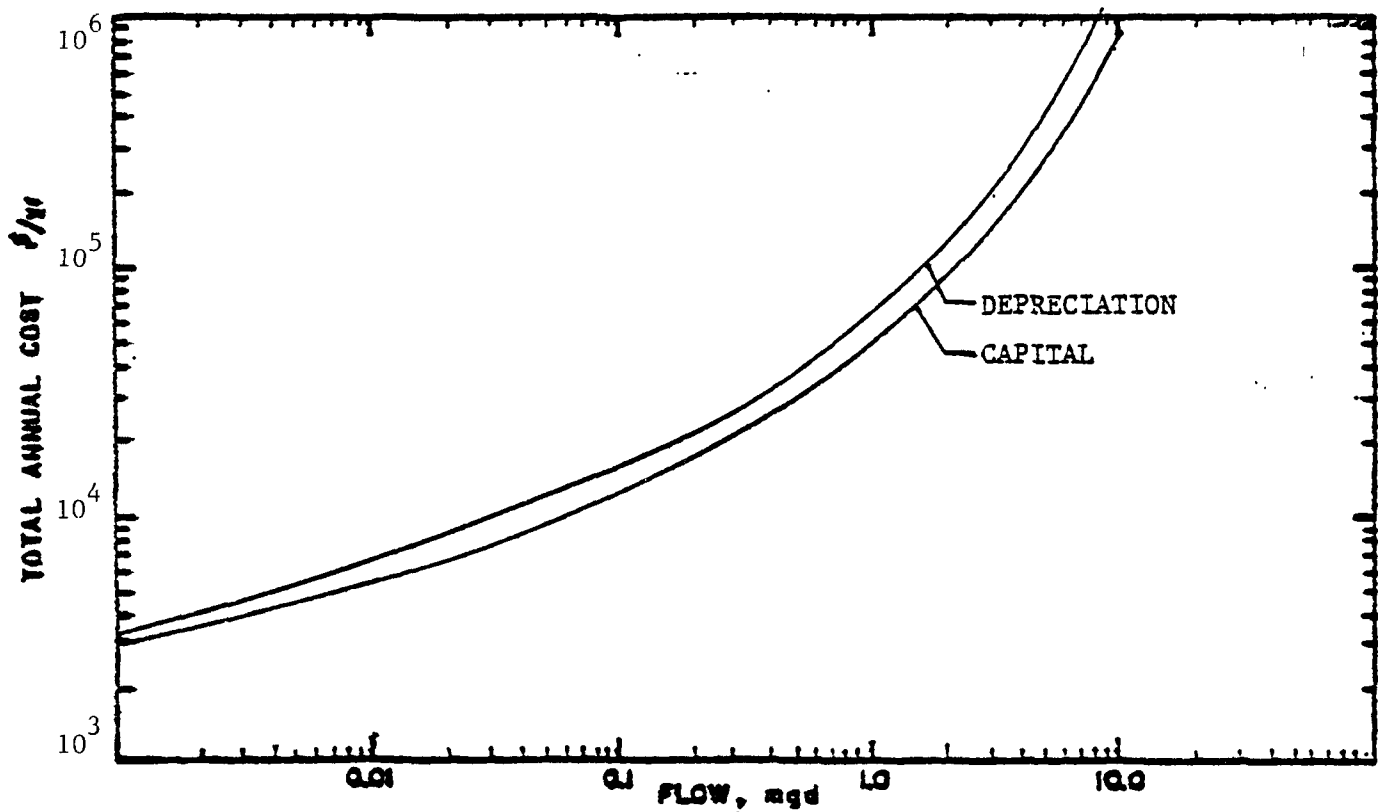


Figure VIII-9

HOLDING TANK COSTS

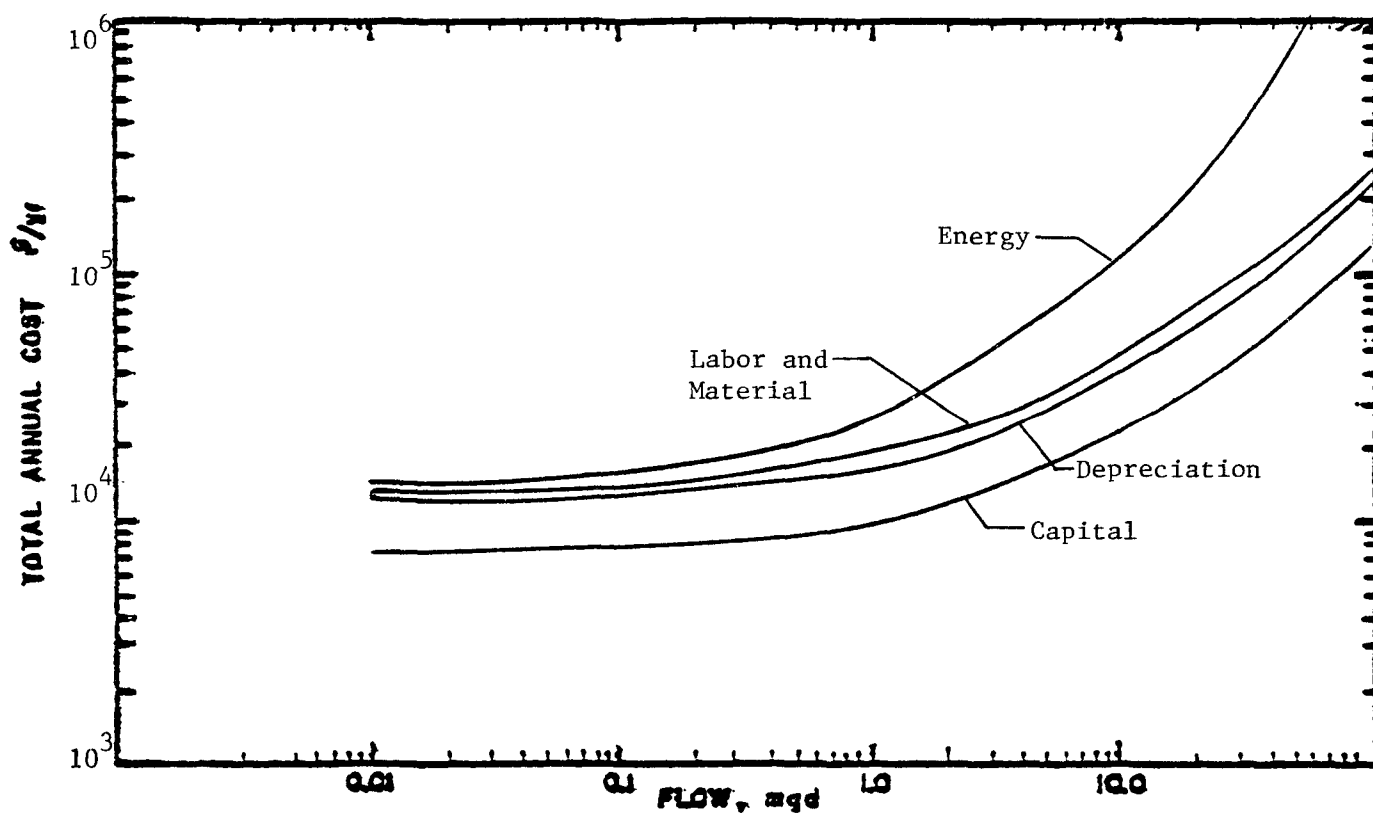


Figure VIII-10

COOLING TOWER COSTS CASTING CONTACT COOLING

## SECONDARY LEAD SUBCATEGORY

### 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), Section 301(b)(a)(A). BPT reflects the existing performance by plants of various sizes, ages, and manufacturing processes within the secondary lead 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 (see Tanner's Council of America v. Train, 540 F.2d 1188 (4th Cir. 1176)). BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common subcategory practice.

#### TECHNICAL APPROACH TO BPT

The Agency studied the nonferrous metals manufacturing category to identify the processes used, the wastewaters generated, and the treatment processes installed. Information was collected from industry using data collection portfolios, and specific plants were sampled and the wastewaters analyzed. Some of the factors which must be considered in establishing effluent limitations based on BPT have already been discussed. The age of equipment and facilities, processes used, and raw materials were taken into account in subcategorization and subdivision and are discussed fully in Section IV. Nonwater quality impacts and energy requirements are considered in Section VIII.

As explained in Section IV, the secondary lead 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. To account for production and flow variability from plant to plant, 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 (1) whether or not operations included generated wastewater, (2) specific flow rates generated, and (3) the specific production normalized flows for each process. 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.

Normalized flows were analyzed to determine which flow was 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 subcategory. The BPT normalized 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. In most cases, this will involve improving housekeeping practices, better maintenance to limit water leakage, or reducing excess flow by turning down a flow valve. It is not believed that these modifications would incur any costs for the plants.

For the development of effluent limitations, mass loadings were calculated for each wastewater source or subdivision. This calculation was made on a stream-by-stream basis, primarily because plants in this category may perform one or more of the operations in various combinations. The mass loadings (milligrams of pollutant per metric ton of production unit - mg/kkg) were calculated by multiplying the BPT normalized flow (1/kkg) by the concentration achievable using the BPT treatment system (mg/l) for each pollutant parameter to be limited under BPT.

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 secondary lead 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/kg) 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.

BPT effluent limitations are based on the average of the discharge flow rates for each source; consequently, the treatment levels which are currently used by the lowest dischargers will be the treatment technologies most likely required to meet BPT guidelines. Section VII discusses the various treatment technologies which are currently in place for each wastewater source. In most cases, the current treatment levels consist of chemical precipitation and sedimentation (lime and settle technology) and a combination of reuse and recycle to reduce flow.

