United States
Environmental Protection
Agency

Effluent Guidelines Division
WH-552
Washington DC 20460

EPA-440/1-84-019-B 02/84

Water and Waste Management

Development Document for Effluent Limitations Guidelines and Standards for the Nonferrous Metals Forming and Iron and Steel, Copper Forming, Aluminum Metal Powder Production and Powder Metallurgy

Proposed

Point Source Category

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST
CHICAGO, ILLINOIS 60604

APR 1 - 1984

REPLY TO ATTENTION OF
5WQP-11

Re: Proposed Development Document on Effluent Guidelines for the Nonferrous Metals Forming and Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy Industrial Category (EPA 440/1-84/019-B)

To: See Below

Enclosed for your information and use is a copy of the proposed Development Document published by the U.S. EPA Effluent Guidelines Division for the Nonferrous Metals Forming and Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy industrial category. If you have any questions, please call Lorraine Kosik at (312) 886-6108.

Sincerely,

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DEVELOPMENT DOCUMENT
for
EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS
for the
NONFERROUS METALS FORMING AND IRON AND STEEL/ COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY POINT SOURCE CATEGORY

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(q) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	970	430
120	COPPER	5,400	2,800
121	CYANIDE	820	340
126	SILVER	1,200	480
	OIL & GREASE	57,000	34,000
	TOTAL SUSPENDED SOLIDS	120,000	55,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned			
118	CADMIUM	1.20	.60
120	COPPER	7.00	3.70
121	CYANIDE	1.10	.40
126	SILVER	1.50	.60
	OIL & GREASE	73.00	44.00
	TOTAL SUSPENDED SOLIDS	150.00	72.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(s) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals alkaline cleaned		
118	CADMIUM	2,400	1,000
120	COPPER	13,000	6,900
121	CYANIDE	2,000	830
126	SILVER	2,800	1,200
	OIL & GREASE	140,000	83,000
	TOTAL SUSPENDED SOLIDS	280,000	130,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Pre-Bonding Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metal and base metal cleaned prior to bonding		
118	CADMIUM	1,200	510
120	COPPER	6,500	3,400
121	CYANIDE	990	410
126	SILVER	1,400	580
	OIL & GREASE	68,000	41,000
	TOTAL SUSPENDED SOLIDS	140,000	66,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals tumbled		
118 CADMIUM	390	170
120 COPPER	2,200	1,200
121 CYANIDE	330	140
126 SILVER	470	200
OIL & GREASE	23,000	14,000
TOTAL SUSPENDED SOLIDS	47,000	22,000
pH	Within the range of 7.5 to 10.0 at all times.	

(v) Burnishing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals burnished		
118 CADMIUM	8,700	3,900
120 COPPER	49,000	26,000
121 CYANIDE	7,500	3,100
126 SILVER	11,000	4,400
OIL & GREASE	510,000	310,000
TOTAL SUSPENDED SOLIDS	1,100,000	500,000
pH	Within the range of 7.5 to 10.0 at all times.	

(w) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals sawed or ground		
118	CADMIUM	2.10	.90
120	COPPER	11.00	6.10
121	CYANIDE	1.80	.70
126	SILVER	2.50	1.00
	OIL & GREASE	120.00	73.00
	TOTAL SUSPENDED SOLIDS	250.00	120.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART F. BPT MASS LIMITATIONS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals rolled with emulsions		
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,500	1,100
	FLUORIDE	71,000	32,000
	MOLYBDENUM	2,500	1,100
	TANTALUM	2,500	1,100
	TUNGSTEN	2,500	1,100
	VANADIUM	2,500	1,100
	OIL & GREASE	24,000	14,000
	TOTAL SUSPENDED SOLIDS	49,000	23,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded refractory metals heat treated		
120	COPPER	6,600	3,500
124	NICKEL	6,600	4,400
	COLUMBIUM	7,100	3,100
	FLUORIDE	210,000	91,000
	MOLYBDENUM	7,100	3,100
	TANTALUM	7,100	3,100
	TUNGSTEN	7,100	3,100
	VANADIUM	7,100	3,100
	OIL & GREASE	69,000	42,000
	TOTAL SUSPENDED SOLIDS	140,000	67,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded		
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,400	1,100
	FLUORIDE	71,000	31,000
	MOLYBDENUM	2,400	1,100
	TANTALUM	2,400	1,100
	TUNGSTEN	2,400	1,100
	VANADIUM	2,400	1,100
	OIL & GREASE	24,000	14,000
	TOTAL SUSPENDED SOLIDS	49,000	23,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(g) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged refractory metals heat treated		
120	COPPER	11,000	5,800
124	NICKEL	11,000	7,400
	COLUMBIUM	12,000	5,300
	FLUORIDE	340,000	150,000
	MOLYBDENUM	12,000	5,300
	TANTALUM	12,000	5,300
	TUNGSTEN	12,000	5,300
	VANADIUM	12,000	5,300
	OIL & GREASE	120,000	69,000
	TOTAL SUSPENDED SOLIDS	240,000	110,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Extrusion And Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded or forged		
120	COPPER	790	420
124	NICKEL	800	530
	COLUMBIUM	850	380
	FLUORIDE	25,000	11,000
	MOLYBDENUM	850	380
	TANTALUM	850	380
	TUNGSTEN	850	380
	VANADIUM	850	380
	OIL & GREASE	8,300	5,000
	TOTAL SUSPENDED SOLIDS	17,000	8,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Metal Powder Production Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals powder produced		
120	COPPER	3,100	1,600
124	NICKEL	3,100	2,100
	COLUMBIUM	3,400	1,500
	FLUORIDE	98,000	43,000
	MOLYBDENUM	3,400	1,500
	TANTALUM	3,400	1,500
	TUNGSTEN	3,400	1,500
	VANADIUM	3,400	1,500
	OIL & GREASE	33,000	20,000
	TOTAL SUSPENDED SOLIDS	67,000	32,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Metal Powder Production Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(k) Metal Powder Pressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(l) Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(m) Post-Casting Billet Washwater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of cast refractory metals billet washed		
120	COPPER	57	30
124	NICKEL	57	38
	COLUMBIUM	61	27
	FLUORIDE	1,800	790
	MOLYBDENUM	61	27
	TANTALUM	61	27
	TUNGSTEN	61	27
	VANADIUM	61	27
	OIL & GREASE	600	360
	TOTAL SUSPENDED SOLIDS	1,200	580
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	24	13
124	NICKEL	24	16
	COLUMBIUM	26	12
	FLUORIDE	760	340
	MOLYBDENUM	26	12
	TANTALUM	26	12
	TUNGSTEN	26	12
	VANADIUM	26	12
	OIL & GREASE	250	150
	TOTAL SUSPENDED SOLIDS	520	250
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	230,000	120,000
124	NICKEL	230,000	150,000
	COLUMBIUM	250,000	110,000
	FLUORIDE	7,200,000	3,200,000
	MOLYBDENUM	250,000	110,000
	TANTALUM	250,000	110,000
	TUNGSTEN	250,000	110,000
	VANADIUM	250,000	110,000
	OIL & GREASE	2,400,000	1,500,000
	TOTAL SUSPENDED SOLIDS	5,000,000	2,400,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(p) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	22,000	12,000
124	NICKEL	23,000	15,000
	COLUMBIUM	24,000	11,000
	FLUORIDE	700,000	310,000
	MOLYBDENUM	24,000	11,000
	TANTALUM	24,000	11,000
	TUNGSTEN	24,000	11,000
	VANADIUM	24,000	11,000
	OIL & GREASE	240,000	140,000
	TOTAL SUSPENDED SOLIDS	480,000	230,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(q) Surface Coating Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface coated		
120	COPPER	2,100	1,100
124	NICKEL	2,100	1,400
	COLUMBIUM	2,200	980
	FLUORIDE	64,000	29,000
	MOLYBDENUM	2,200	980
	TANTALUM	2,200	980
	TUNGSTEN	2,200	980
	VANADIUM	2,200	980
	OIL & GREASE	22,000	13,000
	TOTAL SUSPENDED SOLIDS	44,000	21,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	58	31
124	NICKEL	59	39
	COLUMBIUM	63	28
	FLUORIDE	1,800	810
	MOLYBDENUM	63	28
	TANTALUM	63	28
	TUNGSTEN	63	28
	VANADIUM	63	28
	OIL & GREASE	610	370
	TOTAL SUSPENDED SOLIDS	1,300	600
	pH	Within the range of 7.5 to 10.0 at all times.	

(a) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	270,000	140,000
124	NICKEL	270,000	180,000
	COLUMBIUM	290,000	130,000
	FLUORIDE	8,300,000	3,700,000
	MOLYBDENUM	290,000	130,000
	TANTALUM	290,000	130,000
	TUNGSTEN	290,000	130,000
	VANADIUM	290,000	130,000
	OIL & GREASE	2,800,000	1,700,000
	TOTAL SUSPENDED SOLIDS	5,700,000	2,700,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Molten Salt Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals cleaned with molten salt		
120	COPPER	170,000	90,000
124	NICKEL	170,000	110,000
	COLUMBIUM	180,000	82,000
	FLUORIDE	5,400,000	2,400,000
	MOLYBDENUM	180,000	82,000
	TANTALUM	180,000	82,000
	TUNGSTEN	180,000	82,000
	VANADIUM	180,000	82,000
	OIL & GREASE	1,800,000	1,100,000
	TOTAL SUSPENDED SOLIDS	3,700,000	1,800,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling/Burnishing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals tumbled or burnished		
120	COPPER	42,000	22,000
124	NICKEL	42,000	28,000
	COLUMBIUM	45,000	20,000
	FLUORIDE	1,300,000	580,000
	MOLYBDENUM	45,000	20,000
	TANTALUM	45,000	20,000
	TUNGSTEN	45,000	20,000
	VANADIUM	45,000	20,000
	OIL & GREASE	440,000	270,000
	TOTAL SUSPENDED SOLIDS	910,000	430,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(v) Sawing/Grinding Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(w) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with emulsions		
120	COPPER	410	220
124	NICKEL	420	280
	COLUMBIUM	440	200
	FLUORIDE	13,000	5,700
	MOLYBDENUM	440	200
	TANTALUM	440	200
	TUNGSTEN	440	200
	VANADIUM	440	200
	OIL & GREASE	4,300	2,600
	TOTAL SUSPENDED SOLIDS	8,900	4,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Sawing/Grinding Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with lubricant-coolant water		
120	COPPER	1,500	810
124	NICKEL	1,600	1,000
	COLUMBIUM	1,700	740
	FLUORIDE	48,000	21,000
	MOLYBDENUM	1,700	740
	TANTALUM	1,700	740
	TUNGSTEN	1,700	740
	VANADIUM	1,700	740
	OIL & GREASE	16,000	9,700
	TOTAL SUSPENDED SOLIDS	33,000	16,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(y) Sawing/Grinding Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground		
120	COPPER	2,100	1,100
124	NICKEL	2,100	1,400
	COLUMBIUM	2,200	980
	FLUORIDE	64,000	29,000
	MOLYBDENUM	2,200	980
	TANTALUM	2,200	980
	TUNGSTEN	2,200	980
	VANADIUM	2,200	980
	OIL & GREASE	22,000	13,000
	TOTAL SUSPENDED SOLIDS	44,000	21,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(z) Post Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground refractory metals rinsed		
120	COPPER	970	510
124	NICKEL	980	650
	COLUMBIUM	1,100	470
	FLUORIDE	31,000	14,000
	MOLYBDENUM	1,100	470
	TANTALUM	1,100	470
	TUNGSTEN	1,100	470
	VANADIUM	1,100	470
	OIL & GREASE	10,000	6,200
	TOTAL SUSPENDED SOLIDS	21,000	10,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(aa) Product Testing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals product tested		
120	COPPER	150	78
124	NICKEL	150	99
	COLUMBIUM	160	71
	FLUORIDE	4,600	2,000
	MOLYBDENUM	160	71
	TANTALUM	160	71
	TUNGSTEN	160	71
	VANADIUM	160	71
	OIL & GREASE	1,600	930
	TOTAL SUSPENDED SOLIDS	3,200	1,500
	pH	Within the range of 7.5 to 10.0 at all times.	

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART G. BPT MASS LIMITATIONS FOR THE TITANIUM FORMING SUBCATEGORY

(a) Cold Rolling Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium cold rolled		
121	CYANIDE	970	400
122	LEAD	1,400	670
128	ZINC	4,900	2,000
	AMMONIA	450,000	200,000
	FLUORIDE	200,000	88,000
	TITANIUM	6,800	3,000
	OIL & GREASE	67,000	40,000
	TOTAL SUSPENDED SOLIDS	140,000	65,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Hot Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium hot rolled with contact lubricant-coolant water		
121	CYANIDE	1,200	520
122	LEAD	1,800	860
128	ZINC	6,300	2,600
	AMMONIA	570,000	250,000
	FLUORIDE	260,000	110,000
	TITANIUM	8,800	3,900
	OIL & GREASE	86,000	52,000
	TOTAL SUSPENDED SOLIDS	180,000	84,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium extruded		
121	CYANIDE	79	33
122	LEAD	120	55
128	ZINC	400	170
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,200
	TITANIUM	560	250
	OIL & GREASE	5,500	3,300
	TOTAL SUSPENDED SOLIDS	11,000	5,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Die Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	870	360
122	LEAD	1,300	600
128	ZINC	4,400	1,800
	AMMONIA	400,000	180,000
	FLUORIDE	180,000	79,000
	TITANIUM	6,200	2,700
	OIL & GREASE	60,000	36,000
	TOTAL SUSPENDED SOLIDS	120,000	59,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	590	240
122	LEAD	850	400
128	ZINC	2,900	1,200
	AMMONIA	270,000	120,000
	FLUORIDE	120,000	53,000
	TITANIUM	4,100	1,800
	OIL & GREASE	40,000	24,000
	TOTAL SUSPENDED SOLIDS	83,000	39,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium heat treated		
121	CYANIDE	1,300	540
122	LEAD	1,900	900
128	ZINC	6,600	2,800
	AMMONIA	600,000	260,000
	FLUORIDE	270,000	120,000
	TITANIUM	9,200	4,100
	OIL & GREASE	90,000	54,000
	TOTAL SUSPENDED SOLIDS	180,000	88,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	46	19
122	LEAD	67	32
128	ZINC	230	98
	AMMONIA	21,000	9,400
	FLUORIDE	9,500	4,200
	TITANIUM	330	150
	OIL & GREASE	3,200	1,900
	TOTAL SUSPENDED SOLIDS	6,600	3,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	6,100	2,500
122	LEAD	8,900	4,200
128	ZINC	31,000	13,000
	AMMONIA	2,800,000	1,200,000
	FLUORIDE	1,300,000	560,000
	TITANIUM	43,000	19,000
	OIL & GREASE	420,000	250,000
	TOTAL SUSPENDED SOLIDS	870,000	410,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	49	20
122	LEAD	71	34
128	ZINC	250	100
	AMMONIA	23,000	10,000
	FLUORIDE	10,000	4,500
	TITANIUM	350	150
	OIL & GREASE	3,400	2,000
	TOTAL SUSPENDED SOLIDS	7,000	3,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
121	CYANIDE	740	310
122	LEAD	1,100	510
128	ZINC	3,700	1,600
	AMMONIA	340,000	150,000
	FLUORIDE	150,000	67,000
	TITANIUM	5,200	2,300
	OIL & GREASE	51,000	31,000
	TOTAL SUSPENDED SOLIDS	100,000	50,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
121	CYANIDE	800	330
122	LEAD	1,200	550
128	ZINC	4,000	1,700
	AMMONIA	370,000	160,000
	FLUORIDE	160,000	73,000
	TITANIUM	5,700	2,500
	OIL & GREASE	55,000	33,000
	TOTAL SUSPENDED SOLIDS	110,000	54,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Tumbling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium tumbled		
121	CYANIDE	230	95
122	LEAD	330	160
128	ZINC	1,200	480
	AMMONIA	110,000	46,000
	FLUORIDE	47,000	21,000
	TITANIUM	1,600	720
	OIL & GREASE	16,000	9,500
	TOTAL SUSPENDED SOLIDS	32,000	15,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Sawing/Grinding Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium sawed or ground		
121	CYANIDE	14.0	6.0
122	LEAD	21.0	10.0
128	ZINC	73.0	30.0
	AMMONIA	6,600.0	2,900.0
	FLUORIDE	3,000.0	1,300.0
	TITANIUM	100.0	45.0
	OIL & GREASE	990.0	600.0
	TOTAL SUSPENDED SOLIDS	2,000.0	970.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART H. BPT MASS LIMITATIONS FOR THE URANIUM FORMING SUBCATEGORY

(a) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Tool Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium extruded		
118	CADMIUM	180	78
120	COPPER	980	520
124	NICKEL	990	660
	FLUORIDE	31,000	14,000
	RADIUM	(1)	(1)
	URANIUM	1,100	470
	OIL & GREASE	10,000	6,200
	TOTAL SUSPENDED SOLIDS	21,000	10,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(c) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded uranium heat treated		
118	CADMIUM	920	410
120	COPPER	5,200	2,700
124	NICKEL	5,200	3,500
	FLUORIDE	160,000	72,000
	RADIUM	(1)	(1)
	URANIUM	5,600	2,500
	OIL & GREASE	54,000	33,000
	TOTAL SUSPENDED SOLIDS	110,000	53,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged uranium heat treated		
118	CADMIUM	970	430
120	COPPER	5,400	2,800
124	NICKEL	5,500	3,600
	FLUORIDE	170,000	75,000
	RADIUM	(1)	(1)
	URANIUM	5,800	2,600
	OIL & GREASE	57,000	34,000
	TOTAL SUSPENDED SOLIDS	120,000	55,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(f) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	12.0	5.3
120	COPPER	68.0	36.0
124	NICKEL	68.0	45.0
	FLUORIDE	2,100.0	940.0
	RADIUM	(1)	(1)
	URANIUM	73.0	32.0
	OIL & GREASE	710.0	430.0
	TOTAL SUSPENDED SOLIDS	1,500.0	690.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(g) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	500	220
120	COPPER	2,800	1,500
124	NICKEL	2,800	1,900
	FLUORIDE	88,000	39,000
	RADIUM	(1)	(1)
	URANIUM	3,000	1,300
	OIL & GREASE	30,000	18,000
	TOTAL SUSPENDED SOLIDS	61,000	29,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(h) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	25	11
120	COPPER	140	74
124	NICKEL	140	94
	FLUORIDE	4,400	2,000
	RADIUM	(1)	(1)
	URANIUM	150	68
	OIL & GREASE	1,500	890
	TOTAL SUSPENDED SOLIDS	3,000	1,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(i) Sawing/Grinding Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium sawed or ground			
118	CADMIUM	1.10	.50
120	COPPER	5.90	3.10
124	NICKEL	6.00	3.90
	FLUORIDE	180.00	82.00
	RADIUM	(1)	(1)
	URANIUM	6.40	2.80
	OIL & GREASE	62.00	37.00
	TOTAL SUSPENDED SOLIDS	130.00	60.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(j) Post-Sawing/Grinding Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of sawed or ground uranium rinsed			
118	CADMIUM	13.0	5.7
120	COPPER	72.0	38.0
124	NICKEL	73.0	48.0
	FLUORIDE	2,300.0	1,000.0
	RADIUM	(1)	(1)
	URANIUM	78.0	35.0
	OIL & GREASE	760.0	460.0
	TOTAL SUSPENDED SOLIDS	1,600.0	740.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART I. BPT MASS LIMITATIONS FOR THE ZINC FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc rolled with emulsions		
119	CHROMIUM	.60	.30
121	CYANIDE	.40	.20
128	ZINC	2.00	.80
	OIL & GREASE	28.00	17.00
	TOTAL SUSPENDED SOLIDS	57.00	27.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc rolled with contact lubricant-coolant water		
119	CHROMIUM	150	62
121	CYANIDE	100	42
128	ZINC	510	210
	OIL & GREASE	6,900	4,200
	TOTAL SUSPENDED SOLIDS	14,000	6,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Drawing Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc drawn with emulsions		
119	CHROMIUM	3.5	1.4
121	CYANIDE	2.3	1.0
128	ZINC	12.0	4.9
	OIL & GREASE	160.0	96.0
	TOTAL SUSPENDED SOLIDS	330.0	160.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Direct Chill Casting Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc cast by the direct chill method		
119	CHROMIUM	220	91
121	CYANIDE	150	60
128	ZINC	730	310
	OIL & GREASE	10,000	6,000
	TOTAL SUSPENDED SOLIDS	21,000	9,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Stationary Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Heat Treatment Contact Colling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc heat treated		
119 CHROMIUM	330	140
121 CYANIDE	220	91
128 ZINC	1,100	460
OIL & GREASE	15,000	9,100
TOTAL SUSPENDED SOLIDS	31,000	15,000
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc surface treated		
119 CHROMIUM	4.2	1.7
121 CYANIDE	2.8	1.1
128 ZINC	14.0	5.8
OIL & GREASE	190.0	110.0
TOTAL SUSPENDED SOLIDS	390.0	190.0
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc surface treated		
119 CHROMIUM	2,100	870
121 CYANIDE	1,400	580
128 ZINC	7,100	3,000
OIL & GREASE	97,000	58,000
TOTAL SUSPENDED SOLIDS	200,000	95,000
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned			
119	CHROMIUM	.30	.10
121	CYANIDE	.20	.10
128	ZINC	1.00	.40
	OIL & GREASE	14.00	8.60
	TOTAL SUSPENDED SOLIDS	29.00	14.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned			
119	CHROMIUM	2,500	1,000
121	CYANIDE	1,700	690
128	ZINC	8,400	3,500
	OIL & GREASE	110,000	69,000
	TOTAL SUSPENDED SOLIDS	230,000	110,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc sawed or ground			
119	CHROMIUM	24.0	10.0
121	CYANIDE	16.0	6.6
128	ZINC	80.0	33.0
	OIL & GREASE	1,100.0	660.0
	TOTAL SUSPENDED SOLIDS	2,300.0	1,100.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART J. BPT MASS LIMITATIONS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

(a) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded with emulsions		
119	CHROMIUM	33.0	13.0
121	CYANIDE	21.0	8.9
124	NICKEL	140.0	94.0
	AMMONIA	9,900.0	4,300.0
	FLUORIDE	4,400.0	2,000.0
	HAFNIUM	150.0	67.0
	ZIRCONIUM	150.0	67.0
	OIL & GREASE	1,500.0	890.0
	TOTAL SUSPENDED SOLIDS	3,000.0	1,400.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded		
119	CHROMIUM	160	67
121	CYANIDE	110	44
124	NICKEL	710	470
	AMMONIA	49,000	22,000
	FLUORIDE	22,000	9,800
	HAFNIUM	760	340
	ZIRCONIUM	760	340
	OIL & GREASE	7,400	4,400
	TOTAL SUSPENDED SOLIDS	15,000	7,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded zirconium/hafnium heat treated		
119	CHROMIUM	130	51
121	CYANIDE	83	34
124	NICKEL	550	360
	AMMONIA	38,000	17,000
	FLUORIDE	17,000	7,500
	HAFNIUM	580	260
	ZIRCONIUM	580	260
	OIL & GREASE	5,700	3,400
	TOTAL SUSPENDED SOLIDS	12,000	5,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged zirconium/hafnium heat treated		
119	CHROMIUM	15.0	6.3
121	CYANIDE	10.0	4.2
124	NICKEL	67.0	44.0
	AMMONIA	4,700.0	2,000.0
	FLUORIDE	2,100.0	920.0
	HAFNIUM	72.0	32.0
	ZIRCONIUM	72.0	32.0
	OIL & GREASE	700.0	420.0
	TOTAL SUSPENDED SOLIDS	1,400.0	680.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium rolled with emulsions		
119	CHROMIUM	180	72
121	CYANIDE	120	48
124	NICKEL	770	510
	AMMONIA	53,000	23,000
	FLUORIDE	24,000	11,000
	HAFNIUM	820	360
	ZIRCONIUM	820	360
	OIL & GREASE	8,000	4,800
	TOTAL SUSPENDED SOLIDS	16,000	7,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(q) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	970	430
120	COPPER	5,400	2,800
121	CYANIDE	820	340
126	SILVER	1,200	480
	OIL & GREASE	57,000	34,000
	TOTAL SUSPENDED SOLIDS	120,000	55,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned			
118	CADMIUM	1.20	.60
120	COPPER	7.00	3.70
121	CYANIDE	1.10	.40
126	SILVER	1.50	.60
	OIL & GREASE	73.00	44.00
	TOTAL SUSPENDED SOLIDS	150.00	72.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(s) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals alkaline cleaned		
118	CADMIUM	2,400	1,000
120	COPPER	13,000	6,900
121	CYANIDE	2,000	830
126	SILVER	2,800	1,200
	OIL & GREASE	140,000	83,000
	TOTAL SUSPENDED SOLIDS	280,000	130,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Pre-Bonding Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metal and base metal cleaned prior to bonding		
118	CADMIUM	1,200	510
120	COPPER	6,500	3,400
121	CYANIDE	990	410
126	SILVER	1,400	580
	OIL & GREASE	68,000	41,000
	TOTAL SUSPENDED SOLIDS	140,000	66,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals tumbled		
118 CADMIUM	390	170
120 COPPER	2,200	1,200
121 CYANIDE	330	140
126 SILVER	470	200
OIL & GREASE	23,000	14,000
TOTAL SUSPENDED SOLIDS	47,000	22,000
pH	Within the range of 7.5 to 10.0 at all times.	

(v) Burnishing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals burnished		
118 CADMIUM	8,700	3,900
120 COPPER	49,000	26,000
121 CYANIDE	7,500	3,100
126 SILVER	11,000	4,400
OIL & GREASE	510,000	310,000
TOTAL SUSPENDED SOLIDS	1,100,000	500,000
pH	Within the range of 7.5 to 10.0 at all times.	

(w) Sawing/Grinding Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals sawed or ground			
118	CADMIUM	2.10	.90
120	COPPER	11.00	6.10
121	CYANIDE	1.80	.70
126	SILVER	2.50	1.00
	OIL & GREASE	120.00	73.00
	TOTAL SUSPENDED SOLIDS	250.00	120.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART F. BPT MASS LIMITATIONS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of refractory metals rolled with emulsions			
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,500	1,100
	FLUORIDE	71,000	32,000
	MOLYBDENUM	2,500	1,100
	TANTALUM	2,500	1,100
	TUNGSTEN	2,500	1,100
	VANADIUM	2,500	1,100
	OIL & GREASE	24,000	14,000
	TOTAL SUSPENDED SOLIDS	49,000	23,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded refractory metals heat treated		
120	COPPER	6,600	3,500
124	NICKEL	6,600	4,400
	COLUMBIUM	7,100	3,100
	FLUORIDE	210,000	91,000
	MOLYBDENUM	7,100	3,100
	TANTALUM	7,100	3,100
	TUNGSTEN	7,100	3,100
	VANADIUM	7,100	3,100
	OIL & GREASE	69,000	42,000
	TOTAL SUSPENDED SOLIDS	140,000	67,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded		
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,400	1,100
	FLUORIDE	71,000	31,000
	MOLYBDENUM	2,400	1,100
	TANTALUM	2,400	1,100
	TUNGSTEN	2,400	1,100
	VANADIUM	2,400	1,100
	OIL & GREASE	24,000	14,000
	TOTAL SUSPENDED SOLIDS	49,000	23,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(g) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged refractory metals heat treated		
120	COPPER	11,000	5,800
124	NICKEL	11,000	7,400
	COLUMBIUM	12,000	5,300
	FLUORIDE	340,000	150,000
	MOLYBDENUM	12,000	5,300
	TANTALUM	12,000	5,300
	TUNGSTEN	12,000	5,300
	VANADIUM	12,000	5,300
	OIL & GREASE	120,000	69,000
	TOTAL SUSPENDED SOLIDS	240,000	110,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Extrusion And Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded or forged		
120	COPPER	790	420
124	NICKEL	800	530
	COLUMBIUM	850	380
	FLUORIDE	25,000	11,000
	MOLYBDENUM	850	380
	TANTALUM	850	380
	TUNGSTEN	850	380
	VANADIUM	850	380
	OIL & GREASE	8,300	5,000
	TOTAL SUSPENDED SOLIDS	17,000	8,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Metal Powder Production Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals powder produced		
120	COPPER	3,100	1,600
124	NICKEL	3,100	2,100
	COLUMBIUM	3,400	1,500
	FLUORIDE	98,000	43,000
	MOLYBDENUM	3,400	1,500
	TANTALUM	3,400	1,500
	TUNGSTEN	3,400	1,500
	VANADIUM	3,400	1,500
	OIL & GREASE	33,000	20,000
	TOTAL SUSPENDED SOLIDS	67,000	32,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Metal Powder Production Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(k) Metal Powder Pressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(l) Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(m) Post-Casting Billet Washwater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of cast refractory metals billet washed		
120	COPPER	57	30
124	NICKEL	57	38
	COLUMBIUM	61	27
	FLUORIDE	1,800	790
	MOLYBDENUM	61	27
	TANTALUM	61	27
	TUNGSTEN	61	27
	VANADIUM	61	27
	OIL & GREASE	600	360
	TOTAL SUSPENDED SOLIDS	1,200	580
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	24	13
124	NICKEL	24	16
	COLUMBIUM	26	12
	FLUORIDE	760	340
	MOLYBDENUM	26	12
	TANTALUM	26	12
	TUNGSTEN	26	12
	VANADIUM	26	12
	OIL & GREASE	250	150
	TOTAL SUSPENDED SOLIDS	520	250
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	230,000	120,000
124	NICKEL	230,000	150,000
	COLUMBIUM	250,000	110,000
	FLUORIDE	7,200,000	3,200,000
	MOLYBDENUM	250,000	110,000
	TANTALUM	250,000	110,000
	TUNGSTEN	250,000	110,000
	VANADIUM	250,000	110,000
	OIL & GREASE	2,400,000	1,500,000
	TOTAL SUSPENDED SOLIDS	5,000,000	2,400,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(p) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	22,000	12,000
124	NICKEL	23,000	15,000
	COLUMBIUM	24,000	11,000
	FLUORIDE	700,000	310,000
	MOLYBDENUM	24,000	11,000
	TANTALUM	24,000	11,000
	TUNGSTEN	24,000	11,000
	VANADIUM	24,000	11,000
	OIL & GREASE	240,000	140,000
	TOTAL SUSPENDED SOLIDS	480,000	230,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(q) Surface Coating Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface coated		
120	COPPER	2,100	1,100
124	NICKEL	2,100	1,400
	COLUMBIUM	2,200	980
	FLUORIDE	64,000	29,000
	MOLYBDENUM	2,200	980
	TANTALUM	2,200	980
	TUNGSTEN	2,200	980
	VANADIUM	2,200	980
	OIL & GREASE	22,000	13,000
	TOTAL SUSPENDED SOLIDS	44,000	21,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	58	31
124	NICKEL	59	39
	COLUMBIUM	63	28
	FLUORIDE	1,800	810
	MOLYBDENUM	63	28
	TANTALUM	63	28
	TUNGSTEN	63	28
	VANADIUM	63	28
	OIL & GREASE	610	370
	TOTAL SUSPENDED SOLIDS	1,300	600
	pH	Within the range of 7.5 to 10.0 at all times.	

(a) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	270,000	140,000
124	NICKEL	270,000	180,000
	COLUMBIUM	290,000	130,000
	FLUORIDE	8,300,000	3,700,000
	MOLYBDENUM	290,000	130,000
	TANTALUM	290,000	130,000
	TUNGSTEN	290,000	130,000
	VANADIUM	290,000	130,000
	OIL & GREASE	2,800,000	1,700,000
	TOTAL SUSPENDED SOLIDS	5,700,000	2,700,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Molten Salt Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of refractory metals cleaned with molten salt		
120 COPPER	170,000	90,000
124 NICKEL	170,000	110,000
COLUMBIUM	180,000	82,000
FLUORIDE	5,400,000	2,400,000
MOLYBDENUM	180,000	82,000
TANTALUM	180,000	82,000
TUNGSTEN	180,000	82,000
VANADIUM	180,000	82,000
OIL & GREASE	1,800,000	1,100,000
TOTAL SUSPENDED SOLIDS	3,700,000	1,800,000
pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling/Burnishing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of refractory metals tumbled or burnished		
120 COPPER	42,000	22,000
124 NICKEL	42,000	28,000
COLUMBIUM	45,000	20,000
FLUORIDE	1,300,000	580,000
MOLYBDENUM	45,000	20,000
TANTALUM	45,000	20,000
TUNGSTEN	45,000	20,000
VANADIUM	45,000	20,000
OIL & GREASE	440,000	270,000
TOTAL SUSPENDED SOLIDS	910,000	430,000
pH	Within the range of 7.5 to 10.0 at all times.	

(v) Sawing/Grinding Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(w) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with emulsions		
120	COPPER	410	220
124	NICKEL	420	280
	COLUMBIUM	440	200
	FLUORIDE	13,000	5,700
	MOLYBDENUM	440	200
	TANTALUM	440	200
	TUNGSTEN	440	200
	VANADIUM	440	200
	OIL & GREASE	4,300	2,600
	TOTAL SUSPENDED SOLIDS	8,900	4,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Sawing/Grinding Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with lubricant-coolant water		
120	COPPER	1,500	810
124	NICKEL	1,600	1,000
	COLUMBIUM	1,700	740
	FLUORIDE	48,000	21,000
	MOLYBDENUM	1,700	740
	TANTALUM	1,700	740
	TUNGSTEN	1,700	740
	VANADIUM	1,700	740
	OIL & GREASE	16,000	9,700
	TOTAL SUSPENDED SOLIDS	33,000	16,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(y) Sawing/Grinding Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground		
120	COPPER	2,100	1,100
124	NICKEL	2,100	1,400
	COLUMBIUM	2,200	980
	FLUORIDE	64,000	29,000
	MOLYBDENUM	2,200	980
	TANTALUM	2,200	980
	TUNGSTEN	2,200	980
	VANADIUM	2,200	980
	OIL & GREASE	22,000	13,000
	TOTAL SUSPENDED SOLIDS	44,000	21,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(z) Post Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground refractory metals rinsed		
120	COPPER	970	510
124	NICKEL	980	650
	COLUMBIUM	1,100	470
	FLUORIDE	31,000	14,000
	MOLYBDENUM	1,100	470
	TANTALUM	1,100	470
	TUNGSTEN	1,100	470
	VANADIUM	1,100	470
	OIL & GREASE	10,000	6,200
	TOTAL SUSPENDED SOLIDS	21,000	10,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(aa) Product Testing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals product tested		
120	COPPER	150	78
124	NICKEL	150	99
	COLUMBIUM	160	71
	FLUORIDE	4,600	2,000
	MOLYBDENUM	160	71
	TANTALUM	160	71
	TUNGSTEN	160	71
	VANADIUM	160	71
	OIL & GREASE	1,600	930
	TOTAL SUSPENDED SOLIDS	3,200	1,500
	pH	Within the range of 7.5 to 10.0 at all times.	

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART G. BPT MASS LIMITATIONS FOR THE TITANIUM FORMING SUBCATEGORY

(a) Cold Rolling Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium cold rolled		
121	CYANIDE	970	400
122	LEAD	1,400	670
128	ZINC	4,900	2,000
	AMMONIA	450,000	200,000
	FLUORIDE	200,000	88,000
	TITANIUM	6,800	3,000
	OIL & GREASE	67,000	40,000
	TOTAL SUSPENDED SOLIDS	140,000	65,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Hot Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium hot rolled with contact lubricant-coolant water		
121	CYANIDE	1,200	520
122	LEAD	1,800	860
128	ZINC	6,300	2,600
	AMMONIA	570,000	250,000
	FLUORIDE	260,000	110,000
	TITANIUM	8,800	3,900
	OIL & GREASE	86,000	52,000
	TOTAL SUSPENDED SOLIDS	180,000	84,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium extruded		
121	CYANIDE	79	33
122	LEAD	120	55
128	ZINC	400	170
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,200
	TITANIUM	560	250
	OIL & GREASE	5,500	3,300
	TOTAL SUSPENDED SOLIDS	11,000	5,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Die Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	870	360
122	LEAD	1,300	600
128	ZINC	4,400	1,800
	AMMONIA	400,000	180,000
	FLUORIDE	180,000	79,000
	TITANIUM	6,200	2,700
	OIL & GREASE	60,000	36,000
	TOTAL SUSPENDED SOLIDS	120,000	59,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	590	240
122	LEAD	850	400
128	ZINC	2,900	1,200
	AMMONIA	270,000	120,000
	FLUORIDE	120,000	53,000
	TITANIUM	4,100	1,800
	OIL & GREASE	40,000	24,000
	TOTAL SUSPENDED SOLIDS	83,000	39,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium heat treated		
121	CYANIDE	1,300	540
122	LEAD	1,900	900
128	ZINC	6,600	2,800
	AMMONIA	600,000	260,000
	FLUORIDE	270,000	120,000
	TITANIUM	9,200	4,100
	OIL & GREASE	90,000	54,000
	TOTAL SUSPENDED SOLIDS	180,000	88,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	46	19
122	LEAD	67	32
128	ZINC	230	98
	AMMONIA	21,000	9,400
	FLUORIDE	9,500	4,200
	TITANIUM	330	150
	OIL & GREASE	3,200	1,900
	TOTAL SUSPENDED SOLIDS	6,600	3,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	6,100	2,500
122	LEAD	8,900	4,200
128	ZINC	31,000	13,000
	AMMONIA	2,800,000	1,200,000
	FLUORIDE	1,300,000	560,000
	TITANIUM	43,000	19,000
	OIL & GREASE	420,000	250,000
	TOTAL SUSPENDED SOLIDS	870,000	410,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	49	20
122	LEAD	71	34
128	ZINC	250	100
	AMMONIA	23,000	10,000
	FLUORIDE	10,000	4,500
	TITANIUM	350	150
	OIL & GREASE	3,400	2,000
	TOTAL SUSPENDED SOLIDS	7,000	3,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium alkaline cleaned			
121	CYANIDE	740	310
122	LEAD	1,100	510
128	ZINC	3,700	1,600
	AMMONIA	340,000	150,000
	FLUORIDE	150,000	67,000
	TITANIUM	5,200	2,300
	OIL & GREASE	51,000	31,000
	TOTAL SUSPENDED SOLIDS	100,000	50,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium alkaline cleaned			
121	CYANIDE	800	330
122	LEAD	1,200	550
128	ZINC	4,000	1,700
	AMMONIA	370,000	160,000
	FLUORIDE	160,000	73,000
	TITANIUM	5,700	2,500
	OIL & GREASE	55,000	33,000
	TOTAL SUSPENDED SOLIDS	110,000	54,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Tumbling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium tumbled		
121	CYANIDE	230	95
122	LEAD	330	160
128	ZINC	1,200	480
	AMMONIA	110,000	46,000
	FLUORIDE	47,000	21,000
	TITANIUM	1,600	720
	OIL & GREASE	16,000	9,500
	TOTAL SUSPENDED SOLIDS	32,000	15,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Sawing/Grinding Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium sawed or ground		
121	CYANIDE	14.0	6.0
122	LEAD	21.0	10.0
128	ZINC	73.0	30.0
	AMMONIA	6,600.0	2,900.0
	FLUORIDE	3,000.0	1,300.0
	TITANIUM	100.0	45.0
	OIL & GREASE	990.0	600.0
	TOTAL SUSPENDED SOLIDS	2,000.0	970.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART H. BPT MASS LIMITATIONS FOR THE URANIUM FORMING SUBCATEGORY

(a) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Tool Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium extruded		
118	CADMIUM	180	78
120	COPPER	980	520
124	NICKEL	990	660
	FLUORIDE	31,000	14,000
	RADIUM	(1)	(1)
	URANIUM	1,100	470
	OIL & GREASE	10,000	6,200
	TOTAL SUSPENDED SOLIDS	21,000	10,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(c) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded uranium heat treated		
118	CADMIUM	920	410
120	COPPER	5,200	2,700
124	NICKEL	5,200	3,500
	FLUORIDE	160,000	72,000
	RADIUM	(1)	(1)
	URANIUM	5,600	2,500
	OIL & GREASE	54,000	33,000
	TOTAL SUSPENDED SOLIDS	110,000	53,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged uranium heat treated		
118	CADMIUM	970	430
120	COPPER	5,400	2,800
124	NICKEL	5,500	3,600
	FLUORIDE	170,000	75,000
	RADIUM	(1)	(1)
	URANIUM	5,800	2,600
	OIL & GREASE	57,000	34,000
	TOTAL SUSPENDED SOLIDS	120,000	55,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(f) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	12.0	5.3
120	COPPER	68.0	36.0
124	NICKEL	68.0	45.0
	FLUORIDE	2,100.0	940.0
	RADIUM	(1)	(1)
	URANIUM	73.0	32.0
	OIL & GREASE	710.0	430.0
	TOTAL SUSPENDED SOLIDS	1,500.0	690.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(g) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	500	220
120	COPPER	2,800	1,500
124	NICKEL	2,800	1,900
	FLUORIDE	88,000	39,000
	RADIUM	(1)	(1)
	URANIUM	3,000	1,300
	OIL & GREASE	30,000	18,000
	TOTAL SUSPENDED SOLIDS	61,000	29,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(h) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	25	11
120	COPPER	140	74
124	NICKEL	140	94
	FLUORIDE	4,400	2,000
	RADIUM	(1)	(1)
	URANIUM	150	68
	OIL & GREASE	1,500	890
	TOTAL SUSPENDED SOLIDS	3,000	1,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(i) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium sawed or ground		
118	CADMIUM	1.10	.50
120	COPPER	5.90	3.10
124	NICKEL	6.00	3.90
	FLUORIDE	180.00	82.00
	RADIUM	(1)	(1)
	URANIUM	6.40	2.80
	OIL & GREASE	62.00	37.00
	TOTAL SUSPENDED SOLIDS	130.00	60.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(j) Post-Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground uranium rinsed		
118	CADMIUM	13.0	5.7
120	COPPER	72.0	38.0
124	NICKEL	73.0	48.0
	FLUORIDE	2,300.0	1,000.0
	RADIUM	(1)	(1)
	URANIUM	78.0	35.0
	OIL & GREASE	760.0	460.0
	TOTAL SUSPENDED SOLIDS	1,600.0	740.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART I. BPT MASS LIMITATIONS FOR THE ZINC FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc rolled with emulsions		
119	CHROMIUM	.60	.30
121	CYANIDE	.40	.20
128	ZINC	2.00	.80
	OIL & GREASE	28.00	17.00
	TOTAL SUSPENDED SOLIDS	57.00	27.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc rolled with contact lubricant-coolant water		
119	CHROMIUM	150	62
121	CYANIDE	100	42
128	ZINC	510	210
	OIL & GREASE	6,900	4,200
	TOTAL SUSPENDED SOLIDS	14,000	6,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Drawing Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc drawn with emulsions		
119	CHROMIUM	3.5	1.4
121	CYANIDE	2.3	1.0
128	ZINC	12.0	4.9
	OIL & GREASE	160.0	96.0
	TOTAL SUSPENDED SOLIDS	330.0	160.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Direct Chill Casting Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc cast by the direct chill method		
119	CHROMIUM	220	91
121	CYANIDE	150	60
128	ZINC	730	310
	OIL & GREASE	10,000	6,000
	TOTAL SUSPENDED SOLIDS	21,000	9,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Stationary Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Heat Treatment Contact Colling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc heat treated		
119	CHROMIUM	330	140
121	CYANIDE	220	91
128	ZINC	1,100	460
	OIL & GREASE	15,000	9,100
	TOTAL SUSPENDED SOLIDS	31,000	15,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc surface treated		
119	CHROMIUM	4.2	1.7
121	CYANIDE	2.8	1.1
128	ZINC	14.0	5.8
	OIL & GREASE	190.0	110.0
	TOTAL SUSPENDED SOLIDS	390.0	190.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc surface treated		
119	CHROMIUM	2,100	870
121	CYANIDE	1,400	580
128	ZINC	7,100	3,000
	OIL & GREASE	97,000	58,000
	TOTAL SUSPENDED SOLIDS	200,000	95,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned			
119	CHROMIUM	.30	.10
121	CYANIDE	.20	.10
128	ZINC	1.00	.40
	OIL & GREASE	14.00	8.60
	TOTAL SUSPENDED SOLIDS	29.00	14.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned			
119	CHROMIUM	2,500	1,000
121	CYANIDE	1,700	690
128	ZINC	8,400	3,500
	OIL & GREASE	110,000	69,000
	TOTAL SUSPENDED SOLIDS	230,000	110,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc sawed or ground			
119	CHROMIUM	24.0	10.0
121	CYANIDE	16.0	6.6
128	ZINC	80.0	33.0
	OIL & GREASE	1,100.0	660.0
	TOTAL SUSPENDED SOLIDS	2,300.0	1,100.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART J. BPT MASS LIMITATIONS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

(a) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded with emulsions		
119	CHROMIUM	33.0	13.0
121	CYANIDE	21.0	8.9
124	NICKEL	140.0	94.0
	AMMONIA	9,900.0	4,300.0
	FLUORIDE	4,400.0	2,000.0
	HAFNIUM	150.0	67.0
	ZIRCONIUM	150.0	67.0
	OIL & GREASE	1,500.0	890.0
	TOTAL SUSPENDED SOLIDS	3,000.0	1,400.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded		
119	CHROMIUM	160	67
121	CYANIDE	110	44
124	NICKEL	710	470
	AMMONIA	49,000	22,000
	FLUORIDE	22,000	9,800
	HAFNIUM	760	340
	ZIRCONIUM	760	340
	OIL & GREASE	7,400	4,400
	TOTAL SUSPENDED SOLIDS	15,000	7,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded zirconium/hafnium heat treated		
119	CHROMIUM	130	51
121	CYANIDE	83	34
124	NICKEL	550	360
	AMMONIA	38,000	17,000
	FLUORIDE	17,000	7,500
	HAFNIUM	580	260
	ZIRCONIUM	580	260
	OIL & GREASE	5,700	3,400
	TOTAL SUSPENDED SOLIDS	12,000	5,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged zirconium/hafnium heat treated		
119	CHROMIUM	15.0	6.3
121	CYANIDE	10.0	4.2
124	NICKEL	67.0	44.0
	AMMONIA	4,700.0	2,000.0
	FLUORIDE	2,100.0	920.0
	HAFNIUM	72.0	32.0
	ZIRCONIUM	72.0	32.0
	OIL & GREASE	700.0	420.0
	TOTAL SUSPENDED SOLIDS	1,400.0	680.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium rolled with emulsions		
119	CHROMIUM	180	72
121	CYANIDE	120	48
124	NICKEL	770	510
	AMMONIA	53,000	23,000
	FLUORIDE	24,000	11,000
	HAFNIUM	820	360
	ZIRCONIUM	820	360
	OIL & GREASE	8,000	4,800
	TOTAL SUSPENDED SOLIDS	16,000	7,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium surface treated		
119	CHROMIUM	6,700	2,800
121	CYANIDE	4,400	1,800
124	NICKEL	29,000	19,000
	AMMONIA	2,000,000	900,000
	FLUORIDE	910,000	400,000
	HAFNIUM	31,000	14,000
	ZIRCONIUM	31,000	14,000
	OIL & GREASE	310,000	180,000
	TOTAL SUSPENDED SOLIDS	630,000	300,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned		
119	CHROMIUM	940	380
121	CYANIDE	620	260
124	NICKEL	4,100	2,700
	AMMONIA	280,000	120,000
	FLUORIDE	130,000	56,000
	HAFNIUM	4,400	1,900
	ZIRCONIUM	4,400	1,900
	OIL & GREASE	43,000	26,000
	TOTAL SUSPENDED SOLIDS	87,000	42,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned		
119	CHROMIUM	24,000	10,000
121	CYANIDE	16,000	6,600
124	NICKEL	110,000	70,000
	AMMONIA	7,400,000	3,200,000
	FLUORIDE	3,300,000	1,500,000
	HAFNIUM	110,000	50,000
	ZIRCONIUM	110,000	50,000
	OIL & GREASE	1,100,000	660,000
	TOTAL SUSPENDED SOLIDS	2,300,000	1,100,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Sawing/Grinding Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium sawed or ground		
119	CHROMIUM	4.0	1.6
121	CYANIDE	2.6	1.1
124	NICKEL	17.0	11.0
	AMMONIA	1,200.0	530.0
	FLUORIDE	540.0	240.0
	HAFNIUM	18.0	8.2
	ZIRCONIUM	18.0	8.2
	OIL & GREASE	180.0	110.0
	TOTAL SUSPENDED SOLIDS	370.0	180.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Sawing/Grinding Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(n) Degreasing Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium degreased		
119	CHROMIUM	890	370
121	CYANIDE	590	240
124	NICKEL	3,900	2,600
	AMMONIA	270,000	120,000
	FLUORIDE	120,000	54,000
	HAFNIUM	4,200	1,800
	ZIRCONIUM	4,200	1,800
	OIL & GREASE	41,000	24,000
	TOTAL SUSPENDED SOLIDS	83,000	40,000
	pH	Within the range of 7.5 to 10.0 at all times.	