The overall effectiveness of end-of-pipe treatment for the removal of wastewater pollutants is improved by the application of water flow controls within the process to limit the volume of wastewater requiring treatment. The controls or in-process technologies recommended under BPT include only those measures which are commonly practiced within the subcategory and which reduce flows to meet the production normalized flow for each operation.

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.

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

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 BPT. See Weyerhaeuser Company v. Costle, 590 F.2d 1011 (D.C. Cir. 1978).

The methodology for calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Tables X-2 and XII-1 show the estimated pollutant reduction benefits for each treatment option for direct and indirect dischargers. Compliance costs are presented in Table X-3.

#### BPT OPTION SELECTION

The BPT treatment scheme (Figure IX-1) selected consists of complete recycle of kettle scrubber liquor, and chemical precipitation and sedimentation (lime and settle) end-of-pipe technology. Dry air pollution control of air emissions from kettle refining is required; or alternately, complete recycle of kettle scrubber liquor may be used to achieve zero discharge of wastewater pollutants. The BPT treatment is equivalent to Option A described in Section X. The proposed BPT will result in the removal of approximately 14,350 kg/yr of toxic metal pollutants and 5,398,900 kg/yr of conventional pollutants from the estimated raw discharge. The estimated capital cost of BPT is \$470,000 (1978 dollars) and the estimated annual cost is \$228,000 (1978 dollars).

#### 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 the 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. 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 PNP's, are also listed in Table IX-1.

#### BATTERY CRACKING

The BPT wastewater discharge rate for battery cracking is 940 l/kg (225 gal/ton) of lead produced. All 32 of the plants with this process discharge this wastewater at rates ranging from 80.5 to 5,086 l/kg (19.3 to 1,220 gal/ton). A distribution of wastewater rates for battery cracking wastewater is presented in

Section V (Table V-1). None of the plants practice recycle of this wastewater, therefore the BPT rate is the average discharge rate of 32 plants. Twenty-three plants meet the BPT discharge rate.

#### BLAST AND REVERBERATORY FURNACE WET AIR POLLUTION CONTROL

The BPT wastewater discharge rate for blast and reverberatory furnace wet air pollution control is 3,380 l/kg (811 gal/ton) of lead produced. This rate is allocated only for those plants having wet air pollution control for smelting operations. Of the 47 plants with this process, seven use air scrubbing devices. One of the seven plants did not report sufficient production data to calculate a discharge rate but reported a recycle rate of 97.8 percent. One plant discharges with no recycle. Three plants practice partial recycle, ranging from 83.3 to 93.3 percent. Two of the seven plants achieve zero discharge by 100 percent recycle. Extensive recycling is possible for this wastewater stream, but a zero discharge may not be technically feasible unless (1) a recycle system controls dissolved solids buildup; (2) the wastewater is evaporated; or (3) there is a production operation that can accept the quality of treated wastewater. Some of these zero discharge possibilities are site-specific and, therefore, are not applicable to the secondary lead subcategory as a whole. The discharge rates from the four discharging plants range from 1,776 to 6,587 l/kg (426 to 1,580 gal/ton). The average of these four discharges is the basis for the BPT rate. Five of six plants meet the BPT rate. Wastewater rates for blast and reverberatory furnace wet air pollution control are presented in Table V-3.

#### KETTLE WET AIR POLLUTION CONTROL

No BPT wastewater discharge allowance is provided for kettle scrubbing wastewater. Twenty-eight plants control kettle air emissions; 19 use dry controls (baghouses), and nine use scrubbers. Six plants practice complete recycle of the scrubber liquor and one plant uses the liquor in the battery cracking and decasing operation. The remaining two plants practice recycle of 91.7 and 96 percent. Since complete recycle of kettle scrubber wastewater is so widely demonstrated in this subcategory, the Agency believes that zero discharge of wastewater pollutants is feasible for all secondary lead kettle wet air pollution control.

#### CASTING CONTACT COOLING WATER

The BPT wastewater discharge rate for casting contact cooling water is 221 l/kg (53.1 gal/ton) of lead cast. Of the 66 secondary lead plants with casting operations, 11 generate wastewater from the process. Three plants practice total recycle and two plants reported discharging "insignificant" amounts of

wastewater. Six plants are once-through dischargers, with flow rates ranging from 5 to 963 l/kg (1 to 231 gal/ton). Wastewater rates for casting contact cooling are presented in Table V-7. The BPT discharge rate is based on the average of the six discharging plants. Ten of the 11 plants using casting contact cooling water meet the BPT discharge rate.

#### 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 consideration for limitation. This examination and evaluation was presented in Section VI. A total of seven pollutants or pollutant parameters are selected for limitation under BPT and are listed below:

- 114. antimony
- 115. arsenic
- 122. lead
- 128. zinc
- ammonia
- total suspended solids (TSS)
- pH

#### EFFLUENT LIMITATIONS

The treatable concentrations achievable by the proposed BPT treatment scheme are explained in Section VII of General Development Document and summarized there in Table VII-22. The treatable 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 kilograms of pollutant per metric ton of product represent the BPT effluent limitations and are presented in Table IX-2 for each individual waste stream.

Table IX-1

## BPT WASTEWATER DISCHARGE RATES FOR THE SECONDARY LEAD SUBCATEGORY

<u>Wastewater Stream</u>	<u>BPT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Battery Cracking	940	225	kgg of lead scrap produced
Blast and Reverberatory Furnace Wet Air Pollution Control	3,380	811	kgg of lead produced from smelting
Kettle Wet Air Pollution Control	0	0	kgg of lead produced from kettle furnaces
Casting Contact Cooling Water	221	53	kgg of lead cast

Table IX-2

## BPT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY

Battery Cracking

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs. of lead scrap produced		
Antimony	2,697.80	1,193.80
Arsenic	1,964.60	808.40
Lead	141.0	122.20
Zinc	1,250.20	526.40
Ammonia (as N)	0.0	0.0
Total Suspended Solids	38,540.0	18,800.0
pH	Within the range of 7.5 to 10.0 at all times	

Blast and Reverberatory Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	9,700.60	4,292.60
Arsenic	7,064.20	2,906.80
Lead	507.0	439.40
Zinc	4,495.40	1,892.80
Ammonia (as N)	0.0	0.0
Total Suspended Solids	138,580.0	67,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Table IX-2 (Continued)

## BPT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY

Kettle Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	634.84	280.92
Arsenic	462.31	190.23
Lead	33.18	28.76
Zinc	294.20	123.87
Ammonia (as N)	0.0	0.0
Total Suspended Solids	9,069.20	4,424.0
pH	Within the range of 7.5 to 10.0 at all times	

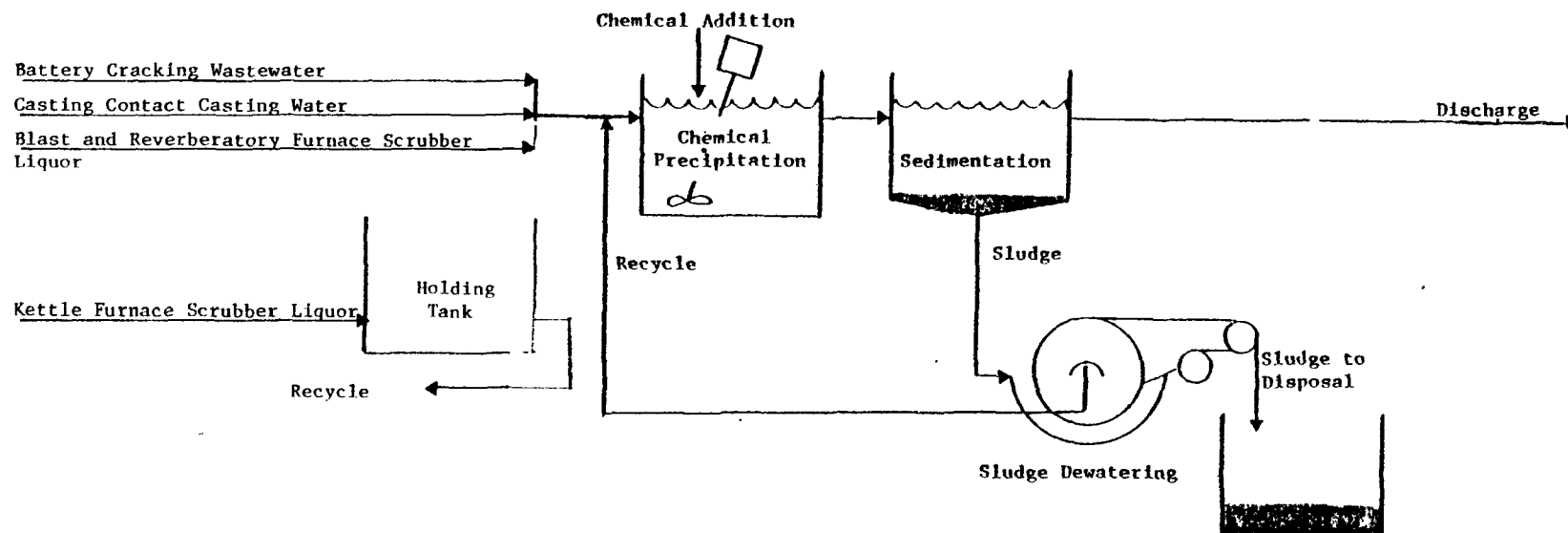


Figure IX-1

BPT TREATMENT SCHEME FOR THE SECONDARY LEAD SUBCATEGORY



## SECONDARY LEAD SUBCATEGORY

### SECTION X

#### BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

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

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

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

#### TECHNICAL APPROACH TO BAT

In pursuing this second round of effluent regulations, 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 five technology options which could be applied to the secondary lead subcategory as alternatives for the basis of BAT effluent limitations.