SUBPART K. BPT MASS LIMITATIONS FOR THE IRON AND STEEL/COPPER/ ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

(a) Metal Powder Production Atomization Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet atomized		
120	COPPER	9,600	5,000
121	CYANIDE	1,500	600
122	LEAD	2,100	1,000
	ALUMINUM	32,000	16,000
	IRON	6,000	3,100
	OIL & GREASE	100,000	60,000
	TOTAL SUSPENDED SOLIDS	210,000	98,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Metal Powder Production Milling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet milled		
120	COPPER	3,200	1,700
121	CYANIDE	480	200
122	LEAD	700	330
	ALUMINUM	11,000	5,300
	IRON	2,000	1,000
	OIL & GREASE	33,000	20,000
	TOTAL SUSPENDED SOLIDS	68,000	33,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Metal Powder Production Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder produced		
120	COPPER	5,000	2,600
121	CYANIDE	770	320
122	LEAD	1,100	530
	ALUMINUM	17,000	8,400
	IRON	3,200	1,600
	OIL & GREASE	53,000	32,000
	TOTAL SUSPENDED SOLIDS	110,000	51,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Sizing/Repressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Oil-Resin Impregnation Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts impregnated with oil-resin		
120	COPPER	140.0	75.0
121	CYANIDE	22.0	8.9
122	LEAD	31.0	15.0
	ALUMINUM	480.0	240.0
	IRON	89.0	45.0
	OIL & GREASE	1,500.0	890.0
	TOTAL SUSPENDED SOLIDS	3,100.0	1,500.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Steam Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder powder metallurgy parts steam treated		
120	COPPER	5,400	2,800
121	CYANIDE	820	340
122	LEAD	1,200	570
	ALUMINUM	18,000	9,100
	IRON	3,400	1,700
	OIL & GREASE	57,000	34,000
	TOTAL SUSPENDED SOLIDS	120,000	55,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Tumbling, Burnishing And Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts tumbled, burnished, or cleaned		
120	COPPER	14,000	7,200
121	CYANIDE	2,100	860
122	LEAD	3,000	1,400
	ALUMINUM	46,000	23,000
	IRON	8,600	4,400
	OIL & GREASE	140,000	86,000
	TOTAL SUSPENDED SOLIDS	290,000	140,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts sawed or ground		
120 COPPER	1,900	1,000
121 CYANIDE	290	120
122 LEAD	420	200
ALUMINUM	6,400	3,200
IRON	1,200	610
OIL & GREASE	20,000	12,000
TOTAL SUSPENDED SOLIDS	41,000	20,000
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

3. BAT is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods for nine of the eleven subcategories. BAT is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods for the Lead/Tin/Bismuth Forming and the Iron And Steel/Copper/Aluminum Metal Powder Production And Powder Metallurgy Subcategories. The following BAT effluent limitations are proposed for existing sources:

SUBPART A. BAT MASS LIMITATIONS FOR THE BERYLLIUM FORMING SUBCATEGORY

(a) Area Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium formed			
117	BERYLLIUM	17,000	7,200
120	COPPER	27,000	13,000
121	CYANIDE	4,300	1,700
	FLUORIDE	1,300,000	560,000

(b) Billet Washing Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium billets washed			
117	BERYLLIUM	31.0	13.0
120	COPPER	49.0	23.0
121	CYANIDE	7.6	3.1
	FLUORIDE	2,300.0	1,000.0

(c) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium surface treated			
117	BERYLLIUM	250	100
120	COPPER	390	190
121	CYANIDE	62	25
	FLUORIDE	18,000	8,100

(d) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium surface treated			
117	BERYLLIUM	630	260
120	COPPER	980	470
121	CYANIDE	150	61
	FLUORIDE	46,000	20,000

(e) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium sawed or ground			
117	BERYLLIUM	350	140
120	COPPER	540	260
121	CYANIDE	85	34
	FLUORIDE	25,000	11,000

(f) Inspection/Testing Wastewater

There shall be no discharge of process wastewater pollutants.

(g) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART B. BAT MASS LIMITATIONS FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with emulsions		
114 ANTIMONY	67.0	30.0
122 LEAD	10.0	4.7

(b) Rolling Spent Soap Solutions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with soap solutions		
114 ANTIMONY	120.0	55.0
122 LEAD	18.0	8.6

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with emulsions		
114 ANTIMONY	48.0	21.0
122 LEAD	7.0	3.3

(e) Drawing Spent Soap Solutions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with soap solutions		
114 ANTIMONY	21.0	10.0
122 LEAD	3.1	1.5

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth heat treated		
114 ANTIMONY	500	220
122 LEAD	74	35

(g) Extrusion Press Hydraulic Fluid Leakage

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth extruded		
114 ANTIMONY	140	63
122 LEAD	21	10

(h) Continuous Strip Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
114 ANTIMONY	2.90	1.30
122 LEAD	.40	.20

(i) Semi-Continuous Ingot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
114 ANTIMONY	8.40	3.80
122 LEAD	1.20	.60

(j) Shot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth shot cast		
114 ANTIMONY	12.00	5.40
122 LEAD	1.80	.80

(k) Shot-Forming Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(l) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned		
114 ANTIMONY	1,700	780
122 LEAD	250	120

(m) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned	
114 ANTIMONY	1,900	830
122 LEAD	270	130

(n) Swaging Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth swaged with emulsions	
114 ANTIMONY	5.10	2.30
122 LEAD	.70	.40

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(p) Miscellaneous Nondescript Wastewater Sources

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth formed	
114 ANTIMONY	170	75
122 LEAD	25	12

SUBPART C. BAT MASS LIMITATIONS FOR THE MAGNESIUM FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

There shall be no discharge of process wastewater pollutants.

(b) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(c) Forging Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium forged		
119	CHROMIUM	98,000	40,000
128	ZINC	270,000	110,000
	AMMONIA	35,000,000	16,000,000
	FLUORIDE	16,000,000	7,000,000
	MAGNESIUM	180,000	80,000

(d) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged magnesium heat treated		
119	CHROMIUM	230	95
128	ZINC	650	270
	AMMONIA	84,000	37,000
	FLUORIDE	38,000	17,000
	MAGNESIUM	440	190

(e) Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium forged		
119	CHROMIUM	60	24
128	ZINC	170	68
	AMMONIA	22,000	9,500
	FLUORIDE	9,600	4,300
	MAGNESIUM	110	49

(f) Direct Chill Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium surface treated		
119	CHROMIUM	170	70
128	ZINC	470	200
	AMMONIA	62,000	27,000
	FLUORIDE	28,000	12,000
	MAGNESIUM	320	140

(h) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium surface treated		
119	CHROMIUM	650	270
128	ZINC	1,800	740
	AMMONIA	240,000	100,000
	FLUORIDE	110,000	47,000
	MAGNESIUM	1,200	530

(i) Sawing/Grinding Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(j) Sanding And Repairing Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of magnesium sanded and repaired			
119	CHROMIUM	160	64
128	ZINC	440	180
	AMMONIA	57,000	25,000
	FLUORIDE	25,000	11,000
	MAGNESIUM	300	130

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART D. BAT MASS LIMITATIONS FOR THE NICKEL/COBALT FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt rolled with emulsions			
119	CHROMIUM	550	220
124	NICKEL	820	550
	FLUORIDE	89,000	39,000

(c) Rolling Contact Lubricant-Coolant Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt rolled with contact lubricant-coolant water			
119	CHROMIUM	500	200
124	NICKEL	740	500
	FLUORIDE	80,000	35,000

(d) Rolling Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of rolled nickel/cobalt heat treated			
119	CHROMIUM	.00	.00
124	NICKEL	.00	.00
	FLUORIDE	1.60	.70

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(g) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt drawn with emulsions			
119	CHROMIUM	35	14
124	NICKEL	52	35
	FLUORIDE	5,700	2,500

(h) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(i) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded nickel/cobalt heat treated		
119	CHROMIUM	31	12
124	NICKEL	46	31
	FLUORIDE	5,000	2,200

(j) Forging, Extrusion, And Isostatic Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt forged, extruded, or pressed		
119	CHROMIUM	46	19
124	NICKEL	68	46
	FLUORIDE	7,400	3,300

(k) Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt forged		
119	CHROMIUM	60	24
124	NICKEL	90	60
	FLUORIDE	9,700	4,300

(l) Forging Die Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt forged		
119 CHROMIUM	47	19
124 NICKEL	69	47
FLUORIDE	7,500	3,300

(m) Forging/Swaging Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(n) Stationary And Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt cast by the stationary or direct chill method		
119 CHROMIUM	660	270
124 NICKEL	980	660
FLUORIDE	110,000	47,000

(o) Casting Vacuum Melting Steam Condensate

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt vacuum melted		
119 CHROMIUM	62	25
124 NICKEL	92	62
FLUORIDE	10,000	4,400

(p) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt metal powder atomized			
119	CHROMIUM	1,100	430
124	NICKEL	1,600	1,100
	FLUORIDE	170,000	75,000

(q) Annealing Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt annealed			
119	CHROMIUM	170	69
124	NICKEL	250	170
	FLUORIDE	27,000	12,000

(r) Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt formed			
119	CHROMIUM	93	38
124	NICKEL	140	93
	FLUORIDE	15,000	6,600

(s) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt surface treated			
119	CHROMIUM	320	130
124	NICKEL	470	320
	FLUORIDE	51,000	23,000

(t) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt surface treated			
119	CHROMIUM	390	160
124	NICKEL	580	390
	FLUORIDE	63,000	28,000

(u) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned			
119	CHROMIUM	11.0	4.6
124	NICKEL	17.0	11.0
	FLUORIDE	1,800.0	810.0

(v) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned			
119	CHROMIUM	180	75
124	NICKEL	270	180
	FLUORIDE	30,000	13,000

(w) Molten Salt Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with molten salt			
119	CHROMIUM	470	190
124	NICKEL	700	470
	FLUORIDE	76,000	34,000

(x) Ammonia Rinse Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with ammonia solution			
119	CHROMIUM	5.8	2.4
124	NICKEL	8.6	5.8
	FLUORIDE	930.0	410.0

(y) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt sawed or ground			
119	CHROMIUM	370	150
124	NICKEL	550	370
	FLUORIDE	60,000	26,000

(z) Steam Cleaning Condensate

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt steam cleaned			
119	CHROMIUM	8.6	3.5
124	NICKEL	13.0	8.6
	FLUORIDE	1,400.0	610.0

(aa) Hydrostatic Tube Testing Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt tube tested by the hydrostatic method			
119	CHROMIUM	50	20
124	NICKEL	74	50
	FLUORIDE	8,000	3,600

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(ac) Miscellaneous Nondescript Wastewater Sources

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt formed			
119	CHROMIUM	22.0	8.8
124	NICKEL	32.0	22.0
	FLUORIDE	3,500.0	1,500.0

SUBPART E. BAT MASS LIMITATIONS FOR THE PRECIOUS METALS FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals rolled with emulsions			
118	CADMIUM	7.2	2.9
120	COPPER	46.0	22.0
121	CYANIDE	7.2	2.9
126	SILVER	10.0	4.3

(b) Rolling Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of rolled precious metals heat treated			
118	CADMIUM	140	56
120	COPPER	900	430
121	CYANIDE	140	56
126	SILVER	200	84

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals drawn with emulsions			
118	CADMIUM	4.3	1.7
120	COPPER	27.0	13.0
121	CYANIDE	4.3	1.7
126	SILVER	6.2	2.6

(e) Drawing Spent Soap Solutions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals drawn with soap solutions			
118	CADMIUM	1.40	.60
120	COPPER	8.90	4.20
121	CYANIDE	1.40	.60
126	SILVER	2.00	.80

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded precious metals heat treated			
118	CADMIUM	270	110
120	COPPER	1,800	840
121	CYANIDE	270	110
126	SILVER	400	160

(g) Semi-Continuous And Continuous Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the semi-continuous or continuous method			
118	CADMIUM	220	90
120	COPPER	1,400	680
121	CYANIDE	220	90
126	SILVER	320	130

(h) Stationary Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the stationary method			
118	CADMIUM	.80	.30
120	COPPER	5.30	2.50
121	CYANIDE	.80	.30
126	SILVER	1.20	.50

(i) Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the direct chill method			
118	CADMIUM	160	65
120	COPPER	1,000	500
121	CYANIDE	160	65
126	SILVER	240	98

(j) Shot Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals shot cast			
118	CADMIUM	18.0	7.1
120	COPPER	110.0	54.0
121	CYANIDE	18.0	7.1
126	SILVER	26.0	11.0

(k) Casting Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast			
118	CADMIUM	1.20	.50
120	COPPER	7.50	3.60
121	CYANIDE	1.20	.50
126	SILVER	1.70	.70

(l) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals powder wet atomized			
118	CADMIUM	1,300	530
120	COPPER	8,500	4,100
121	CYANIDE	1,300	530
126	SILVER	1,900	800

(m) Metal Powder Production Ball Milling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals powder wet ball milled			
118	CADMIUM	430	170
120	COPPER	2,800	1,300
121	CYANIDE	430	170
126	SILVER	630	260

(n) Pressure Bonding Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metal and base metal pressure bonded			
118	CADMIUM	17.0	6.7
120	COPPER	110.0	51.0
121	CYANIDE	17.0	6.7
126	SILVER	24.0	10.0

(o) Annealing Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals annealed			
118	CADMIUM	200	80
120	COPPER	1,300	610
121	CYANIDE	200	80
126	SILVER	290	120

(p) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	31	12
120	COPPER	200	95
121	CYANIDE	31	12
126	SILVER	45	19

(q) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated		
118 CADMIUM	570	230
120 COPPER	3,600	1,700
121 CYANIDE	570	230
126 SILVER	820	340

(r) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned		
118 CADMIUM	.70	.30
120 COPPER	4.70	2.20
121 CYANIDE	.70	.30
126 SILVER	1.10	.40

(s) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned		
118 CADMIUM	140	55
120 COPPER	890	420
121 CYANIDE	140	55
126 SILVER	200	83

(t) Pre-Bonding Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metal and base metal cleaned prior to bonding			
118	CADMIUM	68	27
120	COPPER	440	210
121	CYANIDE	68	27
126	SILVER	99	41

(u) Tumbling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals tumbled			
118	CADMIUM	88	35
120	COPPER	570	270
121	CYANIDE	88	35
126	SILVER	130	53

(v) Burnishing Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals burnished			
118	CADMIUM	510	210
120	COPPER	3,300	1,600
121	CYANIDE	510	210
126	SILVER	750	310

(w) Sawing/Grinding Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals sawed or ground		
118 CADMIUM	1.20	.50
120 COPPER	7.70	3.70
121 CYANIDE	1.20	.50
126 SILVER	1.80	.70

(x) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART F. BAT MASS LIMITATIONS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of refractory metals rolled with emulsions		
120 COPPER	1,500	730
124 NICKEL	660	440
COLUMBIUM	830	360
FLUORIDE	71,000	32,000
MOLYBDENUM	830	360
TANTALUM	830	360
TUNGSTEN	830	360
VANADIUM	830	360

(c) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded refractory metals heat treated		
120	COPPER	440	210
124	NICKEL	190	130
	COLUMBIUM	240	100
	FLUORIDE	21,000	9,100
	MOLYBDENUM	240	100
	TANTALUM	240	100
	TUNGSTEN	240	100
	VANADIUM	240	100

(e) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded		
120	COPPER	1,500	730
124	NICKEL	650	440
	COLUMBIUM	820	360
	FLUORIDE	71,000	31,000
	MOLYBDENUM	820	360
	TANTALUM	820	360
	TUNGSTEN	820	360
	VANADIUM	820	360

(f) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(g) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged refractory metals heat treated		
120	COPPER	740	350
124	NICKEL	320	210
	COLUMBIUM	400	170
	FLUORIDE	34,000	15,000
	MOLYBDENUM	400	170
	TANTALUM	400	170
	TUNGSTEN	400	170
	VANADIUM	400	170

(h) Extrusion And Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded or forged		
120	COPPER	53	25
124	NICKEL	23	15
	COLUMBIUM	29	13
	FLUORIDE	2,500	1,100
	MOLYBDENUM	29	13
	TANTALUM	29	13
	TUNGSTEN	29	13
	VANADIUM	29	13

(i) Metal Powder Production Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals powder produced		
120	COPPER	2,100	1,000
124	NICKEL	900	610
	COLUMBIUM	1,100	490
	FLUORIDE	98,000	43,000
	MOLYBDENUM	1,100	490
	TANTALUM	1,100	490
	TUNGSTEN	1,100	490
	VANADIUM	1,100	490

(j) Metal Powder Production Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(k) Metal Powder Pressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(l) Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(m) Post-Casting Billet Washwater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of cast refractory metals billet washed		
120	COPPER	38.0	18.0
124	NICKEL	16.0	11.0
	COLUMBIUM	21.0	8.9
	FLUORIDE	1,800.0	790.0
	MOLYBDENUM	21.0	8.9
	TANTALUM	21.0	8.9
	TUNGSTEN	21.0	8.9
	VANADIUM	21.0	8.9

(n) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	16.0	7.7
124	NICKEL	7.0	4.7
	COLUMBIUM	8.8	3.8
	FLUORIDE	760.0	340.0
	MOLYBDENUM	8.8	3.8
	TANTALUM	8.8	3.8
	TUNGSTEN	8.8	3.8
	VANADIUM	8.8	3.8

(o) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	15,000	7,400
124	NICKEL	6,700	4,500
	COLUMBIUM	8,300	3,600
	FLUORIDE	720,000	320,000
	MOLYBDENUM	8,300	3,600
	TANTALUM	8,300	3,600
	TUNGSTEN	8,300	3,600
	VANADIUM	8,300	3,600

(p) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	15,000	7,200
124	NICKEL	6,500	4,400
	COLUMBIUM	8,100	3,500
	FLUORIDE	700,000	310,000
	MOLYBDENUM	8,100	3,500
	TANTALUM	8,100	3,500
	TUNGSTEN	8,100	3,500
	VANADIUM	8,100	3,500

(q) Surface Coating Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface coated		
120	COPPER	1,400	660
124	NICKEL	590	400
	COLUMBIUM	750	320
	FLUORIDE	64,000	29,000
	MOLYBDENUM	750	320
	TANTALUM	750	320
	TUNGSTEN	750	320
	VANADIUM	750	320

(r) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	39.0	19.0
124	NICKEL	17.0	11.0
	COLUMBIUM	21.0	9.2
	FLUORIDE	1,800.0	810.0
	MOLYBDENUM	21.0	9.2
	TANTALUM	21.0	9.2
	TUNGSTEN	21.0	9.2
	VANADIUM	21.0	9.2

(s) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	1,800	850
124	NICKEL	770	520
	COLUMBIUM	970	420
	FLUORIDE	83,000	37,000
	MOLYBDENUM	970	420
	TANTALUM	970	420
	TUNGSTEN	970	420
	VANADIUM	970	420

(t) Molten Salt Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals cleaned with molten salt		
120	COPPER	120,000	55,000
124	NICKEL	50,000	33,000
	COLUMBIUM	62,000	27,000
	FLUORIDE	5,400,000	2,400,000
	MOLYBDENUM	62,000	27,000
	TANTALUM	62,000	27,000
	TUNGSTEN	62,000	27,000
	VANADIUM	62,000	27,000

(u) Tumbling/Burnishing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals tumbled or burnished		
120	COPPER	2,800	1,300
124	NICKEL	1,200	820
	COLUMBIUM	1,500	660
	FLUORIDE	130,000	58,000
	MOLYBDENUM	1,500	660
	TANTALUM	1,500	660
	TUNGSTEN	1,500	660
	VANADIUM	1,500	660

(v) Sawing/Grinding Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(w) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with emulsions		
120	COPPER	280	130
124	NICKEL	120	80
	COLUMBIUM	150	65
	FLUORIDE	13,000	5,700
	MOLYBDENUM	150	65
	TANTALUM	150	65
	TUNGSTEN	150	65
	VANADIUM	150	65

(x) Sawing/Grinding Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with lubricant-coolant water		
120	COPPER	1,000	500
124	NICKEL	450	300
	COLUMBIUM	560	240
	FLUORIDE	48,000	21,000
	MOLYBDENUM	560	240
	TANTALUM	560	240
	TUNGSTEN	560	240
	VANADIUM	560	240

(y) Sawing/Grinding Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground		
120	COPPER	140	66
124	NICKEL	59	40
	COLUMBIUM	75	32
	FLUORIDE	6,400	2,900
	MOLYBDENUM	75	32
	TANTALUM	75	32
	TUNGSTEN	75	32
	VANADIUM	75	32

(z) Post Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground refractory metals rinsed		
120	COPPER	66	31
124	NICKEL	28	19
	COLUMBIUM	35	15
	FLUORIDE	3,100	1,400
	MOLYBDENUM	35	15
	TANTALUM	35	15
	TUNGSTEN	35	15
	VANADIUM	35	15

(aa) Product Testing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of refractory metals product tested		
120 COPPER	10.0	4.7
124 NICKEL	4.3	2.9
COLUMBIUM	5.4	2.3
FLUORIDE	460.0	200.0
MOLYBDENUM	5.4	2.3
TANTALUM	5.4	2.3
TUNGSTEN	5.4	2.3
VANADIUM	5.4	2.3

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART G. BAT MASS LIMITATIONS FOR THE TITANIUM FORMING SUBCATEGORY

(a) Cold Rolling Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium cold rolled		
121 CYANIDE	67	27
122 LEAD	94	43
128 ZINC	340	140
AMMONIA	45,000	20,000
FLUORIDE	20,000	8,800
TITANIUM	230	100

(b) Hot Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium hot rolled with contact lubricant-coolant water		
121	CYANIDE	86	34
122	LEAD	120	56
128	ZINC	440	180
	AMMONIA	57,000	25,000
	FLUORIDE	26,000	11,000
	TITANIUM	300	130

(c) Extrusion Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium extruded		
121	CYANIDE	55	22
122	LEAD	77	36
128	ZINC	280	120
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,200
	TITANIUM	190	82

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Die Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	60	24
122	LEAD	84	39
128	ZINC	310	130
	AMMONIA	40,000	18,000
	FLUORIDE	18,000	7,900
	TITANIUM	210	90

(f) Forging Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	40	16
122	LEAD	57	26
128	ZINC	210	85
	AMMONIA	27,000	12,000
	FLUORIDE	12,000	5,300
	TITANIUM	140	61

(g) Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium heat treated		
121	CYANIDE	90	36
122	LEAD	130	59
128	ZINC	460	190
	AMMONIA	60,000	26,000
	FLUORIDE	27,000	12,000
	TITANIUM	310	140

(h) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	32	13
122	LEAD	45	21
128	ZINC	160	67
	AMMONIA	21,000	9,400
	FLUORIDE	9,500	4,200
	TITANIUM	110	48

(i) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	420	170
122	LEAD	590	270
128	ZINC	2,200	890
	AMMONIA	280,000	120,000
	FLUORIDE	130,000	56,000
	TITANIUM	1,500	630

(j) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	3.4	1.4
122	LEAD	4.8	2.2
128	ZINC	17.0	7.1
	AMMONIA	2,300.0	1,000.0
	FLUORIDE	1,000.0	450.0
	TITANIUM	12.0	5.1

(k) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium alkaline cleaned			
121	CYANIDE	130	51
122	LEAD	180	83
128	ZINC	650	270
	AMMONIA	85,000	37,000
	FLUORIDE	38,000	17,000
	TITANIUM	440	190

(l) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium alkaline cleaned			
121	CYANIDE	55	22
122	LEAD	77	36
128	ZINC	280	120
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,300
	TITANIUM	190	83

(m) Tumbling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium tumbled			
121	CYANIDE	16.0	6.3
122	LEAD	22.0	10.0
128	ZINC	81.0	33.0
	AMMONIA	11,000.0	4,600.0
	FLUORIDE	4,700.0	2,100.0
	TITANIUM	55.0	24.0

(n) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium sawed or ground			
121	CYANIDE	10.0	4.0
122	LEAD	14.0	6.5
128	ZINC	51.0	21.0
	AMMONIA	6,600.0	2,900.0
	FLUORIDE	3,000.0	1,300.0
	TITANIUM	34.0	15.0

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART H. BAT MASS LIMITATIONS FOR THE URANIUM FORMING SUBCATEGORY

(a) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Tool Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium extruded			
118	CADMIUM	10.0	4.1
120	COPPER	66.0	32.0
124	NICKEL	28.0	19.0
	FLUORIDE	3,100.0	1,400.0
	RADIUM	(1)	(1)
	URANIUM	36.0	16.0

(1) Concentration Value Is 5 Picocuries Per Liter

(c) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded uranium heat treated		
118	CADMIUM	54	22
120	COPPER	350	170
124	NICKEL	150	100
	FLUORIDE	16,000	7,200
	RADIUM	(1)	(1)
	URANIUM	190	82

(1) Concentration Value Is 5 Picocuries Per Liter

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged uranium heat treated		
118	CADMIUM	57	23
120	COPPER	360	170
124	NICKEL	160	110
	FLUORIDE	17,000	7,500
	RADIUM	(1)	(1)
	URANIUM	200	85

(1) Concentration Value Is 5 Picocuries Per Liter

(f) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated			
118	CADMIUM	7.1	2.8
120	COPPER	46.0	22.0
124	NICKEL	20.0	13.0
	FLUORIDE	2,100.0	940.0
	RADIUM	(1)	(1)
	URANIUM	25.0	11.0

(1) Concentration Value Is 5 Picocuries Per Liter

(g) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated			
118	CADMIUM	30	12
120	COPPER	190	90
124	NICKEL	81	55
	FLUORIDE	8,800	3,900
	RADIUM	(1)	(1)
	URANIUM	100	44

(1) Concentration Value Is 5 Picocuries Per Liter

(h) Surface Treatment Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated			
118	CADMIUM	15.0	5.9
120	COPPER	95.0	45.0
124	NICKEL	41.0	27.0
	FLUORIDE	4,400.0	2,000.0
	RADIUM	(1)	(1)
	URANIUM	51.0	22.0

(1) Concentration Value Is 5 Picocuries Per Liter

(i) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium sawed or ground		
118	CADMIUM	.60	.20
120	COPPER	4.00	1.90
124	NICKEL	1.70	1.10
	FLUORIDE	180.00	82.00
	RADIUM	(1)	(1)
	URANIUM	2.10	.90

(1) Concentration Value Is 5 Picocuries Per Liter

(j) Post-Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground uranium rinsed		
118	CADMIUM	7.6	3.0
120	COPPER	49.0	23.0
124	NICKEL	21.0	14.0
	FLUORIDE	2,300.0	1,000.0
	RADIUM	(1)	(1)
	URANIUM	26.0	11.0

(1) Concentration Value Is 5 Picocuries Per Liter

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART I. BAT MASS LIMITATIONS FOR THE ZINC FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc rolled with emulsions			
119	CHROMIUM	.50	.20
121	CYANIDE	.30	.10
128	ZINC	1.40	.60

(c) Rolling Contact Lubricant-Coolant Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc rolled with contact lubricant-coolant water			
119	CHROMIUM	13.0	5.2
121	CYANIDE	6.9	2.8
128	ZINC	35.0	15.0

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc drawn with emulsions			
119	CHROMIUM	3.00	1.20
121	CYANIDE	1.60	.60
128	ZINC	8.20	3.40

(e) Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc cast by the direct chill method			
119	CHROMIUM	19.0	7.5
121	CYANIDE	10.0	4.0
128	ZINC	51.0	21.0

(f) Stationary Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Heat Treatment Contact Colling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc heat treated			
119	CHROMIUM	28.0	11.0
121	CYANIDE	15.0	6.1
128	ZINC	78.0	32.0

(h) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc surface treated			
119	CHROMIUM	3.50	1.40
121	CYANIDE	1.90	.80
128	ZINC	10.00	4.00

(i) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc surface treated			
119	CHROMIUM	180	73
121	CYANIDE	97	39
128	ZINC	500	200

(j) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned			
119	CHROMIUM	.30	.10
121	CYANIDE	.10	.10
128	ZINC	.70	.30

(k) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned			
119	CHROMIUM	2,100	860
121	CYANIDE	1,100	460
128	ZINC	5,800	2,400

(l) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc sawed or ground			
119	CHROMIUM	20.0	8.2
121	CYANIDE	11.0	4.4
128	ZINC	56.0	23.0

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART J. BAT MASS LIMITATIONS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

(a) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded with emulsions		
119	CHROMIUM	27.0	11.0
121	CYANIDE	15.0	5.9
124	NICKEL	41.0	27.0
	AMMONIA	9,900.0	4,300.0
	FLUORIDE	4,400.0	2,000.0
	HAFNIUM	51.0	22.0
	ZIRCONIUM	51.0	22.0

(c) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded		
119	CHROMIUM	140	56
121	CYANIDE	74	30
124	NICKEL	200	140
	AMMONIA	49,000	22,000
	FLUORIDE	22,000	9,800
	HAFNIUM	260	110
	ZIRCONIUM	260	110

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded zirconium/hafnium heat treated			
119	CHROMIUM	11.0	4.3
121	CYANIDE	5.7	2.3
124	NICKEL	16.0	11.0
	AMMONIA	3,800.0	1,700.0
	FLUORIDE	1,700.0	750.0
	HAFNIUM	20.0	8.6
	ZIRCONIUM	20.0	8.6

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Forging Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of forged zirconium/hafnium heat treated			
119	CHROMIUM	13.0	5.2
121	CYANIDE	7.0	2.8
124	NICKEL	19.0	13.0
	AMMONIA	4,700.0	2,000.0
	FLUORIDE	2,100.0	920.0
	HAFNIUM	24.0	10.0
	ZIRCONIUM	24.0	10.0

(g) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium rolled with emulsions		
119	CHROMIUM	150	60
121	CYANIDE	80	32
124	NICKEL	220	150
	AMMONIA	53,000	23,000
	FLUORIDE	24,000	11,000
	HAFNIUM	280	120
	ZIRCONIUM	280	120

(h) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium surface treated		
119	CHROMIUM	570	230
121	CYANIDE	310	120
124	NICKEL	840	570
	AMMONIA	200,000	90,000
	FLUORIDE	91,000	40,000
	HAFNIUM	1,100	460
	ZIRCONIUM	1,100	460

(i) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned		
119	CHROMIUM	790	320
121	CYANIDE	430	170
124	NICKEL	1,200	790
	AMMONIA	280,000	120,000
	FLUORIDE	130,000	56,000
	HAFNIUM	1,500	640
	ZIRCONIUM	1,500	640

(j) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned			
119	CHROMIUM	2,000	830
121	CYANIDE	1,100	440
124	NICKEL	3,000	2,000
	AMMONIA	740,000	320,000
	FLUORIDE	330,000	150,000
	HAFNIUM	3,800	1,700
	ZIRCONIUM	3,800	1,700

(k) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium sawed or ground			
119	CHROMIUM	3.30	1.40
121	CYANIDE	1.80	.70
124	NICKEL	5.00	3.30
	AMMONIA	1,200.00	530.00
	FLUORIDE	540.00	240.00
	HAFNIUM	6.20	2.70
	ZIRCONIUM	6.20	2.70

(l) Sawing/Grinding Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(n) Degreasing Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium degreased		
119	CHROMIUM	75	30
121	CYANIDE	41	16
124	NICKEL	110	75
	AMMONIA	27,000	12,000
	FLUORIDE	12,000	5,400
	HAFNIUM	140	61
	ZIRCONIUM	140	61

SUBPART K. BAT MASS LIMITATIONS FOR THE IRON AND STEEL/COPPER/ ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

(a) Metal Powder Production Atomization Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet atomized		
120	COPPER	9,600	5,000
121	CYANIDE	1,500	600
122	LEAD	2,100	1,000
	ALUMINUM	32,000	16,000
	IRON	6,000	3,100

(b) Metal Powder Production Milling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet milled		
120	COPPER	3,200	1,700
121	CYANIDE	480	200
122	LEAD	700	330
	ALUMINUM	11,000	5,300
	IRON	2,000	1,000

(c) Metal Powder Production Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder produced		
120	COPPER	5,000	2,600
121	CYANIDE	770	320
122	LEAD	1,100	530
	ALUMINUM	17,000	8,400
	IRON	3,200	1,600

(d) Sizing/Repressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Oil-Resin Impregnation Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts impregnated with oil-resin		
120	COPPER	140.0	75.0
121	CYANIDE	22.0	8.9
122	LEAD	31.0	15.0
	ALUMINUM	480.0	240.0
	IRON	89.0	45.0

(f) Steam Treatment Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder powder metallurgy parts steam treated			
120	COPPER	540	280
121	CYANIDE	82	34
122	LEAD	120	57
	ALUMINUM	1,800	910
	IRON	340	170

(g) Tumbling, Burnishing And Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts tumbled, burnished, or cleaned			
120	COPPER	1,400	720
121	CYANIDE	210	86
122	LEAD	300	140
	ALUMINUM	4,600	2,300
	IRON	860	440

(h) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts sawed or ground			
120	COPPER	1,900	1,000
121	CYANIDE	290	120
122	LEAD	420	200
	ALUMINUM	6,400	3,200
	IRON	1,200	610

(i) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

4. NSPS is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods for nine of the eleven subcategories. NSPS is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods for the Lead/Tin/Bismuth Forming and the Iron And Steel/Copper/Aluminum Metal Powder Production And Powder Metallurgy Subcategories. The following effluent standards are proposed for new sources:

SUBPART A. NSPS FOR THE BERYLLIUM FORMING SUBCATEGORY

(a) Area Cleaning Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium formed		
117 BERYLLIUM	17,000	7,200
120 COPPER	27,000	13,000
121 CYANIDE	4,300	1,700
FLUORIDE	1,300,000	560,000
OIL & GREASE	210,000	210,000
TOTAL SUSPENDED SOLIDS	320,000	260,000
pH	Within the range of 7.5 to 10.0 at all times.	

(b) Billet Washing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium billets washed		
117 BERYLLIUM	31.0	13.0
120 COPPER	49.0	23.0
121 CYANIDE	7.6	3.1
FLUORIDE	2,300.0	1,000.0
OIL & GREASE	380.0	380.0
TOTAL SUSPENDED SOLIDS	570.0	460.0
pH	Within the range of 7.5 to 10.0 at all times.	

(c) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium surface treated		
117	BERYLLIUM	250	100
120	COPPER	390	190
121	CYANIDE	62	25
	FLUORIDE	18,000	8,100
	OIL & GREASE	3,100	3,100
	TOTAL SUSPENDED SOLIDS	4,600	3,700
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium surface treated		
117	BERYLLIUM	630	260
120	COPPER	980	470
121	CYANIDE	150	61
	FLUORIDE	46,000	20,000
	OIL & GREASE	7,700	7,700
	TOTAL SUSPENDED SOLIDS	12,000	9,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Sawing/Grinding Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium sawed or ground		
117	BERYLLIUM	350	140
120	COPPER	540	260
121	CYANIDE	85	34
	FLUORIDE	25,000	11,000
	OIL & GREASE	4,200	4,200
	TOTAL SUSPENDED SOLIDS	6,400	5,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Inspection/Testing Wastewater

There shall be no discharge of process wastewater pollutants.

(g) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART B. NSPS FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

The standards for antimony and lead are the same as specified in Section II, Part 3, Subpart B. The standards for TSS, oil and grease, and pH are the same as specified in Section II, Part 7, Subpart B.

SUBPART C. NSPS FOR THE MAGNESIUM FORMING SUBCATEGORY

The standards for chromium, zinc, ammonia, fluoride, and magnesium are the same as specified in Section II, Part 3, Subpart C. The standards for TSS, oil and grease, and pH are the same as specified in Section II, Part 7, Subpart C.

SUBPART D. NSPS FOR THE NICKEL/COBALT FORMING SUBCATEGORY

The standards for chromium, nickel, and fluoride are the same as specified in Section II, Part 3, Subpart D. The standards for TSS, oil and grease, and pH are the same as specified in Section II, Part 7, Subpart D.

SUBPART E. NSPS FOR THE PRECIOUS METALS FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals rolled with emulsions		
118	CADMIUM	7.2	2.9
120	COPPER	46.0	22.0
121	CYANIDE	7.2	2.9
126	SILVER	10.0	4.3
	OIL & GREASE	360.0	360.0
	TOTAL SUSPENDED SOLIDS	540.0	430.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Rolling Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of rolled precious metals heat treated		
118	CADMIUM	140	56
120	COPPER	900	430
121	CYANIDE	140	56
126	SILVER	200	84
	OIL & GREASE	7,000	7,000
	TOTAL SUSPENDED SOLIDS	11,000	8,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals drawn with emulsions		
118	CADMIUM	4.3	1.7
120	COPPER	27.0	13.0
121	CYANIDE	4.3	1.7
126	SILVER	6.2	2.6
	OIL & GREASE	210.0	210.0
	TOTAL SUSPENDED SOLIDS	320.0	260.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Drawing Spent Soap Solutions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals drawn with soap solutions		
118	CADMIUM	1.40	.60
120	COPPER	8.90	4.20
121	CYANIDE	1.40	.60
126	SILVER	2.00	.80
	OIL & GREASE	69.00	69.00
	TOTAL SUSPENDED SOLIDS	100.00	83.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded precious metals heat treated		
118	CADMIUM	270	110
120	COPPER	1,800	840
121	CYANIDE	270	110
126	SILVER	400	160
	OIL & GREASE	14,000	14,000
	TOTAL SUSPENDED SOLIDS	21,000	16,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Semi-Continuous And Continuous Casting Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals cast by the semi-continuous or continuous method		
118	CADMIUM	220	90
120	COPPER	1,400	680
121	CYANIDE	220	90
126	SILVER	320	130
	OIL & GREASE	11,000	11,000
	TOTAL SUSPENDED SOLIDS	17,000	13,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Stationary Casting Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals cast by the stationary method		
118	CADMIUM	.80	.30
120	COPPER	5.30	2.50
121	CYANIDE	.80	.30
126	SILVER	1.20	.50
	OIL & GREASE	42.00	42.00
	TOTAL SUSPENDED SOLIDS	63.00	50.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Direct Chill Casting Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals cast by the direct chill method		
118	CADMIUM	160	65
120	COPPER	1,000	500
121	CYANIDE	160	65
126	SILVER	240	98
	OIL & GREASE	8,200	8,200
	TOTAL SUSPENDED SOLIDS	12,000	9,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Shot Casting Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals shot cast		
118	CADMIUM	18.0	7.1
120	COPPER	110.0	54.0
121	CYANIDE	18.0	7.1
126	SILVER	26.0	11.0
	OIL & GREASE	890.0	890.0
	TOTAL SUSPENDED SOLIDS	1,300.0	1,100.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Casting Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals cast		
118	CADMIUM	1.20	.50
120	COPPER	7.50	3.60
121	CYANIDE	1.20	.50
126	SILVER	1.70	.70
	OIL & GREASE	59.00	59.00
	TOTAL SUSPENDED SOLIDS	88.00	70.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Metal Powder Production Atomization Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals powder wet atomized		
118	CADMIUM	1,300	530
120	COPPER	8,500	4,100
121	CYANIDE	1,300	530
126	SILVER	1,900	800
	OIL & GREASE	67,000	67,000
	TOTAL SUSPENDED SOLIDS	100,000	80,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Metal Powder Production Ball Milling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals powder wet ball milled		
118	CADMIUM	430	170
120	COPPER	2,800	1,300
121	CYANIDE	430	170
126	SILVER	630	260
	OIL & GREASE	22,000	22,000
	TOTAL SUSPENDED SOLIDS	33,000	26,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Preasure Bonding Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metal and base metal pressure bonded		
118	CADMIUM	17.0	6.7
120	COPPER	110.0	51.0
121	CYANIDE	17.0	6.7
126	SILVER	24.0	10.0
	OIL & GREASE	840.0	840.0
	TOTAL SUSPENDED SOLIDS	1,300.0	1,000.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Annealing Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals annealed		
118	CADMIUM	200	80
120	COPPER	1,300	610
121	CYANIDE	200	80
126	SILVER	290	120
	OIL & GREASE	10,000	10,000
	TOTAL SUSPENDED SOLIDS	15,000	12,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(p) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	31	12
120	COPPER	200	95
121	CYANIDE	31	12
126	SILVER	45	19
	OIL & GREASE	1,600	1,600
	TOTAL SUSPENDED SOLIDS	2,300	1,900
	pH	Within the range of 7.5 to 10.0 at all times.	

(q) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	570	230
120	COPPER	3,600	1,700
121	CYANIDE	570	230
126	SILVER	820	340
	OIL & GREASE	28,000	28,000
	TOTAL SUSPENDED SOLIDS	43,000	34,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned			
118	CADMIUM	.70	.30
120	COPPER	4.70	2.20
121	CYANIDE	.70	.30
126	SILVER	1.10	.40
	OIL & GREASE	37.00	37.00
	TOTAL SUSPENDED SOLIDS	55.00	44.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(s) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned			
118	CADMIUM	140	55
120	COPPER	890	420
121	CYANIDE	140	55
126	SILVER	200	83
	OIL & GREASE	6,900	6,900
	TOTAL SUSPENDED SOLIDS	10,000	8,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Pre-Bonding Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metal and base metal cleaned prior to bonding			
118	CADMIUM	68	27
120	COPPER	440	210
121	CYANIDE	68	27
126	SILVER	99	41
	OIL & GREASE	3,400	3,400
	TOTAL SUSPENDED SOLIDS	5,100	4,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals tumbled			
118	CADMIUM	88	35
120	COPPER	570	270
121	CYANIDE	88	35
126	SILVER	130	53
	OIL & GREASE	4,400	4,400
	TOTAL SUSPENDED SOLIDS	6,600	5,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(v) Burnishing Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals burnished			
118	CADMIUM	510	210
120	COPPER	3,300	1,600
121	CYANIDE	510	210
126	SILVER	750	310
	OIL & GREASE	26,000	26,000
	TOTAL SUSPENDED SOLIDS	110,000	50,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(w) Sawing/Grinding Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals sawed or ground			
118	CADMIUM	1.20	.50
120	COPPER	7.70	3.70
121	CYANIDE	1.20	.50
126	SILVER	1.80	.70
	OIL & GREASE	61.00	61.00
	TOTAL SUSPENDED SOLIDS	250.00	120.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART F. NSPS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals rolled with emulsions		
120	COPPER	1,500	730
124	NICKEL	660	440
	COLUMBIUM	830	360
	FLUORIDE	71,000	32,000
	MOLYBDENUM	830	360
	TANTALUM	830	360
	TUNGSTEN	830	360
	VANADIUM	830	360
	OIL & GREASE	12,000	12,000
	TOTAL SUSPENDED SOLIDS	18,000	14,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded refractory metals heat treated		
120	COPPER	440	210
124	NICKEL	190	130
	COLUMBIUM	240	100
	FLUORIDE	21,000	9,100
	MOLYBDENUM	240	100
	TANTALUM	240	100
	TUNGSTEN	240	100
	VANADIUM	240	100
	OIL & GREASE	3,500	3,500
	TOTAL SUSPENDED SOLIDS	5,200	4,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded		
120	COPPER	1,500	730
124	NICKEL	650	440
	COLUMBIUM	820	360
	FLUORIDE	71,000	31,000
	MOLYBDENUM	820	360
	TANTALUM	820	360
	TUNGSTEN	820	360
	VANADIUM	820	360
	OIL & GREASE	12,000	12,000
	TOTAL SUSPENDED SOLIDS	18,000	14,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(g) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged refractory metals heat treated		
120	COPPER	740	350
124	NICKEL	320	210
	COLUMBIUM	400	170
	FLUORIDE	34,000	15,000
	MOLYBDENUM	400	170
	TANTALUM	400	170
	TUNGSTEN	400	170
	VANADIUM	400	170
	OIL & GREASE	5,800	5,800
	TOTAL SUSPENDED SOLIDS	8,700	6,900
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Extrusion And Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded or forged		
120	COPPER	53	25
124	NICKEL	23	15
	COLUMBIUM	29	13
	FLUORIDE	2,500	1,100
	MOLYBDENUM	29	13
	TANTALUM	29	13
	TUNGSTEN	29	13
	VANADIUM	29	13
	OIL & GREASE	420	420
	TOTAL SUSPENDED SOLIDS	630	500
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Metal Powder Production Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals powder produced		
120	COPPER	2,100	1,000
124	NICKEL	900	610
	COLUMBIUM	1,100	490
	FLUORIDE	98,000	43,000
	MOLYBDENUM	1,100	490
	TANTALUM	1,100	490
	TUNGSTEN	1,100	490
	VANADIUM	1,100	490
	OIL & GREASE	16,000	16,000
	TOTAL SUSPENDED SOLIDS	25,000	20,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Metal Powder Production Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(k) Metal Powder Pressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(l) Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(m) Post-Casting Billet Washwater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of cast refractory metals billet washed		
120	COPPER	38.0	18.0
124	NICKEL	16.0	11.0
	COLUMBIUM	21.0	8.9
	FLUORIDE	1,800.0	790.0
	MOLYBDENUM	21.0	8.9
	TANTALUM	21.0	8.9
	TUNGSTEN	21.0	8.9
	VANADIUM	21.0	8.9
	OIL & GREASE	300.0	300.0
	TOTAL SUSPENDED SOLIDS	450.0	360.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	16.0	7.7
124	NICKEL	7.0	4.7
	COLUMBIUM	8.8	3.8
	FLUORIDE	760.0	340.0
	MOLYBDENUM	8.8	3.8
	TANTALUM	8.8	3.8
	TUNGSTEN	8.8	3.8
	VANADIUM	8.8	3.8
	OIL & GREASE	130.0	130.0
	TOTAL SUSPENDED SOLIDS	190.0	150.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	15,000	7,400
124	NICKEL	6,700	4,500
	COLUMBIUM	8,300	3,600
	FLUORIDE	720,000	320,000
	MOLYBDENUM	8,300	3,600
	TANTALUM	8,300	3,600
	TUNGSTEN	8,300	3,600
	VANADIUM	8,300	3,600
	OIL & GREASE	120,000	120,000
	TOTAL SUSPENDED SOLIDS	180,000	150,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(p) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	15,000	7,200
124	NICKEL	6,500	4,400
	COLUMBIUM	8,100	3,500
	FLUORIDE	700,000	310,000
	MOLYBDENUM	8,100	3,500
	TANTALUM	8,100	3,500
	TUNGSTEN	8,100	3,500
	VANADIUM	8,100	3,500
	OIL & GREASE	120,000	120,000
	TOTAL SUSPENDED SOLIDS	180,000	140,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(q) Surface Coating Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface coated		
120	COPPER	1,400	660
124	NICKEL	590	400
	COLUMBIUM	750	320
	FLUORIDE	64,000	29,000
	MOLYBDENUM	750	320
	TANTALUM	750	320
	TUNGSTEN	750	320
	VANADIUM	750	320
	OIL & GREASE	11,000	11,000
	TOTAL SUSPENDED SOLIDS	16,000	13,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	39.0	19.0
124	NICKEL	17.0	11.0
	COLUMBIUM	21.0	9.2
	FLUORIDE	1,800.0	810.0
	MOLYBDENUM	21.0	9.2
	TANTALUM	21.0	9.2
	TUNGSTEN	21.0	9.2
	VANADIUM	21.0	9.2
	OIL & GREASE	310.0	310.0
	TOTAL SUSPENDED SOLIDS	460.0	370.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(s) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	1,800	850
124	NICKEL	770	520
	COLUMBIUM	970	420
	FLUORIDE	83,000	37,000
	MOLYBDENUM	970	420
	TANTALUM	970	420
	TUNGSTEN	970	420
	VANADIUM	970	420
	OIL & GREASE	14,000	14,000
	TOTAL SUSPENDED SOLIDS	21,000	17,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Molten Salt Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals cleaned with molten salt		
120	COPPER	120,000	55,000
124	NICKEL	50,000	33,000
	COLUMBIUM	62,000	27,000
	FLUORIDE	5,400,000	2,400,000
	MOLYBDENUM	62,000	27,000
	TANTALUM	62,000	27,000
	TUNGSTEN	62,000	27,000
	VANADIUM	62,000	27,000
	OIL & GREASE	900,000	900,000
	TOTAL SUSPENDED SOLIDS	1,400,000	1,100,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling/Burnishing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals tumbled or burnished		
120	COPPER	2,800	1,300
124	NICKEL	1,200	820
	COLUMBIUM	1,500	660
	FLUORIDE	130,000	58,000
	MOLYBDENUM	1,500	660
	TANTALUM	1,500	660
	TUNGSTEN	1,500	660
	VANADIUM	1,500	660
	OIL & GREASE	22,000	22,000
	TOTAL SUSPENDED SOLIDS	33,000	27,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(v) Sawing/Grinding Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(w) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with emulsions		
120	COPPER	280	130
124	NICKEL	120	80
	COLUMBIUM	150	65
	FLUORIDE	13,000	5,700
	MOLYBDENUM	150	65
	TANTALUM	150	65
	TUNGSTEN	150	65
	VANADIUM	150	65
	OIL & GREASE	2,200	2,200
	TOTAL SUSPENDED SOLIDS	3,300	2,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Sawing/Grinding Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with lubricant-coolant water		
120	COPPER	1,000	500
124	NICKEL	450	300
	COLUMBIUM	560	240
	FLUORIDE	48,000	21,000
	MOLYBDENUM	560	240
	TANTALUM	560	240
	TUNGSTEN	560	240
	VANADIUM	560	240
	OIL & GREASE	8,100	8,100
	TOTAL SUSPENDED SOLIDS	12,000	9,700
	pH	Within the range of 7.5 to 10.0 at all times.	