In summary, the treatment technologies considered for BAT are presented below:

Option A is based on:

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining or alternatively, complete recycle of kettle scrubber liquor

Option B is based on:

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining or alternatively, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater

Option C is based on:

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining or alternatively, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration

Option D is based on:

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining or alternatively, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration
- o Activated alumina adsorption

Option F is based on:

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining or alternatively, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration
- o Reverse osmosis in conjunction with multiple-effect evaporation for complete recycle of treated water

The five options examined for BAT are discussed in greater detail below. The first option considered (Option A) is the same as the BPT treatment technology which was presented in the previous section.

## OPTION A

Option A for the secondary lead subcategory is equivalent to the control and treatment technologies which were analyzed for BPT in Section IX. The BPT end-of-pipe treatment scheme consists of complete recycle of kettle scrubber liquor, and chemical precipitation and sedimentation (lime and settle) end-of-pipe technology (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. Dry air pollution control of kettle refining air emissions is required to achieve zero discharge of wastewater pollutants, or alternatively, complete recycle of kettle scrubber liquor may be used.

## OPTION B

Option B for the secondary lead subcategory achieves lower pollutant discharge by building upon the Option A end-of-pipe treatment technology. Flow reduction measures are added to Option A treatment, chemical precipitation and sedimentation (see Figure X-2). These flow reduction measures, including in-process changes, result in the elimination of some wastewater streams and the concentration of pollutants in other effluents. As explained in Section VII of the General Development Document, treatment of a more concentrated effluent allows achievement of a greater net pollutant removal and introduces the possible economic benefits associated with treating a lower volume of wastewater.

Methods used in Option B to reduce process wastewater generation and discharge rates include the following:

### Recycle of Casting Contact Cooling Water Through Cooling Towers

The function of casting contact cooling water is to quickly remove heat from the newly formed lead ingots. Therefore, the principal requirements of the water are that it be cool and not contain dissolved solids at a concentration that would cause water marks or other surface imperfections. There is sufficient experience within the category with the cooling and recycling of casting contact cooling wastewater to assure the success of this technology using cooling towers or heat exchangers (refer to Section VII of the General Development Document). A blowdown or periodic cleaning is likely to be needed to prevent a build-up of dissolved and suspended solids. (EPA has determined that a blowdown of 10 percent of the water applied in a process is adequate.)

## Recycle of Water Used in Wet Air Pollution Control

There are two wastewater sources associated with wet air pollution control which are regulated under these effluent limitations:

- Blast and reverberatory furnace scrubber, and
- Kettle scrubber.

Table X-1 presents the number of plants reporting wastewater use with these sources, the number of plants practicing recycle of scrubber liquor, and the range of recycle values being used. Although some plants report total recycle of their scrubber water, a blowdown or periodic cleaning may be needed to prevent the buildup of dissolved and suspended solids since the water picks up particulates and fumes from the air. Since the BPT discharge rate for the kettle scrubber is zero, no further flow reduction can be achieved at BAT.

### OPTION C

Option C for the secondary lead subcategory consists of in-process flow reduction, chemical precipitation, and sedimentation treatment of Option B plus multimedia filtration technology added at the end of Option B treatment (see Figure X-3). Multimedia filtration is used to remove suspended solids, including precipitates of toxic metals, beyond the concentration 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 satisfactorily.

### OPTION D

Option D for the secondary lead subcategory consists of in-process flow reduction, chemical precipitation, sedimentation, and multimedia filtration treatment of Option C with the addition of activated alumina technology at the end of the Option C treatment. The activated alumina process is used to remove dissolved arsenic which remains after lime precipitation.

### OPTION F

Option F for the secondary lead subcategory consists of in-process flow reduction, chemical precipitation, sedimentation, and multimedia filtration treatment of Option C with the addition of reverse osmosis and multiple-effect evaporation technology at the end of the Option C treatment (see Figure X-4). Option F is used for complete recycle of the treated water by controlling the concentration of dissolved solids. Multiple-effect evaporation is used in dewater brines rejected by reverse osmosis.

Another treatment technology, activated carbon adsorption (Option E) was not considered for this subcategory. In Section VI of this supplement, none of the toxic organic pollutants were selected for further consideration in establishing limitations for the secondary lead subcategory. Therefore, Option E, which includes activated carbon adsorption for organic removal, is not applicable.

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

As a 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 REDUCTION BENEFITS

A complete description of the methodology used to calculate the estimated pollutant reduction, or benefit, achieved by the application of the various treatment options is presented in Section X of the General Development Document. In short, sampling data collected during the field sampling program were used to characterize the 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 lead subcategory. By multiplying the total subcategory production for a unit operation by the corresponding raw waste value, the mass of pollutant generated for that unit operation was estimated.

The volume of wastewater discharged after the application of each treatment option was estimated by multiplying the regulatory flow determined for each unit process by the total subcategory production. The mass of pollutant discharged was then estimated by multiplying the achievable concentration values attainable by the option (mg/l) by the estimated volume of process wastewater discharged by the subcategory. The mass of pollutant removed, referred to as the benefit, is simply 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 Agency varied this procedure slightly in computing estimated BPT discharge in a subcategory where there is an existing BPT limitation. In this case, EPA took the mass limits from the BPT limitations (for all pollutants limited at BPT) and multiplied these limits by the total subcategory production (from dcp).

(The assumption is that plants are discharging a volume equal to their BPT allowance times their production.) Where pollutants are not controlled by existing BPT, EPA used the achievable concentration for the associated technology proposed in this document, and multiplied these concentrations by the total end-of-pipe discharge of process wastewater for the subcategory (from dcp). The total of both these calculations represents estimated mass loadings for the subcategory. The pollutant reduction benefit estimates for direct discharges in the secondary lead subcategory are presented in Table X-2.

## COMPLIANCE COSTS

In estimating subcategory-wide compliance costs, the first step was to develop uniformly-applicable cost curves, relating the total costs associated with installation and operation of wastewater treatment technologies to plant process wastewater discharge. EPA applied these curves on a per plant basis, a plant's costs (both capital, and operating and maintenance) being 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-3). These costs were used in assessing economic achievability.

## BAT OPTION SELECTION

EPA has selected both Option B and Option C as the basis for alternative BAT effluent limitations for the secondary lead subcategory due to current adverse structural economic changes that are not reflected in the Agency's current economic analysis. These alternative limitations are based on lime precipitation, sedimentation, and in-process control technologies to reduce the volume of process wastewater discharged for Option B and the addition of multimedia filtration for Option C. The major changes affecting the secondary lead market are an overall stagnant demand, and a major shift by battery manufacturers to low-antimony maintenance free (MF) batteries. A more detailed explanation regarding this economic analysis can be found in the Economic Impact Analysis of Proposed Effluent Standards and Limitations for the Nonferrous Smelting and Refining Industry, EPA 440/2-82-002.

The selected BAT Alternative A (Option B) increases the removal of toxic metals by an estimated 132 kg/yr over the estimated BPT discharge. The estimated capital cost of proposed Alternative A is \$0.470 million (1978 dollars), and the annualized cost is \$0.228 million (1978 dollars). The selected BAT Alternative B (Option C) would remove approximately 14,602 kg/yr of toxic metals and 495 kg/yr of ammonia from raw discharge and increases

the removal of toxic metals by an estimated 189 kg/yr over the estimated BPT discharge. The estimated capital cost of the proposed Alternative B is \$2.12 million (1978 dollars), and the annualized cost is \$1.36 million (1978 dollars).

Activated alumina (Option D) was considered; however, this technology was rejected because it was not demonstrated in this subcategory nor was it clearly transferable to nonferrous wastewater. Reverse osmosis (Option F) was considered for the purpose of achieving zero discharge of process wastewater; however, the Agency ultimately rejected this technology because it was determined that its performance for this specific purpose was not adequately demonstrated in this subcategory nor was it clearly transferable from another subcategory or category.

#### 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 concentration 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-4. 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 (PNP) are also listed in Table X-4.

The BAT wastewater discharge rate equals the BPT wastewater discharge rate for kettle wet air pollution control. Since the kettle scrubber regulatory discharge rate is zero, no further flow reduction is feasible. Wastewater streams for which BAT discharge rates differ from BPT are discussed below.

#### BATTERY CRACKING

The BAT wastewater discharge rate for battery cracking is 673 l/kg (162 gal/ton) of lead produced from battery cracking. All 32 of the secondary lead plants with this process discharge this wastewater; none practice recycle. The BAT rate is predicated on the average of discharge rates from 30 plants with flow rates ranging from 80.5 to 1,984 l/kg (19.3 to 476 gal/ton). Two plants use significantly larger volumes of wash water than the other facilities and thus were excluded from the BAT flow calculation. Wastewater rates for battery cracking are presented in Section V (Table V-1). Seventeen of the 32 plants meet the BAT discharge rate.

## BLAST AND REVERBERATORY FURNACE WET AIR POLLUTION CONTROL

The BAT wastewater discharge rate for smelting furnace wet air pollution control is 2,610 l/kg (626 gal/ton) of lead produced from smelting. This rate is based on 90 percent recycle of the scrubber water used at four plants that discharge from this process and is allocated only for those plants having wet air pollution control for smelting operations. (Refer to Section VII of the General Development Document.) Of the 47 plants with smelting processes, seven use wet scrubbing devices. One of the seven did not provide sufficient production information in the dcp to calculate a discharge rate but reported a recycle rate of 97.8 percent. One plant is a once-through discharger, practicing no recycle. The recycle in three other plants ranges from 83.3 to 93.3 percent. Two plants achieve zero discharge by 100 percent recycle. Some zero discharge possibilities are site-specific and thus, are not applicable on a nationwide basis. The distribution of wastewater rates for this waste stream is presented in Table V-3. Four of the six plants reporting flow data for this waste stream meet the BAT discharge rate.

## CASTING CONTACT COOLING WATER

The BAT wastewater discharge rate is 22 l/kg (5.3 gal/ton), based on 90 percent recycle of the BPT discharge allowance (refer to Section VII of the General Development Document). Eleven of the 66 plants with casting operations use contact cooling water. Three plants achieve zero discharge through 100 percent recycle or evaporation. Six plants are once-through dischargers with flow rates ranging from 5 to 963 l/kg (1 to 231 gal/ton). Seven of the 11 plants using casting contact cooling water meet the BAT discharge rate.

## REGULATED POLLUTANT PARAMETERS

In implementing the terms of the Consent Agreement in NRDC v. Train, Op. Cit., and 33 U.S.C. 1314(b)(2)(A and B) (1976), the Agency placed particular emphasis on the toxic pollutants. The raw wastewater concentrations from individual operations and the subcategory as a whole were examined to select certain pollutants and pollutant parameters for consideration for limitation. This examination and evaluation, presented in Section VI, concluded that 13 pollutants or pollutant parameters are present in secondary lead wastewaters at concentrations that can be effectively reduced by identified treatment technologies.

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 proposing effluent mass limitations only for those pollutants generated in the greatest quantities as shown by the pollutant reduction benefit analysis. The pollutants selected for specific limitation are listed below:

- 114. antimony
- 115. arsenic
- 122. lead
- 128. zinc
- ammonia (as N)

By establishing limitations and standards for certain toxic metal pollutants, dischargers will attain the same degree of control over toxic 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 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 lime 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 secondary lead subcategory to control the discharges of toxic metal pollutants are antimony, arsenic, lead, and zinc. The following toxic pollutants are excluded from limitation on the basis that they are effectively controlled by the limitations developed for the selected toxic metals:

- 118. cadmium
- 119. chromium (Total)
- 120. copper
- 124. nickel
- 126. silver
- 127. thallium

The conventional pollutant parameters TSS and pH will be limited by the best conventional technology (BCT) effluent limitations. These effluent limitations and a discussion of BCT are presented in Section XIII of this supplement.

#### EFFLUENT LIMITATIONS

The treatable concentrations, achievable by application of the two BAT technologies (Options B and C) are summarized in Table VII-19 of the General Development Document. These treatable concentrations (both one day maximum and monthly average) are multiplied by the BAT normalized discharge flows summarized in Table

X-4 to calculate the mass of pollutants allowed to be discharged per mass of product. The results of these calculations in milligrams of pollutant per metric ton of product represent the BAT effluent limitations for the secondary lead subcategory. Two sets of BAT effluent limitations, each based on one of the two alternative BAT options, have been developed for the secondary lead subcategory. BAT effluent limitations based on Option B (lime precipitation, sedimentation, and in-process flow reduction) are presented in Table X-5, while limitations based on Option C (lime precipitation, sedimentation, in-process flow reduction, and multimedia filtration) are presented in Table X-6.

Table X-1

CURRENT RECYCLE PRACTICES WITHIN THE  
SECONDARY LEAD SUBCATEGORY

<u>Waste Stream</u>	<u>Number of Plants With Wastewater</u>	<u>Number of Plants Practicing Recycle</u>	<u>Range of Recycle Values (%)</u>
Blast and Reverberatory Furnace Wet Air Pollution Control	7	6	83.7-100
Kettle Wet Air Pollution Control	9	8	91.7-100

Table X-2

TREATMENT PERFORMANCE  
SECONDARY LEAD SUBCATEGORY  
DIRECT DISCHARGERS

Flow (l/yr)		281.8 x 10 <sup>6</sup>		205.3 x 10 <sup>6</sup>		205.3 x 10 <sup>6</sup>	
	Raw Waste	Option 1	Option 1	Option 2	Option 2	Option 3	Option 3
<u>Pollutant</u>	<u>kg/yr</u>	<u>Removed</u>	<u>Discharged</u>	<u>Removed</u>	<u>Discharged</u>	<u>Removed</u>	<u>Discharged</u>
		<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>
Antimony	2,770.2	2,756.1	14.1	2,759.9	10.3	2,763.2	7.0
Arsenic	2,206.0	2,062.3	143.7	2,101.3	104.7	2,136.2	69.8
Cadmium	117.7	95.5	22.3	101.5	16.2	107.7	10.1
Chromium	23.4	0.8	22.5	7.0	16.4	9.0	14.4
Copper	170.8	7.3	163.5	51.7	119.1	90.7	80.1
Lead	9,234.9	9,201.1	33.8	9,210.3	24.6	9,218.5	16.4
Nickel	54.9	0.0	54.9	0.0	54.9	9.8	45.2
Silver	10.7	0.0	10.7	0.0	10.7	0.0	10.7
Thallium	38.1	0.0	38.1	0.0	38.1	0.0	38.1
Zinc	314.4	229.8	84.5	252.8	61.6	267.1	47.2
TSS	5,402,268.8	5,398,886.9	3,381.9	5,399,805.0	2,463.8	5,401,734.9	533.8
Ammonia	494.8	494.8	0.0	494.8	0.0	494.8	0.0
Total Toxic Metals	14,941.1	14,352.9	588.1	14,484.5	456.6	14,602.2	399.0
Total Conventionals	5,402,268.8	5,398,886.9	3,381.9	5,399,805.0	2,463.8	5,401,734.9	533.8
Total Nonconven- tionals	494.8	494.8	0.0	494.8	0.0	494.8	0.0
Total Pollutants	5,417,704.7	5,413,734.6	3,970.0	5,414,784.3	2,920.4	5,416,831.9	872.8

Table X-2 (Continued)

TREATMENT PERFORMANCE  
SECONDARY LEAD SUBCATEGORY  
DIRECT DISCHARGERS  
(Continued)

Flow (l/yr)	205.3 x 10 <sup>6</sup>		0.0	
	Option 4	Option 4	Option 5	Option 5
Pollutant	Removed	Discharged	Removed	Discharged
	kg/yr	kg/yr	kg/yr	kg/yr
Antimony	2,763.2	7.0	2,770.2	0.0
Arsenic	2,185.5	20.5	2,206.0	0.0
Cadmium	107.7	10.1	117.7	0.0
Chromium	9.0	14.4	23.4	0.0
Copper	90.7	80.1	170.8	0.0
Lead	9,218.5	16.4	9,234.9	0.0
Nickel	9.8	45.2	54.9	0.0
Silver	0.0	10.7	10.7	0.0
Thallium	0.0	38.1	38.1	0.0
Zinc	267.1	47.2	314.4	0.0
TSS	5,401,734.9	533.8	5,402,268.8	0.0
Ammonia	494.8	0.0	494.8	0.0
Total Toxic Metals	14,651.5	289.7	14,941.1	0.0
Total Conventionals	5,401,734.9	533.8	5,402,268.8	0.0
Total Nonconven- tionals	494.8	0.0	494.8	0.0
Total Pollutants	5,416,881.2	823.5	5,417,704.7	0.0

NOTE: Total Toxic Metals = Antimony + Arsenic + Cadmium + Chromium + Copper + Lead + Nickel  
+ Silver + Thallium + Zinc

Total Conventionals = TSS

Total Nonconventionals = Ammonia

Total Pollutants = Total Toxic Metals + Total Nonconventionals + Total Conventionals

Option A - Chemical Precipitation and Sedimentation  
Option B - Option A plus Flow Reduction  
Option C - Option B plus Filtration  
Option D - Option C plus Activated Alumina Adsorption  
Option F - Option C plus Reverse Osmosis

Table X-3

COST OF COMPLIANCE FOR THE SECONDARY LEAD  
SUBCATEGORY

<u>Option</u>	Direct Dischargers	
	<u>Capital Cost (1978 Dollars)</u>	<u>Annual Cost (1978 Dollars)</u>
A	470,000	288,000
B	470,000	228,000
C	2,116,000	1,358,000
D	2,486,000	1,642,000

Table X-4

BAT WASTEWATER DISCHARGE RATES  
FOR THE  
SECONDARY LEAD SUBCATEGORY

<u>Wastewater Stream</u>	<u>BAT Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>1/kg</u>	<u>gal/ton</u>	
Battery Cracking	673	162	kg of lead scrap produced
Blast and Reverberatory Furnace Wet Air Pollution Control	2,610	626	kg of lead produced from smelting
Kettle Wet Air Pollution Control	0	0	kg of lead produced from kettle furnaces
Casting Contact Cooling Water	22	5.3	kg of lead cast

Table X-5

**BAT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION B)**

**Battery Cracking**

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,931.51	854.71
Arsenic	1,406.57	578.78
Lead	100.95	87.49
Zinc	895.09	376.88
Ammonia (as N)	0.0	0.0

**Blast and Reverberatory Furnace Wet Air Pollution Control**

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	7,490.7	3,314.7
Arsenic	5,454.9	2,244.6
Lead	391.5	339.3
Zinc	3,471.30	1,461.6
Ammonia (as N)	0.0	0.0

**Kettle Wet Air Pollution Control**

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0



Table X-5 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION B)

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	63.43	28.07
Arsenic	46.19	19.01
Lead	3.32	2.87
Zinc	29.39	12.38
Ammonia (as N)	0.0	0.0

Table X-6

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION C)

Battery Cracking

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0

Blast and Reverberatory Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	5,037.30	2,244.60
Arsenic	3,627.90	1,487.70
Lead	261.0	234.90
Zinc	2,662.20	1,096.20
Ammonia (as N)	0.0	0.0

Kettle Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table X-6 (Continued)