(y) Sawing/Grinding Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground		
120	COPPER	140	66
124	NICKEL	59	40
	COLUMBIUM	75	32
	FLUORIDE	6,400	2,900
	MOLYBDENUM	75	32
	TANTALUM	75	32
	TUNGSTEN	75	32
	VANADIUM	75	32
	OIL & GREASE	1,100	1,100
	TOTAL SUSPENDED SOLIDS	1,600	1,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(z) Post Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground refractory metals rinsed		
120	COPPER	66	31
124	NICKEL	28	19
	COLUMBIUM	35	15
	FLUORIDE	3,100	1,400
	MOLYBDENUM	35	15
	TANTALUM	35	15
	TUNGSTEN	35	15
	VANADIUM	35	15
	OIL & GREASE	510	510
	TOTAL SUSPENDED SOLIDS	770	620
	pH	Within the range of 7.5 to 10.0 at all times.	

(aa) Product Testing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals product tested		
120	COPPER	10.0	4.7
124	NICKEL	4.3	2.9
	COLUMBIUM	5.4	2.3
	FLUORIDE	460.0	200.0
	MOLYBDENUM	5.4	2.3
	TANTALUM	5.4	2.3
	TUNGSTEN	5.4	2.3
	VANADIUM	5.4	2.3
	OIL & GREASE	78.0	78.0
	TOTAL SUSPENDED SOLIDS	120.0	93.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART G. NSPS FOR THE TITANIUM FORMING SUBCATEGORY

The standards for cyanide, lead, zinc, ammonia, fluoride, and titanium are the same as specified in Section II, Part 3, Subpart G. The standards for TSS, oil and grease, and pH are the same as specified in Section II, Part 7, Subpart G.

SUBPART H. NSPS FOR THE URANIUM FORMING SUBCATEGORY

The standards for cadmium, copper, nickel, fluoride, radium, and uranium are the same as specified in Section II, Part 3, Subpart H. The standards for TSS, oil and grease, and pH are the same as specified in Section II, Part 7, Subpart H.

SUBPART I. NSPS FOR THE ZINC FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc rolled with emulsions			
119	CHROMIUM	.50	.20
121	CYANIDE	.30	.10
128	ZINC	1.40	.60
	OIL & GREASE	14.00	14.00
	TOTAL SUSPENDED SOLIDS	21.00	17.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Rolling Contact Lubricant-Coolant Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc rolled with contact lubricant-coolant water			
119	CHROMIUM	13.0	5.2
121	CYANIDE	6.9	2.8
128	ZINC	35.0	15.0
	OIL & GREASE	350.0	350.0
	TOTAL SUSPENDED SOLIDS	520.0	420.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc drawn with emulsions			
119	CHROMIUM	3.00	1.20
121	CYANIDE	1.60	.60
128	ZINC	8.20	3.40
	OIL & GREASE	80.00	80.00
	TOTAL SUSPENDED SOLIDS	120.00	96.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc cast by the direct chill method			
119	CHROMIUM	19.0	7.5
121	CYANIDE	10.0	4.0
128	ZINC	51.0	21.0
	OIL & GREASE	500.0	500.0
	TOTAL SUSPENDED SOLIDS	750.0	600.0
	pH		

(f) Stationary Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Heat Treatment Contact Colling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc heat treated			
119	CHROMIUM	28.0	11.0
121	CYANIDE	15.0	6.1
128	ZINC	78.0	32.0
	OIL & GREASE	760.0	760.0
	TOTAL SUSPENDED SOLIDS	1,100.0	910.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc surface treated		
119	CHROMIUM	3.50	1.40
121	CYANIDE	1.90	.80
128	ZINC	10.00	4.00
	OIL & GREASE	95.00	95.00
	TOTAL SUSPENDED SOLIDS	140.00	110.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc surface treated		
119	CHROMIUM	180	73
121	CYANIDE	97	39
128	ZINC	500	200
	OIL & GREASE	4,900	4,900
	TOTAL SUSPENDED SOLIDS	7,300	5,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc alkaline cleaned		
119	CHROMIUM	.30	.10
121	CYANIDE	.10	.10
128	ZINC	.70	.30
	OIL & GREASE	7.20	7.20
	TOTAL SUSPENDED SOLIDS	11.00	8.60
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned		
119 CHROMIUM	2,100	860
121 CYANIDE	1,100	460
128 ZINC	5,800	2,400
OIL & GREASE	57,000	57,000
TOTAL SUSPENDED SOLIDS	86,000	69,000
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc sawed or ground		
119 CHROMIUM	20.0	8.2
121 CYANIDE	11.0	4.4
128 ZINC	56.0	23.0
OIL & GREASE	550.0	550.0
TOTAL SUSPENDED SOLIDS	820.0	660.0
pH	Within the range of 7.5 to 10.0 at all times.	

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART J. NSPS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

(a) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded with emulsions		
119	CHROMIUM	27.0	11.0
121	CYANIDE	15.0	5.9
124	NICKEL	41.0	27.0
	AMMONIA	9,900.0	4,300.0
	FLUORIDE	4,400.0	2,000.0
	HAFNIUM	51.0	22.0
	ZIRCONIUM	51.0	22.0
	OIL & GREASE	740.0	740.0
	TOTAL SUSPENDED SOLIDS	1,100.0	890.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded		
119	CHROMIUM	140	56
121	CYANIDE	74	30
124	NICKEL	200	140
	AMMONIA	49,000	22,000
	FLUORIDE	22,000	9,800
	HAFNIUM	260	110
	ZIRCONIUM	260	110
	OIL & GREASE	3,700	3,700
	TOTAL SUSPENDED SOLIDS	5,600	4,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded zirconium/hafnium heat treated		
119	CHROMIUM	11.0	4.3
121	CYANIDE	5.7	2.3
124	NICKEL	16.0	11.0
	AMMONIA	3,800.0	1,700.0
	FLUORIDE	1,700.0	750.0
	HAFNIUM	20.0	8.6
	ZIRCONIUM	20.0	8.6
	OIL & GREASE	290.0	290.0
	TOTAL SUSPENDED SOLIDS	430.0	340.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged zirconium/hafnium heat treated		
119	CHROMIUM	13.0	5.2
121	CYANIDE	7.0	2.8
124	NICKEL	19.0	13.0
	AMMONIA	4,700.0	2,000.0
	FLUORIDE	2,100.0	920.0
	HAFNIUM	24.0	10.0
	ZIRCONIUM	24.0	10.0
	OIL & GREASE	350.0	350.0
	TOTAL SUSPENDED SOLIDS	520.0	420.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium rolled with emulsions		
119	CHROMIUM	150	60
121	CYANIDE	80	32
124	NICKEL	220	150
	AMMONIA	53,000	23,000
	FLUORIDE	24,000	11,000
	HAFNIUM	280	120
	ZIRCONIUM	280	120
	OIL & GREASE	4,000	4,000
	TOTAL SUSPENDED SOLIDS	6,000	4,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium surface treated		
119	CHROMIUM	570	230
121	CYANIDE	310	120
124	NICKEL	840	570
	AMMONIA	200,000	90,000
	FLUORIDE	91,000	40,000
	HAFNIUM	1,100	460
	ZIRCONIUM	1,100	460
	OIL & GREASE	15,000	15,000
	TOTAL SUSPENDED SOLIDS	23,000	18,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned		
119	CHROMIUM	790	320
121	CYANIDE	430	170
124	NICKEL	1,200	790
	AMMONIA	280,000	120,000
	FLUORIDE	130,000	56,000
	HAFNIUM	1,500	640
	ZIRCONIUM	1,500	640
	OIL & GREASE	21,000	21,000
	TOTAL SUSPENDED SOLIDS	32,000	26,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned		
119	CHROMIUM	2,000	830
121	CYANIDE	1,100	440
124	NICKEL	3,000	2,000
	AMMONIA	740,000	320,000
	FLUORIDE	330,000	150,000
	HAFNIUM	3,800	1,700
	ZIRCONIUM	3,800	1,700
	OIL & GREASE	55,000	55,000
	TOTAL SUSPENDED SOLIDS	83,000	66,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Sawing/Grinding Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium sawed or ground		
119	CHROMIUM	3.30	1.40
121	CYANIDE	1.80	.70
124	NICKEL	5.00	3.30
	AMMONIA	1,200.00	530.00
	FLUORIDE	540.00	240.00
	HAFNIUM	6.20	2.70
	ZIRCONIUM	6.20	2.70
	OIL & GREASE	90.00	90.00
	TOTAL SUSPENDED SOLIDS	140.00	110.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Sawing/Grinding Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(n) Degreasing Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium degreased		
119	CHROMIUM	75	30
121	CYANIDE	41	16
124	NICKEL	110	75
	AMMONIA	27,000	12,000
	FLUORIDE	12,000	5,400
	HAFNIUM	140	61
	ZIRCONIUM	140	61
	OIL & GREASE	2,000	2,000
	TOTAL SUSPENDED SOLIDS	3,000	2,400
	pH	Within the range of 7.5 to 10.0 at all times.	

SUBPART K. NSPS FOR THE IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

The standards for copper, cyanide, lead, aluminum, and iron are the same as specified in Section II, Part 3, Subpart K. The standards for TSS, oil and grease, and pH are the same as specified in Section II, Part 7, Subpart K.

5. PSES is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods for seven of the eleven subcategories. PSES is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods for the Lead/Tin/Bismuth Forming and the Iron And Steel/Copper/Aluminum Metal Powder Production And Powder Metallurgy Subcategories. The Agency proposes to exclude the Beryllium Forming and Zinc Forming Subcategories. The following pretreatment standards are proposed for existing sources:

SUBPART A. PSES FOR THE BERYLLIUM FORMING SUBCATEGORY

[Reserved]

SUBPART B. PSES FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

The standards for antimony and lead are the same as specified in Section II, Part 3, Subpart B.

SUBPART C. PSES FOR THE MAGNESIUM FORMING SUBCATEGORY

The standards for chromium, zinc, ammonia, fluoride, and magnesium are the same as specified in Section II, Part 3, Subpart C.

SUBPART D. PSES FOR THE NICKEL/COBALT FORMING SUBCATEGORY

The standards for chromium, nickel, and fluoride are the same as specified in Section II, Part 3, Subpart D.

SUBPART E. PSES FOR THE PRECIOUS METALS FORMING SUBCATEGORY

The standards for cadmium, copper, silver, and cyanide are the same as specified in Section II, Part 3, Subpart E.

SUBPART F. PSES FOR THE REFRACTORY METALS FORMING SUBCATEGORY

The standards for copper, nickel, columbium, fluoride, molybdenum, tantalum, tungsten, and vanadium are the same as specified in Section II, Part 3, Subpart F.

SUBPART G. PSES FOR THE TITANIUM FORMING SUBCATEGORY

The standards for cyanide, lead, zinc, ammonia, fluoride, and titanium are the same as specified in Section II, Part 3, Subpart G.

SUBPART H. PSES FOR THE URANIUM FORMING SUBCATEGORY

The standards for cadmium, copper, nickel, fluoride, radium, and uranium are the same as specified in Section II, Part 3, Subpart H.

SUBPART I. PSES FOR THE ZINC FORMING SUBCATEGORY

[Reserved]

SUBPART J. PSES FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

The standards for chromium, cyanide, nickel, ammonia, fluoride, hafnium, and zirconium are the same as specified in Section II, Part 3, Subpart J.

SUBPART K. PSES FOR THE IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

The standards for copper, cyanide, lead, aluminum, and iron are the same as specified in Section II, Part 3, Subpart K.

6. PSNS is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods for nine of the eleven subcategories. PSNS is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods for the Lead/Tin/Bismuth Forming and the Iron And Steel/Copper/Aluminum Metal Powder Production And Powder Metallurgy Subcategories. The following pretreatment standards are being proposed for new sources:

SUBPART A. PSNS FOR THE BERYLLIUM FORMING SUBCATEGORY

The standards for beryllium, copper, cyanide, and fluoride are the same as specified in Section II, Part 3, Subpart A.

SUBPART B. PSNS FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

The standards for antimony and lead are the same as specified in Section II, Part 3, Subpart B.

SUBPART C. PSNS FOR THE MAGNESIUM FORMING SUBCATEGORY

The standards for chromium, zinc, ammonia, fluoride, and magnesium are the same as specified in Section II, Part 3, Subpart C.

SUBPART D. PSNS FOR THE NICKEL/COBALT FORMING SUBCATEGORY

The standards for chromium, nickel, and fluoride are the same as specified in Section II, Part 3, Subpart D.

SUBPART E. PSNS FOR THE PRECIOUS METALS FORMING SUBCATEGORY

The standards for cadmium, copper, silver, and cyanide are the same as specified in Section II, Part 3, Subpart E.

SUBPART F. PSNS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

The standards for copper, nickel, columbium, fluoride, molybdenum, tantalum, tungsten, and vanadium are the same as specified in Section II, Part 3, Subpart F.

SUBPART G. PSNS FOR THE TITANIUM FORMING SUBCATEGORY

The standards for cyanide, lead, zinc, ammonia, fluoride, and titanium are the same as specified in Section II, Part 3, Subpart G.

SUBPART H. PSNS FOR THE URANIUM FORMING SUBCATEGORY

The standards for cadmium, copper, nickel, fluoride, radium, and uranium are the same as specified in Section II, Part 3, Subpart H.

SUBPART I. PSNS FOR THE ZINC FORMING SUBCATEGORY

The standards for chromium, cyanide, and zinc are the same as specified in Section II, Part 3, Subpart I.

SUBPART J. PSNS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

The standards for chromium, cyanide, nickel, ammonia, fluoride, hafnium, and zirconium are the same as specified in Section II, Part 3, Subpart J.

SUBPART K. PSNS FOR THE IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

The standards for copper, cyanide, lead, aluminum, and iron are the same as specified in Section II, Part 3, Subpart K.

7. BCT is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods for four of the eleven subcategories. BCT is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods for the Lead/Tin/Bismuth Forming, Zirconium/Hafnium Forming, and Iron And Steel/Copper/Aluminum Metal Powder Production And Powder Metallurgy Subcategories. BCT is proposed based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology for the Beryllium Forming, Precious Metals Forming, Refractory Metals Forming, and Zinc Forming Subcategories. The following effluent limitations are proposed for existing sources:

SUBPART A. BCT MASS LIMITATIONS FOR THE BERYLLIUM FORMING SUBCATEGORY

The limitations for TSS, oil and grease, and pH are the same as specified in Section II, Part 2, Subpart A.

SUBPART B. BCT MASS LIMITATIONS FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with emulsions		
OIL & GREASE	470	280
TOTAL SUSPENDED SOLIDS	960	450
pH	Within the range of 7.5 to 10.0 at all times.	

(b) Rolling Spent Soap Solutions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with soap solutions		
OIL & GREASE	860	520
TOTAL SUSPENDED SOLIDS	1,800	840
pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with emulsions		
OIL & GREASE	330	200
TOTAL SUSPENDED SOLIDS	680	330
pH	Within the range of 7.5 to 10.0 at all times.	

(e) Drawing Spent Soap Solutions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with soap solutions		
OIL & GREASE	150	90
TOTAL SUSPENDED SOLIDS	310	150
pH	Within the range of 7.5 to 10.0 at all times.	

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth heat treated		
OIL & GREASE	3,500	2,100
TOTAL SUSPENDED SOLIDS	7,200	3,400
pH	Within the range of 7.5 to 10.0 at all times.	

(g) Extrusion Press Hydraulic Fluid Leakage

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth extruded		
OIL & GREASE	990	590
TOTAL SUSPENDED SOLIDS	2,000	960
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Continuous Strip Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
OIL & GREASE	20	12
TOTAL SUSPENDED SOLIDS	41	20
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Semi-Continuous Ingot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
OIL & GREASE	59	35
TOTAL SUSPENDED SOLIDS	120	57
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Shot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth shot cast		
OIL & GREASE	84	50
TOTAL SUSPENDED SOLIDS	170	82
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Shot-Forming Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth shot formed		
OIL & GREASE	.20	.10
TOTAL SUSPENDED SOLIDS	.40	.20
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned		
OIL & GREASE	12,000	7,300
TOTAL SUSPENDED SOLIDS	25,000	12,000
pH	Within the range of 7.5 to 10.0 at all times.	

(m) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned		
OIL & GREASE	13,000	7,800
TOTAL SUSPENDED SOLIDS	26,000	13,000
pH	Within the range of 7.5 to 10.0 at all times.	

(n) Swaging Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth swaged with emulsions		
OIL & GREASE	35	21
TOTAL SUSPENDED SOLIDS	73	35
pH	Within the range of 7.5 to 10.0 at all times.	

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(p) Miscellaneous Nondescript Wastewater Sources

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth formed		
OIL & GREASE	1,200	700
TOTAL SUSPENDED SOLIDS	2,400	1,100
pH	Within the range of 7.5 to 10.0 at all times.	

SUBPART C. BCT MASS LIMITATIONS FOR THE MAGNESIUM FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

There shall be no discharge of process wastewater pollutants.

(b) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(c) Forging Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of magnesium forged		
OIL & GREASE	2,700,000	2,700,000
TOTAL SUSPENDED SOLIDS	4,000,000	3,200,000
pH	Within the range of 7.5 to 10.0 at all times.	

(d) Forging Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of forged magnesium heat treated		
OIL & GREASE	6,300	6,300
TOTAL SUSPENDED SOLIDS	9,500	7,600
pH	Within the range of 7.5 to 10.0 at all times.	

(e) Forging Equipment Cleaning Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of magnesium forged		
OIL & GREASE	1,600	1,600
TOTAL SUSPENDED SOLIDS	2,400	1,900
pH	Within the range of 7.5 to 10.0 at all times.	

(f) Direct Chill Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of magnesium surface treated		
OIL & GREASE	4,700	4,700
TOTAL SUSPENDED SOLIDS	7,000	5,600
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of magnesium surface treated		
OIL & GREASE	18,000	18,000
TOTAL SUSPENDED SOLIDS	27,000	21,000
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Sawing/Grinding Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(j) Sanding And Repairing Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of magnesium sanded and repaired		
OIL & GREASE	4,300	4,300
TOTAL SUSPENDED SOLIDS	6,400	5,100
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART D. BCT MASS LIMITATIONS FOR THE NICKEL/COBALT FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt rolled with emulsions		
OIL & GREASE	15,000	15,000
TOTAL SUSPENDED SOLIDS	22,000	18,000
pH	Within the range of 7.5 to 10.0 at all times.	

(c) Rolling Contact Lubricant-Coolant Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt rolled with contact lubricant-coolant water		
OIL & GREASE	13,000	13,000
TOTAL SUSPENDED SOLIDS	20,000	16,000
pH	Within the range of 7.5 to 10.0 at all times.	

(d) Rolling Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of rolled nickel/cobalt heat treated		
OIL & GREASE	.30	.30
TOTAL SUSPENDED SOLIDS	.40	.30
pH	Within the range of 7.5 to 10.0 at all times.	

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(g) Drawing Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt drawn with emulsions		
OIL & GREASE	950	950
TOTAL SUSPENDED SOLIDS	1,400	1,100
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(i) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded nickel/cobalt heat treated		
OIL & GREASE	830	830
TOTAL SUSPENDED SOLIDS	1,200	1,000
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Forging, Extrusion, And Isostatic Press Hydraulic Fluid Leakage

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt forged, extruded, or pressed		
OIL & GREASE	1,200	1,200
TOTAL SUSPENDED SOLIDS	1,900	1,500
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Forging Equipment Cleaning Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt forged		
OIL & GREASE	1,600	1,600
TOTAL SUSPENDED SOLIDS	2,400	2,000
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Forging Die Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt forged		
OIL & GREASE	1,300	1,300
TOTAL SUSPENDED SOLIDS	1,900	1,500
pH	Within the range of 7.5 to 10.0 at all times.	

(m) Forging/Swaging Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(n) Stationary And Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt cast by the stationary or direct chill method		
OIL & GREASE	18,000	18,000
TOTAL SUSPENDED SOLIDS	27,000	21,000
pH	Within the range of 7.5 to 10.0 at all times.	

(o) Casting Vacuum Melting Steam Condensate

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt vacuum melted		
OIL & GREASE	1,700	1,700
TOTAL SUSPENDED SOLIDS	2,500	2,000
pH	Within the range of 7.5 to 10.0 at all times.	

(p) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt metal powder atomized		
OIL & GREASE	28,000	28,000
TOTAL SUSPENDED SOLIDS	43,000	34,000
pH	Within the range of 7.5 to 10.0 at all times.	

(q) Annealing Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt annealed		
OIL & GREASE	4,600	4,600
TOTAL SUSPENDED SOLIDS	6,900	5,500
pH	Within the range of 7.5 to 10.0 at all times.	

(r) Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt formed		
OIL & GREASE	2,500	2,500
TOTAL SUSPENDED SOLIDS	3,800	3,000
pH	Within the range of 7.5 to 10.0 at all times.	

(s) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt surface treated		
OIL & GREASE	8,600	8,600
TOTAL SUSPENDED SOLIDS	13,000	10,000
pH	Within the range of 7.5 to 10.0 at all times.	

(t) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt surface treated		
OIL & GREASE	11,000	11,000
TOTAL SUSPENDED SOLIDS	16,000	13,000
pH	Within the range of 7.5 to 10.0 at all times.	

(u) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned		
OIL & GREASE	310	310
TOTAL SUSPENDED SOLIDS	460	370
pH	Within the range of 7.5 to 10.0 at all times.	

(v) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned		
OIL & GREASE	5,000	5,000
TOTAL SUSPENDED SOLIDS	7,500	6,000
pH	Within the range of 7.5 to 10.0 at all times.	

(w) Molten Salt Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with molten salt		
OIL & GREASE	13,000	13,000
TOTAL SUSPENDED SOLIDS	19,000	15,000
pH	Within the range of 7.5 to 10.0 at all times.	

(x) Ammonia Rinse Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with ammonia solution		
OIL & GREASE	160	160
TOTAL SUSPENDED SOLIDS	240	190
pH	Within the range of 7.5 to 10.0 at all times.	

(y) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt sawed or ground		
OIL & GREASE	10,000	10,000
TOTAL SUSPENDED SOLIDS	15,000	12,000
pH	Within the range of 7.5 to 10.0 at all times.	

(z) Steam Cleaning Condensate

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt steam cleaned		
OIL & GREASE	230	230
TOTAL SUSPENDED SOLIDS	350	280
pH	Within the range of 7.5 to 10.0 at all times.	

(aa) Hydrostatic Tube Testing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt tube tested by the hydrostatic method		
OIL & GREASE	1,400	1,400
TOTAL SUSPENDED SOLIDS	2,000	1,600
pH	Within the range of 7.5 to 10.0 at all times.	

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(ac) Miscellaneous Nondescript Wastewater Sources

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt formed		
OIL & GREASE	580	580
TOTAL SUSPENDED SOLIDS	880	700
pH	Within the range of 7.5 to 10.0 at all times.	

SUBPART E. BCT MASS LIMITATIONS FOR THE PRECIOUS METALS FORMING SUBCATEGORY

The limitations for TSS, oil and grease, and pH are the same as specified in Section II, Part 2, Subpart E.

SUBPART F. BCT MASS LIMITATIONS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

The limitations for TSS, oil and grease, and pH are the same as specified in Section II, Part 2, Subpart F.

SUBPART G. BCT MASS LIMITATIONS FOR THE TITANIUM FORMING SUBCATEGORY

(a) Cold Rolling Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium cold rolled		
OIL & GREASE	3,300	3,300
TOTAL SUSPENDED SOLIDS	5,000	4,000
pH	Within the range of 7.5 to 10.0 at all times.	

(b) Hot Rolling Contact Lubricant-Coolant Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium hot rolled with contact lubricant-coolant water		
OIL & GREASE	4,300	4,300
TOTAL SUSPENDED SOLIDS	6,500	5,200
pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium extruded		
OIL & GREASE	2,700	2,700
TOTAL SUSPENDED SOLIDS	4,100	3,300
pH	Within the range of 7.5 to 10.0 at all times.	

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Die Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium forged		
OIL & GREASE	3,000	3,000
TOTAL SUSPENDED SOLIDS	4,500	3,600
pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium forged		
OIL & GREASE	2,000	2,000
TOTAL SUSPENDED SOLIDS	3,000	2,400
pH	Within the range of 7.5 to 10.0 at all times.	

(g) Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium heat treated		
OIL & GREASE	4,500	4,500
TOTAL SUSPENDED SOLIDS	6,800	5,400
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium surface treated		
OIL & GREASE	1,600	1,600
TOTAL SUSPENDED SOLIDS	2,400	1,900
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium surface treated		
OIL & GREASE	21,000	21,000
TOTAL SUSPENDED SOLIDS	32,000	25,000
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Surface Treatment Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium surface treated		
OIL & GREASE	170	170
TOTAL SUSPENDED SOLIDS	260	200
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
OIL & GREASE	6,400	6,400
TOTAL SUSPENDED SOLIDS	9,600	7,700
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
OIL & GREASE	2,800	2,800
TOTAL SUSPENDED SOLIDS	4,100	3,300
pH	Within the range of 7.5 to 10.0 at all times.	

(m) Tumbling Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium tumbled		
OIL & GREASE	790	790
TOTAL SUSPENDED SOLIDS	1,200	950
pH	Within the range of 7.5 to 10.0 at all times.	

(n) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium sawed or ground		
OIL & GREASE	500	500
TOTAL SUSPENDED SOLIDS	750	600
pH	Within the range of 7.5 to 10.0 at all times.	

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART H. BCT MASS LIMITATIONS FOR THE URANIUM FORMING SUBCATEGORY

(a) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Tool Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium extruded		
OIL & GREASE	520	520
TOTAL SUSPENDED SOLIDS	780	620
pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded uranium heat treated		
OIL & GREASE	2,700	2,700
TOTAL SUSPENDED SOLIDS	4,100	3,300
pH	Within the range of 7.5 to 10.0 at all times.	

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of forged uranium heat treated		
OIL & GREASE	2,800	2,800
TOTAL SUSPENDED SOLIDS	4,300	3,400
pH	Within the range of 7.5 to 10.0 at all times.	

(f) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated		
OIL & GREASE	360	360
TOTAL SUSPENDED SOLIDS	530	430
pH	Within the range of 7.5 to 10.0 at all times.	

(g) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated		
OIL & GREASE	1,500	1,500
TOTAL SUSPENDED SOLIDS	2,200	1,800
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated		
OIL & GREASE	740	740
TOTAL SUSPENDED SOLIDS	1,100	890
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Sawing/Grinding Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium sawed or ground		
OIL & GREASE	31	31
TOTAL SUSPENDED SOLIDS	47	37
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Post-Sawing/Grinding Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of sawed or ground uranium rinsed		
OIL & GREASE	380	380
TOTAL SUSPENDED SOLIDS	570	460
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART I. BCT MASS LIMITATIONS FOR THE ZINC FORMING SUBCATEGORY

The limitations for TSS, oil and grease, and pH are the same as specified in Section II, Part 2, Subpart I.

SUBPART J. BCT MASS LIMITATIONS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

(a) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium extruded with emulsions		
OIL & GREASE	1,500	890
TOTAL SUSPENDED SOLIDS	3,000	1,400
pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Press Hydraulic Fluid Leakage

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium extruded		
OIL & GREASE	7,400	4,400
TOTAL SUSPENDED SOLIDS	15,000	7,200
pH	Within the range of 7.5 to 10.0 at all times.	

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded zirconium/hafnium heat treated		
OIL & GREASE	570	340
TOTAL SUSPENDED SOLIDS	1,200	560
pH	Within the range of 7.5 to 10.0 at all times.	

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Forging Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of forged zirconium/hafnium heat treated		
OIL & GREASE	700	420
TOTAL SUSPENDED SOLIDS	1,400	680
pH	Within the range of 7.5 to 10.0 at all times.	

(g) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium rolled with emulsions		
OIL & GREASE	8,000	4,800
TOTAL SUSPENDED SOLIDS	16,000	7,800
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium surface treated		
OIL & GREASE	31,000	18,000
TOTAL SUSPENDED SOLIDS	63,000	30,000
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned		
OIL & GREASE	43,000	26,000
TOTAL SUSPENDED SOLIDS	87,000	42,000
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned		
OIL & GREASE	110,000	66,000
TOTAL SUSPENDED SOLIDS	230,000	110,000
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium sawed or ground		
OIL & GREASE	180	110
TOTAL SUSPENDED SOLIDS	370	180
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Sawing/Grinding Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(n) Degreasing Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium degreased		
OIL & GREASE	4,100	2,400
TOTAL SUSPENDED SOLIDS	8,300	4,000
pH	Within the range of 7.5 to 10.0 at all times.	

SUBPART K. BCT MASS LIMITATIONS FOR THE IRON AND STEEL/COPPER/ ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

(a) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet atomized		
OIL & GREASE	100,000	60,000
TOTAL SUSPENDED SOLIDS	210,000	98,000
pH	Within the range of 7.5 to 10.0 at all times.	

(b) Metal Powder Production Milling Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet milled		
OIL & GREASE	33,000	20,000
TOTAL SUSPENDED SOLIDS	68,000	33,000
pH	Within the range of 7.5 to 10.0 at all times.	

(c) Metal Powder Production Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder produced		
OIL & GREASE	53,000	32,000
TOTAL SUSPENDED SOLIDS	110,000	51,000
pH	Within the range of 7.5 to 10.0 at all times.	

(d) Sizing/Repressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Oil-Resin Impregnation Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts impregnated with oil-resin		
OIL & GREASE	1,500	890
TOTAL SUSPENDED SOLIDS	3,100	1,500
pH	Within the range of 7.5 to 10.0 at all times.	

(f) Steam Treatment Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder powder metallurgy parts steam treated		
OIL & GREASE	5,700	3,400
TOTAL SUSPENDED SOLIDS	12,000	5,500
pH	Within the range of 7.5 to 10.0 at all times.	

(g) Tumbling, Burnishing And Cleaning Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts tumbled, burnished, or cleaned		
OIL & GREASE	14,000	8,600
TOTAL SUSPENDED SOLIDS	29,000	14,000
pH	Within the range of 7.5 to 10.0 at all times.	

(h) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts sawed or ground		
OIL & GREASE	20,000	12,000
TOTAL SUSPENDED SOLIDS	41,000	20,000
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

8. EPA is considering promulgating BAT effluent limitations which are less stringent than the limitations now proposed for BAT for nine of the eleven subcategories. The limitations would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods. In addition, EPA is considering promulgating BAT effluent limitations more stringent than the limitations now proposed for BAT for the Lead/Tin/Bismuth Forming and the Iron And Steel/Copper/Aluminum Metal Powder Production And Powder Metallurgy Subcategories. The limitations would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods. In the event that the Agency decides to promulgate these alternate BAT effluent limitations, the following would apply for existing sources:

SUBPART A. ALTERNATE BAT MASS LIMITATIONS FOR THE BERYLLIUM FORMING SUBCATEGORY

(a) Area Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium formed			
117	BERYLLIUM	26,000	11,000
120	COPPER	40,000	21,000
121	CYANIDE	6,200	2,600
	FLUORIDE	1,300,000	560,000

(b) Billet Washing Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium billets washed			
117	BERYLLIUM	47.0	19.0
120	COPPER	73.0	38.0
121	CYANIDE	11.0	4.6
	FLUORIDE	2,300.0	1,000.0

(c) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium surface treated			
117	BERYLLIUM	380	160
120	COPPER	590	310
121	CYANIDE	89	37
	FLUORIDE	18,000	8,100

(d) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium surface treated			
117	BERYLLIUM	940	390
120	COPPER	1,500	770
121	CYANIDE	220	92
	FLUORIDE	46,000	20,000

(e) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of beryllium sawed or ground			
117	BERYLLIUM	520	220
120	COPPER	810	420
121	CYANIDE	120	51
	FLUORIDE	25,000	11,000

(f) Inspection/Testing Wastewater

There shall be no discharge of process wastewater pollutants.

(g) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART B. ALTERNATE BAT MASS LIMITATIONS FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with emulsions			
114	ANTIMONY	45.0	20.0
122	LEAD	6.5	3.0

(b) Rolling Spent Soap Solutions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with soap solutions			
114	ANTIMONY	83.0	37.0
122	LEAD	12.0	5.6

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with emulsions			
114	ANTIMONY	32.0	14.0
122	LEAD	4.7	2.2

(e) Drawing Spent Soap Solutions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with soap solutions		
114 ANTIMONY	14.0	6.4
122 LEAD	2.1	1.0

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth heat treated		
114 ANTIMONY	340	150
122 LEAD	49	23

(g) Extrusion Press Hydraulic Fluid Leakage

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth extruded		
114 ANTIMONY	95.0	42.0
122 LEAD	14.0	6.4

(h) Continuous Strip Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
114 ANTIMONY	1.90	.90
122 LEAD	.30	.10

(i) Semi-Continuous Ingot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
114 ANTIMONY	5.70	2.50
122 LEAD	.80	.40

(j) Shot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth shot cast		
114 ANTIMONY	8.10	3.60
122 LEAD	1.20	.50

(k) Shot-Forming Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(l) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned		
114 ANTIMONY	1,200	520
122 LEAD	170	79

(m) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned		
114 ANTIMONY	1,200	560
122 LEAD	180	84

(n) Swaging Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth swaged with emulsions		
114 ANTIMONY	3.40	1.50
122 LEAD	.50	.20

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(p) Miscellaneous Nondescript Wastewater Sources

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth formed			
114	ANTIMONY	110.0	50.0
122	LEAD	16.0	7.6

SUBPART C. ALTERNATE BAT MASS LIMITATIONS FOR THE MAGNESIUM FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

There shall be no discharge of process wastewater pollutants.

(b) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(c) Forging Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of magnesium forged			
119	CHROMIUM	120,000	48,000
128	ZINC	390,000	160,000
	AMMONIA	35,000,000	16,000,000
	FLUORIDE	16,000,000	7,000,000
	MAGNESIUM	550,000	240,000

(d) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged magnesium heat treated		
119	CHROMIUM	280	110
128	ZINC	920	390
	AMMONIA	84,000	37,000
	FLUORIDE	38,000	17,000
	MAGNESIUM	1,300	580

(e) Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium forged		
119	CHROMIUM	71	29
128	ZINC	240	99
	AMMONIA	22,000	9,500
	FLUORIDE	9,600	4,300
	MAGNESIUM	330	150

(f) Direct Chill Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium surface treated		
119	CHROMIUM	200	84
128	ZINC	680	280
	AMMONIA	62,000	27,000
	FLUORIDE	28,000	12,000
	MAGNESIUM	950	420

(h) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium surface treated		
119	CHROMIUM	780	320
128	ZINC	2,600	1,100
	AMMONIA	240,000	100,000
	FLUORIDE	110,000	47,000
	MAGNESIUM	3,600	1,600

(i) Sawing/Grinding Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(j) Sanding And Repairing Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium sanded and repaired		
119	CHROMIUM	190	77
128	ZINC	620	260
	AMMONIA	57,000	25,000
	FLUORIDE	25,000	11,000
	MAGNESIUM	880	390

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART D. ALTERNATE BAT MASS LIMITATIONS FOR THE NICKEL/COBALT FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt rolled with emulsions			
119	CHROMIUM	660	270
124	NICKEL	2,900	1,900
	FLUORIDE	89,000	39,000

(c) Rolling Contact Lubricant-Coolant Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt rolled with contact lubricant-coolant water			
119	CHROMIUM	590	240
124	NICKEL	2,600	1,700
	FLUORIDE	80,000	35,000

(d) Rolling Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of rolled nickel/cobalt heat treated			
119	CHROMIUM	.00	.00
124	NICKEL	.10	.00
	FLUORIDE	1.60	.70

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(g) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt drawn with emulsions			
119	CHROMIUM	42	17
124	NICKEL	180	120
	FLUORIDE	5,700	2,500

(h) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(i) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded nickel/cobalt heat treated			
119	CHROMIUM	37	15
124	NICKEL	160	110
	FLUORIDE	5,000	2,200

(j) Forging, Extrusion, And Isostatic Press Hydraulic Fluid Leakage

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt forged, extruded, or pressed			
119	CHROMIUM	55	22
124	NICKEL	240	160
	FLUORIDE	7,400	3,300

(k) Forging Equipment Cleaning Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt forged		
119 CHROMIUM	72	29
124 NICKEL	310	210
FLUORIDE	9,700	4,300

(l) Forging Die Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt forged		
119 CHROMIUM	55	23
124 NICKEL	240	160
FLUORIDE	7,500	3,300

(m) Forging/Swaging Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(n) Stationary And Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt cast by the stationary or direct chill method		
119 CHROMIUM	780	320
124 NICKEL	3,400	2,300
FLUORIDE	110,000	47,000

(o) Casting Vacuum Melting Steam Condensate

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lba) of nickel/cobalt vacuum melted			
119	CHROMIUM	74	30
124	NICKEL	320	210
	FLUORIDE	10,000	4,400

(p) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt metal powder atomized			
119	CHROMIUM	1,200	510
124	NICKEL	5,500	3,600
	FLUORIDE	170,000	75,000

(q) Annealing Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt annealed			
119	CHROMIUM	200	82
124	NICKEL	880	580
	FLUORIDE	27,000	12,000

(r) Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt formed			
119	CHROMIUM	110	45
124	NICKEL	480	320
	FLUORIDE	15,000	6,600

(s) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt surface treated			
119	CHROMIUM	380	150
124	NICKEL	1,700	1,100
	FLUORIDE	51,000	23,000

(t) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt surface treated			
119	CHROMIUM	470	190
124	NICKEL	2,000	1,300
	FLUORIDE	63,000	28,000

(u) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned			
119	CHROMIUM	13.0	5.5
124	NICKEL	59.0	39.0
	FLUORIDE	1,800.0	810.0

(v) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned			
119	CHROMIUM	220	89
124	NICKEL	950	630
	FLUORIDE	30,000	13,000

(w) Molten Salt Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with molten salt			
119	CHROMIUM	560	230
124	NICKEL	2,500	1,600
	FLUORIDE	76,000	34,000

(x) Ammonia Rinse Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with ammonia solution			
119	CHROMIUM	6.9	2.8
124	NICKEL	30.0	20.0
	FLUORIDE	930.0	410.0

(y) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt sawed or ground			
119	CHROMIUM	440	180
124	NICKEL	1,900	1,300
	FLUORIDE	60,000	26,000

(z) Steam Cleaning Condensate

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt steam cleaned			
119	CHROMIUM	10.0	4.2
124	NICKEL	45.0	29.0
	FLUORIDE	1,400.0	610.0

(aa) Hydrostatic Tube Testing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt tube tested by the hydrostatic method		
119 CHROMIUM	59	24
124 NICKEL	260	170
FLUORIDE	8,000	3,600

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(ac) Miscellaneous Nondescript Wastewater Sources

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt formed		
119 CHROMIUM	26	11
124 NICKEL	110	74
FLUORIDE	3,500	1,500

SUBPART E. ALTERNATE BAT MASS LIMITATIONS FOR THE PRECIOUS METALS FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals rolled with emulsions		
118 CADMIUM	12.0	5.4
120 COPPER	68.0	36.0
121 CYANIDE	10.0	4.3
126 SILVER	15.0	6.1

(b) Rolling Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of rolled precious metals heat treated			
118	CADMIUM	240	110
120	COPPER	1,300	700
121	CYANIDE	200	84
126	SILVER	290	120

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals drawn with emulsions			
118	CADMIUM	7.2	3.2
120	COPPER	40.0	21.0
121	CYANIDE	6.2	2.6
126	SILVER	8.7	3.6

(e) Drawing Spent Soap Solutions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals drawn with soap solutions			
118	CADMIUM	2.40	1.00
120	COPPER	13.00	6.90
121	CYANIDE	2.00	.80
126	SILVER	2.80	1.20

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded precious metals heat treated			
118	CADMIUM	470	210
120	COPPER	2,600	1,400
121	CYANIDE	400	160
126	SILVER	560	230

(g) Semi-Continuous And Continuous Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the semi-continuous or continuous method			
118	CADMIUM	380	170
120	COPPER	2,100	1,100
121	CYANIDE	320	130
126	SILVER	460	190

(h) Stationary Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the stationary method			
118	CADMIUM	1.40	.60
120	COPPER	7.90	4.20
121	CYANIDE	1.20	.50
126	SILVER	1.70	.70

(i) Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the direct chill method			
118	CADMIUM	280	120
120	COPPER	1,600	820
121	CYANIDE	240	98
126	SILVER	340	140

(j) Shot Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals shot cast			
118	CADMIUM	30	13
120	COPPER	170	89
121	CYANIDE	26	11
126	SILVER	37	15

(k) Casting Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast			
118	CADMIUM	2.00	.90
120	COPPER	11.00	5.90
121	CYANIDE	1.70	.70
126	SILVER	2.40	1.00

(l) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals powder wet atomized			
118	CADMIUM	2,300	1,000
120	COPPER	13,000	6,700
121	CYANIDE	1,900	800
126	SILVER	2,700	1,100

(m) Metal Powder Production Ball Milling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals powder wet ball milled			
118	CADMIUM	740	330
120	COPPER	4,100	2,200
121	CYANIDE	630	260
126	SILVER	890	370

(n) Pressure Bonding Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metal and base metal pressure bonded			
118	CADMIUM	28	13
120	COPPER	160	84
121	CYANIDE	24	10
126	SILVER	34	14

(o) Annealing Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals annealed			
118	CADMIUM	340	150
120	COPPER	1,900	1,000
121	CYANIDE	290	120
126	SILVER	410	170

(p) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	53	23
120	COPPER	290	160
121	CYANIDE	45	19
126	SILVER	64	26

(q) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	970	430
120	COPPER	5,400	2,800
121	CYANIDE	820	340
126	SILVER	1,200	480

(r) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned			
118	CADMIUM	1.20	.60
120	COPPER	7.00	3.70
121	CYANIDE	1.10	.40
126	SILVER	1.50	.60

(s) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals alkaline cleaned			
118	CADMIUM	240	100
120	COPPER	1,300	690
121	CYANIDE	200	83
126	SILVER	280	120

(t) Pre-Bonding Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metal and base metal cleaned prior to bonding			
118	CADMIUM	120	51
120	COPPER	650	340
121	CYANIDE	99	41
126	SILVER	140	58

(u) Tumbling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals tumbled			
118	CADMIUM	150	66
120	COPPER	840	440
121	CYANIDE	130	53
126	SILVER	180	75

(v) Burnishing Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals burnished			
118	CADMIUM	870	390
120	COPPER	4,900	2,600
121	CYANIDE	750	310
126	SILVER	1,100	440

(w) Sawing/Grinding Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals sawed or ground			
118	CADMIUM	2.10	.90
120	COPPER	11.00	6.10
121	CYANIDE	1.80	.70
126	SILVER	2.50	1.00

(x) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART F. ALTERNATE BAT MASS LIMITATIONS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals rolled with emulsions		
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,500	1,100
	FLUORIDE	71,000	32,000
	MOLYBDENUM	2,500	1,100
	TANTALUM	2,500	1,100
	TUNGSTEN	2,500	1,100
	VANADIUM	2,500	1,100

(c) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded refractory metals heat treated		
120	COPPER	660	350
124	NICKEL	660	440
	COLUMBIUM	710	310
	FLUORIDE	21,000	9,100
	MOLYBDENUM	710	310
	TANTALUM	710	310
	TUNGSTEN	710	310
	VANADIUM	710	310

(e) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded		
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,400	1,100
	FLUORIDE	71,000	31,000
	MOLYBDENUM	2,400	1,100
	TANTALUM	2,400	1,100
	TUNGSTEN	2,400	1,100
	VANADIUM	2,400	1,100

(f) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(g) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged refractory metals heat treated		
120	COPPER	1,100	580
124	NICKEL	1,100	740
	COLUMBIUM	1,200	530
	FLUORIDE	34,000	15,000
	MOLYBDENUM	1,200	530
	TANTALUM	1,200	530
	TUNGSTEN	1,200	530
	VANADIUM	1,200	530

(h) Extrusion And Forging Equipment Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of refractory metals extruded or forged			
120	COPPER	79	42
124	NICKEL	80	53
	COLUMBIUM	85	38
	FLUORIDE	2,500	1,100
	MOLYBDENUM	85	38
	TANTALUM	85	38
	TUNGSTEN	85	38
	VANADIUM	85	38

(i) Metal Powder Production Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of refractory metals powder produced			
120	COPPER	3,100	1,600
124	NICKEL	3,100	2,100
	COLUMBIUM	3,400	1,500
	FLUORIDE	98,000	43,000
	MOLYBDENUM	3,400	1,500
	TANTALUM	3,400	1,500
	TUNGSTEN	3,400	1,500
	VANADIUM	3,400	1,500

(j) Metal Powder Production Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(k) Metal Powder Pressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(l) Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(m) Post-Casting Billet Washwater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of cast refractory metals billet washed		
120	COPPER	57	30
124	NICKEL	57	38
	COLUMBIUM	61	27
	FLUORIDE	1,800	790
	MOLYBDENUM	61	27
	TANTALUM	61	27
	TUNGSTEN	61	27
	VANADIUM	61	27

(n) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	24	13
124	NICKEL	24	16
	COLUMBIUM	26	12
	FLUORIDE	760	340
	MOLYBDENUM	26	12
	TANTALUM	26	12
	TUNGSTEN	26	12
	VANADIUM	26	12

(o) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	23,000	12,000
124	NICKEL	23,000	15,000
	COLUMBIUM	25,000	11,000
	FLUORIDE	720,000	320,000
	MOLYBDENUM	25,000	11,000
	TANTALUM	25,000	11,000
	TUNGSTEN	25,000	11,000
	VANADIUM	25,000	11,000

(p) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	22,000	12,000
124	NICKEL	23,000	15,000
	COLUMBIUM	24,000	11,000
	FLUORIDE	700,000	310,000
	MOLYBDENUM	24,000	11,000
	TANTALUM	24,000	11,000
	TUNGSTEN	24,000	11,000
	VANADIUM	24,000	11,000

(q) Surface Coating Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface coated		
120	COPPER	2,100	1,100
124	NICKEL	2,100	1,400
	COLUMBIUM	2,200	980
	FLUORIDE	64,000	29,000
	MOLYBDENUM	2,200	980
	TANTALUM	2,200	980
	TUNGSTEN	2,200	980
	VANADIUM	2,200	980

(r) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	58	31
124	NICKEL	59	39
	COLUMBIUM	63	28
	FLUORIDE	1,800	810
	MOLYBDENUM	63	28
	TANTALUM	63	28
	TUNGSTEN	63	28
	VANADIUM	63	28

(s) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	2,700	1,400
124	NICKEL	2,700	1,800
	COLUMBIUM	2,900	1,300
	FLUORIDE	83,000	37,000
	MOLYBDENUM	2,900	1,300
	TANTALUM	2,900	1,300
	TUNGSTEN	2,900	1,300
	VANADIUM	2,900	1,300

(t) Molten Salt Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals cleaned with molten salt		
120	COPPER	170,000	90,000
124	NICKEL	170,000	110,000
	COLUMBIUM	180,000	82,000
	FLUORIDE	5,400,000	2,400,000
	MOLYBDENUM	180,000	82,000
	TANTALUM	180,000	82,000
	TUNGSTEN	180,000	82,000
	VANADIUM	180,000	82,000

(u) Tumbling/Burnishing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals tumbled or burnished		
120	COPPER	4,200	2,200
124	NICKEL	4,200	2,800
	COLUMBIUM	4,500	2,000
	FLUORIDE	130,000	58,000
	MOLYBDENUM	4,500	2,000
	TANTALUM	4,500	2,000
	TUNGSTEN	4,500	2,000
	VANADIUM	4,500	2,000

(v) Sawing/Grinding Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(w) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with emulsions		
120	COPPER	410	220
124	NICKEL	420	280
	COLUMBIUM	440	200
	FLUORIDE	13,000	5,700
	MOLYBDENUM	440	200
	TANTALUM	440	200
	TUNGSTEN	440	200
	VANADIUM	440	200

(x) Sawing/Grinding Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with lubricant-coolant water		
120	COPPER	1,500	810
124	NICKEL	1,600	1,000
	COLUMBIUM	1,700	740
	FLUORIDE	48,000	21,000
	MOLYBDENUM	1,700	740
	TANTALUM	1,700	740
	TUNGSTEN	1,700	740
	VANADIUM	1,700	740

(y) Sawing/Grinding Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground		
120	COPPER	210	110
124	NICKEL	210	140
	COLUMBIUM	220	98
	FLUORIDE	6,400	2,900
	MOLYBDENUM	220	98
	TANTALUM	220	98
	TUNGSTEN	220	98
	VANADIUM	220	98

(z) Post Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground refractory metals rinsed		
120	COPPER	97	51
124	NICKEL	98	65
	COLUMBIUM	110	47
	FLUORIDE	3,100	1,400
	MOLYBDENUM	110	47
	TANTALUM	110	47
	TUNGSTEN	110	47
	VANADIUM	110	47

(aa) Product Testing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals product tested		
120	COPPER	15.0	7.8
124	NICKEL	15.0	10.0
	COLUMBIUM	16.0	7.1
	FLUORIDE	460.0	200.0
	MOLYBDENUM	16.0	7.1
	TANTALUM	16.0	7.1
	TUNGSTEN	16.0	7.1
	VANADIUM	16.0	7.1

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART G. ALTERNATE BAT MASS LIMITATIONS FOR THE TITANIUM FORMING SUBCATEGORY

(a) Cold Rolling Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium cold rolled		
121	CYANIDE	97	40
122	LEAD	140	67
128	ZINC	490	200
	AMMONIA	45,000	20,000
	FLUORIDE	20,000	8,800
	TITANIUM	680	300

(b) Hot Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium hot rolled with contact lubricant-coolant water		
121	CYANIDE	120	52
122	LEAD	180	86
128	ZINC	630	260
	AMMONIA	57,000	25,000
	FLUORIDE	26,000	11,000
	TITANIUM	880	390

(c) Extruaion Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium extruded		
121	CYANIDE	79	33
122	LEAD	120	55
128	ZINC	400	170
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,200
	TITANIUM	560	250

(d) Forging Spent Lubricants

There shall be no discharege of process wastewater pollutants.

(e) Forging Die Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	87	36
122	LEAD	130	60
128	ZINC	440	180
	AMMONIA	40,000	18,000
	FLUORIDE	18,000	7,900
	TITANIUM	620	270

(f) Forging Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	59	24
122	LEAD	85	40
128	ZINC	290	120
	AMMONIA	27,000	12,000
	FLUORIDE	12,000	5,300
	TITANIUM	410	180

(g) Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium heat treated		
121 CYANIDE	130	54
122 LEAD	190	90
128 ZINC	660	280
AMMONIA	60,000	26,000
FLUORIDE	27,000	12,000
TITANIUM	920	410

(h) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium surface treated		
121 CYANIDE	46	19
122 LEAD	67	32
128 ZINC	230	98
AMMONIA	21,000	9,400
FLUORIDE	9,500	4,200
TITANIUM	330	150

(i) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium surface treated		
121 CYANIDE	610	250
122 LEAD	890	420
128 ZINC	3,100	1,300
AMMONIA	280,000	120,000
FLUORIDE	130,000	56,000
TITANIUM	4,300	1,900

(j) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	4.9	2.0
122	LEAD	7.1	3.4
128	ZINC	25.0	10.0
	AMMONIA	2,300.0	1,000.0
	FLUORIDE	1,000.0	450.0
	TITANIUM	35.0	15.0

(k) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
121	CYANIDE	190	77
122	LEAD	270	130
128	ZINC	930	390
	AMMONIA	85,000	37,000
	FLUORIDE	38,000	17,000
	TITANIUM	1,300	580

(l) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
121	CYANIDE	80	33
122	LEAD	120	55
128	ZINC	400	170
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,300
	TITANIUM	570	250

(m) Tumbling Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium tumbled		
121 CYANIDE	23.0	9.5
122 LEAD	33.0	16.0
128 ZINC	120.0	48.0
AMMONIA	11,000.0	4,600.0
FLUORIDE	4,700.0	2,100.0
TITANIUM	160.0	72.0

(n) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of titanium sawed or ground		
121 CYANIDE	14.0	6.0
122 LEAD	21.0	10.0
128 ZINC	73.0	30.0
AMMONIA	6,600.0	2,900.0
FLUORIDE	3,000.0	1,300.0
TITANIUM	100.0	45.0

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART H. ALTERNATE BAT MASS LIMITATIONS FOR THE URANIUM FORMING SUBCATEGORY

(a) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Tool Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium extruded		
118	CADMIUM	18.0	7.8
120	COPPER	98.0	52.0
124	NICKEL	99.0	66.0
	FLUORIDE	3,100.0	1,400.0
	RADIUM	(1)	(1)
	URANIUM	110.0	47.0

(1) Concentration Value Is 5 Picocuries Per Liter

(c) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded uranium heat treated		
118	CADMIUM	92	41
120	COPPER	520	270
124	NICKEL	520	350
	FLUORIDE	16,000	7,200
	RADIUM	(1)	(1)
	URANIUM	560	250

(1) Concentration Value Is 5 Picocuries Per Liter

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of forged uranium heat treated			
118	CADMIUM	97	43
120	COPPER	540	280
124	NICKEL	550	360
	FLUORIDE	17,000	7,500
	RADIUM	(1)	(1)
	URANIUM	580	260

(1) Concentration Value Is 5 Picocuries Per Liter

(f) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated			
118	CADMIUM	12.0	5.3
120	COPPER	68.0	36.0
124	NICKEL	68.0	45.0
	FLUORIDE	2,100.0	940.0
	RADIUM	(1)	(1)
	URANIUM	73.0	32.0

(1) Concentration Value Is 5 Picocuries Per Liter

(g) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of uranium surface treated			
118	CADMIUM	50	22
120	COPPER	280	150
124	NICKEL	280	190
	FLUORIDE	8,800	3,900
	RADIUM	(1)	(1)
	URANIUM	300	130

(1) Concentration Value Is 5 Picocuries Per Liter

(h) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	25	11
120	COPPER	140	74
124	NICKEL	140	94
	FLUORIDE	4,400	2,000
	RADIUM	(1)	(1)
	URANIUM	150	68

(1) Concentration Value Is 5 Picocuries Per Liter

(i) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium sawed or ground		
118	CADMIUM	1.10	.50
120	COPPER	5.90	3.10
124	NICKEL	6.00	3.90
	FLUORIDE	180.00	82.00
	RADIUM	(1)	(1)
	URANIUM	6.40	2.80

(1) Concentration Value Is 5 Picocuries Per Liter

(j) Post-Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground uranium rinsed		
118	CADMIUM	13.0	5.7
120	COPPER	72.0	38.0
124	NICKEL	73.0	48.0
	FLUORIDE	2,300.0	1,000.0
	RADIUM	(1)	(1)
	URANIUM	78.0	35.0

(1) Concentration Value Is 5 Picocuries Per Liter

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART I. ALTERNATE BAT MASS LIMITATIONS FOR THE ZINC FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc rolled with emulsions			
119	CHROMIUM	.60	.30
121	CYANIDE	.40	.20
128	ZINC	2.00	.80

(c) Rolling Contact Lubricant-Coolant Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc rolled with contact lubricant-coolant water			
119	CHROMIUM	15.0	6.2
121	CYANIDE	10.0	4.2
128	ZINC	51.0	21.0

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc drawn with emulsions			
119	CHROMIUM	3.5	1.4
121	CYANIDE	2.3	1.0
128	ZINC	12.0	4.9

(e) Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc cast by the direct chill method			
119	CHROMIUM	22.0	9.1
121	CYANIDE	15.0	6.0
128	ZINC	73.0	31.0

(f) Stationary Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Heat Treatment Contact Colling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc heat treated			
119	CHROMIUM	33.0	14.0
121	CYANIDE	22.0	9.1
128	ZINC	110.0	46.0

(h) Surface Treatment Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc surface treated		
119 CHROMIUM	4.2	1.7
121 CYANIDE	2.8	1.1
128 ZINC	14.0	5.8

(i) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc surface treated		
119 CHROMIUM	210	87
121 CYANIDE	140	58
128 ZINC	710	300

(j) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned		
119 CHROMIUM	.30	.10
121 CYANIDE	.20	.10
128 ZINC	1.00	.40

(k) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned		
119 CHROMIUM	2,500	1,000
121 CYANIDE	1,700	690
128 ZINC	8,400	3,500

(l) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc sawed or ground		
119 CHROMIUM	24.0	10.0
121 CYANIDE	16.0	6.6
128 ZINC	80.0	33.0

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART J. ALTERNATE BAT MASS LIMITATIONS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

(a) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded with emulsions		
119	CHROMIUM	33.0	13.0
121	CYANIDE	21.0	8.9
124	NICKEL	140.0	94.0
	AMMONIA	9,900.0	4,300.0
	FLUORIDE	4,400.0	2,000.0
	HAFNIUM	150.0	67.0
	ZIRCONIUM	150.0	67.0

(c) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium extruded		
119	CHROMIUM	160	67
121	CYANIDE	110	44
124	NICKEL	710	470
	AMMONIA	49,000	22,000
	FLUORIDE	22,000	9,800
	HAFNIUM	760	340
	ZIRCONIUM	760	340

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded zirconium/hafnium heat treated		
119	CHROMIUM	13.0	5.1
121	CYANIDE	8.3	3.4
124	NICKEL	55.0	36.0
	AMMONIA	3,800.0	1,700.0
	FLUORIDE	1,700.0	750.0
	HAFNIUM	58.0	26.0
	ZIRCONIUM	58.0	26.0

(e) Tube Reducing Spent Lubricants

	Pollutant or	Maximum for	Maximum for

(f) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged zirconium/hafnium heat treated		
119	CHROMIUM	15.0	6.3
121	CYANIDE	10.0	4.2
124	NICKEL	67.0	44.0
	AMMONIA	4,700.0	2,000.0
	FLUORIDE	2,100.0	920.0
	HAFNIUM	72.0	32.0
	ZIRCONIUM	72.0	32.0

(g) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium rolled with emulsions		
119	CHROMIUM	180	72
121	CYANIDE	120	48
124	NICKEL	770	510
	AMMONIA	53,000	23,000
	FLUORIDE	24,000	11,000
	HAFNIUM	820	360
	ZIRCONIUM	820	360

(h) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zirconium/hafnium surface treated		
119	CHROMIUM	670	280
121	CYANIDE	440	180
124	NICKEL	2,900	1,900
	AMMONIA	200,000	90,000
	FLUORIDE	91,000	40,000
	HAFNIUM	3,100	1,400
	ZIRCONIUM	3,100	1,400

(i) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned			
119	CHROMIUM	940	380
121	CYANIDE	620	260
124	NICKEL	4,100	2,700
	AMMONIA	280,000	120,000
	FLUORIDE	130,000	56,000
	HAFNIUM	4,400	1,900
	ZIRCONIUM	4,400	1,900

(j) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium alkaline cleaned			
119	CHROMIUM	2,400	1,000
121	CYANIDE	1,600	660
124	NICKEL	11,000	7,000
	AMMONIA	740,000	320,000
	FLUORIDE	330,000	150,000
	HAFNIUM	11,000	5,000
	ZIRCONIUM	11,000	5,000

(k) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium sawed or ground			
119	CHROMIUM	4.0	1.6
121	CYANIDE	2.6	1.1
124	NICKEL	17.0	11.0
	AMMONIA	1,200.0	530.0
	FLUORIDE	540.0	240.0
	HAFNIUM	18.0	8.2
	ZIRCONIUM	18.0	8.2

(l) Sawing/Grinding Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(n) Degreasing Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zirconium/hafnium degreased			
119	CHROMIUM	89	37
121	CYANIDE	59	24
124	NICKEL	390	260
	AMMONIA	27,000	12,000
	FLUORIDE	12,000	5,400
	HAFNIUM	420	180
	ZIRCONIUM	420	180

SUBPART K. ALTERNATE BAT MASS LIMITATIONS FOR THE IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

(a) Metal Powder Production Atomization Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet atomized		
120	COPPER	6,500	3,100
121	CYANIDE	1,000	400
122	LEAD	1,400	660
	ALUMINUM	31,000	14,000
	IRON	6,000	3,100

(b) Metal Powder Production Milling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet milled		
120	COPPER	2,100	1,000
121	CYANIDE	330	130
122	LEAD	470	220
	ALUMINUM	10,000	4,500
	IRON	2,000	1,000

(c) Metal Powder Production Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder produced		
120	COPPER	3,400	1,600
121	CYANIDE	530	210
122	LEAD	740	340
	ALUMINUM	16,000	7,200
	IRON	3,200	1,600

(d) Sizing/Repressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Oil-Resin Impregnation Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts impregnated with oil-resin		
120	COPPER	95.0	45.0
121	CYANIDE	15.0	6.0
122	LEAD	21.0	10.0
	ALUMINUM	460.0	200.0
	IRON	89.0	45.0

(f) Steam Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder powder metallurgy parts steam treated		
120	COPPER	360	170
121	CYANIDE	57	23
122	LEAD	80	37
	ALUMINUM	1,700	770
	IRON	340	170

(g) Tumbling, Burnishing And Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts tumbled, burnished, or cleaned			
120	COPPER	920	440
121	CYANIDE	140	57
122	LEAD	200	93
	ALUMINUM	4,400	1,900
	IRON	860	440

(h) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts sawed or ground			
120	COPPER	1,300	610
121	CYANIDE	200	80
122	LEAD	280	130
	ALUMINUM	6,100	2,700
	IRON	1,200	610

(i) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

9. EPA is considering promulgating NSPS which are less stringent than the standards now proposed for NSPS for nine of the eleven subcategories. The standards would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods. In addition, EPA is considering promulgating NSPS which are more stringent than the standards now proposed for NSPS for the Lead/Tin/Bismuth Forming and the Iron and Steel/Copper/Aluminum Metal Powder Production And

Powder Metallurgy Subcategories. The standards would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods. In the event that the Agency decides to promulgate these alternate NSPS, the following would apply for new sources:

SUBPART A. ALTERNATE NSPS FOR THE BERYLLIUM FORMING SUBCATEGORY

(a) Area Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium formed		
117	BERYLLIUM	26,000	11,000
120	COPPER	40,000	21,000
121	CYANIDE	6,200	2,600
	FLUORIDE	1,300,000	560,000
	OIL & GREASE	430,000	260,000
	TOTAL SUSPENDED SOLIDS	870,000	420,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Billet Washing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium billets washed		
117	BERYLLIUM	47.0	19.0
120	COPPER	73.0	38.0
121	CYANIDE	11.0	4.6
	FLUORIDE	2,300.0	1,000.0
	OIL & GREASE	760.0	460.0
	TOTAL SUSPENDED SOLIDS	1,600.0	740.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium surface treated		
117	BERYLLIUM	380	160
120	COPPER	590	310
121	CYANIDE	89	37
	FLUORIDE	18,000	8,100
	OIL & GREASE	6,200	3,700
	TOTAL SUSPENDED SOLIDS	13,000	6,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium surface treated		
117	BERYLLIUM	940	390
120	COPPER	1,500	770
121	CYANIDE	220	92
	FLUORIDE	46,000	20,000
	OIL & GREASE	15,000	9,200
	TOTAL SUSPENDED SOLIDS	31,000	15,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Sawing/Grinding Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of beryllium sawed or ground		
117	BERYLLIUM	520	220
120	COPPER	810	420
121	CYANIDE	120	51
	FLUORIDE	25,000	11,000
	OIL & GREASE	8,500	5,100
	TOTAL SUSPENDED SOLIDS	17,000	8,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Inspection/Testing Wastewater

There shall be no discharge of process wastewater pollutants.

(g) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART B. ALTERNATE NSPS FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with emulsions		
114	ANTIMONY	45.0	20.0
122	LEAD	6.5	3.0
	OIL & GREASE	230.0	230.0
	TOTAL SUSPENDED SOLIDS	350.0	280.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Rolling Spent Soap Solutions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth rolled with soap solutions		
114	ANTIMONY	83.0	37.0
122	LEAD	12.0	5.6
	OIL & GREASE	430.0	430.0
	TOTAL SUSPENDED SOLIDS	650.0	520.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with emulsions		
114	ANTIMONY	32.0	14.0
122	LEAD	4.7	2.2
	OIL & GREASE	170.0	170.0
	TOTAL SUSPENDED SOLIDS	250.0	200.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Drawing Spent Soap Solutions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth drawn with soap solutions			
114	ANTIMONY	14.0	6.4
122	LEAD	2.1	1.0
	OIL & GREASE	75.0	75.0
	TOTAL SUSPENDED SOLIDS	110.0	90.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth heat treated			
114	ANTIMONY	340	150
122	LEAD	49	23
	OIL & GREASE	1,800	1,800
	TOTAL SUSPENDED SOLIDS	2,600	2,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Extrusion Press Hydraulic Fluid Leakage

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth extruded			
114	ANTIMONY	95.0	42.0
122	LEAD	14.0	6.4
	OIL & GREASE	490.0	490.0
	TOTAL SUSPENDED SOLIDS	740.0	590.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Continuous Strip Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
114 ANTIMONY	1.90	.90
122 LEAD	.30	.10
OIL & GREASE	10.00	10.00
TOTAL SUSPENDED SOLIDS	15.00	12.00
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Semi-Continuous Ingot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth cast by the continuous strip method		
114 ANTIMONY	5.70	2.50
122 LEAD	.80	.40
OIL & GREASE	29.00	29.00
TOTAL SUSPENDED SOLIDS	44.00	35.00
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Shot Casting Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth shot cast		
114 ANTIMONY	8.10	3.60
122 LEAD	1.20	.50
OIL & GREASE	42.00	42.00
TOTAL SUSPENDED SOLIDS	63.00	50.00
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Shot-Forming Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth shot formed		
114	ANTIMONY	.00	.00
122	LEAD	.00	.00
	OIL & GREASE	.10	.10
	TOTAL SUSPENDED SOLIDS	.10	.10
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned		
114	ANTIMONY	1,200	520
122	LEAD	170	79
	OIL & GREASE	6,100	6,100
	TOTAL SUSPENDED SOLIDS	9,100	7,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of lead/tin/bismuth alkaline cleaned		
114	ANTIMONY	1,200	560
122	LEAD	180	84
	OIL & GREASE	6,500	6,500
	TOTAL SUSPENDED SOLIDS	9,700	7,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Swaging Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth swaged with emulsions		
114 ANTIMONY	3.40	1.50
122 LEAD	.50	.20
OIL & GREASE	18.00	18.00
TOTAL SUSPENDED SOLIDS	27.00	21.00
pH	Within the range of 7.5 to 10.0 at all times.	

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(p) Miscellaneous Nondescript Wastewater Sources

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of lead/tin/bismuth formed		
114 ANTIMONY	110.0	50.0
122 LEAD	16.0	7.6
OIL & GREASE	580.0	580.0
TOTAL SUSPENDED SOLIDS	880.0	700.0
pH	Within the range of 7.5 to 10.0 at all times.	

SUBPART C. ALTERNATE NSPS FOR THE MAGNESIUM FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

There shall be no discharge of process wastewater pollutants.

(b) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(c) Forging Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium forged		
119	CHROMIUM	120,000	48,000
128	ZINC	390,000	160,000
	AMMONIA	35,000,000	16,000,000
	FLUORIDE	16,000,000	7,000,000
	MAGNESIUM	550,000	240,000
	OIL & GREASE	5,300,000	3,200,000
	TOTAL SUSPENDED SOLIDS	11,000,000	5,200,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged magnesium heat treated		
119	CHROMIUM	280	110
128	ZINC	920	390
	AMMONIA	84,000	37,000
	FLUORIDE	38,000	17,000
	MAGNESIUM	1,300	580
	OIL & GREASE	13,000	7,600
	TOTAL SUSPENDED SOLIDS	26,000	12,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium forged		
119	CHROMIUM	71	29
128	ZINC	240	99
	AMMONIA	22,000	9,500
	FLUORIDE	9,600	4,300
	MAGNESIUM	330	150
	OIL & GREASE	3,200	1,900
	TOTAL SUSPENDED SOLIDS	6,600	3,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Direct Chill Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium surface treated		
119	CHROMIUM	200	84
128	ZINC	680	280
	AMMONIA	62,000	27,000
	FLUORIDE	28,000	12,000
	MAGNESIUM	950	420
	OIL & GREASE	9,300	5,600
	TOTAL SUSPENDED SOLIDS	19,000	9,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium surface treated		
119	CHROMIUM	780	320
128	ZINC	2,600	1,100
	AMMONIA	240,000	100,000
	FLUORIDE	110,000	47,000
	MAGNESIUM	3,600	1,600
	OIL & GREASE	35,000	21,000
	TOTAL SUSPENDED SOLIDS	73,000	35,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Sawing/Grinding Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(j) Sanding And Repairing Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of magnesium sanded and repaired		
119	CHROMIUM	190	77
128	ZINC	620	260
	AMMONIA	57,000	25,000
	FLUORIDE	25,000	11,000
	MAGNESIUM	880	390
	OIL & GREASE	8,600	5,100
	TOTAL SUSPENDED SOLIDS	18,000	8,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART D. ALTERNATE NSPS FOR THE NICKEL/COBALT FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt rolled with emulsions		
119	CHROMIUM	660	270
124	NICKEL	2,900	1,900
	FLUORIDE	89,000	39,000
	OIL & GREASE	30,000	18,000
	TOTAL SUSPENDED SOLIDS	61,000	29,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt rolled with contact lubricant-coolant water		
119	CHROMIUM	590	240
124	NICKEL	2,600	1,700
	FLUORIDE	80,000	35,000
	OIL & GREASE	27,000	16,000
	TOTAL SUSPENDED SOLIDS	55,000	26,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Rolling Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of rolled nickel/cobalt heat treated		
119	CHROMIUM	.00	.00
124	NICKEL	.10	.00
	FLUORIDE	1.60	.70
	OIL & GREASE	.50	.30
	TOTAL SUSPENDED SOLIDS	1.10	.50
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Tube Reducing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(f) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(g) Drawing Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt drawn with emulsions		
119	CHROMIUM	42	17
124	NICKEL	180	120
	FLUORIDE	5,700	2,500
	OIL & GREASE	1,900	1,100
	TOTAL SUSPENDED SOLIDS	3,900	1,900
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(i) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded nickel/cobalt heat treated		
119	CHROMIUM	37	15
124	NICKEL	160	110
	FLUORIDE	5,000	2,200
	OIL & GREASE	1,700	1,000
	TOTAL SUSPENDED SOLIDS	3,400	1,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Forging, Extrusion, And Isostatic Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt forged, extruded, or pressed		
119	CHROMIUM	55	22
124	NICKEL	240	160
	FLUORIDE	7,400	3,300
	OIL & GREASE	2,500	1,500
	TOTAL SUSPENDED SOLIDS	5,100	2,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt forged		
119	CHROMIUM	72	29
124	NICKEL	310	210
	FLUORIDE	9,700	4,300
	OIL & GREASE	3,300	2,000
	TOTAL SUSPENDED SOLIDS	6,700	3,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Forging Die Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt forged		
119	CHROMIUM	55	23
124	NICKEL	240	160
	FLUORIDE	7,500	3,300
	OIL & GREASE	2,500	1,500
	TOTAL SUSPENDED SOLIDS	5,200	2,500
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Forging/Swaging Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(n) Stationary And Direct Chill Casting Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt cast by the stationary or direct chill method		
119	CHROMIUM	780	320
124	NICKEL	3,400	2,300
	FLUORIDE	110,000	47,000
	OIL & GREASE	36,000	21,000
	TOTAL SUSPENDED SOLIDS	73,000	35,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Casting Vacuum Melting Steam Condensate

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt vacuum melted		
119	CHROMIUM	74	30
124	NICKEL	320	210
	FLUORIDE	10,000	4,400
	OIL & GREASE	3,400	2,000
	TOTAL SUSPENDED SOLIDS	6,900	3,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(p) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt metal powder atomized		
119 CHROMIUM	1,200	510
124 NICKEL	5,500	3,600
FLUORIDE	170,000	75,000
OIL & GREASE	57,000	34,000
TOTAL SUSPENDED SOLIDS	120,000	55,000
pH	Within the range of 7.5 to 10.0 at all times.	

(q) Annealing Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt annealed		
119 CHROMIUM	200	82
124 NICKEL	880	580
FLUORIDE	27,000	12,000
OIL & GREASE	9,100	5,500
TOTAL SUSPENDED SOLIDS	19,000	8,900
pH	Within the range of 7.5 to 10.0 at all times.	

(r) Wet APC Blowdown

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt formed		
119 CHROMIUM	110	45
124 NICKEL	480	320
FLUORIDE	15,000	6,600
OIL & GREASE	5,000	3,000
TOTAL SUSPENDED SOLIDS	10,000	4,900
pH	Within the range of 7.5 to 10.0 at all times.	

(s) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt surface treated		
119	CHROMIUM	380	150
124	NICKEL	1,700	1,100
	FLUORIDE	51,000	23,000
	OIL & GREASE	17,000	10,000
	TOTAL SUSPENDED SOLIDS	35,000	17,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt surface treated		
119	CHROMIUM	470	190
124	NICKEL	2,000	1,300
	FLUORIDE	63,000	28,000
	OIL & GREASE	21,000	13,000
	TOTAL SUSPENDED SOLIDS	43,000	21,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned		
119	CHROMIUM	13.0	5.5
124	NICKEL	59.0	39.0
	FLUORIDE	1,800.0	810.0
	OIL & GREASE	610.0	370.0
	TOTAL SUSPENDED SOLIDS	1,300.0	600.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(v) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt alkaline cleaned			
119	CHROMIUM	220	89
124	NICKEL	950	630
	FLUORIDE	30,000	13,000
	OIL & GREASE	9,900	6,000
	TOTAL SUSPENDED SOLIDS	20,000	9,700
	pH	Within the range of 7.5 to 10.0 at all times.	

(w) Molten Salt Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with molten salt			
119	CHROMIUM	560	230
124	NICKEL	2,500	1,600
	FLUORIDE	76,000	34,000
	OIL & GREASE	26,000	15,000
	TOTAL SUSPENDED SOLIDS	52,000	25,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Ammonia Rinse Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt treated with ammonia solution			
119	CHROMIUM	6.9	2.8
124	NICKEL	30.0	20.0
	FLUORIDE	930.0	410.0
	OIL & GREASE	310.0	190.0
	TOTAL SUSPENDED SOLIDS	640.0	310.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(y) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt sawed or ground		
119 CHROMIUM	440	180
124 NICKEL	1,900	1,300
FLUORIDE	60,000	26,000
OIL & GREASE	20,000	12,000
TOTAL SUSPENDED SOLIDS	41,000	20,000
pH	Within the range of 7.5 to 10.0 at all times.	

(z) Steam Cleaning Condensate

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt steam cleaned		
119 CHROMIUM	10.0	4.2
124 NICKEL	45.0	29.0
FLUORIDE	1,400.0	610.0
OIL & GREASE	460.0	280.0
TOTAL SUSPENDED SOLIDS	950.0	450.0
pH	Within the range of 7.5 to 10.0 at all times.	

(aa) Hydrostatic Tube Testing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of nickel/cobalt tube tested by the hydrostatic method		
119 CHROMIUM	59	24
124 NICKEL	260	170
FLUORIDE	8,000	3,600
OIL & GREASE	2,700	1,600
TOTAL SUSPENDED SOLIDS	5,500	2,600
pH	Within the range of 7.5 to 10.0 at all times.	

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

(ac) Miscellaneous Nondescript Wastewater Sources

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of nickel/cobalt formed		
119	CHROMIUM	26	11
124	NICKEL	110	74
	FLUORIDE	3,500	1,500
	OIL & GREASE	1,200	700
	TOTAL SUSPENDED SOLIDS	2,400	1,100
	pH	Within the range of 7.5 to 10.0 at all times.	

SUBPART E. ALTERNATE NSPS FOR THE PRECIOUS METALS FORMING SUBCATEGORY

(a) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals rolled with emulsions		
118	CADMIUM	12.0	5.4
120	COPPER	68.0	36.0
121	CYANIDE	10.0	4.3
126	SILVER	15.0	6.1
	OIL & GREASE	720.0	430.0
	TOTAL SUSPENDED SOLIDS	1,500.0	700.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Rolling Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of rolled precious metals heat treated		
118	CADMIUM	240	110
120	COPPER	1,300	700
121	CYANIDE	200	84
126	SILVER	290	120
	OIL & GREASE	14,000	8,400
	TOTAL SUSPENDED SOLIDS	29,000	14,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(d) Drawing Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals drawn with emulsions		
118	CADMIUM	7.2	3.2
120	COPPER	40.0	21.0
121	CYANIDE	6.2	2.6
126	SILVER	8.7	3.6
	OIL & GREASE	430.0	260.0
	TOTAL SUSPENDED SOLIDS	870.0	420.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Drawing Spent Soap Solutions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals drawn with soap solutions			
118	CADMIUM	2.40	1.00
120	COPPER	13.00	6.90
121	CYANIDE	2.00	.80
126	SILVER	2.80	1.20
	OIL & GREASE	140.00	83.00
	TOTAL SUSPENDED SOLIDS	280.00	140.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Extrusion Press And Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of extruded precious metals heat treated			
118	CADMIUM	470	210
120	COPPER	2,600	1,400
121	CYANIDE	400	160
126	SILVER	560	230
	OIL & GREASE	27,000	16,000
	TOTAL SUSPENDED SOLIDS	56,000	27,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Semi-Continuous And Continuous Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the semi-continuous or continuous method			
118	CADMIUM	380	170
120	COPPER	2,100	1,100
121	CYANIDE	320	130
126	SILVER	460	190
	OIL & GREASE	22,000	13,000
	TOTAL SUSPENDED SOLIDS	46,000	22,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Stationary Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the stationary method			
118	CADMIUM	1.40	.60
120	COPPER	7.90	4.20
121	CYANIDE	1.20	.50
126	SILVER	1.70	.70
	OIL & GREASE	83.00	50.00
	TOTAL SUSPENDED SOLIDS	170.00	81.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast by the direct chill method			
118	CADMIUM	280	120
120	COPPER	1,600	820
121	CYANIDE	240	98
126	SILVER	340	140
	OIL & GREASE	16,000	9,800
	TOTAL SUSPENDED SOLIDS	34,000	16,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Shot Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals shot cast			
118	CADMIUM	30	13
120	COPPER	170	89
121	CYANIDE	26	11
126	SILVER	37	15
	OIL & GREASE	1,800	1,100
	TOTAL SUSPENDED SOLIDS	3,700	1,700
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Casting Wet APC Blowdown

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals cast			
118	CADMIUM	2.00	.90
120	COPPER	11.00	5.90
121	CYANIDE	1.70	.70
126	SILVER	2.40	1.00
	OIL & GREASE	120.00	70.00
	TOTAL SUSPENDED SOLIDS	240.00	110.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Metal Powder Production Atomization Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals powder wet atomized			
118	CADMIUM	2,300	1,000
120	COPPER	13,000	6,700
121	CYANIDE	1,900	800
126	SILVER	2,700	1,100
	OIL & GREASE	130,000	80,000
	TOTAL SUSPENDED SOLIDS	270,000	130,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Metal Powder Production Ball Milling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals powder wet ball milled			
118	CADMIUM	740	330
120	COPPER	4,100	2,200
121	CYANIDE	630	260
126	SILVER	890	370
	OIL & GREASE	43,000	26,000
	TOTAL SUSPENDED SOLIDS	89,000	42,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Pressure Bonding Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metal and base metal pressure bonded			
118	CADMIUM	28	13
120	COPPER	160	84
121	CYANIDE	24	10
126	SILVER	34	14
	OIL & GREASE	1,700	1,000
	TOTAL SUSPENDED SOLIDS	3,400	1,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Annealing Solution Heat Treatment Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals annealed			
118	CADMIUM	340	150
120	COPPER	1,900	1,000
121	CYANIDE	290	120
126	SILVER	410	170
	OIL & GREASE	20,000	12,000
	TOTAL SUSPENDED SOLIDS	41,000	20,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(p) Surface Treatment Spent Baths

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	53	23
120	COPPER	290	160
121	CYANIDE	45	19
126	SILVER	64	26
	OIL & GREASE	3,100	1,900
	TOTAL SUSPENDED SOLIDS	6,400	3,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(q) Surface Treatment Rinsewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals surface treated			
118	CADMIUM	970	430
120	COPPER	5,400	2,800
121	CYANIDE	820	340
126	SILVER	1,200	480
	OIL & GREASE	57,000	34,000
	TOTAL SUSPENDED SOLIDS	120,000	55,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals alkaline cleaned		
118	CADMIUM	1.20	.60
120	COPPER	7.00	3.70
121	CYANIDE	1.10	.40
126	SILVER	1.50	.60
	OIL & GREASE	73.00	44.00
	TOTAL SUSPENDED SOLIDS	150.00	72.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(s) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of precious metals alkaline cleaned		
118	CADMIUM	240	100
120	COPPER	1,300	690
121	CYANIDE	200	83
126	SILVER	280	120
	OIL & GREASE	14,000	8,300
	TOTAL SUSPENDED SOLIDS	28,000	13,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Pre-Bonding Cleaning Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metal and base metal cleaned prior to bonding			
118	CADMIUM	120	51
120	COPPER	650	340
121	CYANIDE	99	41
126	SILVER	140	58
	OIL & GREASE	6,800	4,100
	TOTAL SUSPENDED SOLIDS	14,000	6,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling Wastewater

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals tumbled			
118	CADMIUM	150	66
120	COPPER	840	440
121	CYANIDE	130	53
126	SILVER	180	75
	OIL & GREASE	8,800	5,300
	TOTAL SUSPENDED SOLIDS	18,000	8,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(v) Burnishing Wastewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals burnished		
118 CADMIUM	870	390
120 COPPER	4,900	2,600
121 CYANIDE	750	310
126 SILVER	1,100	440
OIL & GREASE	51,000	31,000
TOTAL SUSPENDED SOLIDS	110,000	50,000
pH	Within the range of 7.5 to 10.0 at all times.	

(w) Sawing/Grinding Spent Emulsions

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of precious metals sawed or ground		
118 CADMIUM	2.10	.90
120 COPPER	11.00	6.10
121 CYANIDE	1.80	.70
126 SILVER	2.50	1.00
OIL & GREASE	120.00	73.00
TOTAL SUSPENDED SOLIDS	250.00	120.00
pH	Within the range of 7.5 to 10.0 at all times.	

(x) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART F. ALTERNATE NSPS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals rolled with emulsions		
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,500	1,100
	FLUORIDE	71,000	32,000
	MOLYBDENUM	2,500	1,100
	TANTALUM	2,500	1,100
	TUNGSTEN	2,500	1,100
	VANADIUM	2,500	1,100
	OIL & GREASE	24,000	14,000
	TOTAL SUSPENDED SOLIDS	49,000	23,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Drawing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(d) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded refractory metals heat treated		
120	COPPER	660	350
124	NICKEL	660	440
	COLUMBIUM	710	310
	FLUORIDE	21,000	9,100
	MOLYBDENUM	710	310
	TANTALUM	710	310
	TUNGSTEN	710	310
	VANADIUM	710	310
	OIL & GREASE	6,900	4,200
	TOTAL SUSPENDED SOLIDS	14,000	6,700
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Extrusion Press Hydraulic Fluid Leakage

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded		
120	COPPER	2,300	1,200
124	NICKEL	2,300	1,500
	COLUMBIUM	2,400	1,100
	FLUORIDE	71,000	31,000
	MOLYBDENUM	2,400	1,100
	TANTALUM	2,400	1,100
	TUNGSTEN	2,400	1,100
	VANADIUM	2,400	1,100
	OIL & GREASE	24,000	14,000
	TOTAL SUSPENDED SOLIDS	49,000	23,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(g) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged refractory metals heat treated		
120	COPPER	1,100	580
124	NICKEL	1,100	740
	COLUMBIUM	1,200	530
	FLUORIDE	34,000	15,000
	MOLYBDENUM	1,200	530
	TANTALUM	1,200	530
	TUNGSTEN	1,200	530
	VANADIUM	1,200	530
	OIL & GREASE	12,000	6,900
	TOTAL SUSPENDED SOLIDS	24,000	11,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Extrusion And Forging Equipment Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals extruded or forged		
120	COPPER	79	42
124	NICKEL	80	53
	COLUMBIUM	85	38
	FLUORIDE	2,500	1,100
	MOLYBDENUM	85	38
	TANTALUM	85	38
	TUNGSTEN	85	38
	VANADIUM	85	38
	OIL & GREASE	830	500
	TOTAL SUSPENDED SOLIDS	1,700	810
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Metal Powder Production Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals powder produced		
120	COPPER	3,100	1,600
124	NICKEL	3,100	2,100
	COLUMBIUM	3,400	1,500
	FLUORIDE	98,000	43,000
	MOLYBDENUM	3,400	1,500
	TANTALUM	3,400	1,500
	TUNGSTEN	3,400	1,500
	VANADIUM	3,400	1,500
	OIL & GREASE	33,000	20,000
	TOTAL SUSPENDED SOLIDS	67,000	32,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Metal Powder Production Wet APC Blowdown

There shall be no discharge of process wastewater pollutants.

(k) Metal Powder Pressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(l) Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(m) Post-Casting Billet Washwater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of cast refractory metals billet washed		
120	COPPER	57	30
124	NICKEL	57	38
	COLUMBIUM	61	27
	FLUORIDE	1,800	790
	MOLYBDENUM	61	27
	TANTALUM	61	27
	TUNGSTEN	61	27
	VANADIUM	61	27
	OIL & GREASE	600	360
	TOTAL SUSPENDED SOLIDS	1,200	580
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	24	13
124	NICKEL	24	16
	COLUMBIUM	26	12
	FLUORIDE	760	340
	MOLYBDENUM	26	12
	TANTALUM	26	12
	TUNGSTEN	26	12
	VANADIUM	26	12
	OIL & GREASE	250	150
	TOTAL SUSPENDED SOLIDS	520	250
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	23,000	12,000
124	NICKEL	23,000	15,000
	COLUMBIUM	25,000	11,000
	FLUORIDE	720,000	320,000
	MOLYBDENUM	25,000	11,000
	TANTALUM	25,000	11,000
	TUNGSTEN	25,000	11,000
	VANADIUM	25,000	11,000
	OIL & GREASE	240,000	150,000
	TOTAL SUSPENDED SOLIDS	500,000	240,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(p) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface treated		
120	COPPER	22,000	12,000
124	NICKEL	23,000	15,000
	COLUMBIUM	24,000	11,000
	FLUORIDE	700,000	310,000
	MOLYBDENUM	24,000	11,000
	TANTALUM	24,000	11,000
	TUNGSTEN	24,000	11,000
	VANADIUM	24,000	11,000
	OIL & GREASE	240,000	140,000
	TOTAL SUSPENDED SOLIDS	480,000	230,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(q) Surface Coating Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals surface coated		
120	COPPER	2,100	1,100
124	NICKEL	2,100	1,400
	COLUMBIUM	2,200	980
	FLUORIDE	64,000	29,000
	MOLYBDENUM	2,200	980
	TANTALUM	2,200	980
	TUNGSTEN	2,200	980
	VANADIUM	2,200	980
	OIL & GREASE	22,000	13,000
	TOTAL SUSPENDED SOLIDS	44,000	21,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(r) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	58	31
124	NICKEL	59	39
	COLUMBIUM	63	28
	FLUORIDE	1,800	810
	MOLYBDENUM	63	28
	TANTALUM	63	28
	TUNGSTEN	63	28
	VANADIUM	63	28
	OIL & GREASE	610	370
	TOTAL SUSPENDED SOLIDS	1,300	600
	pH	Within the range of 7.5 to 10.0 at all times.	

(s) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals alkaline cleaned		
120	COPPER	2,700	1,400
124	NICKEL	2,700	1,800
	COLUMBIUM	2,900	1,300
	FLUORIDE	83,000	37,000
	MOLYBDENUM	2,900	1,300
	TANTALUM	2,900	1,300
	TUNGSTEN	2,900	1,300
	VANADIUM	2,900	1,300
	OIL & GREASE	28,000	17,000
	TOTAL SUSPENDED SOLIDS	57,000	27,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(t) Molten Salt Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals cleaned with molten salt		
120	COPPER	170,000	90,000
124	NICKEL	170,000	110,000
	COLUMBIUM	180,000	82,000
	FLUORIDE	5,400,000	2,400,000
	MOLYBDENUM	180,000	82,000
	TANTALUM	180,000	82,000
	TUNGSTEN	180,000	82,000
	VANADIUM	180,000	82,000
	OIL & GREASE	1,800,000	1,100,000
	TOTAL SUSPENDED SOLIDS	3,700,000	1,800,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(u) Tumbling/Burnishing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals tumbled or burnished		
120	COPPER	4,200	2,200
124	NICKEL	4,200	2,800
	COLUMBIUM	4,500	2,000
	FLUORIDE	130,000	58,000
	MOLYBDENUM	4,500	2,000
	TANTALUM	4,500	2,000
	TUNGSTEN	4,500	2,000
	VANADIUM	4,500	2,000
	OIL & GREASE	44,000	27,000
	TOTAL SUSPENDED SOLIDS	91,000	43,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(v) Sawing/Grinding Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(w) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with emulsions		
120	COPPER	410	220
124	NICKEL	420	280
	COLUMBIUM	440	200
	FLUORIDE	13,000	5,700
	MOLYBDENUM	440	200
	TANTALUM	440	200
	TUNGSTEN	440	200
	VANADIUM	440	200
	OIL & GREASE	4,300	2,600
	TOTAL SUSPENDED SOLIDS	8,900	4,200
	pH	Within the range of 7.5 to 10.0 at all times.	