BAT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION C)

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0

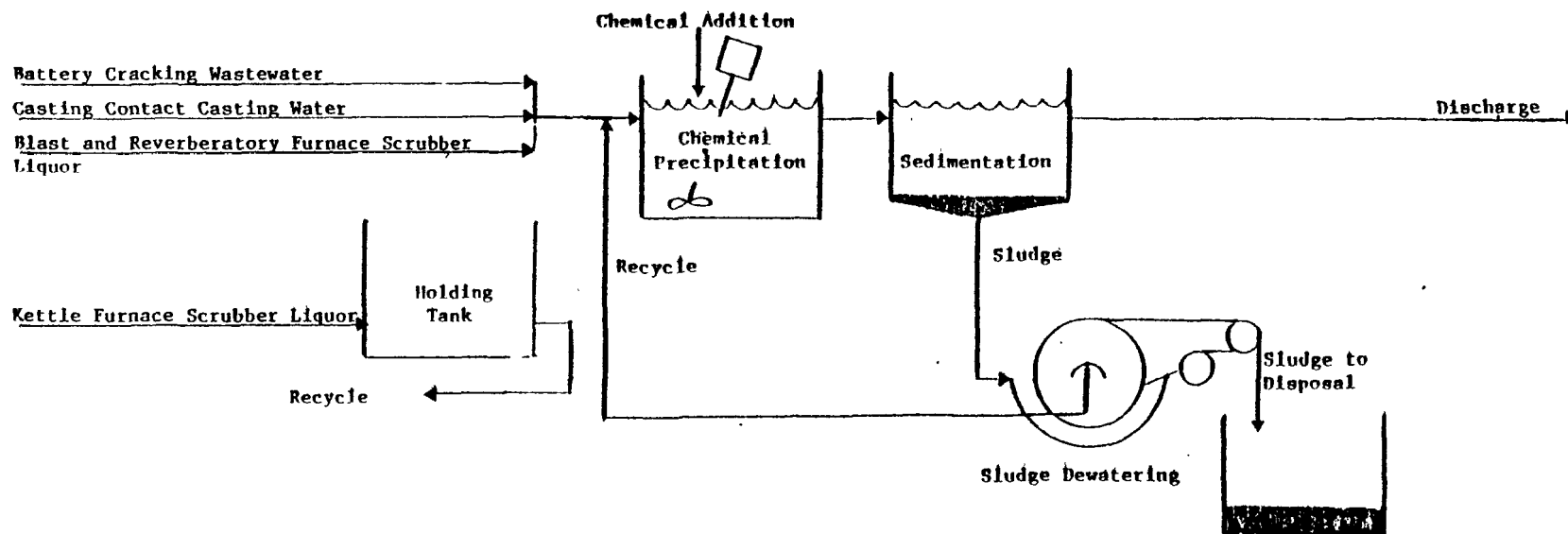


Figure X-1

BAT TREATMENT SCHEME FOR OPTION A

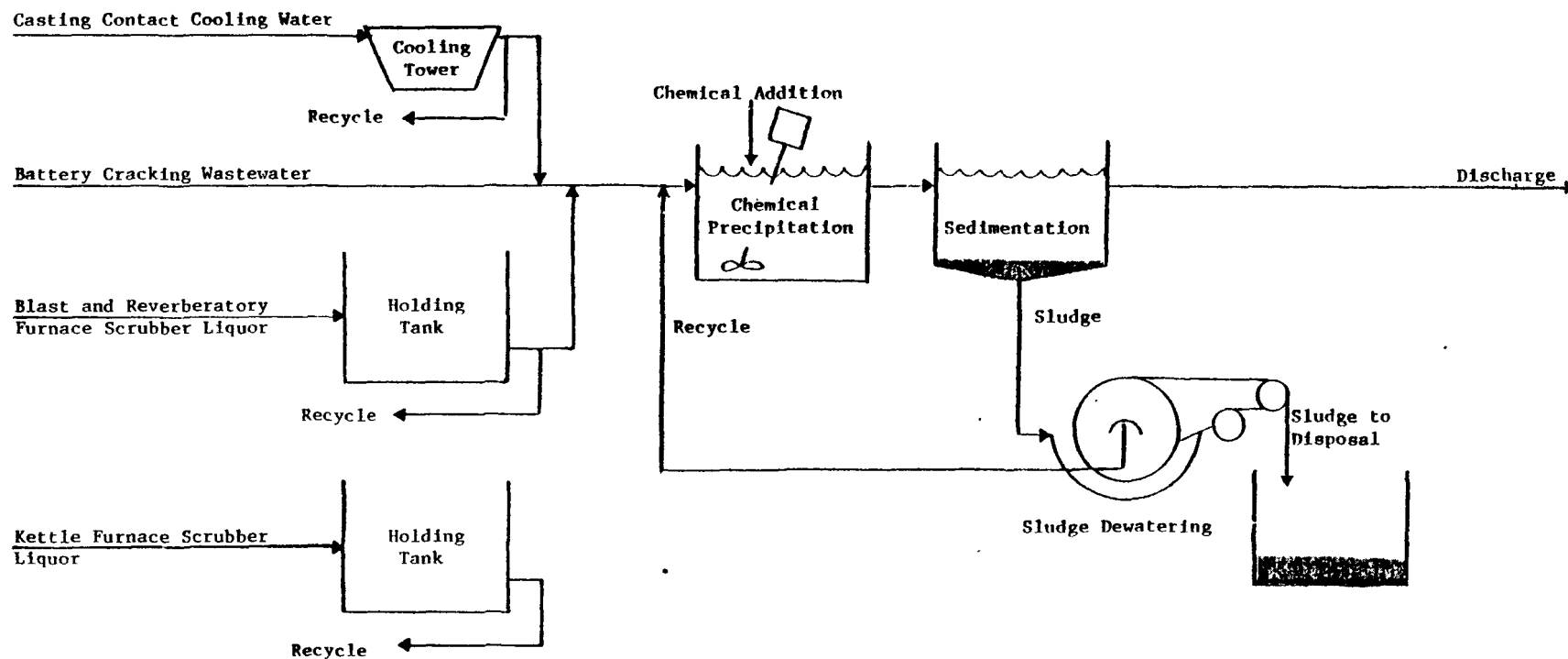


Figure X-2

BAT TREATMENT SCHEME FOR OPTION B

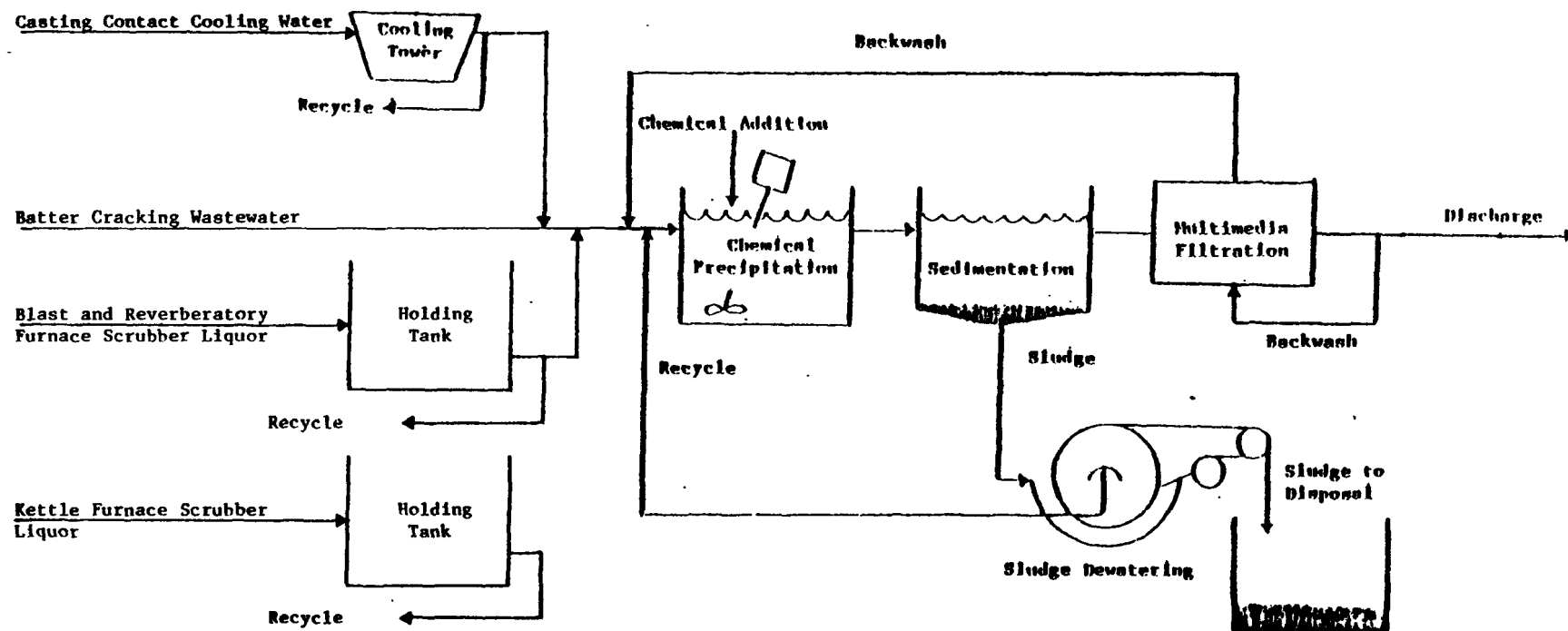


Figure X-3

BAT TREATMENT SCHEME FOR OPTION C

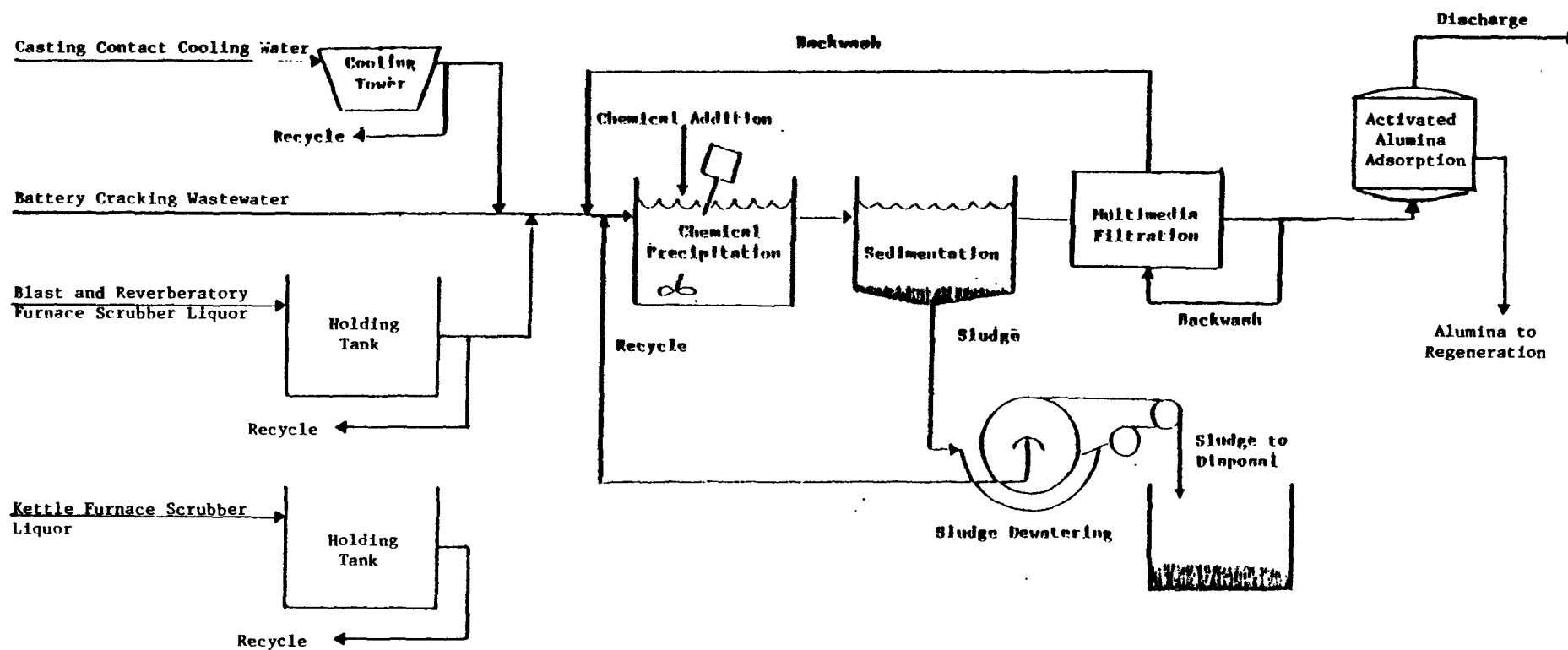


Figure X-4

BAT TREATMENT SCHEME FOR OPTION D

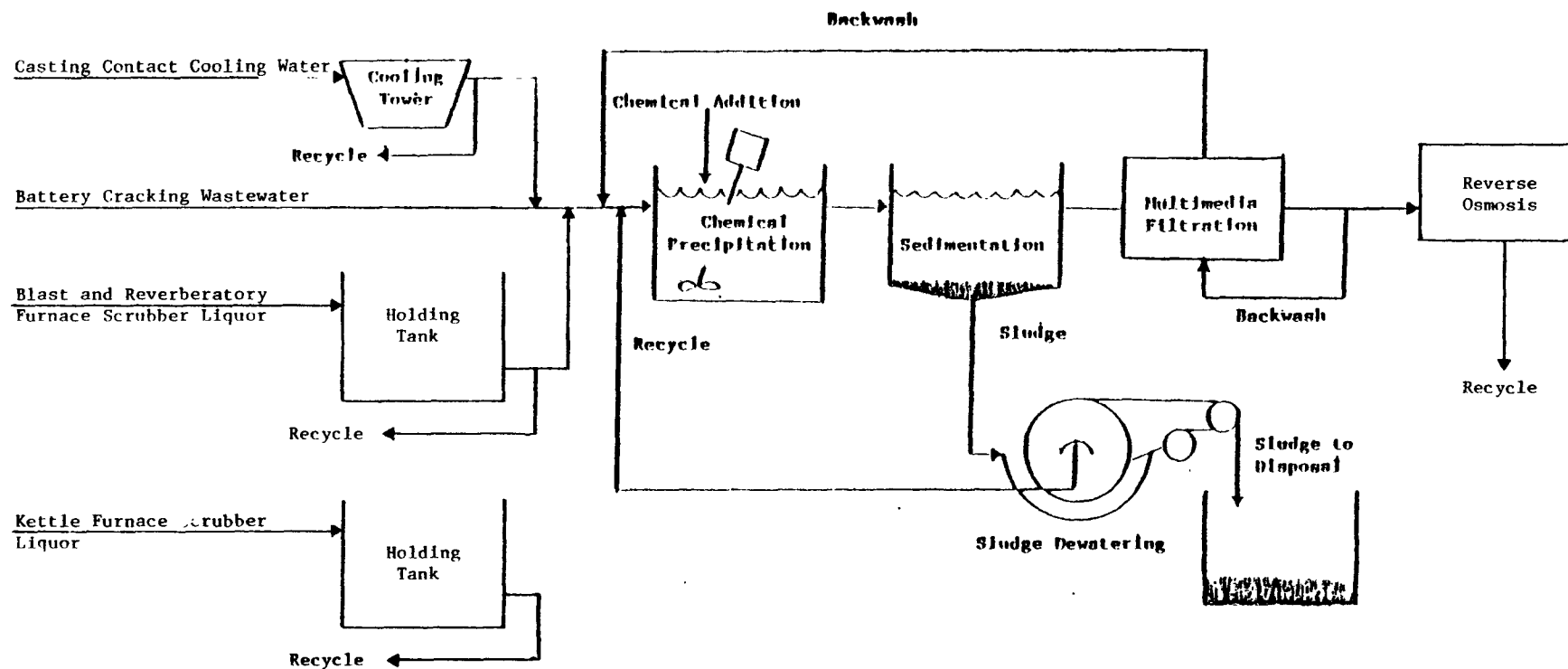


Figure X-5

BAT TREATMENT SCHEME FOR OPTION F



## SECONDARY LEAD SUBCATEGORY

### SECTION XI

#### NEW SOURCE PERFORMANCE STANDARDS

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

This section describes the control technology for treatment of wastewater from new sources and presents mass discharge limitations of regulatory pollutants for NSPS in the secondary lead subcategory, based on the described control technology.

#### TECHNICAL APPROACH TO BDT

As discussed in the General Development Document, all of the treatment technology options applicable to a new source were previously considered for the BAT options. For this reason, five options were considered for BDT, all identical, with one exception, to the BAT options discussed in Section X. It is proposed that the kettle wet air pollution control waste stream be eliminated under BDT through the use of dry air pollution control. Dry scrubbing is widely demonstrated for controlling emissions from kettle smelting. Of the 28 plants with kettle air pollution control, 19 use dry scrubbing. The Agency also considered proposing dry scrubbing for controlling emissions from blast and reverberatory furnaces, but the nature of these emissions precludes the use of dry scrubbing. Exhaust gases from blast and reverberatory furnaces contain hot particulate matter, as well as sulfur dioxide fumes, which requires wet air pollution scrubbing.

The treatment technologies used for the five BDT options are:

#### OPTION A

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternatively, complete recycle of kettle scrubber liquor

#### OPTION B

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater

#### OPTION C

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration

#### OPTION D

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration
- o Activated alumina adsorption

#### OPTION F

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration
- o Reverse osmosis in conjunction with multiple-effect evaporation for complete recycle of treated water

Partial or complete reuse and recycle of wastewater is an essential part of each option. Reuse and recycle can precede or follow end-of-pipe treatment. A more detailed discussion of these treatment options is presented in Section X.

### BDT OPTION SELECTION

EPA is proposing that the best available demonstrated technology for the secondary lead subcategory be equivalent to BAT technology Alternative B (Option C). The selected option consists of dry kettle air pollution control methods (or alternately, complete recycle of kettle scrubber liquor), in-process flow reduction, chemical precipitation, sedimentation, and multimedia filtration.

The Agency recognizes that new sources have the opportunity to implement more advanced levels of treatment without incurring the costs of retrofit equipment, the costs of partial or complete shutdown necessary for installation of the new equipment, and the costs of startup and stabilization of the treatment system that existing plants would have. Specifically, the design of new plants can be based on recycle of contact cooling waters, recycle of air pollution control scrubber liquor, and use of dry air pollution equipment.

Water conservation and advanced wastewater treatment are demonstrated in the secondary lead subcategory, and they form the technical basis of BAT. Therefore, new source performance standards are equivalent to BAT Alternative B (Option C). Control of particulate matter from kettle smelting has been demonstrated with dry methods, but emissions from blast and reverberatory furnaces may not be controlled with a dry method. Emissions from these latter two furnaces contain varying concentrations of sulfur dioxide which is removed most efficiently with a wet scrubber. Review of the subcategory indicates that no additional flow reduction over and above BAT is achievable with currently demonstrated technology. Activated alumina and reverse osmosis are not demonstrated in this subcategory, and are not clearly transferable to nonferrous metals manufacturing wastewater.