(x) Sawing/Grinding Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground with lubricant-coolant water		
120	COPPER	1,500	810
124	NICKEL	1,600	1,000
	COLUMBIUM	1,700	740
	FLUORIDE	48,000	21,000
	MOLYBDENUM	1,700	740
	TANTALUM	1,700	740
	TUNGSTEN	1,700	740
	VANADIUM	1,700	740
	OIL & GREASE	16,000	9,700
	TOTAL SUSPENDED SOLIDS	33,000	16,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(y) Sawing/Grinding Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals sawed or ground		
120	COPPER	210	110
124	NICKEL	210	140
	COLUMBIUM	220	98
	FLUORIDE	6,400	2,900
	MOLYBDENUM	220	98
	TANTALUM	220	98
	TUNGSTEN	220	98
	VANADIUM	220	98
	OIL & GREASE	2,200	1,300
	TOTAL SUSPENDED SOLIDS	4,400	2,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(z) Post Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground refractory metals rinsed		
120	COPPER	97	51
124	NICKEL	98	65
	COLUMBIUM	110	47
	FLUORIDE	3,100	1,400
	MOLYBDENUM	110	47
	TANTALUM	110	47
	TUNGSTEN	110	47
	VANADIUM	110	47
	OIL & GREASE	1,000	620
	TOTAL SUSPENDED SOLIDS	2,100	1,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(aa) Product Testing Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of refractory metals product tested		
120	COPPER	15.0	7.8
124	NICKEL	15.0	10.0
	COLUMBIUM	16.0	7.1
	FLUORIDE	460.0	200.0
	MOLYBDENUM	16.0	7.1
	TANTALUM	16.0	7.1
	TUNGSTEN	16.0	7.1
	VANADIUM	16.0	7.1
	OIL & GREASE	160.0	93.0
	TOTAL SUSPENDED SOLIDS	320.0	150.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(ab) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART G. ALTERNATE NSPS FOR THE TITANIUM FORMING SUBCATEGORY

(a) Cold Rolling Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium cold rolled		
121	CYANIDE	97	40
122	LEAD	140	67
128	ZINC	490	200
	AMMONIA	45,000	20,000
	FLUORIDE	20,000	8,800
	TITANIUM	680	300
	OIL & GREASE	6,700	4,000
	TOTAL SUSPENDED SOLIDS	14,000	6,500
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Hot Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium hot rolled with contact lubricant-coolant water		
121	CYANIDE	120	52
122	LEAD	180	86
128	ZINC	630	260
	AMMONIA	57,000	25,000
	FLUORIDE	26,000	11,000
	TITANIUM	880	390
	OIL & GREASE	8,600	5,200
	TOTAL SUSPENDED SOLIDS	18,000	8,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Extrusion Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium extruded		
121	CYANIDE	79	33
122	LEAD	120	55
128	ZINC	400	170
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,200
	TITANIUM	560	250
	OIL & GREASE	5,500	3,300
	TOTAL SUSPENDED SOLIDS	11,000	5,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Die Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	87	36
122	LEAD	130	60
128	ZINC	440	180
	AMMONIA	40,000	18,000
	FLUORIDE	18,000	7,900
	TITANIUM	620	270
	OIL & GREASE	6,000	3,600
	TOTAL SUSPENDED SOLIDS	12,000	5,900
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Forging Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium forged		
121	CYANIDE	59	24
122	LEAD	85	40
128	ZINC	290	120
	AMMONIA	27,000	12,000
	FLUORIDE	12,000	5,300
	TITANIUM	410	180
	OIL & GREASE	4,000	2,400
	TOTAL SUSPENDED SOLIDS	8,300	3,900
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium heat treated		
121	CYANIDE	130	54
122	LEAD	190	90
128	ZINC	660	280
	AMMONIA	60,000	26,000
	FLUORIDE	27,000	12,000
	TITANIUM	920	410
	OIL & GREASE	9,000	5,400
	TOTAL SUSPENDED SOLIDS	18,000	8,800
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	46	19
122	LEAD	67	32
128	ZINC	230	98
	AMMONIA	21,000	9,400
	FLUORIDE	9,500	4,200
	TITANIUM	330	150
	OIL & GREASE	3,200	1,900
	TOTAL SUSPENDED SOLIDS	6,600	3,100
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	610	250
122	LEAD	890	420
128	ZINC	3,100	1,300
	AMMONIA	280,000	120,000
	FLUORIDE	130,000	56,000
	TITANIUM	4,300	1,900
	OIL & GREASE	42,000	25,000
	TOTAL SUSPENDED SOLIDS	87,000	41,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(j) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium surface treated		
121	CYANIDE	4.9	2.0
122	LEAD	7.1	3.4
128	ZINC	25.0	10.0
	AMMONIA	2,300.0	1,000.0
	FLUORIDE	1,000.0	450.0
	TITANIUM	35.0	15.0
	OIL & GREASE	340.0	200.0
	TOTAL SUSPENDED SOLIDS	700.0	330.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
121	CYANIDE	190	77
122	LEAD	270	130
128	ZINC	930	390
	AMMONIA	85,000	37,000
	FLUORIDE	38,000	17,000
	TITANIUM	1,300	580
	OIL & GREASE	13,000	7,700
	TOTAL SUSPENDED SOLIDS	26,000	12,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(l) Alkaline Cleaning Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium alkaline cleaned		
121	CYANIDE	80	33
122	LEAD	120	55
128	ZINC	400	170
	AMMONIA	37,000	16,000
	FLUORIDE	16,000	7,300
	TITANIUM	570	250
	OIL & GREASE	5,500	3,300
	TOTAL SUSPENDED SOLIDS	11,000	5,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Tumbling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium tumbled		
121	CYANIDE	23.0	9.5
122	LEAD	33.0	16.0
128	ZINC	120.0	48.0
	AMMONIA	11,000.0	4,600.0
	FLUORIDE	4,700.0	2,100.0
	TITANIUM	160.0	72.0
	OIL & GREASE	1,600.0	950.0
	TOTAL SUSPENDED SOLIDS	3,200.0	1,500.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(n) Sawing/Grinding Spent Lubricants

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of titanium sawed or ground		
121	CYANIDE	14.0	6.0
122	LEAD	21.0	10.0
128	ZINC	73.0	30.0
	AMMONIA	6,600.0	2,900.0
	FLUORIDE	3,000.0	1,300.0
	TITANIUM	100.0	45.0
	OIL & GREASE	990.0	600.0
	TOTAL SUSPENDED SOLIDS	2,000.0	970.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(o) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART H. ALTERNATE NSPS FOR THE URANIUM FORMING SUBCATEGORY

(a) Extrusion Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(b) Extrusion Tool Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium extruded		
118	CADMIUM	18.0	7.8
120	COPPER	98.0	52.0
124	NICKEL	99.0	66.0
	FLUORIDE	3,100.0	1,400.0
	RADIUM	(1)	(1)
	URANIUM	110.0	47.0
	OIL & GREASE	1,000.0	620.0
	TOTAL SUSPENDED SOLIDS	2,100.0	1,000.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(c) Extrusion Press And Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of extruded uranium heat treated		
118	CADMIUM	92	41
120	COPPER	520	270
124	NICKEL	520	350
	FLUORIDE	16,000	7,200
	RADIUM	(1)	(1)
	URANIUM	560	250
	OIL & GREASE	5,400	3,300
	TOTAL SUSPENDED SOLIDS	11,000	5,300
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(d) Forging Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Forging Solution Heat Treatment Contact Cooling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of forged uranium heat treated		
118	CADMIUM	97	43
120	COPPER	540	280
124	NICKEL	550	360
	FLUORIDE	17,000	7,500
	RADIUM	(1)	(1)
	URANIUM	580	260
	OIL & GREASE	5,700	3,400
	TOTAL SUSPENDED SOLIDS	12,000	5,500
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(f) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	12.0	5.3
120	COPPER	68.0	36.0
124	NICKEL	68.0	45.0
	FLUORIDE	2,100.0	940.0
	RADIUM	(1)	(1)
	URANIUM	73.0	32.0
	OIL & GREASE	710.0	430.0
	TOTAL SUSPENDED SOLIDS	1,500.0	690.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(g) Surface Treatment Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	50	22
120	COPPER	280	150
124	NICKEL	280	190
	FLUORIDE	8,800	3,900
	RADIUM	(1)	(1)
	URANIUM	300	130
	OIL & GREASE	3,000	1,800
	TOTAL SUSPENDED SOLIDS	6,100	2,900
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(h) Surface Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium surface treated		
118	CADMIUM	25	11
120	COPPER	140	74
124	NICKEL	140	94
	FLUORIDE	4,400	2,000
	RADIUM	(1)	(1)
	URANIUM	150	68
	OIL & GREASE	1,500	890
	TOTAL SUSPENDED SOLIDS	3,000	1,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(i) Sawing/Grinding Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of uranium sawed or ground		
118	CADMIUM	1.10	.50
120	COPPER	5.90	3.10
124	NICKEL	6.00	3.90
	RADIUM	(1)	(1)
	FLUORIDE	180.00	82.00
	URANIUM	6.40	2.80
	OIL & GREASE	62.00	37.00
	TOTAL SUSPENDED SOLIDS	130.00	60.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(j) Post-Sawing/Grinding Rinsewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of sawed or ground uranium rinsed		
118	CADMIUM	13.0	5.7
120	COPPER	72.0	38.0
124	NICKEL	73.0	48.0
	FLUORIDE	2,300.0	1,000.0
	RADIUM	(1)	(1)
	URANIUM	78.0	35.0
	OIL & GREASE	760.0	460.0
	TOTAL SUSPENDED SOLIDS	1,600.0	740.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(1) Concentration Value Is 5 Picocuries Per Liter

(k) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART I. ALTERNATE NSPS FOR THE ZINC FORMING SUBCATEGORY

(a) Rolling Spent Neat Oils

There shall be no discharge of process wastewater pollutants.

(b) Rolling Spent Emulsions

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc rolled with emulsions		
119	CHROMIUM	.60	.30
121	CYANIDE	.40	.20
128	ZINC	2.00	.80
	OIL & GREASE	28.00	17.00
	TOTAL SUSPENDED SOLIDS	57.00	27.00
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Rolling Contact Lubricant-Coolant Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc rolled with contact lubricant-coolant water		
119	CHROMIUM	15.0	6.2
121	CYANIDE	10.0	4.2
128	ZINC	51.0	21.0
	OIL & GREASE	690.0	420.0
	TOTAL SUSPENDED SOLIDS	1,400.0	680.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Drawing Spent Emulsions

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc drawn with emulsions			
119	CHROMIUM	3.5	1.4
121	CYANIDE	2.3	1.0
128	ZINC	12.0	4.9
	OIL & GREASE	160.0	96.0
	TOTAL SUSPENDED SOLIDS	330.0	160.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(e) Direct Chill Casting Contact Cooling Water

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc cast by the direct chill method			
119	CHROMIUM	22.0	9.1
121	CYANIDE	15.0	6.0
128	ZINC	73.0	31.0
	OIL & GREASE	1,000.0	600.0
	TOTAL SUSPENDED SOLIDS	2,100.0	980.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Stationary Casting Contact Cooling Water

There shall be no discharge of process wastewater pollutants.

(g) Heat Treatment Contact Colling Water

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc heat treated		
119	CHROMIUM	33.0	14.0
121	CYANIDE	22.0	9.1
128	ZINC	110.0	46.0
	OIL & GREASE	1,500.0	910.0
	TOTAL SUSPENDED SOLIDS	3,100.0	1,500.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Surface Treatment Spent Baths

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of zinc surface treated		
119	CHROMIUM	4.2	1.7
121	CYANIDE	2.8	1.1
128	ZINC	14.0	5.8
	OIL & GREASE	190.0	110.0
	TOTAL SUSPENDED SOLIDS	390.0	190.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(i) Surface Treatment Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc surface treated		
119 CHROMIUM	210	87
121 CYANIDE	140	58
128 ZINC	710	300
OIL & GREASE	9,700	5,800
TOTAL SUSPENDED SOLIDS	20,000	9,500
pH	Within the range of 7.5 to 10.0 at all times.	

(j) Alkaline Cleaning Spent Baths

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned		
119 CHROMIUM	.30	.10
121 CYANIDE	.20	.10
128 ZINC	1.00	.40
OIL & GREASE	14.00	8.60
TOTAL SUSPENDED SOLIDS	29.00	14.00
pH	Within the range of 7.5 to 10.0 at all times.	

(k) Alkaline Cleaning Rinsewater

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc alkaline cleaned		
119 CHROMIUM	2,500	1,000
121 CYANIDE	1,700	690
128 ZINC	8,400	3,500
OIL & GREASE	110,000	69,000
TOTAL SUSPENDED SOLIDS	230,000	110,000
pH	Within the range of 7.5 to 10.0 at all times.	

(l) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property		Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of zinc sawed or ground			
119	CHROMIUM	24.0	10.0
121	CYANIDE	16.0	6.6
128	ZINC	80.0	33.0
	OIL & GREASE	1,100.0	660.0
	TOTAL SUSPENDED SOLIDS	2,300.0	1,100.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(m) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

SUBPART J. ALTERNATE NSPS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

The standards for chromium, cyanide, nickel, ammonia, fluoride, hafnium and zirconium would be the same as specified in Section II, Part 8, Subpart J. The standards for TSS, oil and grease and pH would be the same as specified in Section II, Part 7, Subpart J.

SUBPART K. ALTERNATE NSPS FOR THE IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

(a) Metal Powder Production Atomization Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet atomized		
120	COPPER	6,500	3,100
121	CYANIDE	1,000	400
122	LEAD	1,400	660
	ALUMINUM	31,000	14,000
	IRON	6,000	3,100
	OIL & GREASE	50,000	50,000
	TOTAL SUSPENDED SOLIDS	76,000	60,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(b) Metal Powder Production Milling Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder wet milled		
120	COPPER	2,100	1,000
121	CYANIDE	330	130
122	LEAD	470	220
	ALUMINUM	10,000	4,500
	IRON	2,000	1,000
	OIL & GREASE	17,000	17,000
	TOTAL SUSPENDED SOLIDS	25,000	20,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(c) Metal Powder Production Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder produced		
120	COPPER	3,400	1,600
121	CYANIDE	530	210
122	LEAD	740	340
	ALUMINUM	16,000	7,200
	IRON	3,200	1,600
	OIL & GREASE	26,000	26,000
	TOTAL SUSPENDED SOLIDS	40,000	32,000
	pH	Within the range of 7.5 to 10.0 at all times.	

(d) Sizing/Repressing Spent Lubricants

There shall be no discharge of process wastewater pollutants.

(e) Oil-Resin Impregnation Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts impregnated with oil-resin		
120	COPPER	95.0	45.0
121	CYANIDE	15.0	6.0
122	LEAD	21.0	10.0
	ALUMINUM	460.0	200.0
	IRON	89.0	45.0
	OIL & GREASE	750.0	750.0
	TOTAL SUSPENDED SOLIDS	1,100.0	890.0
	pH	Within the range of 7.5 to 10.0 at all times.	

(f) Steam Treatment Wet APC Blowdown

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder powder metallurgy parts steam treated		
120	COPPER	360	170
121	CYANIDE	57	23
122	LEAD	80	37
	ALUMINUM	1,700	770
	IRON	340	170
	OIL & GREASE	2,800	2,800
	TOTAL SUSPENDED SOLIDS	4,300	3,400
	pH	Within the range of 7.5 to 10.0 at all times.	

(g) Tumbling, Burnishing And Cleaning Wastewater

	Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts tumbled, burnished, or cleaned		
120	COPPER	920	440
121	CYANIDE	140	57
122	LEAD	200	93
	ALUMINUM	4,400	1,900
	IRON	860	440
	OIL & GREASE	7,200	7,200
	TOTAL SUSPENDED SOLIDS	11,000	8,600
	pH	Within the range of 7.5 to 10.0 at all times.	

(h) Sawing/Grinding Spent Lubricants

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
mg/kkg (lb/billion lbs) of iron, copper, and aluminum powder metallurgy parts sawed or ground		
120 COPPER	1,300	610
121 CYANIDE	200	80
122 LEAD	280	130
ALUMINUM	6,100	2,700
IRON	1,200	610
OIL & GREASE	10,000	10,000
TOTAL SUSPENDED SOLIDS	15,000	12,000
pH	Within the range of 7.5 to 10.0 at all times.	

(i) Degreasing Spent Solvents

There shall be no discharge of process wastewater pollutants.

10. EPA is considering promulgating PSES which are less stringent than the standards now proposed for PSES for seven of the eleven subcategories. The standards would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods. In addition, EPA is considering promulgating PSES which are more stringent than the standards now proposed for PSES for the Lead/Tin/Bismuth Forming and the Iron And Steel/Copper/Aluminum Metal Powder Production And Powder Metallurgy Subcategories. The standards would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods. In addition, EPA is considering promulgating PSES for the Zinc Forming Subcategory. The standards would be based on the treatment effectiveness achievable by one of the following:

1. the application of chemical precipitation and sedimentation (lime and settle) technology;
2. the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods; or
3. the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods.

In addition, the Beryllium Forming Subcategory would still be excluded from PSES. In the event that the Agency decides to promulgate these alternate PSES, the following would apply for existing sources:

SUBPART A. ALTERNATE PSES FOR THE BERYLLIUM FORMING SUBCATEGORY

[Reserved]

SUBPART B. ALTERNATE PSES FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

The standards for antimony and lead would be the same as specified in Section II, Part 8, Subpart B.

SUBPART C. ALTERNATE PSES FOR THE MAGNESIUM FORMING SUBCATEGORY

The standards for chromium, zinc, ammonia, fluoride, and magnesium would be the same as specified in Section II, Part 8, Subpart C.

SUBPART D. ALTERNATE PSES FOR THE NICKEL/COBALT FORMING SUBCATEGORY

The standards for chromium, nickel, and fluoride would be the same as specified in Section II, Part 8, Subpart D.

SUBPART E. ALTERNATE PSES FOR THE PRECIOUS METALS FORMING SUBCATEGORY

The standards for cadmium, copper, silver, and cyanide would be the same as specified in Section II, Part 8, Subpart E.

SUBPART F. ALTERNATE PSES FOR THE REFRACTORY METALS FORMING SUBCATEGORY

The standards for copper, nickel, columbium, fluoride, molybdenum, tantalum, tungsten, and vanadium would be the same as specified in Section II, Part 8, Subpart F.

SUBPART G. ALTERNATE PSES FOR THE TITANIUM FORMING SUBCATEGORY

The standards for cyanide, lead, zinc, ammonia, fluoride, and titanium would be the same as specified in Section II, Part 8, Subpart G.

SUBPART H. ALTERNATE PSES FOR THE URANIUM FORMING SUBCATEGORY

The standards for cadmium, copper, nickel, fluoride, radium, and uranium would be the same as specified in Section II, Part 8, Subpart H.

SUBPART I. ALTERNATE PSES FOR THE ZINC FORMING SUBCATEGORY BASED ON LIME AND SETTLE TECHNOLOGY

The standards for chromium, cyanide, and zinc would be the same as specified in Section II, Part 2, Subpart I.

SUBPART I. ALTERNATE PSES FOR THE ZINC FORMING SUBCATEGORY BASED ON LIME AND SETTLE TECHNOLOGY AND FLOW REDUCTION

The standards for chromium, cyanide, and zinc would be the same as specified in Section II, Part 8, Subpart I.

SUBPART I. ALTERNATE PSES FOR THE ZINC FORMING SUBCATEGORY BASED ON LIME, SETTLE AND FILTER TECHNOLOGY AND FLOW REDUCTION

The standards for chromium, cyanide, and zinc would be the same as specified in Section II, Part 3, Subpart I.

SUBPART J. ALTERNATE PSES FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

The standards for chromium, cyanide, nickel, ammonia, fluoride, hafnium, and zirconium would be the same as specified in Section II, Part 8, Subpart J.

SUBPART K. ALTERNATE PSES FOR THE IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

The standards for copper, cyanide, lead, aluminum, and iron would be the same as specified in Section II, Part 3, Subpart K.

11. EPA is considering promulgating PSNS which are less stringent than the standards now proposed for PSNS for nine of the eleven subcategories. The standards would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation (lime and settle) technology and in-process flow reduction control methods. In addition, EPA is considering promulgating PSNS which are more stringent than the standards now proposed for PSNS for the Lead/Tin/Bismuth Forming and the Iron And Steel/Copper/Aluminum Metal Powder Production And

Powder Metallurgy Subcategories. The standards would be based on the treatment effectiveness achievable by the application of chemical precipitation and sedimentation with the addition of filtration (lime, settle, and filter) technology and in-process flow reduction control methods. In the event that the Agency decides to promulgate these alternate PSNS, the following would apply for new sources:

SUBPART A. ALTERNATE PSNS FOR THE BERYLLIUM FORMING SUBCATEGORY

The standards for beryllium, copper, cyanide, and fluoride would be the same as specified in Section II, Part 8, Subpart A.

SUBPART B. ALTERNATE PSNS FOR THE LEAD/TIN/BISMUTH FORMING SUBCATEGORY

The standards for antimony and lead would be the same as specified in Section II, Part 8, Subpart B.

SUBPART C. ALTERNATE PSNS FOR THE MAGNESIUM FORMING SUBCATEGORY

The standards for chromium, zinc, ammonia, fluoride, and magnesium would be the same as specified in Section II, Part 8, Subpart C.

SUBPART D. ALTERNATE PSNS FOR THE NICKEL/COBALT FORMING SUBCATEGORY

The standards for chromium, nickel, and fluoride would be the same as specified in Section II, Part 8, Subpart D.

SUBPART E. ALTERNATE PSNS FOR THE PRECIOUS METALS FORMING SUBCATEGORY

The standards for cadmium, copper, silver, and cyanide would be the same as specified in Section II, Part 8, Subpart E.

SUBPART F. ALTERNATE PSNS FOR THE REFRACTORY METALS FORMING SUBCATEGORY

The standards for copper, nickel, columbium, fluoride, molybdenum, tantalum, tungsten, and vanadium would be the same as specified in Section II, Part 8, Subpart F.

SUBPART G. ALTERNATE PSNS FOR THE TITANIUM FORMING SUBCATEGORY

The standards for cyanide, lead, zinc, ammonia, fluoride, and titanium would be the same as specified in Section II, Part 8, Subpart G.

SUBPART H. ALTERNATE PSNS FOR THE URANIUM FORMING SUBCATEGORY

The standards for cadmium, copper, nickel, fluoride, radium, and uranium would be the same as specified in Section II, Part 8, Subpart H.

SUBPART I. ALTERNATE PSNS FOR THE ZINC FORMING SUBCATEGORY

The standards for chromium, cyanide, and zinc would be the same as specified in Section II, Part 8, Subpart I.

SUBPART J. ALTERNATE PSNS FOR THE ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

The standards for chromium, cyanide, nickel, ammonia, fluoride, hafnium, and zirconium would be the same as specified in Section II, Part 8, Subpart J.

SUBPART K. ALTERNATE PSNS FOR THE IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

The standards for copper, cyanide, lead, aluminum, and iron would be the same as specified in Section II, Part 3, Subpart K.

SECTION III

INTRODUCTION

LEGAL AUTHORITY

The Federal Water Pollution Control Act Amendments of 1972 established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters," under Section 101(a). By July 1, 1977, existing industrial dischargers were required to achieve "effluent limitations requiring the application of the best practicable control technology currently available" (BPT), under Section 301(b)(1)(A); and by July 1, 1983, these dischargers were required to achieve "effluent limitations requiring the application of the best available technology economically achievable . . . which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants" (BAT), under Section 301(b)(2)(A). New industrial direct dischargers were required to comply with Section 306 new source performance standards (NSPS), based on best available demonstrated technology; existing and new dischargers to publicly owned treatment works (POTW) were subject to pretreatment standards under Sections 307(b) (PSES) and (c) (PSNS), respectively, of the Act. While the requirements for direct dischargers were to be incorporated into National Pollutant Discharge Elimination System (NDPES) permits issued under Section 402 of the Act, pretreatment standards were made enforceable directly against discharges to a POTW (indirect dischargers). Although Section 402(a)(1) of the 1972 Act authorized the setting of NPDES permit requirements for direct dischargers on a case-by-case basis, Congress intended that, for the most part, control requirements would be based on regulations promulgated by the Administrator of EPA. Section 304(b) of the Act required the Administrator to promulgate regulations providing guidelines for effluent limitations setting forth the degree of effluent reduction attainable through the application of BPT and BAT. Moreoever, Sections 304(c) and 306 of the Act required promulgation of regulations for new sources (NSPS); and Sections 304(f), 307(b), and 307(c) required promulgation of regulations for pretreatment standards. In addition to these regulations for designated industry categories, Section 307(a) of the Act required the Administrator to promulgate effluent standards applicable to all dischargers of toxic pollutants. Finally, Section 301(a) of the Act authorized the Administrator to prescribe any additional regulations "necessary to carry out his functions" under the Act.

EPA was unable to promulgate many of these regulations by the dates contained in the Act. In 1976, EPA was sued by several environmental groups and in settlement of this lawsuit, EPA and

the plaintiffs executed a "Settlement Agreement," which was approved by the Court. This Agreement required EPA to develop a program and adhere to a schedule for promulgating for 21 major industries' BAT effluent limitations guidelines, pretreatment standards, and new source performance standards for 65 "priority" pollutants and classes of pollutants. See Settlement Agreement in Natural Resources Defense Council, Inc. v. Train, 8 ERC 2120 (D.D.C. 1976), modified 12 ERC 1833 (D.D.C. 1979), and modified by October 26, 1982, August 2, 1983, and January 6, 1984.

On December 27, 1977, the President signed into law amendments to the Federal Water Pollution Control Act (P.L. 95-217). The Act, as amended, is commonly referred to as the Clean Water Act. Although this Act makes several important changes in the federal water pollution control program, its most significant feature is its incorporation of several of the basic elements of the Settlement Agreement program for toxic pollution control. Sections 301(b)(2)(A) and 301(b)(2)(C) of the Act now require the achievement, by July 1, 1984, of effluent limitations requiring application of BAT for toxic pollutants, including the 65 priority pollutants and classes of pollutants (the same priority pollutants as listed in Natural Resources Defense Council v. Train), which Congress declared toxic under Section 307(a) of the Act. Likewise, EPA's programs for new source performance standards and pretreatment standards are now aimed principally at control of these toxic pollutants. Moreover, to strengthen the toxics control program, Congress added Section 304(e) to the Act, authorizing the Administrator to prescribe "best management practices" (BMPs) to prevent the release of toxic and hazardous pollutants from plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage associated with, or ancillary to, the manufacturing or treatment process.

The 1977 Amendments added Section 301(b)(2)(E) to the Act establishing "best conventional pollutant control technology) (BCT) for discharges of conventional pollutants from existing industrial point sources. Conventional pollutants are those mentioned specifically in Section 304(a)(4) (biochemical oxygen demanding pollutants (BOD_5), total suspended solids (TSS), fecal coliform, and pH), and any additional pollutants defined by the Administrator as "conventional." (To date, the Agency has added one such pollutant, oil and grease, 44 FR 44501, July 30, 1979.)

BCT is not an additional limitation but replaces BAT for the control of conventional pollutants. In addition to other factors specified in Section 304(b)(4)(B), the Act requires that BCT limitations be assessed in light of a two-part "cost-reasonableness" test, American Paper Institute v. EPA, 660 F.2d 954 (4th Cir. 1981). The first test compares the cost for private industry to reduce its conventional pollutants with the

costs to publicly owned treatment works for similar levels of reduction in their discharge of these pollutants. The second test examines the cost-effectiveness of additional industrial treatment beyond BPT. EPA must find that limitations are "reasonable" under both tests before establishing them as BCT. In no case may BCT be less stringent than BPT.

EPA published its methodology for carrying out the BCT analysis on August 29, 1979 (44 FR 50372). In the case mentioned above, the Court of Appeals ordered EPA to correct data errors underlying EPA's calculation of the first test, and to apply the second cost test. (EPA argued that a second cost test was not required.) On October 29, 1982, the Agency proposed a revised BCT methodology (47 FR 49176).

For nontoxic, nonconventional pollutants, Sections 301(b)(2)(A) and (b)(2)(F) require achievement of BAT effluent limitations within three years after their establishment or July 1, 1984, whichever is later, but not later than July 1, 1987.

The purpose of this document is to provide the supporting technical data regarding water use, pollutants, and treatment technologies for BPT, BAT, BCT, NSPS, PSES, and PSNS effluent limitations and standards that EPA is proposing for the nonferrous metals forming category under Sections 301, 304, 306, 307, and 501 of the Clean Water Act.

GUIDELINES DEVELOPMENT SUMMARY

EPA gathered and evaluated technical data in the course of developing these guidelines in order to perform the following tasks:

1. To profile the category with regard to the production, manufacturing processes, geographical distribution, potential wastewater streams, and discharge mode of nonferrous metals forming plants.

2. To subcategorize, if necessary, in order to permit regulation of the nonferrous metals forming category in an equitable and manageable way. This was done by taking all of the factors mentioned above plus others into account.

3. To characterize wastewater, detailing water use, wastewater discharge, and the occurrence of toxic, conventional, and nonconventional pollutants, in waste streams from nonferrous metals forming processes.

4. To select pollutant parameters--those toxic, conventional, and nonconventional pollutants present at significant concentrations in wastewater streams--that should be considered for regulation.

5. To consider control and treatment technologies and select alternative methods for reducing pollutant discharge in this category.

6. To consider the costs of implementing the alternative control and treatment technologies.

7. To present possible regulatory alternatives.

Sources of Industry Data

Data on the nonferrous metals forming category were gathered from previous EPA studies, literature studies, inquiries to federal and state environmental agencies, raw material manufacturers and suppliers, trade association contacts, wastewater treatment equipment manufacturers, and the nonferrous metals forming manufacturers themselves. All known nonferrous metals formers were sent a data collection portfolio (dcp) requesting specific information concerning each facility. Finally, a sampling program was carried out at 17 plants. The sampling program consisted of screen sampling, performed under authority provided by Section 308 of the Clean Water Act, and analysis to determine the presence of a broad range of pollutants and quantification of the pollutants present in nonferrous metals forming wastewater. Specific details of the sampling program and information from the above data sources are presented in Section V.

Literature Review. EPA reviewed and evaluated existing literature for background information to clarify and define various aspects of the nonferrous metals forming category and to determine general characteristics and trends in production processes and wastewater treatment technology. Review of current literature continued throughout the development of these guidelines.

Existing Data Review. Information related to nonferrous metals forming processes, wastewater, and wastewater treatment technology was compiled from a number of sources. Technical data gathered for development of guidelines for related categories, such as the aluminum forming, copper forming, metal finishing, nonferrous metals manufacturing, electroplating, and battery manufacturing categories, were reviewed and incorporated into this guideline, where applicable.

Frequent contact has been maintained with industry personnel. Contributions from these sources were particularly useful for clarifying differences in production processes.

Plant Survey and Evaluation. The nonferrous metals forming plants were surveyed to gather information regarding plant size, age and production, the production processes used, and the quantity, treatment, and disposal of wastewater generated at these plants.

A listing of plants believed to be in the nonferrous metals forming category was compiled from a Dun and Bradstreet computer listing, publications and telephone contacts with various trade associations believed to represent parts of the industry, the Thomas Register, and telephone contacts with commodity specialists at the Bureau of Mines. These sources resulted in the identification of approximately 1,000 plants as being possibly engaged in nonferrous metals forming activities. The SIC codes used were: (1) 3356: Rolling, Drawing, Extruding of Nonferrous Metals; (2) 3357: Drawing and Insulating Nonferrous Wire; (3) 3463: Nonferrous Forgings; and (4) 3497: Metal, Foil, and Leaf.

A comprehensive telephone survey was undertaken in order to determine which plants should comprise a final mailing list, i.e., whether or not nonferrous metals forming operations were present at each of the plants on the original list. During the telephone survey, questions were asked concerning what metals are formed at a particular plant, the type of forming operations utilized on the metal, i.e., rolling, drawing, extruding, forging, casting, cladding, or powder metallurgy and their associated water usage, discharge, and treatment-in-place. Respondents also were asked what surface treatment, cleaning, washing, and/or rinsing operations are utilized and their associated water usage, discharge, and treatment-in-place. At the conclusion of the telephone survey, many of the plants on the original list were determined not to be within the scope of the nonferrous metals forming category.

A list of those plants believed to be a part of the category was then compiled in preparation for dcp distribution. The results of the telephone survey are documented in the administrative record for this rulemaking.

During the first week of April 1983, the Office of Management and Budget (OMB) approved the mailing of 365 data collection portfolios to plants believed to be in the category. On April 19, 1983, these 365 dcp's were sent out under the authority of Section 308 of the Clean Water Act to companies on the mailing list. The dcp's were sent to the corporate office of each company and addressed to the highest ranking corporate official which could be identified. The dcp instructions clearly stated that the portfolio was to be completed for each facility operated by that company which has operations which are defined in the instructions to be nonferrous metals forming.

An additional 47 dcp's were sent out on June 21, 1983 when the Agency decided to include metal powder production and powder metallurgy operations of all metals, including iron and steel, copper, and aluminum in the scope of the category. All but five of these dcp's were sent to companies which had been sent a nonferrous metals forming dcp on April 19, 1983. Between April 19, 1983 and July 11, 1983, seven more dcp's were sent out, as additional facilities believed to be in the category were located. All companies were allowed 30 days from receipt of the dcp in which to complete and return the portfolio.

In all, dcp's were sent to 377 firms. Approximately 95 percent of the companies responded to the survey. In many cases, companies contacted were not actually members of the nonferrous metals forming category as it is defined by the Agency. Where firms had nonferrous metals forming operations at more than one location, a dcp was returned for each plant. A total of 294 dcp's applicable to the nonferrous metals forming category were returned. In cases where the dcp responses were incomplete or unclear, additional information was requested by telephone or letter.

The dcp responses were interpreted individually, and the following data were documented for future reference and evaluation:

- Company name, plant address, and name of the contact listed in the dcp.

- Metal types formed at the plant.

- Plant discharge status as direct (to surface water), indirect (to POTW), or zero discharge by metal type.

- Production process streams present at the plant, as well as associated flow rates; production rates; operating hours; wastewater treatment, reuse, or disposal methods; and the quantity and nature of process chemicals used.

- Plant age and number of employees.

- Availability of pollutant monitoring data provided by the plant.

The summary listing of this information provided a consistent, systematic method of evaluating and summarizing the dcp responses. In addition, procedures were developed to simplify subsequent analyses. The procedures developed had the following capabilities:

- Selection and listing of plants containing specific production process streams or treatment technologies.

- Summation of the number of plants containing specific process streams and treatment combinations.

- Calculation of the percent recycle present for specific streams and summation of the number of plants recycling this stream within various percent recycle ranges.

- Calculation of annual production values associated with each process stream and summation of the number of plants with these process streams having production values within various ranges.

- Calculation of water use and blowdown from individual process streams.

The calculated information and summaries were important and frequently used in the development of this guideline. Summaries were used in the category profile, evaluation of subcategorization, and analysis of in-place treatment and control technologies. Calculated information was used in the determination of water use and discharge values for the conversion of pollutant concentrations to mass loadings.

Discharge Monitoring Reports. To supplement existing data regarding treatment-in-place and the long-term performance of that treatment, the Agency collected discharge monitoring report (DMR) data from state and EPA Regional offices for direct dischargers. DMR data are self-monitoring data supplied by permit holders to meet state or EPA permit requirements. These data were available from 17 nonferrous metals forming plants; however, the data vary widely in character and nature due to the dissimilar nature of the monitoring and reporting requirements placed on nonferrous metals forming plants by the NPDES permit issuing authority. These data were not used in the actual development of the proposed limitations.

Engineering Site Visits and Sampling Trips. In addition to the above data sources, EPA sampled 17 nonferrous metals forming plants. Plant visits were made to sample treated and untreated wastewater and to gather additional information on manufacturing processes, wastewater flows, and wastewater treatment technologies and associated costs. Samples were collected at these 17 plants in order to characterize the wastewaters from the various nonferrous metals forming manufacturing operations and to characterize the performance of existing treatment systems. The 17 plants selected for sampling practice some combination of hot rolling, cold rolling, drawing, extrusion, forging, tube reducing, cladding, metal powder production and powder metallurgy, as

well as the associated operations of casting, heat treatment, surface treatment, alkaline cleaning, sawing, grinding, tumbling, burnishing, and product testing. These plants were chosen for sampling because the flow rates and pollutant concentrations in the wastewaters discharged from their manufacturing operations are representative of the flow rates and pollutant concentrations of wastewaters generated by similar operations at other plants in the nonferrous metals forming industry.

Utilization of Industry Data

Data from the previously listed sources were used to develop BPT, BAT, and BCT limitations and NSPS and pretreatment standards as described in this document. Subcategorization of the nonferrous metals forming category, described in Section IV, was based on information obtained from previous EPA studies and the technical literature and our own sampling data. Sampling results were used to determine raw wastewater characteristics, presented in Section V, and to select pollutant parameters for control, as described in Section VI. After determining the pollutants requiring control and the concentrations at which they are commonly found, applicable treatment technologies were identified. The applicability of wastewater treatment technologies currently in use at nonferrous metals forming plants (reported in dcp's and observed at sampled plants) was especially considered. These technologies are described in Section VII. Section VIII describes the method used to estimate the cost of various treatment technology options. The cost estimates were based on data from the technical literature and from equipment manufacturers. Finally, data from dcp's and sampling, along with estimated treatment system performance, were used to develop the limitations and standards described in Sections IX, X, XI, XII, and XIII of this document. The data were used first to select treatment technologies applicable to the category and then to calculate achievable effluent pollutant concentrations for each subcategory.

DESCRIPTION OF THE NONFERROUS METALS FORMING CATEGORY

The nonferrous metals forming category is generally included within SIC 3356, 3357, 3463, and 3497 of the Standard Industrial Classification Manual, prepared in 1972 and supplemented in 1977 by the Office of Management and Budget, Executive Office of the President. These SIC codes are: (1) 3356: Rolling, Drawing, Extruding of Nonferrous Metals; (2) 3357: Drawing and Insulating Nonferrous Wire; (3) 3463: Nonferrous Forgings; and (4) 3497: Metal, Foil, and Leaf. The category includes establishments engaged in the forming of nonferrous metals and their alloys, except for copper and aluminum for which separate regulations have recently been promulgated [40 CFR Part 468 (48 FR 36942, August 15, 1983), 40 CFR Part 467 (48 FR 49126, October 24,

1983)]. Separate regulations have been or will be proposed for casting of parts [40 CFR Part 464 (proposed at 47 FR 51512 on November 15, 1982)] and for casting which is an integral part of a nonferrous metal smelting and refining operation [40 CFR Part 421 (nonferrous metals manufacturing phase I, proposed at 40 CFR 7032, February 17, 1983, to be promulgated shortly; nonferrous metals manufacturing phase II, scheduled for proposal shortly)].

For the purpose of this regulation, nonferrous metal has been defined as any pure metal other than iron, copper, or aluminum; or metal alloy for which a metal other than iron, copper, or aluminum is its major constituent by weight. Alloys are considered as only one metal type. The metal type of any particular alloy is defined to be the metal that is the major component in percent by composition. Thus, an alloy which is 53 percent lead and 47 percent zinc is considered as lead, and an alloy which is 40 percent nickel, 35 percent zinc, and 25 percent tin is considered as nickel. Forming of an alloy which is greater than 50 percent iron, copper, or aluminum is not included in the category.

Use of the term "metal" throughout this document is not meant to imply pure metals only. "Metal" means any substance having metallic properties, including alloys composed of two or more chemical elements, of which at least one is an elemental metal. Thus "copper" means copper and its alloys (brass, bronze, nickel silver, beryllium copper, etc.), "iron" means iron and its alloys (including steel, an alloy of iron and carbon), and so forth.

Forming is the deformation of a metal into specific shapes by hot or cold working. The major forming operations include rolling, extruding, forging, and drawing. Minor forming operations included in the category are cladding, tube reducing, metal powder production and powder metallurgy. Associated operations performed as an integral part of the forming process are also included in the category. These operations are casting for subsequent forming, heat treatment, surface treatment, alkaline cleaning, solvent degreasing, sawing, grinding, tumbling, burnishing, product testing, and air pollution controls on forming operations and the associated operations.

Iron, copper, and aluminum powder manufacturing and powder metallurgy are covered under the nonferrous metals forming category in order to keep all of the powder operations under a single category, although the other forming operations for these metals are covered under separarate regulations [Iron and Steel, 40 CFR Part 420; Copper Forming, 40 CFR Part 468 (48 FR 36942, August 15, 1983); Aluminum Forming, 40 CFR Part 467 (48 FR 49126, October 24, 1983)]. Separate regulations have been or will be proposed for metal powders produced as an integral part of a nonferrous

metal smelting and refining operation (40 CFR Part 421; see full citation above). Only production of metal powders, ferrous and nonferrous, in operations which do not significantly increase their purity are included in the nonferrous metals forming category.

Casting which is an integral part of nonferrous metals forming is included in the nonferrous metals forming category, i.e., shot-casting and casting of billets, ingots, bars, and strip which are subsequently formed on-site.

Wastewater discharges covered by the nonferrous metals forming point source category, as delineated above, are not subject to regulation under 40 CFR Part 413 (electroplating) or 40 CFR Part 433 (metal finishing).

Historical

The nonferrous metals forming category covers forming operations performed on 31 metals. A group of nine of the metals has been excluded from this regulation under Paragraph 8(a)(iv) of the Settlement Agreement. These metal types are listed in Table III-1. They are excluded from regulation because, according to information reported on dcp's, they are not formed on a production scale in the United States or because the forming operations performed on them do not discharge wastewater. The 22 nonferrous metal types that are covered under this regulation are listed in Table III-2.

Employment data are given in the dcp responses for 235 plants (80 percent of the plants known to be engaged in nonferrous metals forming). These plants report a total of 35,000 workers involved in nonferrous metals forming. At an average plant, 120 employees are engaged in nonferrous metal forming. The employment distribution of nonferrous metals forming workers at the 235 plants is: 34 percent employ fewer than 25 people in nonferrous metals forming operations; 68 percent employ fewer than 100 people in this capacity; and 94 percent employ fewer than 500 people.

Nonferrous metals forming plants are not limited to any one geographical location. As shown in Figure III-1, plants are found throughout most of the United States, but the majority are located east of the Mississippi River. Population density is not a limiting factor in plant location. Nonferrous metals forming plants tend to be more common in urban areas, but they are frequently found in rural areas as well.

The majority of the nonferrous metals forming plants (57 percent) that reported the age of their facilty indicated they were built since 1954. Table III-3 shows the age distribution of nonferrous

metals forming plants according to their classification as direct, indirect, and zero discharge type.

Product Description

Nonferrous metals are formed by a variety of operations, described in the second half of this section. The product of one operation is often the starting material for a subsequent operation, as shown in Figure III-2. Cast ingots and billets are the starting point for making sheet and plate, extrusions, and forgings, as well as rod, for use in drawing operations. Rolled sheet and plate can be used as stock for stampings, can blanks, and roll formed products; as finished products in building, and aircraft construction; or as foil. Extrusions can be used as raw stock for forging and drawing; or can be sold as final products, such as beams or extruded tubing. Forgings are either sold as consumer products or used as parts in the production of machinery, aircraft, and engines.

Products manufactured by nonferrous metals forming operations generally serve as stock for subsequent fabricating operations. Because the 22 metals included in this category have a wide range of physical, chemical, and electrochemical properties, they are used in a wide range of fabricated products. The forming and associated operations in common use for a particular metal depend on what is possible, given the physical properties of the metal, and what is required for a specific application. For example:

- Beryllium, used in aerospace applications because of its high strength and light weight, is rolled into sheet products. Because it is difficult to cast, it is commonly consolidated into billets by powder metallurgy techniques.

- Bismuth has a low melting point and thus is rolled into strip for use in fuses. When alloyed with lead, tin, and/or cadmium, it is also extruded and drawn into solder wire.

- Cobalt is often alloyed with nickel, and is formed by the same method used to form steels. It is used for applications requiring strength and corrosion resistance at high temperatures, such as turbine blades.

- Hafnium is formed into control rods for nuclear reactors because of its special properties.

- Lead is extruded and swaged into bullets because it is dense and inexpensive. When alloyed with tin, bismuth, and cadmium, it is extruded into solder, an application

which makes use of its low melting point. Lead is formed into cases for automobile batteries because of its electrochemical properties and because it is inexpensive.

- Magnesium is extruded into cases for batteries used in portable communications equipment. The application takes advantage of the metal's electrochemical properties and light weight.

- Nickel is often alloyed with chrome and iron to make stainless steel alloys, many greater than 50 percent nickel. It is formed by all major forming operations and is used in applications requiring corrosion resistance at high temperatures, such as tubing for steam and gas turbines and in jet engines.

- Precious metals (silver, gold, platinum, and palladium) are corrosion-resistant and good electrical conductors. Because of their expense, they are often used as a thin layer clad to a layer of base metal (usually copper or nickel) which is rolled into strip and stamped into electrical contacts. Pure and clad precious metals are also drawn to wire used to fabricate jewelry. The corrosion resistance of precious metals makes them useful in dentistry.

- Refractory metals (columbium, molybdenum, rhenium, tantalum, tungsten, and vanadium) must be formed at high temperatures (relative to other metals) or as powders because they have melting points above 1,960°C. Their unique properties make them useful for specialized applications. Columbium is used as a structural material in nuclear reactors. Molybdenum is drawn into semiconductor wires. Tantalum is used in very small capacitors and heat transfer and furnace equipment. Tungsten finds wide application as filaments for electric light bulbs. As tungsten carbide, it is used in cutting tools and abrasives because of its extreme hardness.

- Tin is used in solder, usually alloyed with lead.

- Titanium, used in aerospace applications because of its high strength and light weight, is formed by all major forming techniques. It is also used for corrosion-resistant hardware and surgical implants.

- Uranium, when composed of 0.2 to 0.3 percent ^{235}U (the fissionable isotope), remainder ^{238}U, is called depleted uranium. This material is extruded into armor piercing projectiles because it is extremely dense.

- Zinc is light weight and corrosion-resistant. It is rolled into sheet for architectural uses and stamped into pennies. Its chemical properties make it useful for battery cases and lithographic plates.

- Zirconium is used to clad nuclear fuel rods in water cooled reactors and as a construction material in chemical plants because of its high melting point and corrosion resistance. It is extruded into tubes and rolled into plate and sheet.

Some forming operations are more commonly used on some metals than others. For instance, 67 percent of plants which form lead, tin, or bismuth extrude these metals. Only 6 percent of lead forming plants forge (swage) the metal. Casting is not common at refractory metals plants (8 percent of the plants) but powder metallurgy is (63 percent of the plants). Precious metals are commonly rolled (67 percent) and drawn (50 percent), but seldom extruded (15 percent).

Production of formed nonferrous metal products is tabulated in Table III-4. Production varies widely, from as little as two and a half million pounds of cobalt to 384 million pounds of lead products formed in 1981. Approximately 203 million pounds of iron, steel, copper, and aluminum powders and parts made from powder were produced in 1981. Reported production of formed nonferrous metals at individual plant sites ranged from 24 kg (53 pounds) to almost 23 million kg (51 million pounds) during 1981.

Wastewater Generation and Treatment

One hundred forty-eight plants indicated that no wastewater from nonferrous metals forming operations is discharged to either surface waters or a POTW. Of the remaining 146 plants, 32 discharge an effluent from nonferrous metals forming directly to surface waters, 107 discharge indirectly, sending nonferrous metals forming effluent through a POTW, and seven plants discharge both directly and indirectly. The volume of nonferrous metals forming wastewater discharged by plants in this category ranges from 0 to 680 million liters per year (0 to 180 million gallons per year). The mean volume is approximately 19 million liters per year (5.0 million gallons per year) for those plants having discharges. Only 84 of the discharging plants provided enough information to calculate the volume of wastewater discharged. Of these 84 plants, 20 percent discharge less than 38,000 liters per year (10,000 gallons per year); 55 percent discharge less than 3,800,000 liters per year (1,000,000 gallons per year); and 81 percent discharge less than 38,000,000 liters per year (10,000,000 gallons per year). There is no correlation between overall water use and total nonferrous metals production for a plant as a whole. However, correlations can be developed

between water use or wastewater discharge and production on a process basis, as discussed in Section V.

Approximately 50 percent of the plants reported some form of treatment of wastewater from nonferrous metals forming processes. The most common forms of wastewater treatment are pH adjustment, clarification, and gravity oil separation (skimming). Recirculation, including in-line filtration and cooling towers, is frequently used to control the volume of wastewater generated. Other flow reduction techniques demonstrated include countercurrent cascade and spray rinsing. Oily wastes are separated into oil and water fractions by emulsion breaking using heat or chemicals. Gravity separation is frequently used to separate neat oil and broken emulsions from the water fraction. The oil portion is usually removed by a contractor, although some plants dispose of it by land application or incineration. Wastewater treatment sludges generally are not thickened, but are disposed of without treatment; however, vacuum and pressure filters, centrifuges, and drying beds are occasionally used. Sludge disposal methods include landfill and contractor removal. Disposal of wastewater is being accomplished by discharge to surface waters or a POTW, by contractor removal, or by land application (lagoons and septic tanks).

DESCRIPTION OF NONFERROUS METALS FORMING PROCESSES

In the remainder of this section, nonferrous metal forming operations and operations associated with nonferrous metal forming are described in detail. In these descriptions, particular emphasis is placed on the use of water and generation of wastewater. The major nonferrous metals forming operations covered under this guideline include:

1. Rolling, drawing, extruding and forging of nonferrous metals other than copper and aluminum;

2. Cladding of any metals other than iron, steel, copper, and aluminum to any base metal (including iron, steel, copper, and aluminum);

3. Production of powders of all metals (including iron, copper, and aluminum) by mechanical methods or atomization; and

4. Manufacture of parts from powders of all metals (including iron, copper, and aluminum).

Nonferrous metal forming operations which are associated with the above operations are also covered under this guideline. These include:

1. Casting of nonferrous metals for subsequent forming;

2. Heat treatment;

3. Chemical surface treatments (acid, caustic, chromate);

4. Chemical cleaning (molten salt, alkaline);

5. Degreasing;

6. Mechanical surface treatments (tumbling, burnishing, milling);

7. Sawing and grinding; and

8. Product testing.

Water is used in forming of nonferrous metals to achieve desired metal characteristics such as tensile strength, malleability, hardness, and specific surface characteristics. Water can be used without additives, as in contact cooling and rinsing; in combination with soaps and oils, as in lubricating various operations; and in combination with other chemicals, as in surface treatment and cleaning operations. Water is used in vapor form to steam clean and surface treat some metals and as a high pressure jet in the production of metal powders by atomization. In addition to its use in applications which directly affect metal properties, water is used in cleaning nonferrous metal forming plants and equipment and in devices used to control air pollution generated during forming. A tally of wastewater sources in the nonferrous metals forming industry is presented in Section V. Regulatory flow allowances for waste streams under BPT, BAT, NSPS, pretreatment standards, and BCT are presented and discussed in Sections IX, X, XI, XII, and XIII, respectively.

EPA recognizes that plants sometimes combine wastewater from nonferrous metals forming and other processes and nonprocess wastewater prior to treatment and discharge. Pollutant discharge allowances will be established by this guideline only for nonferrous metals forming process wastewater. The flows and wastewater characteristics for other waste streams are a function of the plant operations, layout, and water handling practices. As a result, the pollutant discharge effluent limitation for wastewater streams other than nonferrous metals forming process water will be prepared by the permitting authority on a case-by-case basis, applying other effluent limitations and guidelines, if appropriate. These wastewaters are not further discussed in this document.

Nonferrous Metals Forming Operations

Rolling. Rolling is the process of reducing the cross-sectional area of metal stock, or otherwise shaping metal products, through the use of rotating rolls. Cylindrical rolls are used to produce flat shapes; grooved rolls produce rounds, squares, and structural shapes. Two common roll configurations are shown in Figure III-3. Because multiple passes through the rolls are often required to reduce the metal to the desired thickness, mills are frequently designed to allow rolling in the reverse direction.

Rolling employs either hot- or cold-working techniques depending on the kind of metal or alloy, and the properties desired in the final product. Hot rolling is defined as rolling above the recrystallization temperature of the metal and is typically the first step in a series of operations to produce a rolled product. Cast ingots or billets are usually reduced by hot rolling to elongated forms, known as blooms or slags. The rolling mills used for this operation are generally referred to as "breakdown mills" or "roughing mills." Additional hot or cold rolling can then follow the "breakdown" process. A diagram of a reversing hot strip mill which would be used subsequent to a "breakdown" operation is presented in Figure III-4.

Cold rolling is defined as rolling below the recrystallization temperature of the metal and may be carried out at temperatures much higher than ambient and still be considered "cold" rolling. A diagram of a typical 4-high cold rolling mill is presented in Figure III-5.

The rolling process is used to produce any one of a number of intermediate or final products from cast metal. Rolling is used to make flat products such as plate, sheet, strip, and foil. Plate is defined as being greater than or equal to 6.3 mm (0.25 inch) thick, and is usually produced from ingots by hot rolling. Cold rolled flat products are generally classified as sheet [from 6.3 to 0.15 mm (0.249 to 0.007 inch) thick] and foil [below 0.15 mm (0.006 inch) thick].

Rod, bar, and wire may be produced by either hot or cold rolling using grooved rolls. Rod is defined as having a solid round cross section 0.95 cm (3/8 inch) or more in diameter. Bar is also identified by a cross section with 0.95 cm (3/8 inch) or more between two parallel sides, but it is not round. Wire is characterized by a diameter of less than 0.95 cm (3/8 inch).

A specialized cold rolling operation, called tube reducing, is used to reduce the diameter and wall thickness of tubing. A mandrel is inserted in the tubing which is then rolled between a pair of rolls with tapered grooves. This process is used on nickel, silver, zirconium, and titanium tubing.

As will be discussed later in this section, heat treatment is usually required before and between stages of the rolling process. Ingots are usually made homogeneous in grain structure prior to hot rolling in order to remove the effects of casting on the metal's mechanical properties. Annealing is typically required between passes or after cold rolling to keep the metal ductile and remove the effects of work hardening. The kind and degree of heat treatment applied depends on the metal and alloy involved, the nature of the rolling operation, and the properties desired in the product.

It is necessary to use a cooling and lubricating compound during rolling to prevent excessive wear on the rolls, to prevent adhesion of metal to the rolls, and to maintain a suitable and uniform rolling temperature. Water and oil-in-water emulsions, stabilized with emulsifying agents such as soaps and other polar organic materials, are used for this purpose in hot rolling operations. Emulsion concentrations usually vary between 5 and 10 percent oil. Evaporation of the lubricant as it is sprayed on the hot metal serves to cool the rolling process. Mist eliminators may be used to recover rolling emulsions that are dispersed to the atmosphere. The emulsions are typically filtered to remove metal fines and other contaminants and recirculated through the mills. The use of deionized water to replace evaporative and carryover losses and the addition of bactericides and antioxidizing agents are practiced at many plants to increase the life of the emulsions. Nevertheless, the emulsions eventually become rancid or degraded and must be eliminated from circulation either by continuous bleed or periodic discharge.

Water without additives is also used as a coolant and lubricant in hot rolling operations. The water is typically not recycled, but used once and discharged. Mineral oil or kerosene-based lubricants are used in cold rolling operations. Neat oils are used to roll nickel, zinc, and refractory metals. Kerosene-based lubricants are used to roll precious metals. Often a light oil or emulsion is used to lubricate the outside of a tube during tube reducing, while the inside is lubricated with a heavier oil or grease.

The steel rolls used in hot and cold rolling operations may require periodic machining to remove metal buildup and to grind away any cracks or imperfections that appear on the surface of the rolls. The survey of the industry indicated that roll grinding with an oil-in-water emulsion is common practice. This emulsion is usually recycled and periodically discharged after treatment with other emulsified waste streams at the plant.

The surveyed plants have 131 rolling operations. Wastewater is discharged from lead, nickel/cobalt, zinc, precious metals, titanium, and refractory metals rolling operations.

Drawing. Drawing is pulling of metal through a die or succession of dies to reduce its diameter, alter the cross-sectional shape, or increase its hardness. This process is used to manufacture tube, rod, bar, and wire. In the drawing of tubing, one end of an extruded tube is swaged to form a solid point and then passed through the die. A clamp, known as a bogie, grips the swaged end of tubing, as shown in Figure III-6. A mandrel is then inserted into the die orifice, and the tubing is pulled between the mandrel and die, reducing the outside diameter and the wall thickness of the tubing. Wire, rod, and bar drawing is accomplished in a similar manner, but the metal is drawn through a simple die orifice without using a mandrel. A diagram of a typical hydraulic draw bench is presented in Figure III-7.

Drawing may be carried out hot or cold. In order to ensure uniform drawing temperatures and avoid excessive wear on the dies and mandrels used, it is essential that a suitable lubricant be applied during drawing. A wide variety of lubricants are used for this purpose. Heavier draws, which have a higher reduction in diameter, may require oil-based lubricants, but oil-in-water emulsions are used for many applications. Graphite, ground glass, soap powders, and soap solutions may also be used for some of the lighter draws. Drawing oils are usually recycled until their lubricating properties are exhausted.

Intermediate annealing is frequently required between draws in order to restore the ductility lost by cold working of the drawn product. Degreasing of the metal may be required to prevent burning of heavy lubricating oils in the annealing furnaces.

The surveyed plants have 96 drawing operations. Spent lubricants are discharged from lead, nickel, zinc, and precious metals drawing operations.

Extrusion. In the extrusion process, high pressures are applied to a cast metal billet, forcing the metal to flow through a die orifice. The resulting product is an elongated shape or tube of uniform cross-sectional area. If a piercing mandrel is used, or if the center of the billet or round has been removed by boring or trepanning, the extruded product is a tube.

There are two basic methods of extrusion practiced in the nonferrous metals forming category:

- Direct extrusion, and
- Indirect extrusion.

The direct extrusion process is shown schematically in Figure III-8. A heated cylindrical billet is placed into the ingot chamber, and the dummy block and ram are placed into position

behind it. Pressure is exerted on the ram by hydraulic or mechanical means, forcing the metal to flow through the die opening. The extrusion is sawed off next to the die, and the dummy block and ingot butt are released. Hollow shapes are produced with the use of a mandrel positioned in the die opening so that the metal is forced to flow around it. A less common technique, indirect extrusion, is similar, except that in this method, the die is forced against the billet extruding the metal in the opposite direction through the ram stem. A dummy block is not used in indirect extrusion. Diagrams of extrusion tooling equipment and a typical extrusion press are presented in Figures III-9 and III-10, respectively.

Although some metals, such as lead, can be extruded cold, most metals are heated first to reduce adhesion of the die to the extrusion and the resulting cracks and flakes in the extruded product (galling). Extrusion at elevated temperatures also reduces the amount of work hardening that will be imposed on the product. Heat treatment is frequently used after extrusion to attain the desired mechanical properties and will be described, in detail, later in this section. At some plants, contact cooling of the extrusion, sometimes called press heat treatment, is practiced as the extrusion leaves the press. This can be done in one of three ways: with a water spray near the die, by immersion in a water tank adjacent to the runout table, or by passing the metal through a water wall. Contact cooling water may also be used to cool extrusion dummy blocks, though no plants in this category specifically reported its use. Following an extrusion, the dummy block drops from the press and is cooled before being used again. Air cooling is most commonly used for this purpose, but water may be used to quench the dummy blocks.

The extrusion process requires the use of a lubricant to prevent adhesion of the metal to the die and ingot container walls. In hot extrusion, limited amounts of lubricant are applied to the ram and die ace or to the billet ends. For cold extrusion, the the container walls, billet surfaces, and die orifice must be lubricated with a thin film of viscous or solid lubricant. Many lubricants are used in extruding the metals in this category. Neat oils are used to lubricate nickel and uranium extrusion, emulsified oils for zirconium and titanium. Molten glass is also used as a lubricant in nickel extrusion; it acts as a heat insulator as well as a lubricant. Graphite and molybdenum disulfide in an oil or water base are other commonly used lubricants. Some metals (zirconium, beryllium, nickel) may be encased in a copper or steel can before extrusion. The can prevents galling of the core metal and is reduced to a very thin shell as a result of the extrusion. The thin shell is then removed from the core metal by acid pickling and/or machining.

The steel dies used in the extrusion proces require frequent dressing and repairing to ensure the necessary dimensional precision and surface quality of the product. The metal that has adhered to the die orifice is typically removed by grinding or polishing, which is a dry process.

The surveyed plants have 81 extrusion operations. Wastewater is discharged from lead, nickel, precious metals, titanium, refractory metals, zirconium, and uranium extrusion operations.

Forging. Forging is deforming metal, usually hot, with compressive force into desired shapes, with or without dies. The actual forging process is a dry operation. Five types of forging are commonly practiced in the nonferrous metals forming category:

- Closed die forging,
- Open die forging,
- Rolled ring forging,
- Impacting, and
- Swaging.

In each of these techniques, pressure is exerted on dies or rolls, forcing the heated stock to take the desired shape. The first three processes are types of hot working; the other two are cold working.

Closed die forging (Figure III-11a), the most prevalent method, is accomplished by hammering or squeezing the metal between two steel dies, one fixed to the hammer or press ram and the other to the anvil. Forging hammers, mechanical presses, and hydraulic presses can be used for the closed die forging of nonferrous metals. The heated stock is placed in the lower die and, by one or more blows of the ram, forced to take the shape of the die set. In closed die forging, the metal is shaped entirely within the cavity created by these two dies. The die set comes together to completely enclose the forging, giving lateral restraining to the flow of the metal.

The process of open die forging (Figure III-11b) is similar to that described above, but in this method, the shape of the forging is determined by manually turning the stock and regulating the blows of the hammer or strokes of the press. Open die forging requires a great deal of skill and only simple, roughly shaped forgings can be produced. It is primarily used as a breakdown process to improve the workability of cast billets and

to form them into rounds, octagons, and other shapes. Occasionally the process is used in development work in which items are produced in small quantities making the cost of closed-type dies prohibitive.

The process of rolled ring forging is used in the manufacture of seamless rings. In one type of ring rolling, a hollow cylindrical billet is rotated between a mandrel and pressure roll to reduce its thickness and increase its diameter (Figure III-12a). In another type of ring rolling, a hollow preform is mounted on a saddle/mandrel and reduced in wall thickness by the repeated blows of a hammer (Figure III-12b).

Impacting, depicted in Figure III-13, is a combination of cold forging and cold extrusion. The process is performed by placing a cut-off piece of metal in a bottom die. A top die consisting of a round or rectangular punch is fastened to the press ram and is driven into the metal slug. This causes the metal to be driven up around the top punch. Usually, the metal adheres to the punch and must be stripped off as the press ram rises.

Swaging, the process of forming a taper or a reduction on metal products such as rod and tubing, is another type of forging. When swaging is the initial step in drawing tube or wire, a solid point is formed by repeated blows of one or more pairs of opposing dies (this process is also called pointing). Swaging can also be used to reduce the diameter of tube or wire without a subsequent drawing operation, especially when the metal being worked is brittle (e.g., tungsten). The process of making tapered bullets from lead wire is also called swaging.

Proper lubrication of the dies is essential in forging nonferrous metals. Colloidal graphite in either a water or an oil medium is usually sprayed onto the dies for this purpose in the hot working types of forging. For shallow impressions, a single spray is usually adequate. Dies may be sprayed manually or with automatic sprays timed with the press stroke. Deeper cavities may require a second manual spray or swabbing to ensure that all die surfaces are covered.

Particulates and smoke may be generated from the partial combustion of oil-based lubricants as they contact the hot forging dies. In those cases, air pollution controls may be required. Baghouses, wet scrubbers, and commercially available dry scrubbers are in use at nonferrous metals forming facilities.

Oil-in-water emulsions and neat oils are used as lubricants in swaging processes. The lubricants are usually filtered to remove metal fines and other contaminants and recirculated. As the lubricants become rancid or degraded they are discarded, either through continuous bleed or periodic batch discharge.

In addition to use in lubricants and air pollution control, water is used to cool forging dies, clean equipment, and in heat treatment. Quenching is employed to attain desired metallurgical properties, usually by plunging hot pieces in a water bath immediately after forging. Titanium, refractory metals, zirconium, magnesium, and uranium forgings are sometimes treated this way.

The surveyed plants have 81 forging operations. Wastewater is discharged from lead, nickel, titanium, refractory metals, zirconium, magnesium, and uranium forging operations.

Cladding. A clad metal is a composite metal containing two or more layers that have been bonded together. Some typical clad configurations are shown in Figure III-14. The bonding may have been accomplished by roll bonding (co-rolling), solder application (brazing), or explosion bonding.

In the roll bonding process, a permanent bond between two metals is obtained by rolling under high pressure in a bonding mill. The high pressure increases the temperature of the metals, promoting codiffusion so that a metallurgical bond forms at the interface. In some cases a sintering step is required to increase bond strength. Clad metals consisting of a base metal with an overlay or inlay of precious metal are produced for the electrical/electronics industry and for jewelery applications (e.g., gold filled wire). To produce an inlay, a ditch is skived in the base metal, filled with a strip of precious metal and rolled to form a bond.

The solder application or brazing process is also used to make clad metals. The term soldering is used where the temperature range falls below 425°C (800°F). The term brazing is used where the temperature exceeds 425°C (800°F). In this process, a thin layer (film or foil) of a low melting point metal is placed between two layers of metal to be bonded. The three-layer assembly is then placed into a furnace at the melting temperature of the filler metal. Bonding results from the intimate contact produced by the dissolution of a small amount of the base metal and the top metal in the molten filler metal, without direct fusion of the two metal layers. Upon cooling, the clad material can be formed by any of the forming operations previously described.

A third method of producing clad metals, pressure bonding, is a combination of roll bonding and solder bonding. A three-layer assembly of solder and the metals to be bonded is placed into a furnace, just as in solder bonding. However, the heating is accompanied by the application of pressure, as in roll bonding. The bonded metal may be cooled by a water spray after it is removed from the bonding furnace.

In explosion bonding, the metallurgical joining of two or more metals is accomplished by the force of a carefully detonated explosion. The explosion moves progressively across the surface of the cladder metal, accelerating it across a "standoff distance" and against the backer metal. The force of the explosion shears away the oxide- and nitride-containing surface layers of both metals and causes them to behave as a fluid. The sheared away layers are jetted out ahead of the point where the two metals collide. As the collision point advances, the jetting action produces metallurgically clean surfaces which, under extreme pressure, allow normal interatomic and intermolecular forces to create an electron-sharing bond. The result is a cold weld, with a characteristic wave pattern at the weld interface caused by the turbulent plastic metal flow after collision.

Explosion bonding is used to produce clad plate, sheet and tubes, and to form structural transition joints. Clad plate can be used in the gauge at which it is formed or it can be rolled down to final gauge.

Except for pressure bonding which uses some contact cooling water, all of the cladding processes described above are dry processes. The main source of process wastewater in metal cladding operations is in cleaning the metal surfaces prior to bonding. For small batch operations, the cleaning steps can involve dipping the metal into small cleaning bath tanks and hand rinsing the metal in a sink. For larger continuous operations, the metal may be cleaned in a power scrubline. In a typical scrubline, metal strip passes through a detergent bath, spray rinse, acid bath, spray rinse, rotating abrasive scrub brushes, and a final rinse. The metal may then pass through a heated drying chamber or may air dry.

Metal Powder Production. For regulatory convenience, the production of all metal powders, including iron, steel, copper, and aluminum, has been included in this category. Atomization, depicted in Figure III-15, is the most common method of producing metal powders. In this process, a stream of fluid, usually water or gas, impinges upon a molten metal stream, breaking it into droplets which solidify as powder particles. The size and shape of atomized powder is determined by jet configuration, jet design, composition of the impinging medium, and composition of the metal. Generally, gas atomization is used to produce spherical particles while water atomization is used to produce irregularly shaped particles, required for powder metallurgy applications in which a powder is cold pressed into a compact. In addition, cooling times play an important role in determining particle configuration. Annealing usually accompanies atomization for the purpose of rearranging internal crystal structures of metal powders, and consequently improving strength.

Powders are also produced by disintegration of solid metal into powder by mechanical comminution. This process is used for brittle ores or chemically embrittled metals. It is also used to produce powder from turnings and other scrap of more ductile metals. The most commonly utilized pieces of mechanical reduction equipment are ball mills, vortex mills, hammer mills, disc mills, and roll mills. Powder production with this type of machinery tends to produce angular, irregular, rod-like, and flaked physical structures. Occasionally, powders are milled in a water slurry.

In addition to its use as an atomization medium and a milling slurry, water is used in the equipment used to control particulate air pollution from metal powder production operations (wet scrubbers and electrostatic precipitators).

Surveyed plants produce powders from all of the metals formed by traditional means except titanium and rhenium (see Table III-4). Iron, stainless steel, and copper alloy powders are produced in the largest quantities and by the greatest number of manufacturers. The high demand for these metal powders is caused by their large-scale applications in the auto manufacturing and machining industries. After iron and steel, copper, and aluminum, and their alloys, the metal powders produced in the largest quantity are tungsten and tungsten carbide, lead and its alloys, and nickel and its alloys. Wastewater is discharged from nickel, precious metals, iron and steel, copper, aluminum, and refractory metals powder production operations.

Production of Powder Metallurgy Parts. Metal powders are formed into parts by a "press and sinter" operation, consisting of blending metal powders, compacting the mixture in a die and then heating or sintering the compacted powder in a controlled atmosphere to bond the particles into a strong shape. A diagram of two pressing configurations is presented in Figure III-16. Compaction forces range from 1 to 350 kkg (1.1 to 385 tons).

Following compaction, "green" metal powder compacts are sent to a furnace for sintering. Furnace temperatures are held below the melting point of the metal being sintered, from 1,000°C to 1,800°C.

To prevent formation of oxide films on particle surfaces (which inhibit formation of metallic bonds between particles) an inert atmosphere or vacuum must be maintained inside the sintering furnace. Hydrogen, although expensive, is the most commonly used inert gas. Alternatively, vacuum systems capable of maintaining a pressure of 10 MPa (2.96×10^{-6} in Hg) are typically employed. As an extra precaution against contamination with air, the vacuum furnace and its inlet and outlet ports may be jacketed with inert gas.

During the sintering process, air present in the metal compacts before sintering is exhausted, thus decreasing the porosity of the compact and increasing its strength. Further strengthening occurs as surface metal atoms recrystallize, realigning into a close crystal lattice pattern.

For some applications, porosity may be further decreased by the process of infiltration, in which a liquid phase is allowed to penetrate the pores between metal particles during sintering. The liquid used may be a nonalloying metal with a lower melting point than the compacted metal, oil, or an anti-friction polymer such as polytetrafluoroethylene. Infiltration with copper is commonly used in manufacturing tungsten and molybdenum compacts for electrical contacts.

In some cases, a final mechanical fabrication step, repressing or coining, is used. In this process, the sintered compact is deformed in a closed die to produce a final shape. Pressures applied during coining range up to 700 MPa (100,000 psi), depending on the size and shape of the die and the nature of the metal compact being formed. In some cases a lubricant is used to prevent the compact from adhering to the sizing die. This lubricant is usually not discharged from the process, but lost through drag-out on the parts. Sintered metal compacts also may be rolled, extruded, or drawn.

Finishing operations used subsequent to the forming of parts from metal powder include deburring, steam oxidation, and treatment with rust inhibitor. Deburring may be sand blasting or shot peening, both of which are dry, or tumbling with grit suspended in water. Because of their porosity, parts made from iron and steel powders may oxidize excessively. To prevent this, steam treatment to produce a protective oxide layer or treatment with rust inhibitors are commonly used. Air pollution from the steam treatment operation is sometimes controlled by wet scrubbers.

As described above, process wastewater is generated in the production of powder metallurgy parts after the pressing and sintering steps. In addition to tumbling and steam treating, the parts may be cleaned or degreased (alkaline, detergent, or solvent) prior to packing and shipping. These cleaning operations are identical to those performed on other metal products and will be described in detail later in this section.

Operations Associated With Nonferrous Metals Forming

Casting. Casting consists of filling a shaped container or mold with molten metal so that upon solidification, the shape of the mold is reproduced. Only casting which is an integral part of nonferrous metals forming is included in the category, that is,

shot-casting and casting of billets, ingots, bars, and strip which are subsequently formed on-site. Casting performed as part of a smelting or refining operation is included in the nonferrous metals manufacturing point source category, 40 CFR Part 421. Casting of parts is included in 40 CFR Part 464, proposed on November 15, 1982 at 47 FR 51512.

The choice of casting method depends on the metal or alloy being cast and the ultimate use of the cast form. The casting methods used in nonferrous metals forming can be divided into four classes:

- Stationary casting;
- Direct chill casting, including arc casting;
- Continuous casting;
- Shot casting.

The method of casting most widely practiced at nonferrous metals forming plants is stationary or pig casting which allows for recycle of in-house scrap. In this process, molten metal is poured into cast iron molds and allowed to air cool. Lubricants are not usually required. Although water may be sprayed onto the molten metal to increase the cooling rate, this generally does not result in any discharge.

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.

As shown in Figures III-17 and III-18, molten metal 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 metal. The base of the mold is attached to a hydraulic cylinder which is gradually lowered as pouring continues. As the solidified metal 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.

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 metal, but contamination of the contact cooling water with oil and oil residues does occur.

Arc casting is a form of direct chill casting used for refractory metals, metals with melting points too high to easily cast by conventional techniques (tungsten, molybdenum, tantalum, columbium, vanadium, and rhenium). The bars serve as consumable electrodes in an arc-melting process. The end product of refining these metals is a powder which can be compacted and sintered into solid bars. Under vacuum, in an appropriate furnace consisting of a water-cooled copper crucible, the preformed bars form an electrode for striking a high current, low voltage arc between the bar and a starting pad of metal. As the bar is progressively melted, molten metal falls through the arc and forms an ingot which gradually freezes into solid form. The ingot may be remelted to improve purity or directly fabricated to product form.

Many nonferrous metals forming plants use continuous casting instead of, or in addition to, direct chill casting methods. Unlike direct chill casting, no restrictions are placed on the length of the casting, and it is not necessary to interrupt production to remove the cast product. The use of continuous casting eliminates or reduces the degree of subsequent rolling required.

A relatively new technology, continuous casting of metal first came into practice in the late 1950's. Since then, improvements and modifications have resulted in the increased use of this process. Current applications in this category include the casting of sheet and strip. Because continuous casting affects the mechanical properties of the metal cast, the use of continuous casting is limited by the metals and alloys used, the nature of subsequent forming operations, and the desired properties of the finished product. In applications where continuous casting can be used, the following advantages have been cited:

- Increased flexibility in the dimensions of the cast product;
- Low capital costs, as little as 10 to 15 percent of the cost of conventional direct chill casting and hot rolling methods; and
- Low energy requirements, reducing the amount of energy required to produce comparable products by direct chill casting and rolling methods by 35 to 80 percent, depending on the product being cast.

In addition, the use of continuous casting techniques has been found to significantly reduce or eliminate the use of contact cooling water and oil lubricants.

Two continuous casting processes are commonly used in the industry. Methods in use at a particular plant will vary somewhat, but they are similar in principle to the processes diagrammed schematically in Figures III-19 and III-20. Continuous sheet casting, shown in Figure III-19, substitutes a single casting process for the conventional direct chill casting, scalping, heating, and hot rolling sequence. The typical continuous sheet casting line consists of melting and holding furnaces, a caster, pinch roll, shear, bridle, and coiler. Molten metal flows from the holding furnace to the caster headbox. The level of molten metal maintained in the headbox causes the metal to flow upwards through the top assembly, which distributes it uniformly across the width of the casting rolls. The metal solidifies as it leaves the tip and is further cooled and solidified as it passes through the internally water-cooled rolls. It leaves the caster as a formed sheet and successively passes through pinch rolls, a shear, and a tension bridle before being wound into a coil. The cooling water associated with this method of continous sheet casting never comes into contact with the metal.

Continuous strip casting is pictured in Figure III-20. Molten metal flows from a casting pot through an open-ended die. The die is water cooled and has the same cross-section as the cast strip. As the metal leaves the die, it descends vertically past water sprays, guided by rolls. The strip can be coiled as it is cast, or small sections can be cut from the end as the strip continues to grow.

Metal shot is commonly produced by casting of a number of metals, including lead and precious metals. In the shot casting process pictured in Figure III-21, metal ingots are melted in a furnace, the furnace is tapped, and the molten metal is poured down a trough or into a heated mold. At the bottom of the trough or mold is a shot mold plate, typically made of steel or a ceramic material, which has holes punched in it. The size of the shot pellets is determined by the size of the holes.

As the molten metal flows through the holes in the shot mold it forms droplets. The droplets become round as they descend through several inches of air, then fall into a tank of water for quick quenching. This water may be stagnant or circulating. In some shot casting operations a wetting agent is added to the quench water, altering the surface tension and ensuring the formation of spherical shot particles. To prevent excessive loss of quench water through evaporation and to maintain the water temperature required by some operations, the quench water may be cooled using noncontact cooling water in a jacket around the tank.

Cast shot may be processed through a sizing operation to remove the irregular shaped particles. Reject shot is usually remelted and recast.

In addition to its use to cast metal, water is used in equipment which controls air pollution from stationary casting and shot-sizing operations. Water is also used to wash billets immediately after casting. In vapor form, water is used to draw a vacuum from some melting furnaces. The condensed steam, which may carry any material volatilized during melting, is recirculated with a periodic blowdown.

The surveyed plants have 88 casting operations. Wastewater is discharged from lead, nickel, zinc, precious metals, and refractory metals casting operations.

Heat Treatment. Heat treatment is an integral part of nonferrous metals forming practiced at nearly every plant in the category. It is frequently used both in-process and as a final step in forming to give the metal the desired mechanical properties. There are four general types of heat treatment:

- Homogenizing, to increase the workability and help control recrystallization and grain growth following casting;

- Annealing, to soften work-hardened and heat-treated metals, relieve stress, and stabilize properties and dimensions;

- Solution heat treatment, to improve mechanical properties by maximizing the concentration of hardening contaminants in solid solution; and

- Artificial aging, to provide hardening by precipitation of constituents from solid solution.

Homogenizing, annealing, and aging are dry processes, while solution heat treatment typically involves significant quantities of contact cooling water.

During casting, large crystals of intermetallic compounds are distributed heterogeneously throughout the ingot. Homogenization of the cast ingot provides a more uniform distribution of the soluble constituents within the metal. By reducing the brittleness caused by casting, homogenization prepares the ingot for subsequent forming operations. The need for homogenization and the time and temperatures required are dependent on the metal and alloy involved, the ingot size, the method of casting used, and the nature of the subsequent forming operations. Typically, the

ingot is heated to an appropriate temperature and held at that temperature for four to 48 hours. The ingots are then allowed to air cool.

Annealing is used by plants in the nonferrous metals forming category to remove the effects of strain hardening or solution heat treatment. In the annealing operation, the metal is raised to its recrystallization temperature. Nonheat-treatable, strain-hardened metals need only be held in the furnace until the annealing temperature is reached; heat-treatable metals usually require a detention time of two to three hours. In continuous furnaces such as that pictured in Figure III-22, the metal is raised to higher temperatures and detained in the furnace for 30 to 60 seconds. Once removed from the annealing furnace, it is essential that the heat-treatable metals be cooled at a slow, controlled rate. After annealing, the metal is in a ductile, more workable condition suitable for subsequent forming operations. Some metals are annealed in a protective (nonoxidizing) atmosphere to prevent discoloration of the bright surface. This process is called bright annealing and is commonly used to anneal silver and its alloys. Typical protective atmospheres are dissociated ammonia, hydrogen, and nitrogen.

Solution heat treatment, also referred to as solution annealing, is accomplished by raising the temperature of a heat-treatable metal to the eutectic temperature, where it is held for the required length of time, then quenching it rapidly. As a result of this process, the metallic constituents in the metal are held in a super-saturated solid solution, improving the mechanical properties of the metal. The required length of time the metal must be held at the eutectic temperature varies from one to 48 hours. Certain nonferrous metal alloys can be solution heat treated immediately following extrusion and forging. In this procedure, known as press heat treatment, the metal is extruded or forged at the required temperatures and quenched with contact cooling water as it emerges from the die or press.

The quenching techniques used in solution heat treatment are frequently critical in achieving the desired mechanical properties. The sensitivity of metals and alloys to quenching varies, but delays in transferring the product from the furnace to the quench, a quenching rate that is incorrect or not uniform, and the quality of the quenching medium used can all have serious detrimental effects. With few exceptions, contact cooling water is used to quench solution heat treated products. Spray or flush quenching is sometimes used to quench thick products. Solution heat treated forgings of certain metals can be quenched using an air blast rather than a water medium. Air quenching can also be used for certain extrusions following press heat treatment. The continuous annealing operation depicted in Figure III-22 contains a spray quench zone.

Artificial aging, also known as precipitation heat treatment, is applied to some nonferrous metals in order to cause precipitation of super-saturated constituents in the metal. The metal is heated to a relatively low temperature for several hours and then air cooled. Artificial aging is frequently used following solution heat treatment to develop the maximum hardness and ultimate tensile and yield strength in the metal. For certain metals, the mechanical properties are maximized by sequentially applying solution heat treatment, cold working, and artificial aging.

Chemical Surface Treatments. Surface treatment operations performed as an integral part of forming processes are within the scope of the nonferrous metals forming category. For the purposes of this regulation, surface treatment of nonferrous metals is considered to be an integral part of nonferrous metals forming whenever it is performed at the same plant site at which nonferrous metals are formed.

A number of chemical treatments may be applied to nonferrous metals after they are formed. The objective of these treatments is to in some way alter the surface of the metal, either by removing some of it or changing its characteristics. Wastewater discharges from these operations are generated when these solutions must be replaced with fresh chemicals and in rinsing operations used to remove residual solution from the formed metal after treatment. The contaminants in the spent solution and rinse water are a function of the chemicals used to make the solutions and the metal treated. Most of the contaminants are acids, bases, and metal salts.

The most frequently used chemical surface treatments are designed to remove the surface layer of oxidized metal created during forming of nonferrous metals at elevated temperatures. The most common method of removing this layer is to dissolve it in acid in an operation known as pickling, brightening, etching, or acid surface treatment. In addition to removing the oxide layer from a metal surface, this treatment will remove burned-on lubricants and any other substances not entirely removed by solvent or alkaline cleaning.

Pickling operations can be batch operations in which formed parts are moved from tank to tank to be dipped in acid baths, overflowing rinse tanks and spray chambers. The rinses are usually plain water, but occasionally ammonia solutions are used. A diagram of a bulk product pickling tank is presented in Figure III-23. A continuous surface treatment line, consisting of a series of tanks, can be used to provide strip metal with a series of treatments. A diagram of a typical continuous strip pickling line is presented in Figure III-24.

Sulfuric, hydrochloric, ammonium bifluoride, hydrofluoric, phosphoric, nitric, and chromic acids or acid mixtures are commonly used as pickling solutions. The pickling process may be chemical (formed metal is immersed in a tank of pickling solution and held until scale is removed) or electrochemical (electric current is forced through the pickling bath to speed up the pickling process). Acid concentration, bath temperature, and process time depend on the type of metal or alloy being treated, the components of the pickling solution, and the amount of scale to be removed.

Acid consumed during pickling operations must be periodically replenished. Dissolved metal salts in the pickling solution gradually reduce pickling efficiency. Spent pickle liquor may be concentrated by high temperature precipitation of metal salts and recycled to minimize acidic waste discharge.

Brightening solutions for nonferrous metals and alloys usually contain mixtures of two or more acids: sulfuric, phosphoric, nitric, chromic, or hydrochloric. Acid ratios and concentrations vary widely. Dipping times range from 5 seconds to greater than 5 minutes. Other chemicals such as metal salts, glycerol, or ethylene glycol also may be added to brightening solutions.

The layer of oxide scale formed on nickel, cobalt, and certain refractory metals is very difficult to remove with acid surface treatments alone. Consequently these metals are treated by dipping the formed parts into molten salts (usually sodium chloride, potassium chloride, and sodium hydroxide) at 480 to 540°C for 15 minutes or more, then rinsing and quenching them in a water bath. The scale loosened by the salt treatment is removed by acid surface treatment followed by a rinse.

Anodizing and chemical conversion coating are used to change the characteristics of the surface of formed metal by chemically or electrochemically depositing an inorganic coating to the metal. These coatings are applied for corrosion protection and in preparation for painting.

Anodizing is an electrochemical oxidation process which forms an insoluble oxide of the metal on the formed metal surface. The oxide coating is used to provide corrosion resistance, decorative surfaces, a base for applying other coatings, and special electrical or mechanical properties. Anodizing is applied by immersing the metal form in an acid solution (containing fluoride, phosphate, chromate, and/or sodium ions) and passing a direct or alternating electrical current through the metal form. After anodizing, parts are rinsed in cold then hot water to facilitate drying.

The metal oxide layer formed on the metal surface (anode) is extremely thin and nonporous. Electrolytic anodizing solutions are composed of dilute sulfuric acid or dilute chromic acid.

Chemical conversion coatings are applied to previously-deposited metal or base metal for increased protection, lubricity, or in preparation for another special coating or to achieve a special surface appearance. Typical operations include chromating to form a protective film, and phosphating which is used to provide a good base for paints and other organic coatings, to lubricate the metal surface before cold forming or drawing, and to impart a corrosion resistance. When chromating, the formed metal surface is coated by immersion or wetting with a solution containing hexavalent chromium and active organic and inorganic compounds. When phosphating, the metal surface is wetted, usually by immersion, with a phosphate solution which reacts with the metal surface.

Surface treatments and their associated rinses are usually combined in a single line of successive tanks. In some cases, rinsewater from one treatment is reused in the rinse of another. Surface treatment rinses are the major source of wastewater in the nonferrous metals forming category. The surveyed plants have 142 surface treatment operations, many plants having several. Wastewater is discharged from operations used to treat nickel, cobalt, zinc, beryllium, precious metals, titanium, refractory metals, zirconium, hafnium, magnesium, and uranium. Wastewater is also generated by the equipment used to control air pollution from surface treatment of nickel, titanium, refractory metals, and uranium.

Alkaline Cleaning. Alkaline cleaning involves the removal of oil, grease, and dirt from the surface of a formed metal product using water with a detergent or other dispersing agent. Ultrasonic vibration is sometimes used in conjunction with chemical cleaners to clean wire and other fine parts.

Alkaline cleaners are formulations of alkaline salts, water, and surfactants. Salts used include sodium hydroxide, sodium orthosilicate, trisodium phosphate, sodium metaborate, sodium carbonate, and sodium polyphosphates. Frequently, two or more of these salts are blended to form the cleaning solution.

Uninhibited alkaline cleaners will attack many nonferrous metals. Therefore, inhibiting compounds which coat the metal with a thin film to prevent etching, pitting, or tarnishing are typically added to the cleaning solution.

Alkaline solutions are commonly used to clean formed metal parts prior to chemical treatment or as a final step before packaging

the product. The type of solution used depends on the metal to be cleaned and the contaminant to be removed. Alkaline cleaning is generally preceded by solvent cleaning via vapor degreasing or cold cleaning. Following this step, formed metal parts are immersed in or sprayed with the alkaline cleaning solution. Solution concentration, temperature, and immersion time vary with metal type.

Following alkaline treating, metal parts are rinsed with water. Rinsewater is often warm, to decrease drying time and reduce water spotting. Spent solutions and rinses are discharged from alkaline cleaning processes. Streams are frequently combined with acid waste streams to adjust wastewater pH prior to discharge. In addition to cleaning nonferrous metals after they are formed, alkaline cleaning is used to prepare metals for cladding. The process may be hand cleaning or use a power scrubline, as described in the cladding discussion above.

Alkaline cleaning is associated with lead, nickel, zinc, precious metals, titanium, refractory metals, and zirconium forming operations.

Degreasing. Solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Straight vapor degreasing uses hot vapors of chlorinated solvents to remove oils, greases, and waxes. A vapor degreasing unit typically consists of an open steel tank as shown in Figure III-25. Solvent at the bottom of the tank is heated to boiling, generating hot vapors. The heavy vapors fill the tank and are condensed at the top of the tank by cooling coils, thus containing the solvent vapors below the condensing coil level. Cooled nonferrous metal forming products are lowered into the hot vapor bath where solvent vapors condense onto the metal surface. Oils and greases are dissolved from the metal surface by the solvent.

Immersion-vapor degreasing is used to clean metal parts coated with large quantities of oil, grease, or hard-to-remove soil. Solvents used are the same as those used in straight vapor degreasing. Metal parts are first immersed in boiling solvent, then in a clean cool solvent rinse, and finally in solvent vapors. Immersion in cool solvent rinses residual matter left from the first cleaning and lowers the metal temperature so that vapor rinsing will be effective. Clean solvent for the cool rinse is supplied by condensation of pure vapors in the condenser section of the degreaser. From the condenser, solvent flows into the cool rinse chamber and overflows into the sump where it is again vaporized.

When mild scrubbing action is required to remove grease or dirt, spray-vapor degreasing is used. In this process, clean solvent is pumped from the degreaser condenser to a spray lance. Parts are impingement-sprayed with clean solvent to loosen soil and insoluble material. Spray lances may be fixed so that parts move in front of them for impingement, or may be hand-held so that an operator may direct the spray. Parts enter the degreaser's vapor phase, pass through the spray bank, and finally go through a final vapor rinse.

Ultrasonic vapor degreasing is similar to immersion-vapor degreasing, with ultrasonic transducers built into the clean solvent rinse tank. Metal parts are initially cleaned by immersion in boiling solvent, then immersed in cool solvent for ultrasonic scrubbing, followed by a vapor or spray-vapor rinse.

During ultrasonic scrubbing, high frequency sound waves are transmitted through the solvent to the part, producing rapid agitation and cavitation (formation/implosion of solvent bubbles). The scrubbing action caused by solvent cavitation efficiently removes particulate and insoluble materials from the metal surface.

The ultrasonic frequency used depends on the type of part being cleaned, the degree of soil contamination, and the solvent used. The most commonly used frequency range is 20,000 to 50,000 cycles per second.

Emulsified solvent degreasing is primarily used to remove both water- and oil-soluble soils from complex mechanical parts. Chlorofluorocarbons are typically employed as solvents in this process. Reclamation of emulsified solvents is generally not economical.

Water contaminated with salts and other water-soluble contaminants is periodically removed from the system and replaced with clean water to renew the system's cleaning strength.

Cold solvent cleaning involves hand wiping, spraying, and immersion of metal parts in solvents to remove oil, grease, and other contaminants from the metal surface. Petroleum and chlorinated hydrocarbons are typically used in cold cleaning operations. Contaminated solvents are reclaimed by distillation or are disposed of via contractor.

Mechanical Surface Treatments. Mechanical surface treatments are used, like chemical surface treatments, to alter the surface of formed nonferrous metals. Machining, grinding, polishing, tumbling (barrel finishing), and burnishing are commonly used mechanical surface treatments.

Machining is the general process of removing stock, in the form of chips, from a workpiece by forcing a cutting tool through the workpiece. Machining operations such as turning, milling, drilling, boring, tapping, planing, broaching, sawing and cutoff, slitting, shaving, threading, reaming, shaping, slotting, hobbing, filing, and chamfering are included in this definition.

Grinding is the process of removing stock from a workpiece by the use of a tool consisting of abrasive grains held by a rigid or semirigid binder. The tool is usually in the form of a disk (the basic shape of grinding wheels), but may also be in the form of a cylinder, ring, cup, stick, strip, or belt. The most commonly used abrasives are aluminum oxide, silicon carbide, and diamond. The processes included in this unit operation are sanding (or cleaning to remove rough edges or excess material), surface finishing, and separating (as in cut-off or slicing operations).

Polishing is an abrading operation used to remove or smooth out surface defects (scratches, pits, tool marks, etc.) that adversely affect the appearance or function of a part. Polishing is usually performed with either a belt or wheel to which an abrasive such as aluminum oxide or silicon carbide is bonded. Both wheels and belts are flexible and will conform to irregular or rounded areas where necessary. The operation usually referred to as buffing is included in the polishing operation.

Burnishing is the process of finish sizing or smooth finishing a workpiece (previously machined or ground) by displacement, rather than removal, of minute surface irregularities. It is accomplished with frictional contact between the workpiece and some hard material, such as hardened metal balls.

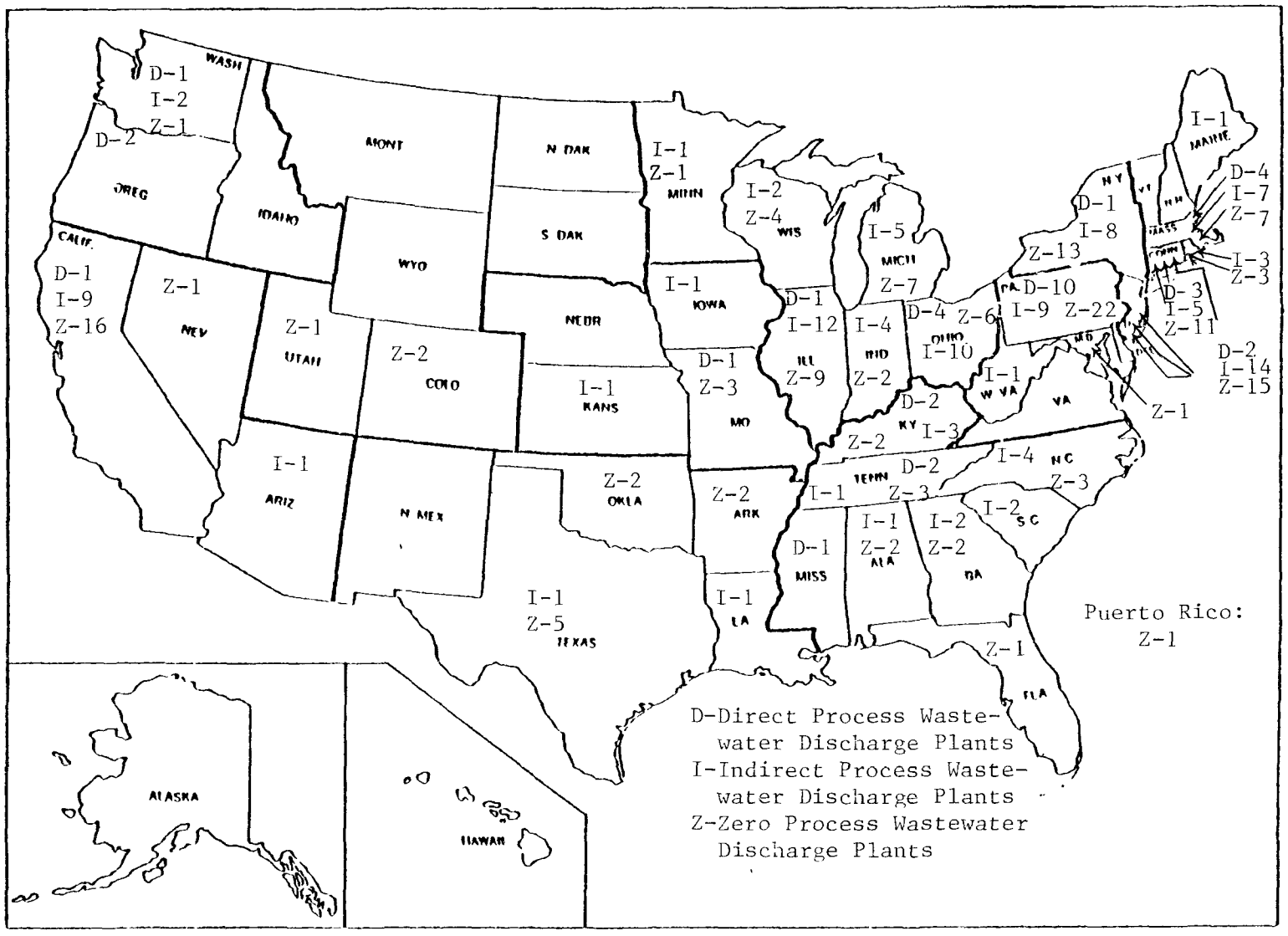
Machining, grinding, polishing, and burnishing operations commonly use a recirculated oil-water emulsion to cool and lubricate the contact between metal and finishing tool. Spent or rancid lubricant is discharged periodically.

Tumbling or barrel finishing is a controlled method of processing parts to remove burrs, scale, flash, and oxides as well as to improve surface finish. Widely used as a finishing operation for many parts, it obtains a uniformity of surface finish not possible by hand finishing. For large quantities of small parts it is generally the most economical method of cleaning and surface conditioning.

Parts to be finished are placed in a rotating barrel or vibrating unit with ceramic or metal slugs or abrasive media, water or oil, and usually some chemical compound to assist in the operation. As the barrel rotates slowly, the upper layer of the work is given a sliding movement toward the lower side of the barrel, causing the abrading or polishing action to occur. The same results may also be accomplished in a vibrating unit, in which the entire contents of the container are in constant motion. When the parts have been sufficiently deburred they are drained in a basket or shaker table and transferred to an oven for drying. The tumbling solution is usually used once and then discarded.

Sawing. Sawing is cutting a workpiece with a band, blade, or circular disc having teeth. It may be required for a number of metal forming processes. Before ingots can be used as stock for rolling or extrusion, the ingot may require scalping or sawing to a suitable length. Following processes such as rolling, extrusion, and drawing, the metal products may be sawed. The circular saws and band saws used generally require a cutting lubricant in order to minimize friction and act as a coolant. Oil-in-water emulsions or mineral-based oils are usually applied to the sides of the blade as a spray. In some cases, a heavy grease or wax may be used as a saw lubricant. Normally, saw oils are not discharged as a wastewater stream. The lubricants frequently are carried over on the product or removed together with the saw chips for reprocessing. In some cases, however, recycle and discharge of a low-volume saw lubricant stream is practiced.

Product Testing. Various product testing operations are used to check nonferrous metals parts for surface defects or subsurface imperfections. Parts are submerged in a water bath and subjected to ultrasonic signals, or in the case of tubing, pressurized with air. Piping and tubing may also be filled with water and pressurized to test their integrity. Product testing operations are sources of wastewater because the spent water bath or test media must be periodically discarded due to the transfer into the testing media of oil and grease, solids, and suspended and dissolved metals from each product tested.



1. Three plants (in MA, CT, and TN) are both D & I dischargers but were classified as D.
2. Four plants (in PA, CT, TS, and NY) are both D & I dischargers but were classified as I.