### 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 presented in Table XI-1. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the appropriate achievable treatment concentration by the production normalized wastewater discharge flows (l/kg). These concentrations are listed in Table VII-19 of the General Development Document. New source performance standards are presented in Table XI-2.

Table XI-1

NSPS WASTEWATER DISCHARGE RATES  
FOR THE  
SECONDARY LEAD SUBCATEGORY

<u>Wastewater Stream</u>	<u>NSPS Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Battery Cracking	673	162	kkg of lead scrap produced
Blast and Reverberatory Furnace Wet Air Pollution Control	2,610	626	kkg of lead produced from smelting
Kettle Wet Air Pollution Control	0	0	kkg of lead produced from kettle furnaces
Casting Contact Cooling Water	22	5.3	kkg of lead cast

Table XI-2

## NSPS FOR THE SECONDARY LEAD SUBCATEGORY

Battery Cracking

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0
Total Suspended Solids	10,095.0	8,076.0
pH	Within the range of 7.5 to 10.0 at all times	

Blast and Reverberatory Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	5,037.30	2,244.60
Arsenic	3,627.90	1,487.70
Lead	261.0	234.90
Zinc	2,662.0	1,096.20
Ammonia (as N)	0	0
Total Suspended Solids	39,150.0	31,320.0
pH	Within the range of 7.5 to 10.0 at all times	

Table XI-2 (Continued)

## NSPS FOR THE SECONDARY LEAD SUBCATEGORY

Kettle Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kkg of cast		
English Units - lbs/billion lbs of lead cast		
Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0
Total Suspended Solids	331.50	265.20
pH	Within the range of 7.5 to 10.0 at all times	

## SECONDARY LEAD SUBCATEGORY

### SECTION XII

#### PRETREATMENT STANDARDS

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES), which must be achieved within three years of promulgation. 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 of 1977 requires pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives. Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time that it promulgates NSPS. 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 technology for removal of toxic pollutants.

This section describes the control and treatment technologies for pretreatment of process wastewaters from existing sources and new sources in the secondary lead subcategory. Pretreatment standards for regulated pollutants are presented based on the selected control and treatment technologies.

#### TECHNICAL APPROACH TO PRETREATMENT

Before proposing 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 9415-16 (January 28, 1981).)

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 nor 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 EXISTING AND NEW SOURCES

The treatment technology options for PSES and PSNS are the same as the BAT Options discussed in Section X. It is proposed for PSNS that the kettle furnace air scrubbing waste stream be eliminated through the use of dry air pollution control. A more detailed discussion, including pollutants controlled by each treatment process and achievable treatment concentration for each option, is presented in Section VII of the General Development Document.

Treatment technologies considered for PSES and PSNS:

##### OPTION A

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor

##### OPTION B

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater

##### OPTION C

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration

#### OPTION D

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration
- o Activated alumina adsorption

#### OPTION F

- o Chemical precipitation and sedimentation
- o Dry air pollution control of kettle refining, or alternately, complete recycle of kettle scrubber liquor
- o In-process flow reduction of casting contact cooling water, blast and reverberatory furnace scrubber liquor, and battery cracking wastewater
- o Multimedia filtration
- o Reverse osmosis in conjunction with multiple-effect evaporation for complete recycle of treated water

#### INDUSTRY COST AND POLLUTANT REDUCTION BENEFITS

The industry cost and pollutant reduction benefits of each treatment option were used to determine the most cost-effective option. The methodology applied in calculating pollutant reduction benefits and plant compliance costs is discussed in Section X. Table XII-1 shows the estimated pollutant reduction benefits for indirect dischargers. Compliance costs are presented in Table XII-2.

#### PSES OPTION SELECTION

EPA has selected both Option B and Option C as the basis for alternative PSES for the secondary lead subcategory. This selection follows the rationale used in reflecting the alternative options as the basis for BAT. (Refer to Section X.) The Option B treatment consists of in-process flow reduction, chemical precipitation, and sedimentation. The Option C treatment consists of dry kettle air pollution control, in-process flow reduction, chemical precipitation, sedimentation, and multimedia filtration. This selection flows the rationale used in selected the alternative options as the basis for BAT. (Refer to Section X.)

The proposed PSES Alternative A (Option B) would remove approximately 17,130 kg/yr of toxic metal pollutants over the raw discharge and approximately 11,527 kg/yr of ammonia. The estimated capital cost of proposed Alternative A is \$1.49 million (1978 dollars) and the estimated annual cost is \$0.559 million (1978 dollars). The proposed PSES Alternative B (Option C) would remove approximately 17,290 kg/yr of toxic metal pollutants over raw discharge and approximately 1,527 kg/yr of ammonia. The estimated capital cost Alternative B is \$3.04 million (1978 dollars) and the annual cost is \$1.94 million (1978 dollars).

Activated alumina (Option D) was considered; however, this technology was rejected because it was not demonstrated in this subcategory nor was it clearly transferable to nonferrous wastewater. Reverse osmosis (Option F) was considered for the purpose of achieving zero discharge of process wastewater; however, the Agency ultimately rejected this technology because it was determined that its performance for this specific purpose was not adequately demonstrated in this subcategory nor was it clearly transferable from another subcategory.

#### PSNS OPTION SELECTION

The technology basis for proposed PSNS is identical to NSPS. The PSNS treatment consists of in-process flow reduction, chemical precipitation, sedimentation, and multimedia filtration. The Agency recognizes that new sources have the opportunity to implement more advanced levels of treatment without incurring the costs of retrofitting and the costs of partial or complete shutdown necessary for installation of the new equipment that existing plants should have. Therefore, PSNS will be based on the Option C technology only, rather than considering two alternatives (Options B and C) as in PSES.

EPA knows of no demonstrated technology that provides more efficient pollutant removal than NSPS technology. Activated alumina was considered; however, this technology was rejected because it was not demonstrated in this subcategory nor was it clearly transferable to nonferrous wastewater. No additional flow reduction for new sources is feasible because the only other available flow reduction technology, reverse osmosis (Option F), is not demonstrated in the subcategory nor is it clearly transferable to nonferrous wastewater.

## REGULATED POLLUTANT PARAMETERS

Pollutants and pollutant parameters selected for limitation in accordance with the rationale of Sections VI and X, are identical to those selected for limitation for BAT. EPA is proposing PSES and PSNS for ammonia, antimony, arsenic, lead, and zinc to prevent pass-through. The conventional pollutants are not limited under PSES and PSNS because they are effectively controlled by POTW.

## PRETREATMENT STANDARDS

The PSES and PSNS discharge flows are identical to the BAT discharge flows for all processes. These discharge flows are listed in Table XII-3. The mass of pollutant allowed to be discharged per mass of product is calculated by multiplying the achievable treatment concentration (mg/l) by the normalized wastewater discharge flow (l/kg). The achievable treatment concentrations are presented in Table VII-19 of the General Development Document. Pretreatment standards for existing and new sources, as determined from the above procedure, are shown in Tables XII-4 through XII-6 for each waste stream.

Table XII-1  
TREATMENT PERFORMANCE  
SECONDARY LEAD SUBCATEGORY  
INDIRECT DISCHARGERS

Flow (l/yr)		248.6 x 10 <sup>6</sup>		176.6 x 10 <sup>6</sup>		176.6 x 10 <sup>6</sup>	
<u>Pollutant</u>	<u>Raw Waste kg/yr</u>	<u>Option 1 Removed</u>	<u>Option 1 Discharged</u>	<u>Option 2 Removed</u>	<u>Option 2 Discharged</u>	<u>Option 3 Removed</u>	<u>Option 3 Discharged</u>
		<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>
Antimony	5,062.9	5,050.5	12.4	5,054.1	8.8	5,056.9	6.0
Arsenic	2,424.7	2,298.0	126.8	2,334.7	90.0	2,364.7	60.0
Cadmium	193.0	173.3	19.6	179.0	13.9	184.3	8.7
Chromium	42.6	22.7	19.9	28.5	14.1	30.2	12.4
Copper	285.6	141.4	144.2	183.2	102.4	216.7	68.9
Lead	8,858.6	8,828.7	29.8	8,837.4	21.2	8,844.4	14.1
Nickel	87.1	0.0	87.1	0.0	87.1	48.2	38.8
Silver	19.4	0.0	19.4	1.7	17.7	7.0	12.4
Thallium	69.6	0.0	69.6	0.0	69.6	9.3	60.3
Zinc	568.1	493.5	74.6	515.1	53.0	527.5	40.6
TSS	2,702,901.1	2,699,918.1	2,983.0	2,700,782.3	2,118.8	2,702,442.1	459.1
Ammonia	1,527.3	1,527.3	0.0	1,527.3	0.0	1,527.3	0.0
Total Toxic Metals	17,611.6	17,008.1	603.4	17,133.8	477.8	17,289.5	321.9
Total Conventional	2,702,901.1	2,699,918.1	2,983.0	2,700,782.3	2,118.8	2,702,442.1	459.1
Total Nonconven- tionals	1,527.3	1,527.3	0.0	1,527.3	0.0	1,527.3	0.0
Total Pollutants	2,722,040.0	2,718,453.5	3,586.4	2,719,443.4	2,596.6	2,721,258.9	781.0

Table XII-1 (Continued)

TREATMENT PERFORMANCE  
SECONDARY LEAD SUBCATEGORY  
INDIRECT DISCHARGERS  
(Continued)