Figure III-1

GEOGRAPHICAL DISTRIBUTION OF NONFERROUS FORMING PLANTS

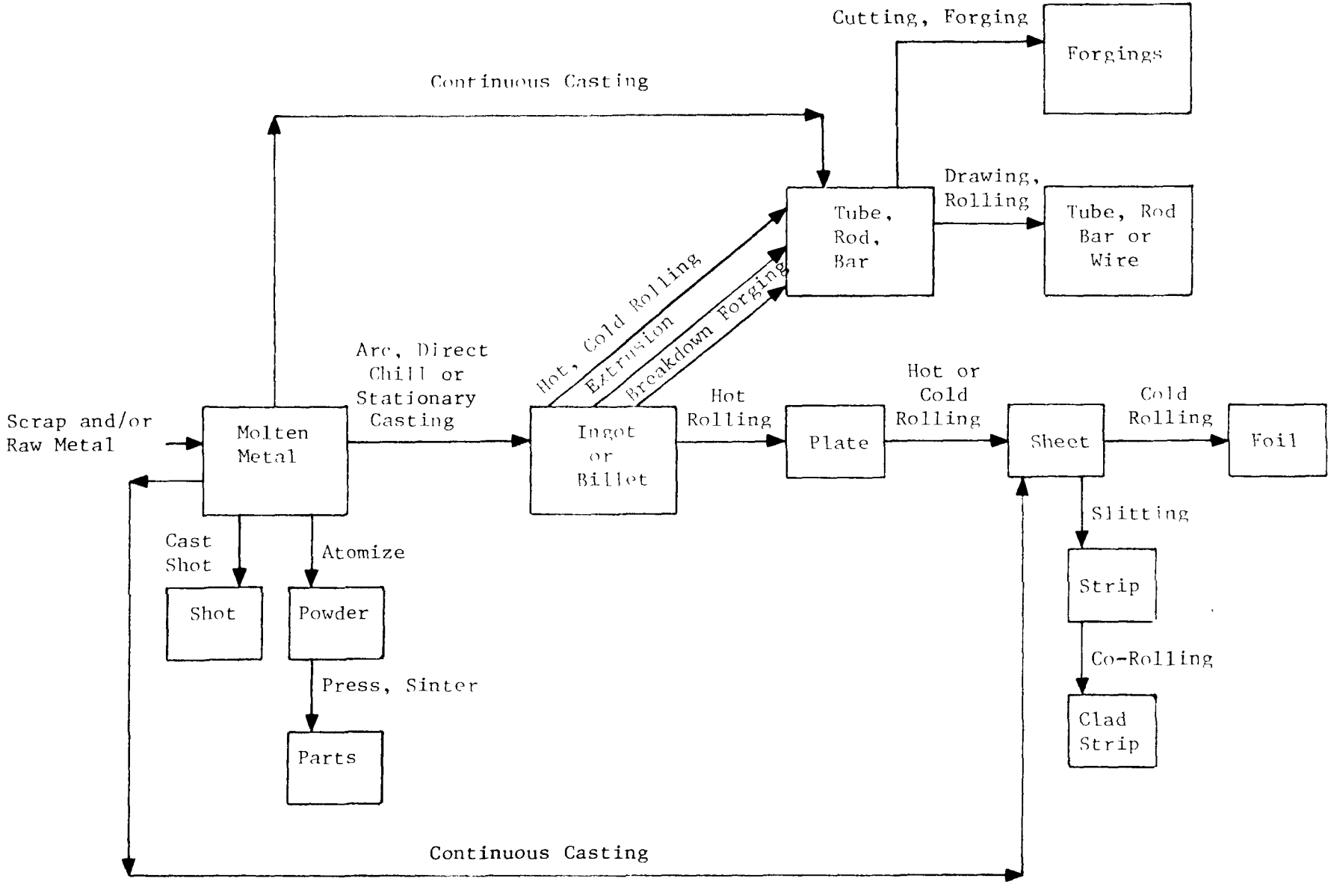
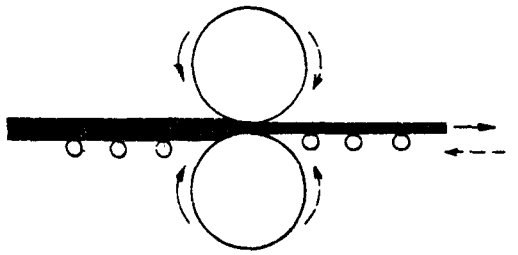
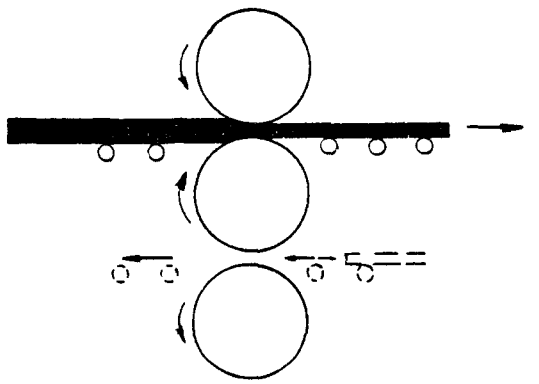


Figure III-2

SEQUENCE OF NONFERROUS METALS FORMING OPERATIONS



A. TWO - HIGH REVERSING MILL



B. THREE - HIGH CONTINUOUS ROLLING MILL

Figure III-3

COMMON ROLLING MILL CONFIGURATIONS

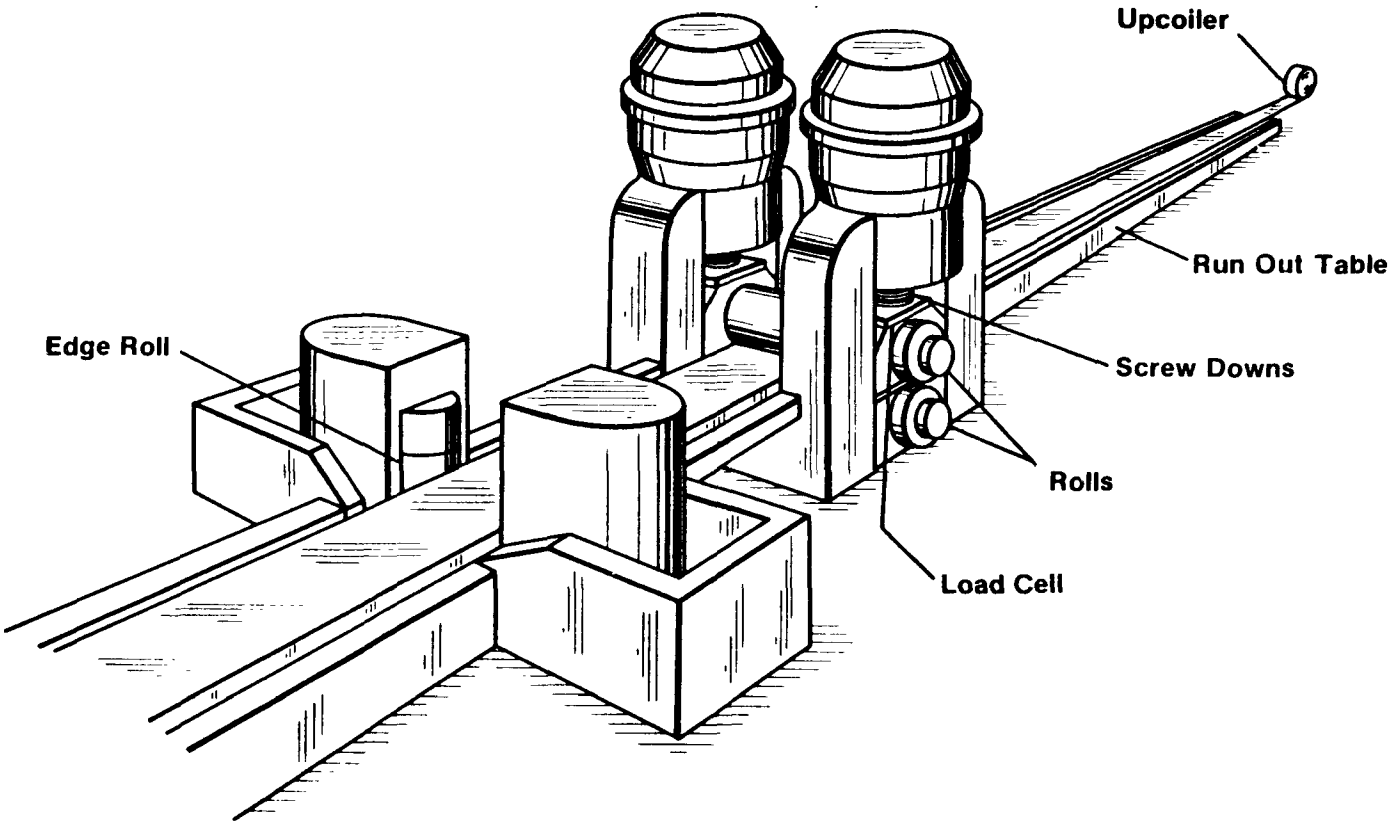


Figure III-4

REVERSING HOT STRIP MILL

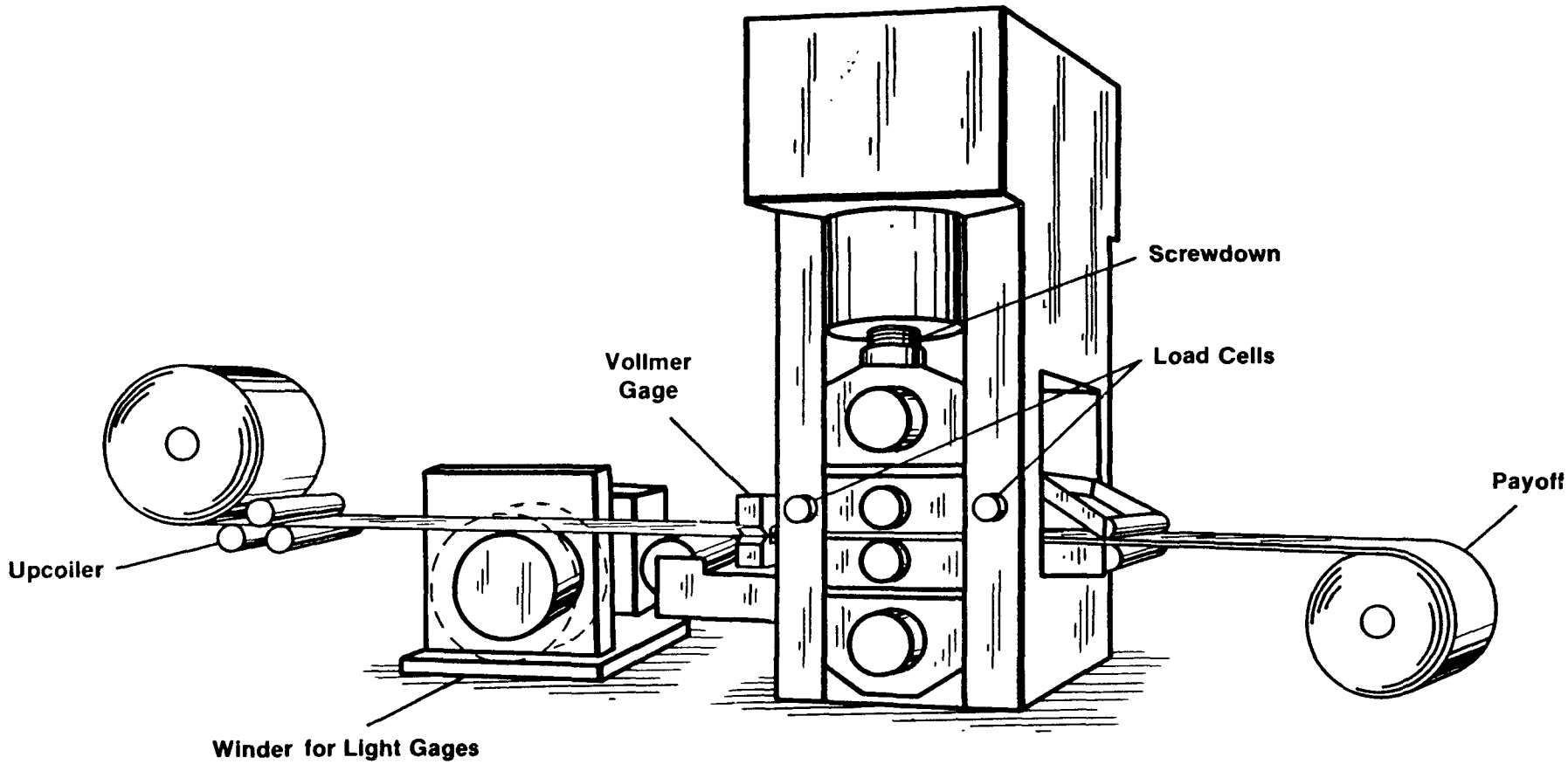


Figure III-5

4-HIGH COLD ROLLING MILL

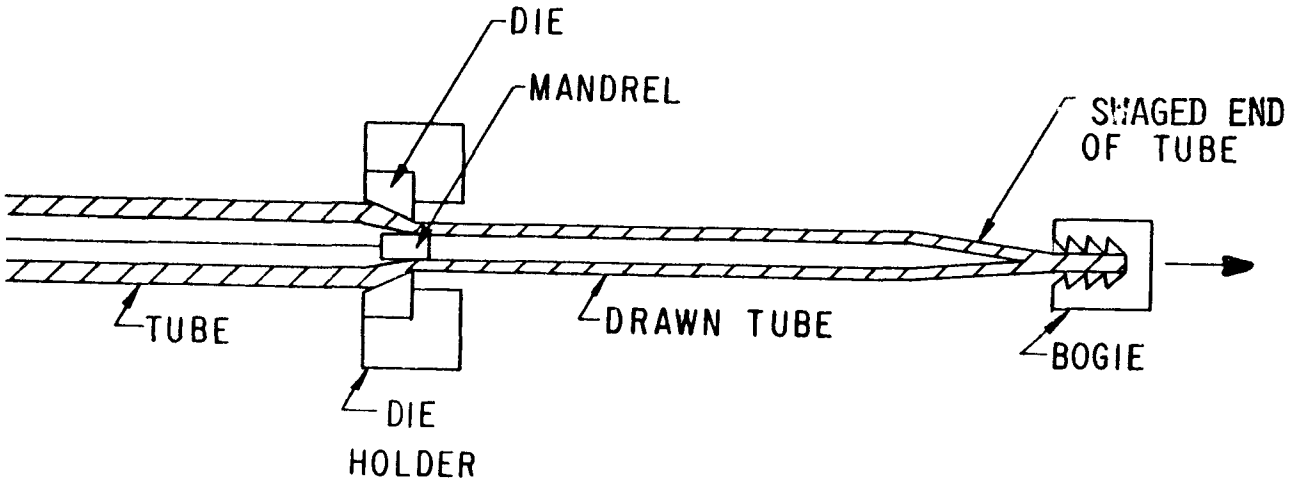


Figure III-6

TUBE DRAWING

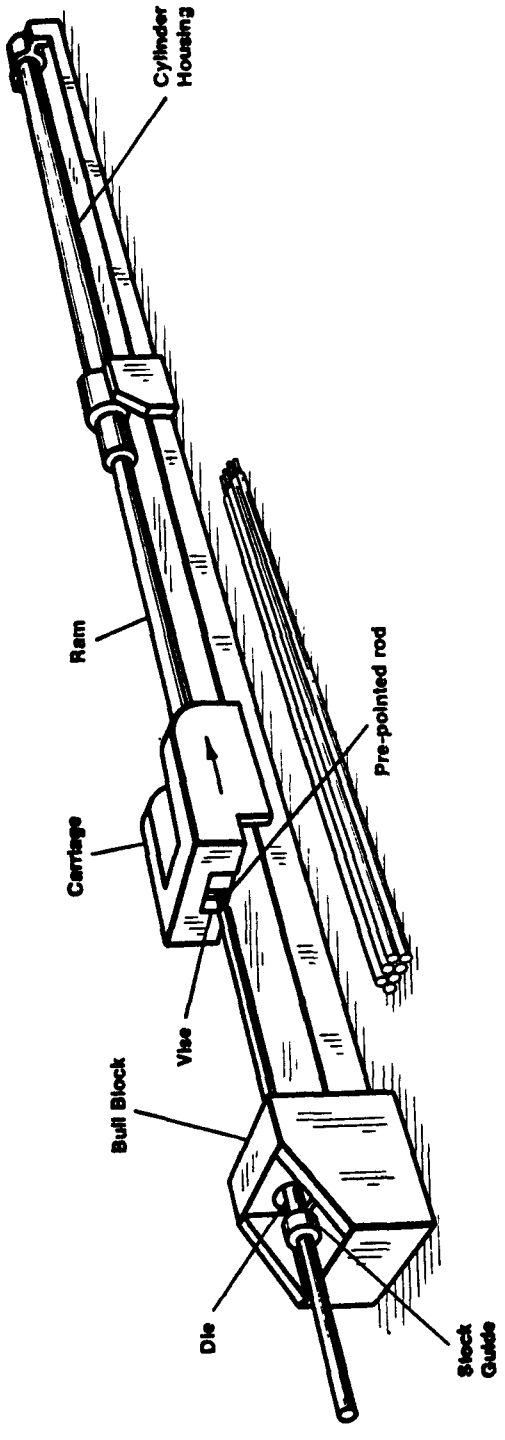


Figure III-7

HYDRAULIC DRAW BENCH

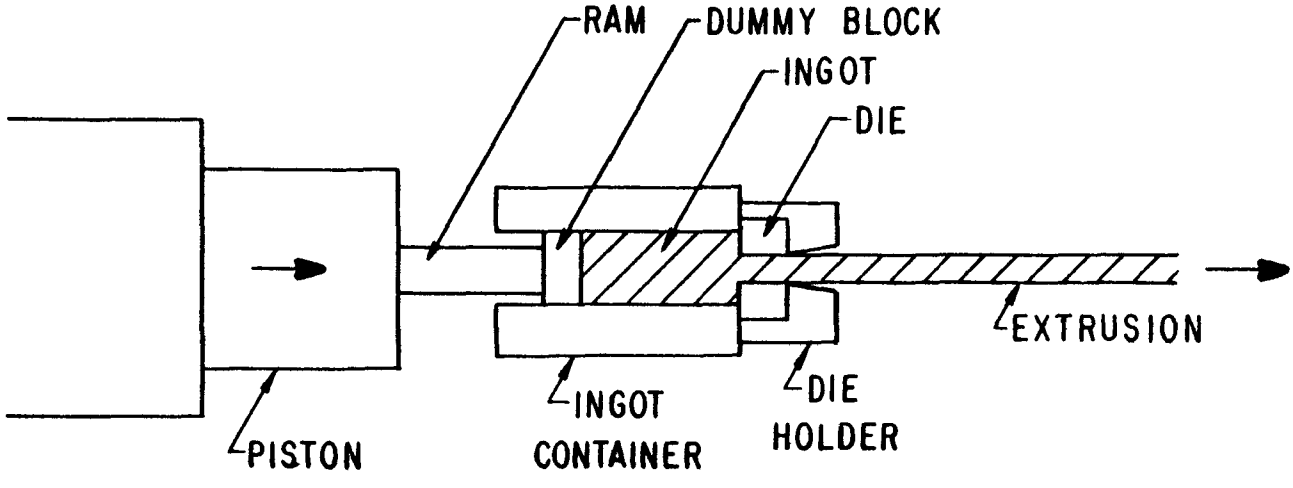


Figure III-8

DIRECT EXTRUSION

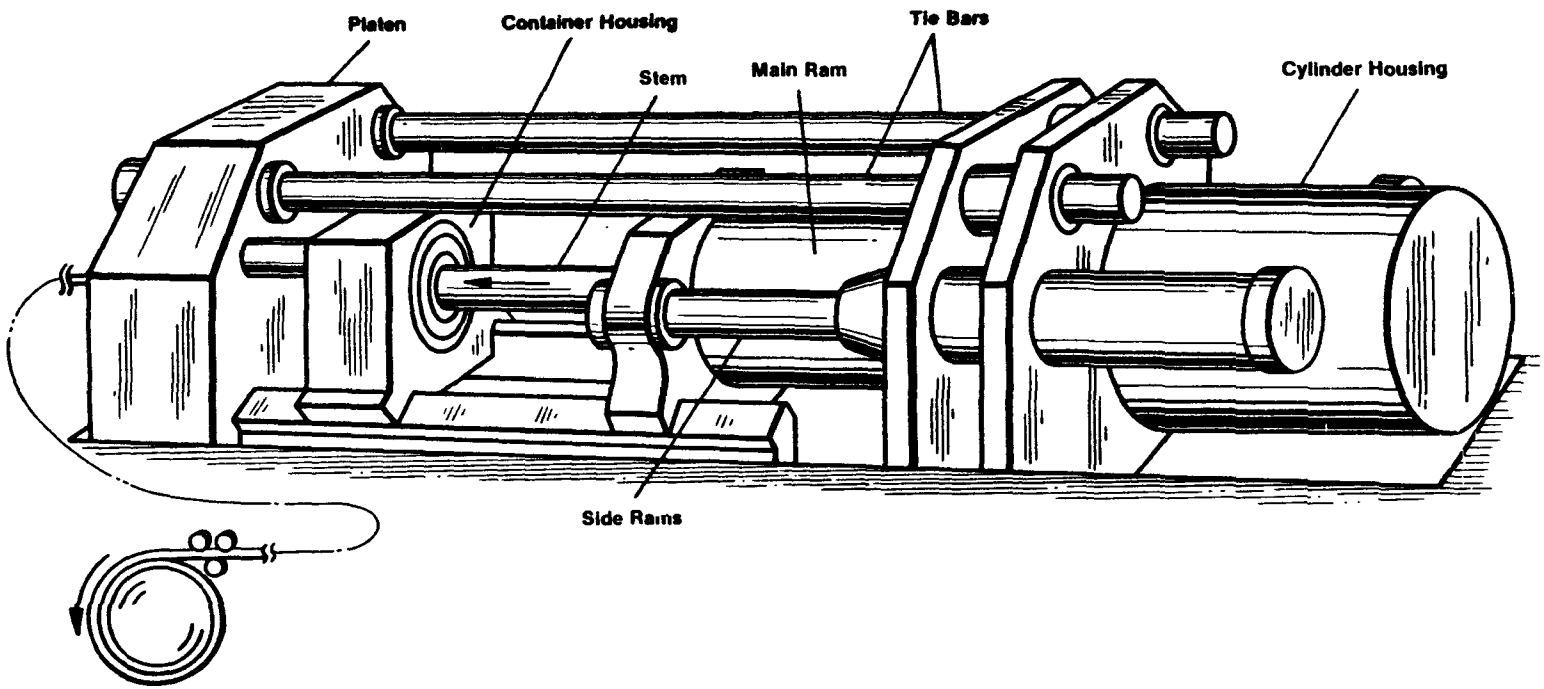


Figure III-9

EXTRUSION PRESS

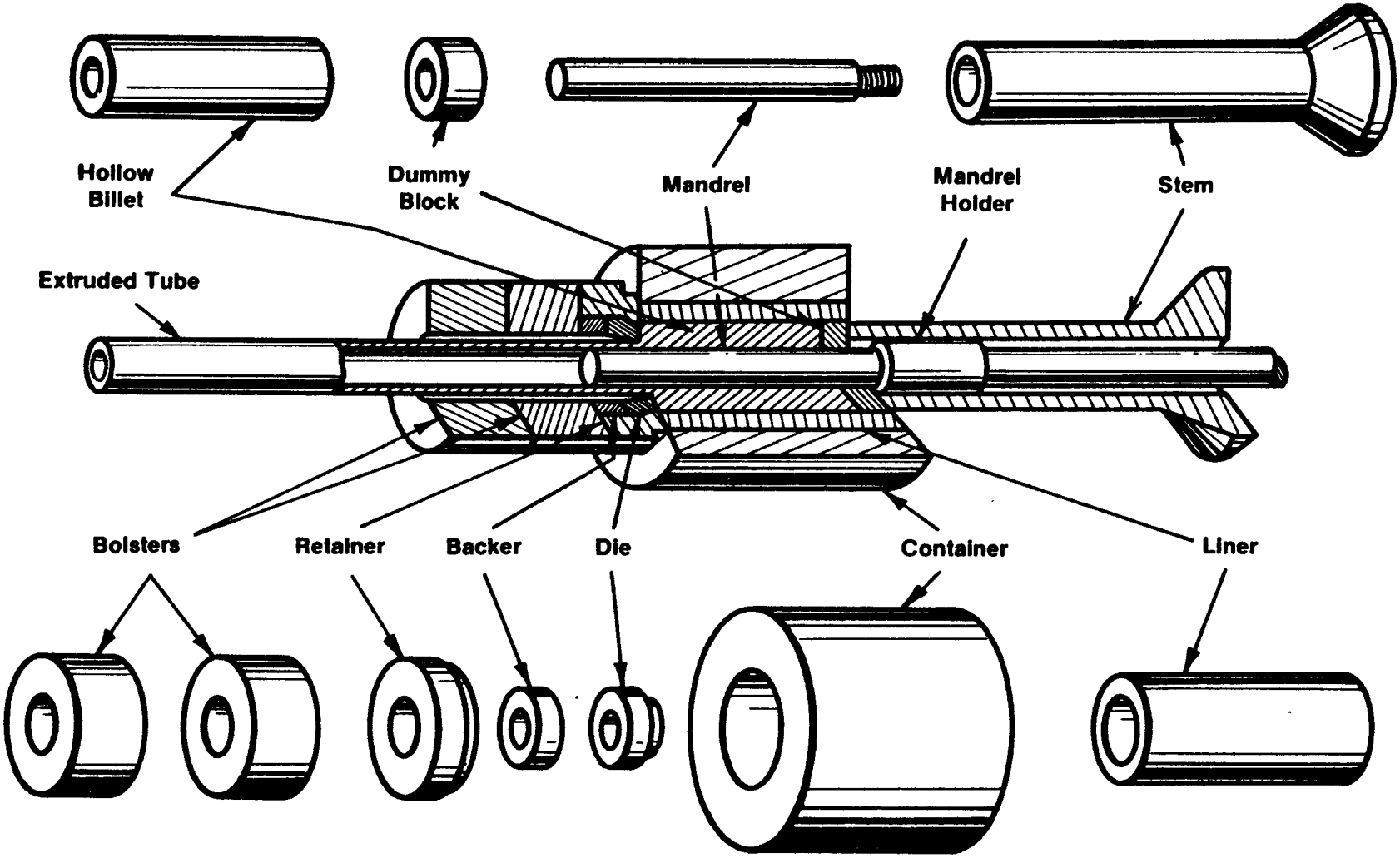


Figure III-10

EXTRUSION TOOLING AND SETUP

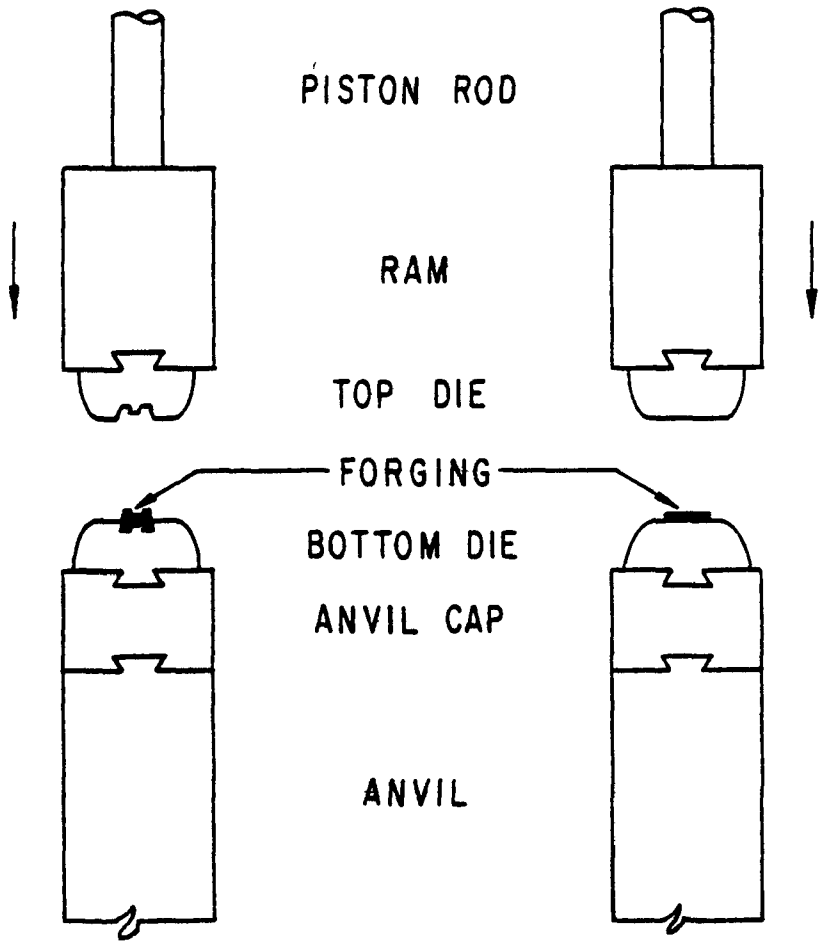
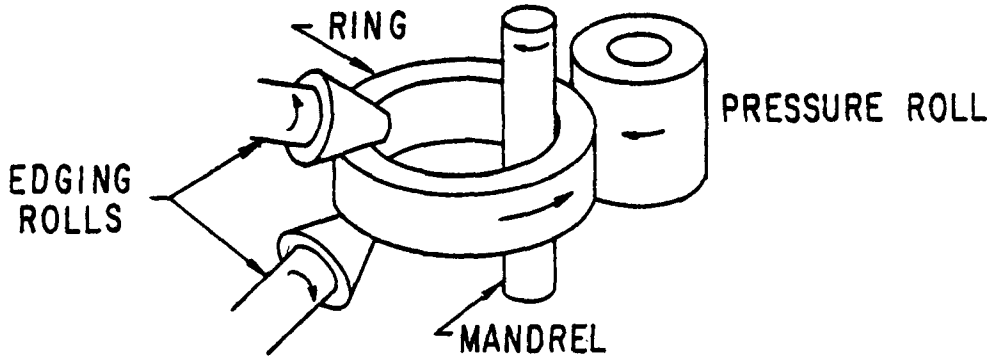
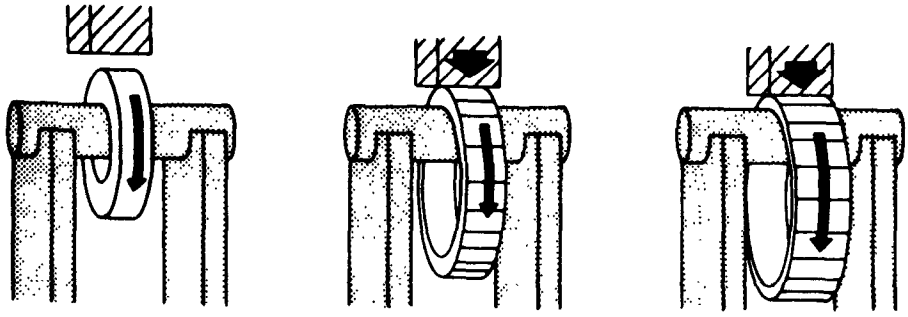


Figure III-11

FORGING



A. ROLLED RING FORGING



B. SADDLE/MANDREL FORGING

Figure III-12

RING ROLLING

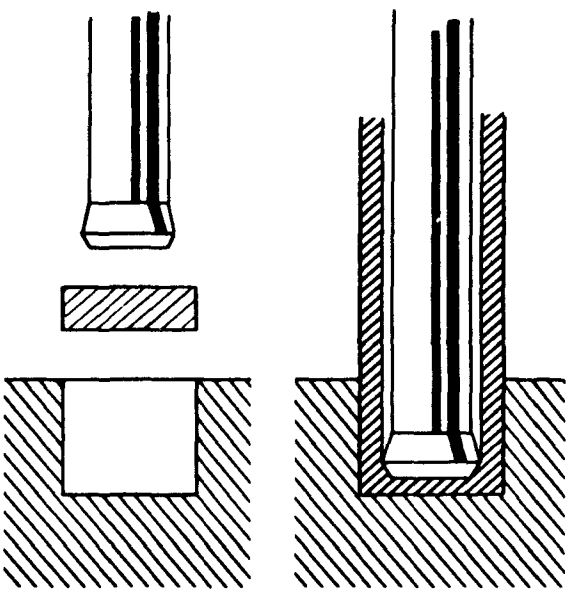


Figure III-13

IMPACTING

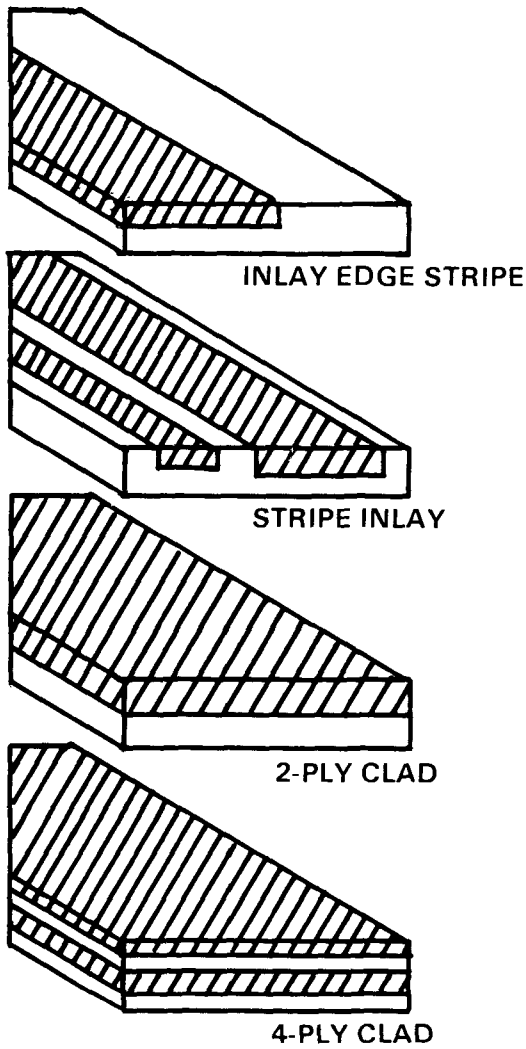


Figure III-14

SOME CLAD CONFIGURATIONS

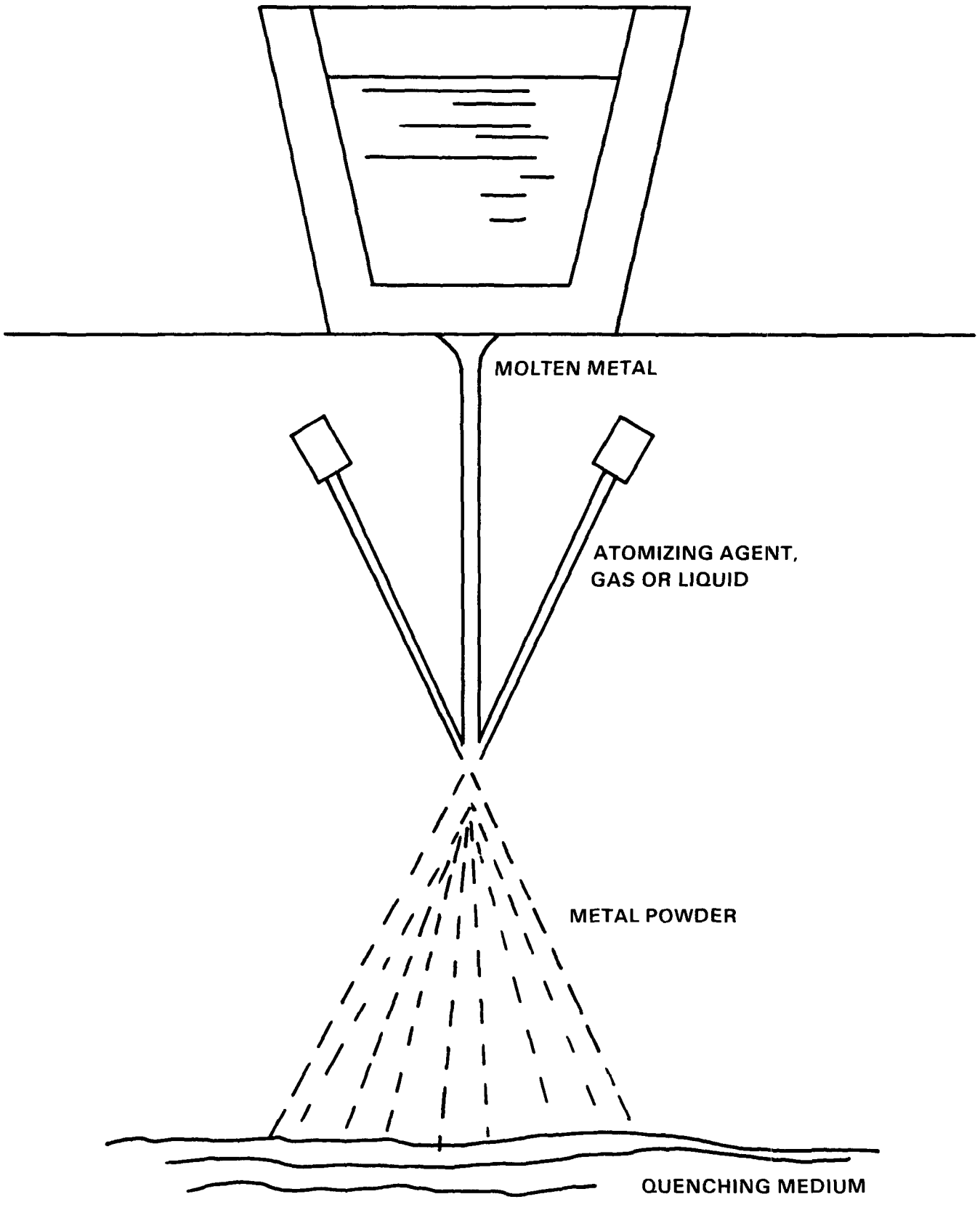
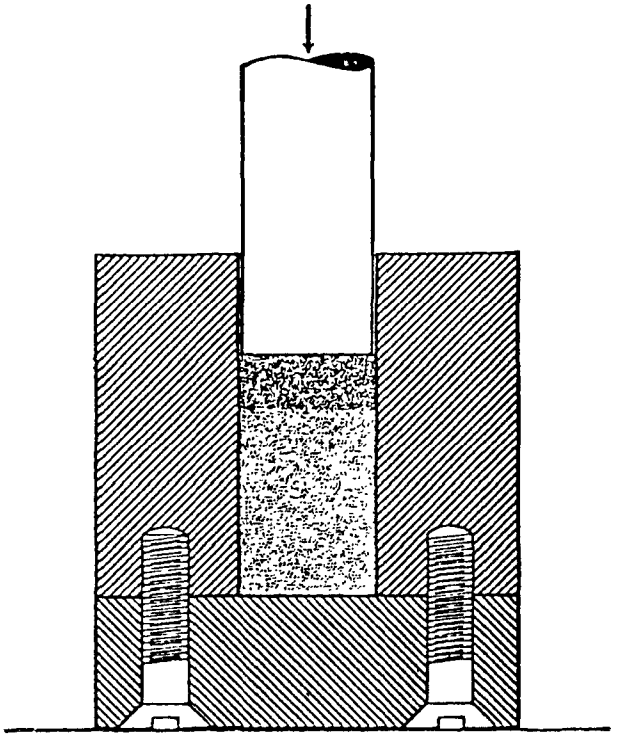
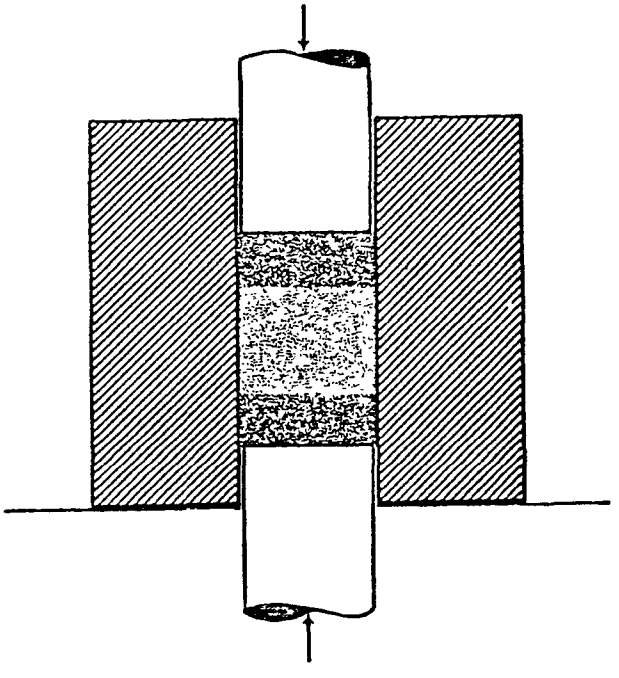