Flow (l/yr)	176.6 x 10 <sup>6</sup>		0.0	
	Option 4	Option 4	Option 5	Option 5
<u>Pollutant</u>	<u>Removed</u>	<u>Discharged</u>	<u>Removed</u>	<u>Discharged</u>
	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>	<u>kg/yr</u>
Antimony	5,056.9	6.0	5,062.9	0.0
Arsenic	2,407.1	17.7	2,424.7	0.0
Cadmium	184.3	8.7	193.0	0.0
Chromium	30.2	12.4	42.6	0.0
Copper	216.7	68.9	285.6	0.0
Lead	8,844.4	14.1	8,858.6	0.0
Nickel	48.2	38.8	87.1	0.0
Silver	7.0	12.4	19.4	0.0
Thallium	9.3	60.3	69.6	0.0
Zinc	527.5	40.6	568.1	0.0
TSS	2,702,442.1	459.1	2,702,901.1	0.0
Ammonia	1,527.3	0.0	1,527.3	0.0
Total Toxic Metals	17,331.9	279.9	17,611.6	0.0
Total Conventionals	2,702,442.1	459.1	2,702,901.1	0.0
Total Nonconven- tionals	1,527.3	0.0	1,527.3	0.0
Total Pollutants	2,721,301.3	739.0	2,722,040.0	0.0

NOTE: Total Toxic Metals = Antimony + Arsenic + Cadmium + Chromium + Copper + Lead + Nickel  
+ Silver + Thallium + Zinc

Total Conventionals = TSS

Total Nonconventionals = Ammonia

Total Pollutants = Total Toxics + Total Nonconventionals + Total Conventionals

Option A - Chemical Precipitation and Sedimentation

Option B - Option A plus Flow Reduction

Option C - Option B plus Filtration

Option D - Option C plus Activated Alumina Adsorption

Option F - Option C plus Reverse Osmosis

Table XII-2

COST OF COMPLIANCE FOR THE  
SECONDARY LEAD SUBCATEGORY

<u>Option</u>	Indirect Dischargers	
	<u>Capital Cost</u> <u>(1978 Dollars)</u>	<u>Annual Cost</u> <u>(1978 Dollars)</u>
A	1,240,000	558,000
B	1,485,000	559,000
C	3,037,000	1,944,000
D	3,910,000	2,310,000

Table XII-3

PSES and PSNS WASTEWATER DISCHARGE RATES  
FOR THE  
SECONDARY LEAD SUBCATEGORY

<u>Wastewater Stream</u>	<u>PSES and PSNS Normalized Discharge Rate</u>		<u>Production Normalizing Parameter</u>
	<u>l/kg</u>	<u>gal/ton</u>	
Battery Cracking	673	162	kkg of lead scrap produced
Blast and Reverberatory Furnace Wet Air Pollution Control	2,610	626	kkg of lead produced from smelting
Kettle Wet Air Pollution Control	0	0	kkg of lead produced from kettle furnaces
Casting Contact Cooling Water	22	5.3	kkg of lead cast



Table XII-4

PSES FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION B)

Battery Cracking

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,931.51	854.71
Arsenic	1,406.57	578.78
Lead	100.95	87.49
Zinc	895.09	376.88
Ammonia (as N)	0.0	0.0

Blast and Reverberatory Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	7,490.7	3,314.7
Arsenic	5,454.9	2,244.6
Lead	391.5	339.3
Zinc	3,471.30	1,461.6
Ammonia (as N)	0.0	0.0

Kettle Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-4 (Continued)

PSES FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION B)

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	63.43	28.07
Arsenic	46.19	19.01
Lead	3.32	2.87
Zinc	29.39	12.38
Ammonia (as N)	0.0	0.0

Table XII-5

PSES FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION C)

Battery Cracking

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0

Blast and Reverberatory Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	5,037.30	2,244.60
Arsenic	3,627.90	1,487.70
Lead	261.0	234.90
Zinc	2,662.20	1,096.20
Ammonia (as N)	0.0	0.0

Kettle Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-5 (Continued)

PSES FOR THE SECONDARY LEAD SUBCATEGORY  
(BASED ON OPTION C)

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0

Table XII-6

## PSNS FOR THE SECONDARY LEAD SUBCATEGORY

Battery Cracking

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Antimony	1,298.89	578.78
Arsenic	935.47	383.61
Lead	67.30	60.57
Zinc	686.46	282.66
Ammonia (as N)	0.0	0.0

Blast and Reverberatory Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Antimony	5,037.30	2,244.60
Arsenic	3,627.9	1,487.7
Lead	261.0	234.9
Zinc	2,662.2	1,096.2
Ammonia (as N)	0	0

Kettle Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Antimony	0	0
Arsenic	0	0
Lead	0	0
Zinc	0	0
Ammonia (as N)	0	0

Table XII-6 (Continued)

PSNS FOR THE SECONDARY LEAD SUBCATEGORY

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Antimony	42.65	19.01
Arsenic	30.72	12.60
Lead	2.21	1.99
Zinc	22.54	9.28
Ammonia (as N)	0.0	0.0

## SECONDARY LEAD SUBCATEGORY

### Section XIII

#### Best Conventional Pollutant Control Technology

The 1977 amendments to the Clean Water Act added Section 301(b)(2)(E), establishing "best conventional pollutant control technology" (BCT) for discharge of conventional pollutants from existing industrial point sources. Biochemical oxygen-demanding pollutants (BOD<sub>5</sub>), total suspended solids (TSS), fecal coliform, oil and grease (O&G), and pH have been designated as conventional pollutants (see 44 FR 44501).

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. In addition to the other factors specified in Section 304(b)(4)(B), the Act requires that limitations for conventional pollutants be assessed in light of a two-part cost-reasonableness test. On October 29, 1982, the Agency proposed a revised methodology for carrying out BCT analyses (47 FR 49176). The purpose of the proposal was to correct errors in the BCT methodology originally established in 1977.

Part 1 of the proposed BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be compared with the cost and level of reduction to remove the same type of pollutants by publicly-owned treatment works (POTW). The POTW comparison figure has been calculated by evaluating the change in costs and removals between secondary treatment (30 mg/l BOD and 30 mg/l TSS) and advanced secondary treatment (10 mg/l BOD and 10 mg/l TSS). The difference in cost is divided by the difference in pounds of conventional pollutants removed, resulting in an estimate of the "dollars per pound" of pollutant removed, that is used as a benchmark value. The proposed POTW test benchmark is \$0.30 per pound (1978 dollars).

Part 2 of the BCT test requires that the cost and level of reduction of conventional pollutants by industrial dischargers be evaluated internally to the industry. In order to develop a benchmark that assesses a reasonable relationship between cost and removal, EPA has developed an industry cost ratio which compares the dollar per pound of conventional pollutant removed in going from primary to secondary treatment levels with that of going from secondary to more advanced treatment levels. The basis of costs for the calculation of this ratio are the costs incurred by a POTW. EPA used these costs because: they reflect the treatment technologies most commonly used to remove conventional pollutants from wastewater; the treatment levels associated with them compare readily to the levels considered for industrial dischargers; and the costs are the most reliable for the treatment levels under consideration. The proposed industry

subcategory benchmark is 1.42. If the industry figure for a subcategory is lower than 1.43, the subcategory passes the BCT test.

The Agency usually considers two conventional pollutants in the cost test, TSS and an oxygen-demanding pollutant. Although both oil and grease and BOD<sub>5</sub> are considered to be oxygen-demanding substances by EPA (see 44 FR 50733), only one can be selected in the cost analysis to conform to procedures used to develop POTW costs. Oil and grease is used rather than BOD<sub>5</sub> in the cost analysis performed for nonferrous metals manufacturing waste streams due to the common use of oils in casting operations in this industry.

BPT is the base for evaluating limitations on conventional pollutants (i.e., it is assumed that BPT is already in place). The test evaluates the cost and removals associated with treatment and controls in addition to that specified as BPT.

If the conventional pollutant removal cost of the candidate BCT is less than the POTW cost, Part 1 of the cost-reasonableness test is passed and Part 2 (the internal industry test) of the cost-reasonableness test must be performed. If the internal industry test is passed, then a BCT limitation is promulgated equivalent to the candidate BCT level. If all candidate BCT technologies fail both parts of the cost-reasonableness test, the BCT requirements for conventional pollutants are equal to BPT.

The BCT test was performed for the proposed BAT basis of lime precipitation, sedimentation, in-process flow reduction, and multimedia filtration. The secondary lead subcategory failed Part 1 of the test with a calculated cost of \$179.94 per pound (1978 dollars) of removal of conventional pollutants using BAT technology. The intermediate flow reduction option was also examined, but it too failed with a cost of \$15.34 per pound (1978 dollars) of conventional removal.



Table XIII-1

## BCT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY

Battery Cracking

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead scrap produced		
English Units - lbs/billion lbs of lead scrap produced		
Total Suspended Solids	38,540.0	18,800.0
pH	Within the range of 7.5 to 10.0 at all times	

Blast and Reverberatory Furnace Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from smelting		
English Units - lbs/billion lbs of lead produced from smelting		
Total Suspended Solids	138,580.0	67,600.0
pH	Within the range of 7.5 to 10.0 at all times	

Kettle Wet Air Pollution Control

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead produced from kettle furnaces		
English Units - lbs/billion lbs of lead produced from kettle furnaces		
Total Suspended Solids	0	0
pH	Within the range of 7.5 to 10.0 at all times	

Table XIII-1 (Continued)

BCT EFFLUENT LIMITATIONS FOR THE SECONDARY LEAD SUBCATEGORY

Casting Contact Cooling

<u>Pollutant or Pollutant Property</u>	<u>Maximum for Any One Day</u>	<u>Maximum for Monthly Average</u>
Metric Units - mg/kg of lead cast		
English Units - lbs/billion lbs of lead cast		
Total Suspended Solids	9,069.20	4,424.0
pH	Within the range of 7.5 to 10.0 at all times	