Figure III-15
ATOMIZATION



A. Pressing In Single-End Die



B. Pressing In Double-End Die

Figure III-16

POWDER METALLURGY DIE COMPACTION

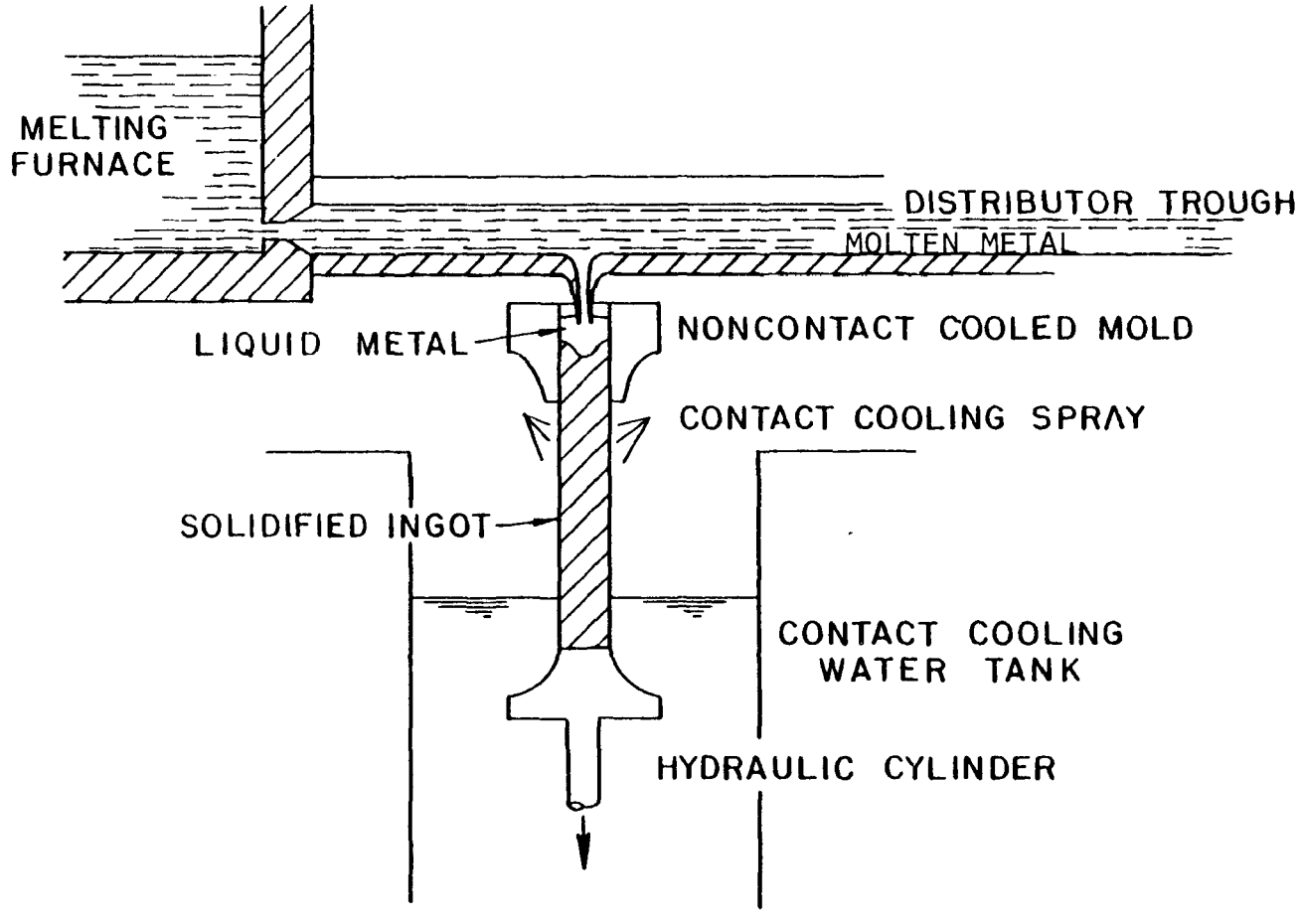


Figure III-17

DIRECT CHILL CASTING

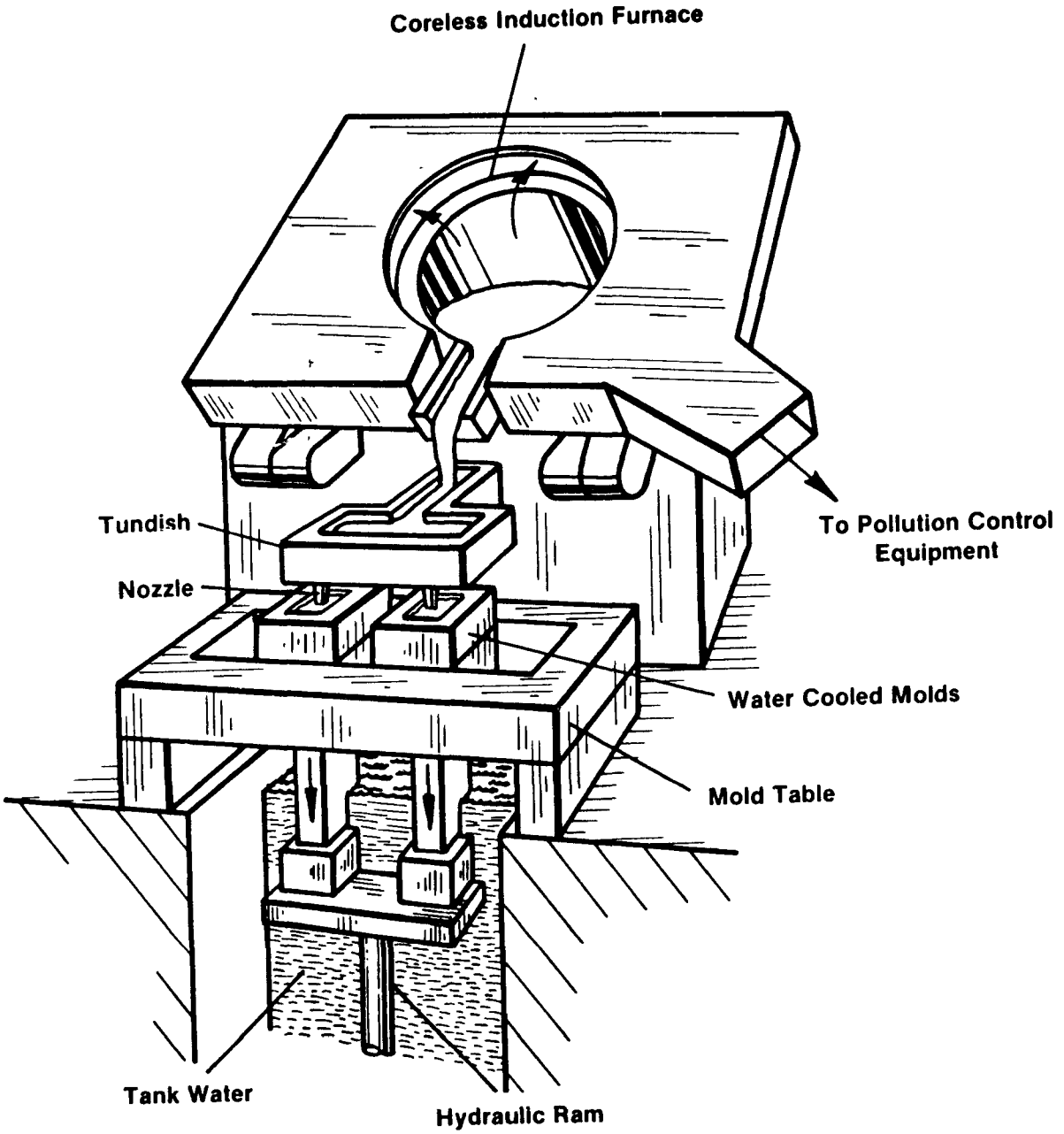


Figure III-18

DIRECT CHILL (D.C.) CASTING UNIT

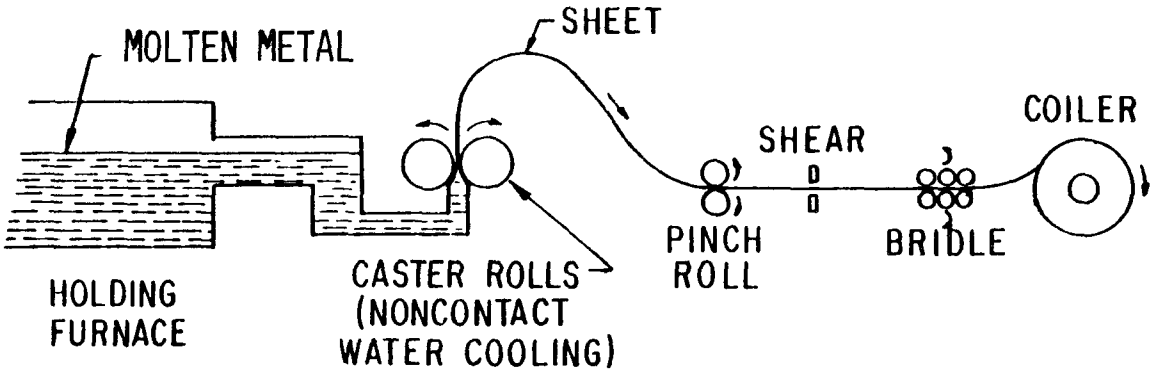


Figure III-19

CONTINUOUS SHEET CASTING

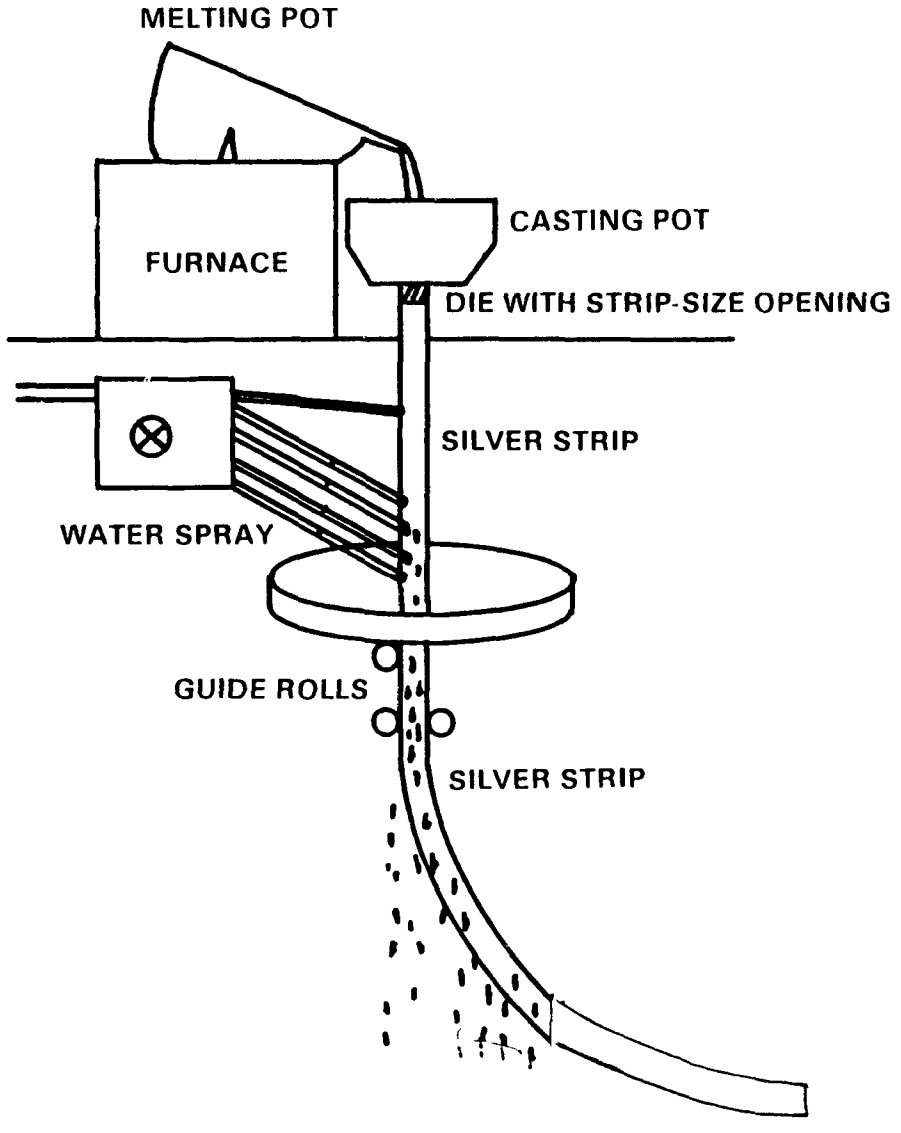


Figure III-20
CONTINUOUS STRIP CASTING

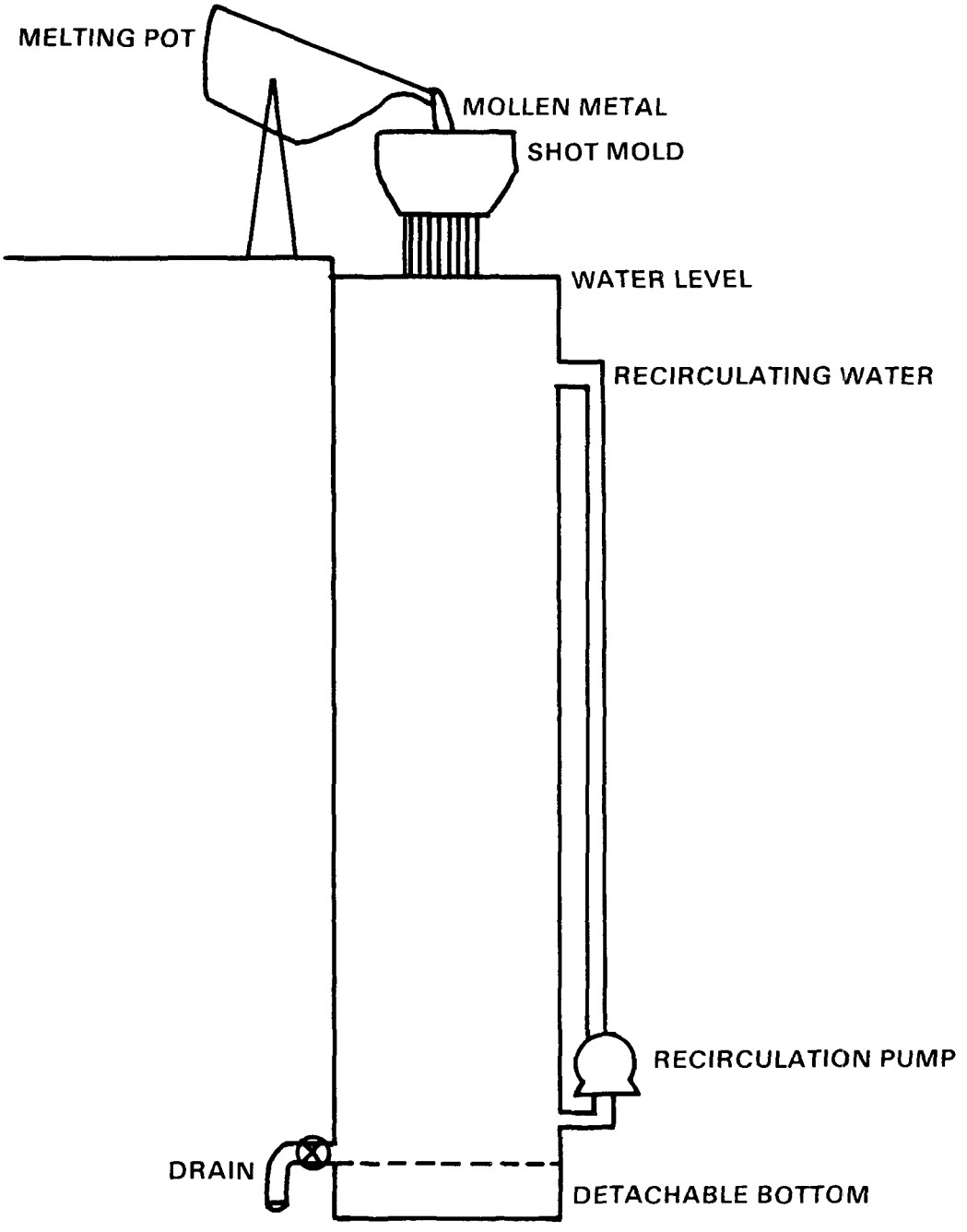


Figure III-21
SHOT CASTING

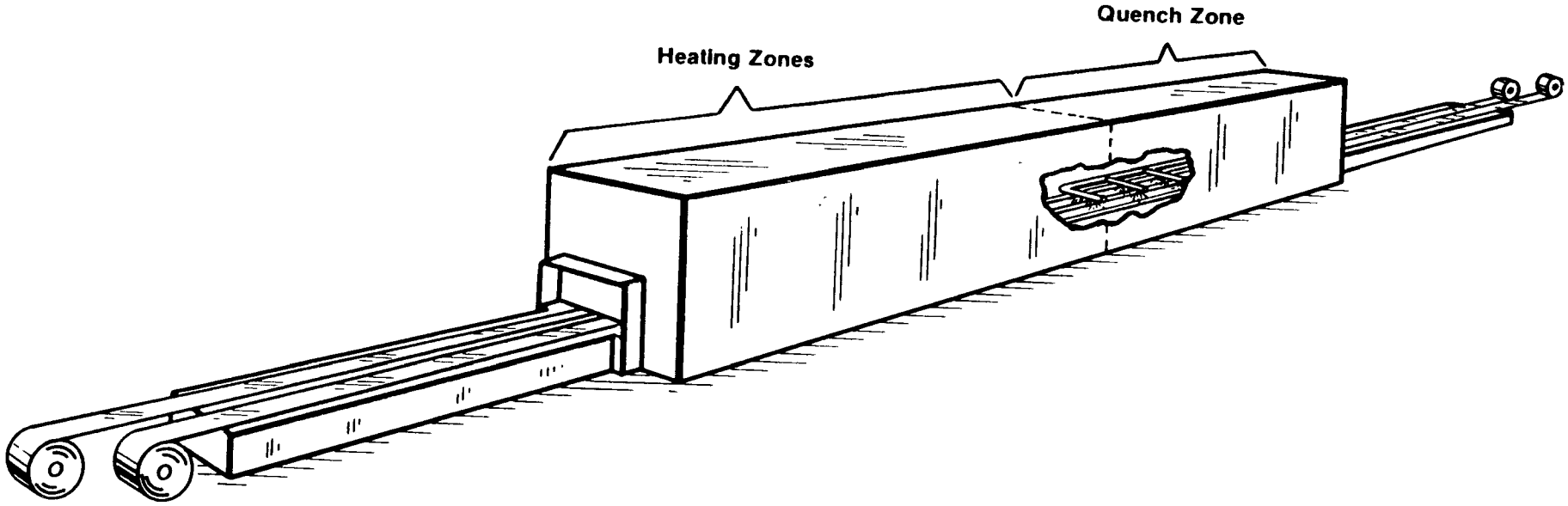


Figure III-22

ROLLER HEARTH ANNEALING FURNANCE

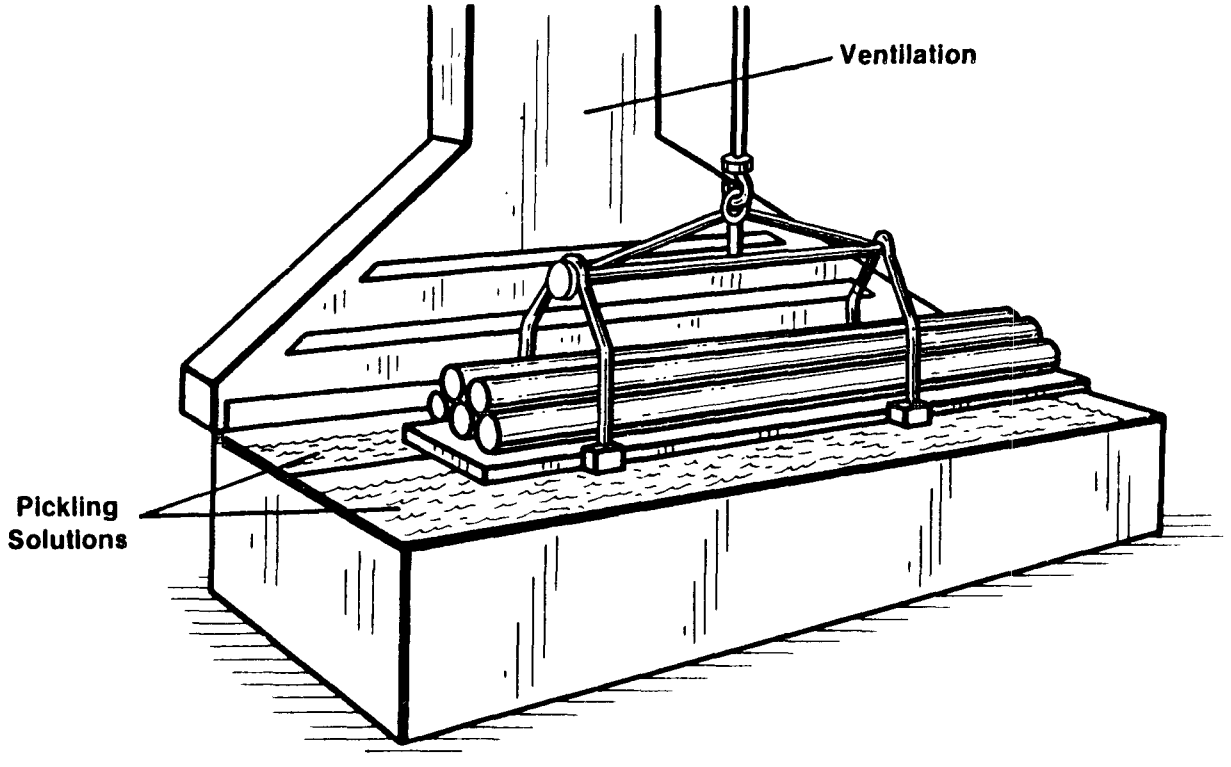


Figure III-23

BULK PICKLING TANK

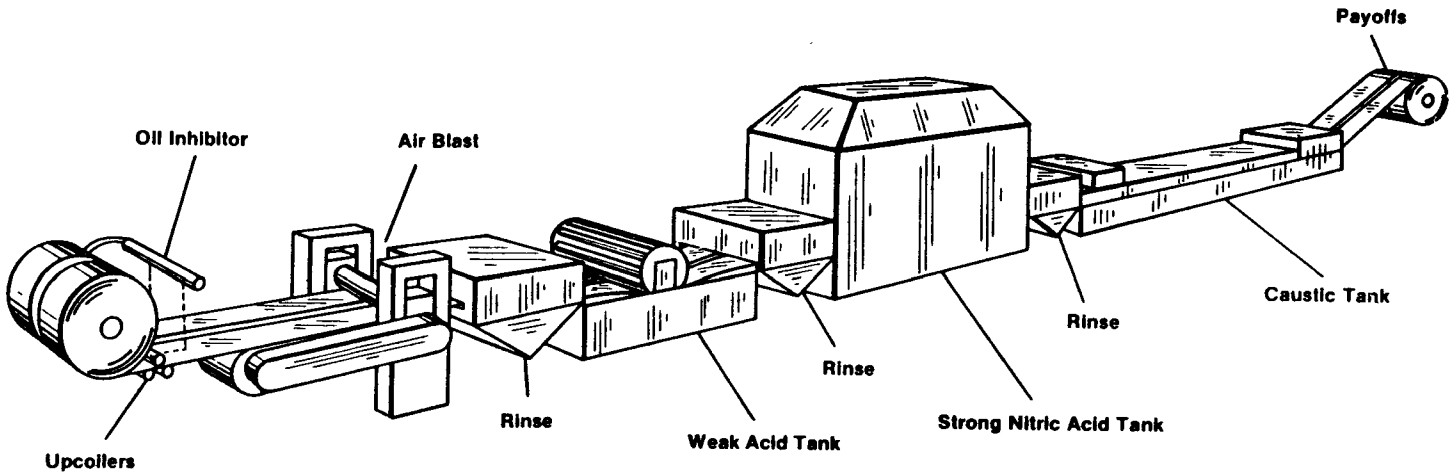
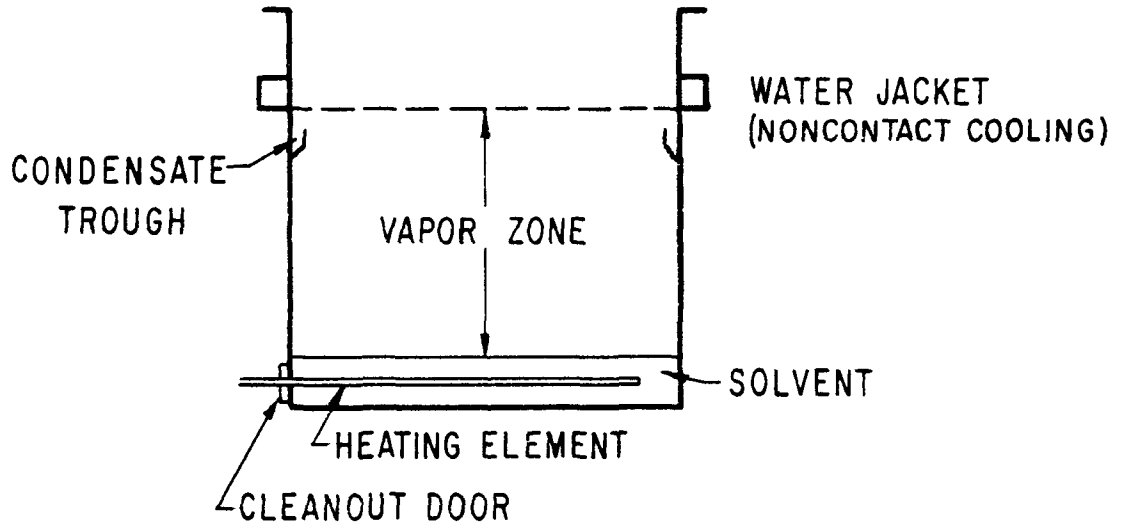
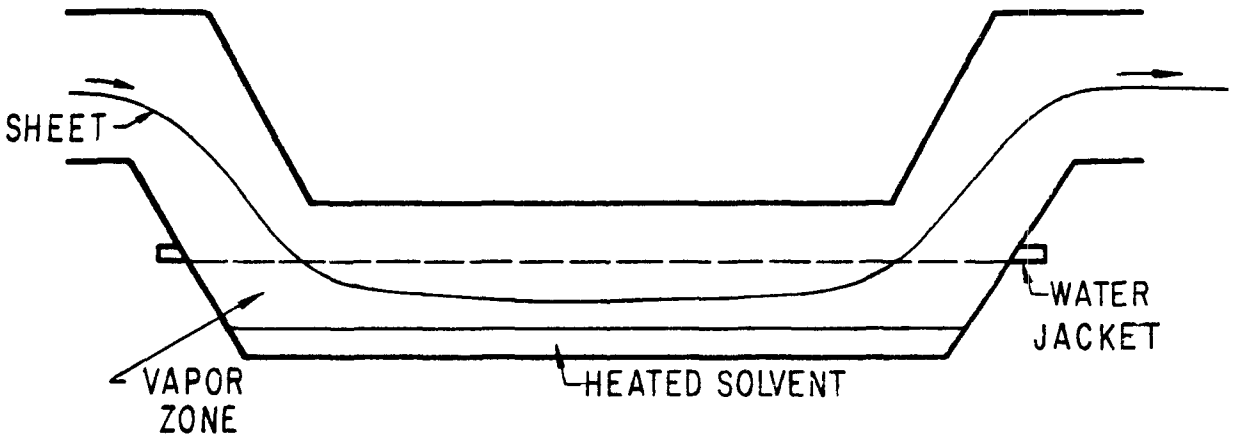


Figure III-24

CONTINUOUS PICKLING LINE



A. OPEN TOP VAPOR DEGREASER



B. STRIP CONVEYORIZED DEGREASER

Figure III-25

VAPOR DEGREASING

Table III-1

METAL TYPES EXCLUDED FROM REGULATION UNDER PARAGRAPH 8 OF THE SETTLEMENT AGREEMENT

Cadmium (Cd)

Chromium (Cr)

Gallium (Ga)

Germanium (Ge)

Indium (In)

Lithium (Li)

Manganese (Mn)

Neodymium (Nd)

Praseodymium (Pr)

Table III-2

METAL TYPES COVERED UNDER THE NONFERROUS METALS FORMING CATEGORY

Beryllium (Be)

Bismuth (Bi)

Cobalt (Co)

Columbium (Niobium) (Cb (Nb))

Gold (Au)

Hafnium (Hf)

Lead (Pb)

Magnesium (Mg)

Molybdenum (Mo)

Nickel (Ni)

Palladium (Pd)

Platinum (Pt)

Rhenium (Re)

Silver (Ag)

Tantalum (Ta)

Tin (Sn)

Titanium (Ti)

Tungsten (W)

Uranium-Depleted (U)

Vanadium (V)

Zinc (Zn)

Zirconium (Zr)

Iron and and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy Operations

Table III-3

YEARS SINCE NONFERROUS FORMING OPERATIONS BEGAN AT PLANT

Plant Discharge Status	AGE AS OF 1984 (YEARS)													
	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-50	51-60	61-74	75+	Insufficient Data	Total
Direct	1	0	3	3	7	6	3	1	3	2	1	1	4	35
Indirect	8	8	10	8	9	18	10	2	1	6	5	7	19	111
Zero	20	12	19	12	14	11	7	4	7	3	3	2	34	148
TOTAL	29	20	32	23	30	35	20	7	11	11	9	10	57	294

Note: Three plants with both direct and indirect discharges were classified as direct dischargers; four plants with both direct and indirect discharges were classified as indirect dischargers.

Table III-4

NONFERROUS METAL PRODUCTION BY PRODUCT FORMED (POUNDS)

Metal	Plate	Sheet and Strip	Foil and Leaf	Tubing, Bar, and Rod	Wire and Cable	Irregular Shapes	Powders	Other	Total
Lead/Tin/Bismuth[1]	3,392,454	98,405,844	10,632,969	28,282,879	60,040,894	23,640,451	6,633,810	153,398,040	384,427,340
Nickel	8,367,100	18,217,914	2,100	41,884,101	22,457,095	15,755,590	6,403,511	23,500,555	136,587,970
Cobalt	66,000	671,000	0	515,171	137,826	180,900	555,303	363,948	2,490,148
Zinc	163,558	22,052,143	100,000	423,252	6,292,230	25,495,000	3,919,600	0	58,445,783
Beryllium	*	*	*	*	*	*	*	*	*
Precious Metals[1,2]	600,756	1,903,619	68,881	27,792	4,304,932	321,924	343,063	1,433,233	9,004,200
Titanium	6,133,244	6,024,982	240	12,727,139	0	10,264,050	0	21,759,176	56,908,831
Refractory Metals[3]	272,335	330,877	16,722	2,436,386	1,654,933	5,478,375	15,368,813	1,785,542	27,343,983
Zirconium/Hafnium[1]	647,845	539,696	54,531	3,596,996	40,623	447,854	60,154	304,839	5,692,538
Iron	--	--	--	--	--	53,054,800	68,682,320	19,524,616	141,261,740
Copper	--	--	--	--	--	3,914,537	30,943,891	1,544,066	36,402,494
Aluminum	--	--	--	--	--	281,008	18,364,657	6,730,871	25,376,530
Magnesium	*	*	*	*	*	*	*	*	*
Uranium	*	*	*	*	*	*	*	*	*
Other[4]	0	1,768	33,450	30,480	321	120,660	4,209,846	40,137,083	44,533,608
Total	19,643,292	148,147,842	10,908,893	89,944,960	94,928,854	138,834,485	155,484,968	270,481,968	928,354,496

*Production information for this subcategory is confidential.

[1]It was not possible to break out production of these metals from information supplied in data collection portfolios.

[2]Precious metals, silver, gold, platinum, and palladium.

[3]Refractory metals = tungsten, columbium, tantalum, molybdenum, rhenium, and vanadium.

[4]Cadmium, chromium, gallium, germanium, indium, lithium, manganese, neodymium, and praseodymium; all excluded under Paragraph 8(a)(iv) of the Settlement Agreement.

Section IV

INDUSTRY SUBCATEGORIZATION

In developing regulations for the nonferrous metals forming category, the Agency considered whether different effluent limitations and standards are appropriate for different segments of the category. The regulations are technology based. If uniform regulations are to be applied to the entire category, the technology upon which they are based must be available and appropriate for every segment of the category. If not, subcategorization is required. Subcategorization is also appropriate if different pollutants are regulated in various segments of the category.

EPA considers several factors to determine the appropriate subcategorization of a category. These include plant location and nonwater quality environmental impacts, including energy costs and solid waste generation. These factors affect the availability of wastewater treatment technology. Other subcategorization factors which must be considered are raw materials, manufacturing processes, products manufactured, plant size and age, and process water use. These factors may influence wastewater characteristics and thus determine the appropriateness of wastewater treatment technologies and the presence of pollutants to be regulated.

EVALUATION AND SELECTION OF SUBCATEGORIZATION FACTORS

Factors Considered

The analysis of potential subcategorization factors was carried out in the context of the scope of the nonferrous metals forming category. The manufacturing activities included in the category are:

1. Forming of nonferrous metals other than copper and aluminum by rolling, drawing, extruding, and forging operations;

2. Production of ferrous and nonferrous metal powders;

3. Production of ingots and metal parts from ferrous and nonferrous metal powders; and

4. Production of clad metals and bimetallics from nonferrous metals other than copper and aluminum.

The following factors were considered as a basis for subcategorization:

1. Metal formed and raw materials used;
2. Manufacturing processes;
3. Products manufactured;
4. Process water use;
5. Plant size;
6. Plant age;
7. Plant location;
8. Solid waste generation and disposal, air emissions, and energy usage; and
9. Individual waste streams generated by manufacturing activities.

In addition to considering how the individual factors influenced subcategorization, the interrelationship between different factors was evaluated. An evaluation of these factors is presented below.

Metal Formed and Raw Materials Used. The raw materials used in the nonferrous metals forming category can be classified as follows:

- Metal and metal alloys;
- Lubricants and additives to lubricants; and
- Surface treatment, degreasing, and furnace fluxing chemicals.

The pollutants discharged from a particular forming operation are dependent on the metal formed and other raw materials used in that operation. For example, nickel forming wastewater will contain nickel and any lubricants or surface treatment chemicals used in forming and associated process steps. Nickel is probably present in all nickel forming wastewater but the presence of other pollutants varies from plant to plant and operation to operation.

All of the manufacturing activities in this category, with the exception of metal cladding, can easily be divided into subcategories according to the metal formed. The metal formed and the metallurgical properties that are required in the final product will determine the other raw materials used during the forming process itself and associated process steps. The metal formed will also determine the manufacturing processes used, the products manufactured, and the amount and type of process water use.

Because the type of metal formed will have a major impact on wastewater flow and characteristics, subcategorization of manufacturing activities by the type of metal formed is appropriate.

Additionally, if two or more metals are formed by identical or very similar operations, generating wastewaters of similar characteristics, it is appropriate to group the metals into one subcategory. One such grouping is the precious metals (gold, silver, platinum, and palladium).

Pollutants generated by the production of clad metals and bimetallics are dependent on the metals processed, just as are discharges from other nonferrous metals forming processes. However, because cladding involves more than one type of metal, the categorization of this forming operation in a subcategorization scheme based on the type of metal formed is not straightforward.

Of the 22 surveyed plants which reported clad metal production, 15 apply precious metal to a base metal. These plants use very similar manufacturing operations and similar materials. Typically a gold or silver overlay or inlay is roll-bonded to a copper-alloy base. Nickel and stainless steel are also used as base metals.

The cladding of precious metals to base metals is closely associated with precious metal forming. All but three of the 15 plants engaged in precious metal cladding also reported forming precious metals. The clad metals are formed by the same techniques and on the same equipment as pure metals. Therefore, it is appropriate to group precious metal cladding with precious metals forming.

Three plants reported cladding nonferrous metals other than precious metals to base metals in processes generating wastewater. Just as cladding precious metals to base metal can be grouped with precious metal forming, other cladding operations can be grouped with the forming of the surface metal of the clad product. For example, manufacture of nickel clad molybdenum would be considered nickel forming but manufacture of molybdenum clad nickel would be considered molybdenum forming.

The Agency does not consider the type of lubricant or surface treatment, degreasing, and furnace fluxing chemicals to have a major, organizing impact on the category's wastewater characteristics. Subcategorization based on these raw materials would not adequately distinguish the type of pollutants likely to be present in waste streams from the resulting subcategories. For instance, beryllium is likely to be present in wastewater generated from surface treatment of beryllium but is not expected to be present in nickel surface treatment wastewater. Thus, raw materials other than the metal formed are not appropriate subcategorization criteria.

Manufacturing Processes. As discussed above, there are four major manufacturing activities included in the nonferrous metals forming category, each of which uses one or more distinct manufacturing processes. Subcategorization on the basis of manufacturing process would group all rolling operations, all drawing operations, all extrusion operations, etc., together. The Agency does not believe this is an appropriate basis for subcategorization because it does not adequately distinguish the type of pollutants likely to be present in waste streams from the resulting subcategories. For instance, lead is likely to be present in lead rolling wastewater but is not expected to be present in nickel rolling wastewater.

Products Manufactured. Another approach is subcategorization based on the products manufactured, as listed below:

Product	Associated Manufacturing Process
Plate	Rolling
Sheet	Rolling
Strip	Rolling
Foil	Rolling
Rod and bar	Rolling, extrusion, drawing
Tubing	Extrusion or drawing
Wire and cable	Drawing or extrusion
Other (L shapes, I-beams, etc)	Drawing or extrusion
Clad metals	Roll bonding, solder application, explosion bonding, co-drawing
Metal powders	Water atomization, gas atomization, grinding, etc.
Miscellaneous shapes	Forging, powder metallurgy

The product manufactured would be an excellent basis for subcategorization if waste characteristics and the process to produce a given item were the same from plant to plant; however, this is not true for many formed metal products. For example, rods can be produced by two different production processes which generate similar wastewater (i.e., rolling and drawing), but the mass of pollutants generated per unit of rod produced by rolling will be different than the amount generated by drawing the rod. Furthermore, rods formed from different metals but produced by the same process may use different lubricants, therefore generating a waste with different characteristics. Because the type and mass of pollutant generated per unit of product will be different depending on the metal formed and type of forming operation employed, the type of products manufactured is an inappropriate basis for subcategorizing the nonferrous metals forming category.

Process Water Use. Major differences in water use (volume of water applied to a process per mass of product) between facilities with large and small production could be considered as a factor in the development of subcategories.

A high water use per mass of product from a particular operation would lead to a waste stream with lower pollutant concentration than a lower production normalized water use (assuming the mass of pollutant generated in a given process is dependent on the mass of material processed). The differences in pollutant concentration may lead to differences in wastewater treatability and required treatment technology. If the differences in process water use are related to total plant production (if, for example, small production requires a large amount of process water, resulting in high production normalized water use and a low pollutant concentration), process water use could be a basis for subcategorization.

However, as will be discussed in Section V, analysis of the data indicates that production normalized water use (i.e., gallons per ton of metal formed) for a given unit operation is usually independent of production volume. For example, a large direct chill casting operation will use about the same amount of water per ton of ingot produced as an operation casting much less nonferrous metal by the same method. Production normalized water use appears to be relatively constant over a wide range of productions and therefore process water use is not an appropriate parameter for subcategorization.

Plant Size. The number of employees and amount of metal processed can be used as relative measures of the size of nonferrous metals forming plants.

Wastewaters produced by a production process are largely independent of the number of plant employees. Variations in staff occur for many reasons, including shift differences, clerical and administrative support, maintenance workers, efficiency of plant operations, and market fluctuations. Due to these and other factors, the number of employees is constantly fluctuating, making it difficult to develop a correlation between the number of employees and wastewater generation.

Subcategorization based on size in terms of production of nonferrous metals would group plants by the off-pounds of extrusions, sheets, rods, etc. This method of subcategorization does not adequately distinguish between waste streams of differing treatability nor does it determine a given plant's ability to achieve effluent limitations.

Subcategorization based on size in terms of volume of wastewater generated would be appropriate if the applicability of a particular treatment technology was dependent on the volume of water

to be treated. However, this is not the case for wastewater generated in the nonferrous metals forming category.

For the reasons discussed above, subcategorization on the basis of size (number of employees, production, or volume of wastewater generated) is not appropriate.

Plant Age. Most nonferrous metals forming plants have been built in the past 30 years. Since metal forming technologies are developing and changing rapidly, most plants have also been modernized frequently in order to remain economical. Therefore, determination of a particular plant's technological age is very difficult. Accordingly, plant age is not an appropriate basis for subcategorization.

The potential subcategorization schemes presented above attempt to create subcategories with similar waste characteristics. Other factors which may affect the availability of wastewater treatment technology must also be evaluated.

Plant Location. The geographical distribution of the nonferrous metals forming plants which responded to the dcp is presented in Figure III-1. The plants are not limited to any one geographical location, but they are generally located east of the Mississippi River. Although some cost savings may be realized for facilities located in nonurban settings where land is available to install lagoons, equivalent control of wastewater pollutant discharge can be achieved by urban plants with the use of physical and chemical treatment systems that have smaller land requirements. Since most plants are located in the eastern part of the United States (an area where precipitation exceeds evaporation) or in urban areas, evaporation and land application of the wastewater are not commonly used. Thus, location does not appear to be a significant factor on which to base subcategorization.

Solid Waste Generation and Disposal, Air Emissions and Energy Usage. Certain manufacturing plants may be limited in the wastewater treatment technology available to them by their patterns of solid waste generation and disposal, air emissions or energy usage. However, after a review of all available information, the Agency was unable to identify any plant or type of plant which has any unusual energy requirements or any unusual limitations in available energy, solid waste disposal, or air emissions.

Individual Waste Streams Generated by Manufacturing Activities. Most of the potential subcategorization schemes described above attempt to create subcategories with similar waste characteristics. An alternative to subcategorizing by a factor which only indirectly influences wastewater characteristics is to consider

each waste stream (such as nickel rolling spent emulsions, lead shot casting contact cooling water, etc.) a separate subcategory. The waste streams generated by the manufacturing activities included in the nonferrous metals forming category are presented in Section V of this document.

Use of this scheme will yield subcategories of homogeneous character and treatability. The principal benefit from using waste streams as a basis for subcategorization is that an appropriate effluent limitation or standard could be established for each stream. For each regulated pollutant, a specific pollutant mass discharge value could be calculated for each waste stream present at the facility. These values would be summed to determine the total mass discharge allowed for that pollutant at that facility.

The difficulties with this approach are the large number of subcategories - approximately 175 - that it would generate. The Agency believes that a guideline with this many subcategories would be extremely difficult to administer. However, waste stream by waste stream analysis of production, flow, and pollutants present was used to calculate pollutant mass limitations for each subcategory.

Summary of Subcategorization

The nonferrous metals forming category can be subcategorized on the basis of metal type formed. Based on information reported by 294 surveyed plants, 11 subcategories which have plants that discharge process water to surface waters or a POTW can be established. These subcategories are:

- Lead/Tin/Bismuth Forming,
- Nickel/Cobalt Forming,
- Zinc Forming,
- Beryllium Forming,
- Precious Metals Forming,
- Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy
- Titanium Forming,
- Refractory Metals Forming,
- Zirconium/Hafnium Forming,
- Magnesium Forming, and
- Uranium Forming.

The iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory includes only manufacturing operations which involve metal powders. Forming of these metals is covered by separate regulations. [Iron and Steel, 40 CFR Part 420; Copper Forming, 40 CFR Part 468 (48 FR 36942, August 15, 1983); Aluminum Forming, 40 CFR Part 467 (48 FR 49126, October 24, 1983).]

PRODUCTION NORMALIZING PARAMETER SELECTION

The objective of effluent limitations and standards is to reduce the total quantity of pollutants discharged into surface waters. Because plants could meet a concentration-based standard by dilution rather than treatment, mass limitations have been developed for the nonferrous metals forming industry. In order for regulations to be equitable for plants with large productions and small productions, the mass limitations must be normalized by an appropriate unit of production called a production normalizing parameter (PNP). That is, pollutant discharge limitations are written as allowable mass of pollutant discharge per PNP (mg/PNP). Therefore, for a PNP to be appropriate, mg/PNP must be independent of both production and wastewater volume, for a particular waste stream. Mass of metal, number of pieces, surface area, and mass of process chemicals used were considered as possible PNP's. An evaluation of these alternatives follows.

Mass of Metal Processed. The nonferrous metals forming category typically maintains production records of the pounds of metal processed. Availability of these production data and lack of data for other production parameters, such as number of pieces produced, makes this the most convenient parameter to use. The nonferrous metals forming dcp requested three production values: the capacity production rate for specific unit operations, the average production rate for 1981 in off-lbs/hr, and the total off-pounds of final product formed in 1981. A PNP based on mass of metal processed would use the average production rates reported in the dcp.

Number of Pieces Processed. The number of pieces processed by a given plant would not account for the variations in size and shape typical of formed products. Forgings, for instance, are produced in a wide range of sizes. It would be unreasonable to expect the quenching of a large forging to use the same amount of water required for a smaller forged product and yield a constant mass of pollutant per piece. Therefore, the Agency concluded that the number of pieces processed is not an appropriate PNP.

Surface Area of Metal Processed. Surface area may be an appropriate production normalizing parameter for formed metal which is rinsed (i.e., the mass of pollutants generated may correlate with surface area). However, the mass of pollutants generated by other metal forming operations, such as cooling, is unrelated to surface area. Hence, surface area might be an adequate PNP for some processes but would be wholely inappropriate for others. In addition, records of the area of metal processed are not generally kept by industry. In some cases, such as forging of miscellaneous shapes, surface area would be very difficult to

determine. In any case, surface area data would be difficult to collect. For these reasons, surface area is an inappropriate PNP for the nonferrous metals forming category.

Mass of Process Chemicals Used. The mass of pollutants discharged is more dependent on the processes which the metal undergoes than on the amount of process chemical used in the process. Some operations, such as heat treatment with contact cooling water, generate pollutants but do not use any process chemicals. In addition, the use of this parameter as the production normalizing parameter would tend to discourage regeneration and reuse of process chemicals. For these reasons, mass of process chemicals used is an inappropriate PNP for the nonferrous metals forming category.

Selection of the Production Normalizing Parameter

For the reasons outlined above, the Agency has selected mass of product formed as the most appropriate PNP. The mass of pollutants can be related to the mass of metal processed and most companies keep production records in terms of mass.

The PNP for nonferrous metals forming is "off-kilograms" or the kilograms of product removed from a machine at the end of a process cycle. For example, in the rolling process, an ingot enters the mill to be processed. Following one process cycle which may substantially reduce the ingot's thickness, the metal is removed from the rolling mill where it may be processed through another operation, such as annealing, sizing, cleaning, or it may simply be stored before being brought back to the rolling mill for another process cycle, further reducing the thickness. The mass of metal removed from the rolling mill after each process cycle multiplied by the number of process cycles is the PNP for that process.

DESCRIPTION OF SUBCATEGORIES

The nonferrous metals forming category was divided into 11 subcategories, based on type of metal formed. Five of these subcategories cover forming operations for more than one metal. This subcategorization allows separate limitations to be established for groups of metals whose wastewater is similar, are formed by similar processes, and would be expected to utilize similar or identical wastewater treatment within the subcategory.

The iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory covers only metal powder production and production of iron, copper, and aluminum metal parts from powder. All other subcategories cover traditional forming operations (rolling, drawing, extruding, forging), powder metallurgy

processes (powder production and compaction), and ancillary operations integral to the production of formed metal (heat treatment, chemical and mechanical surface treatment, and casting). Cladding operations are included in the subcategory of the surface metal of the clad product.

The number of surveyed plants in each subcategory and the number of plants in each subcategory discharging process wastewater (directly to surface streams and to a POTW) are listed in Table IV-1.

Lead/Tin/Bismuth Forming. This subcategory includes the production of three major products: bullets, made by extrusion and swaging lead; solder, formed by extrusion and drawing of lead, tin, and bismuth in various alloy combinations; and insulated cable, in which lead is extruded over copper cable. Smaller amounts of lead sheet and pipe are produced by rolling and extrusion, respectively.

Of the surveyed plants, 63 form lead. Twenty-one of these plants discharge process wastewater, three directly to surface water and 18 to a POTW.

Nickel/Cobalt Forming. Nickel and cobalt are formed by rolling, drawing, extrusion, and forging, with extrusion the least common forming process. The two metals were grouped together because the metals are formed by identical processes. Also, 15 of the 16 surveyed plants which form cobalt also form nickel.

Of the surveyed plants, 73 form nickel and/or cobalt, making this the largest subcategory in the category. Forty-two plants discharge process wastewater, 14 directly to surface water, 26 to a POTW, and two both directly and to a POTW.

Zinc Forming. Zinc is formed by rolling, drawing, and forging. It is surface treated and cleaned with alkaline detergents following forming. Ten of the surveyed plants form zinc. Three plants discharge process wastewater, one directly to surface water and two to a POTW.

Beryllium Forming. After pressing beryllium powder into bricks, the metal is sintered, and rolled to sheet between sheets of stainless steel. Billets and sheets are pickled in acid and rinsed with water. One surveyed plant forms beryllium and it discharges process wastewater directly to surface water.

Precious Metal Forming. This subcategory includes manufacturing processes used to form gold, silver, platinum, and palladium. The Agency believes that it would be very difficult to subcategorize by the individual precious metals because most plants in

this subcategory form all of the precious metals using the same equipment and cleaning operations. In addition, the metals are alloyed with each other in many combinations, some of which have no one constituent that is greater than 50 percent of the alloy. As described above, this subcategory also includes production and forming of clad precious metals.

The most common forming operations are rolling and drawing. Extrusion and forging are practiced to a much smaller extent. Fifty of the surveyed plants form precious metals. Thirty-four of these plants discharge process water, six directly to surface water, 27 to a POTW, and one both directly and to a POTW.

Iron and Steel/Copper/Aluminum Metal Powder Production and Metal Powder Metallurgy. This subcategory includes operations for producing metal powders and metal parts from powder for iron, steel, copper, and aluminum. Powders are produced by wet or dry atomization and mechanical grinding. Pressing and sintering, the major manufacturing processes in powder metallurgy, usually use no process water. Most of the wastewater from operations in this subcategory is generated by post-forming surface treatment.

Sixty surveyed plants are engaged in powder production or powder metallurgy of iron, steel, copper, or aluminum. Twenty-three of these plants discharge process wastewater, three directly to surface water and 20 to a POTW.

Titanium Forming. Titanium is formed by rolling, drawing, extrusion, and forging. Forging is practiced by many plants, many of which primarily forge steel. Rolling is the second most common forming operation, drawing the least. Titanium is often acid etched to remove a hard surface layer which forms at elevated temperatures.

Forty-one of the surveyed plants form titanium. Twenty-seven of these plants discharge process wastewater, 11 directly to surface streams, 15 to a POTW, and one both directly and to a POTW.

Refractory Metal Forming. This subcategory includes processes used to form molybdenum, tungsten, vanadium, rhenium, tantalum, and columbium. The Agency believes that it is unnecessary to subcategorize by the individual refractory metals. The metals are processed and fabricated by similar methods because of their common characteristics. The end product of refining these metals is metal powder which is consolidated into finished products or mill shapes. Only production of metal powders, ferrous and nonferrous, in operations which do not significantly increase their purity are included in this category. Production of nonferrous metals powders in operations which significantly increase their

purity is covered by the guidelines for nonferrous metals manufacturing, 40 CFR Part 421 (phase I, proposed at 40 CFR 7032, February 17, 1983, to be promulgated shortly; and phase II, scheduled for proposal shortly). The powders can also be arc or electron beam melted and cast into ingots. The mill shapes and ingots are shaped into finished form by rolling, drawing, extruding, and forging. A second reason that subcategorization by individual refractory metal is unnecessary is that most of the plants which form one refractory metal also form one or more other refractory metals and waste streams are commonly commingled.

Fifty-two of the surveyed plants reported forming one or more of the refractory metals. Thirty-five of these plants discharge process wastewater, six directly to surface streams, 27 to a POTW, and two both directly and to a POTW.

Zirconium/Hafnium Forming. Zirconium and hafnium are formed by rolling, drawing, and extrusion. One common manufacturing process is tube-reducing (roll-rocking or pilgering), a special type of cold rolling. Post-forming operations include annealing and sand blasting (dry), acid and alkaline cleaning, and conversion coating. All of the plants which form hafnium also form zirconium by similar processes.

Ten of the surveyed plants report forming zirconium. Seven of these plants discharge process wastewater, three directly to surface water, three to a POTW, and one both directly and to a POTW.

Magnesium Forming. Magnesium forming processes consist of forging, rolling, and extrusion. Water is used in post-extrusion etching, chromating, and rinsing processes. Eight of the surveyed plants form magnesium. Five plants discharge process water, three directly to surface streams and two to a POTW.

Uranium Forming. Uranium forming processes consist of forging and extrusion, both of which use contact cooling water. Water is also used in post-forming surface treatment steps. Three surveyed plants report forming uranium. One plant discharges process water directly to a surface stream and one both directly and to a POTW.

Table IV-1

NUMBER OF PLANTS DISCHARGING NONFERROUS METALS FORMING WASTEWATER, BY SUBCATEGORY

Subcategory	Number of Direct Dischargers*	Number of Indirect Dischargers*	Total Plants*
Lead/Tin/Bismuth Forming	3	18	63
Nickel/Cobalt Forming	15	27	73
Zinc Forming	1	2	10
Beryllium Forming	1	0	1
Precious Metals Forming	7	28	50
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	3	20	60
Titanium Forming	12	16	41
Refractory Metals Forming	8	29	52
Zirconium/Hafnium Forming	4	4	10
Magnesium Forming	3	2	8
Uranium Forming	2	1	3

*Plants may be in more than one subcategory.

SECTION V

WATER USE AND WASTEWATER CHARACTERISTICS

This section presents a summary of the analytical data that characterize the raw wastewater in the category. Flow data that serve as the basis for developing regulatory flow allowances in the nonferrous metals forming category are also summarized in this section. The analytical and flow data were obtained from four sources: information obtained during a telephone survey; data collection portfolios (dcp's); sampling and analysis programs; and long-term or historical data. Confidential information was handled in accordance with 40 CFR Part 2.

DATA SOURCES

Telephone Survey

As described in Section III of this document, a comprehensive telephone survey was undertaken in order to determine which plants should comprise a final dcp mailing list, i.e., whether or not operations within the scope of this category were present at the plants contacted. In the telephone survey, the contact at each plant was asked what metals were formed, the type of forming operations the plant employed, i.e., rolling, drawing, extruding, forging, casting, cladding, or powder metallurgy and their associated water usage, discharge, and treatment-in-place. The plant contact was also asked what surface treatment, cleaning, washing, and/or rinsing operations were utilized and their associated water usage, discharge, and treatment-in-place. In addition to the telephone contacts made during the comprehensive survey, many plants were contacted by telephone to clarify dcp responses.

Data Collection Portfolios

Data collection portfolios (dcp's) are questionnaires which were developed by the Agency to obtain extensive data from plants in the nonferrous metals forming category. The dcp's, sent to all facilities known or believed to be engaged in nonferrous metals forming, requested information under the authority of Section 308 of the Clean Water Act. The information requested included plant age, production, number of employees, water usage, manufacturing processes, raw material and process chemical usage, wastewater treatment technologies, and the presence (known or believed) of toxic pollutants in the plant's raw and treated process wastewaters.

Complete dcp responses supplied the following information for each operation present at the responding plant: the total

production in 1981, the average production rate (lb/hr), production rate at full capacity, and the quantity and rate of wastewater discharge. As discussed in Section IV, a mass-based regulation must relate water use and raw waste characteristics to some production normalizing parameter. The average production rate is considered to be the parameter most applicable to operations in this category, and has been used to normalize the water and wastewater flows discussed in this section.

Two production normalized flows (PNF's) were calculated for each operation reported in the dcp's. The first is production normalized water use, defined as the volume of water or other fluid (e.g., emulsions, lubricants) required per mass of metal processed through the operation. Water use is based on the sum of recycle and make-up flows to a given process. The second PNF calculated for each operation is production normalized water discharge, defined as the volume of wastewater discharged from a given process to further treatment, disposal, or discharge per mass of nonferrous metal processed. 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 from similar sources were compiled and statistically analyzed. Wastewater sources with similar production normalized flows and physical and chemical characteristics were grouped together (e.g., spent baths from acid pickling, acid etching, chromating and phosphating were grouped together as "surface treatment spent baths."). These groupings are referred to as "waste streams" in this document. It should be noted that one nonferrous metals forming or associated operation can generate more than one waste stream. Each distinct waste stream will have different production normalized flows, physical and chemical characteristics, or both. The production normalized flow information for each waste stream is presented in the administrative record which accompanies this rulemaking package. An analysis of factors affecting the wastewater flows is presented in Sections IX, X, XI, and XII where representative BPT, BAT, NSPS, and pretreatment discharge flow allowances are selected for use in calculating the effluent limitations and standards.

Sampling and Analysis Program

The sampling and analysis program was undertaken primarily to identify pollutants of concern in the industry, with emphasis on toxic pollutants. Samples were collected at 17 nonferrous metals forming facilities.

This section summarizes the activities undertaken during the sampling trips and identifies the types of sites sampled and parameters analyzed. It also presents an overview of sample collection, preservation, and transportation techniques. Finally, it describes the pollutant parameters quantified, the methods of analyses and laboratories used, the detectable concentration of each pollutant, and the general approach used to ensure the reliability of the analytical data produced.

Site Selection. Seventeen plants engaged in manufacturing operations included in this category were sampled. Four of these plants were sampled in data gathering efforts supporting the development of guidelines for other industrial categories (nonferrous metals manufacturing and battery manufacturing). Information on nonferrous metals forming operations was collected incidentally to the major sampling effort at these plants. Thirteen plants were sampled specifically to gather data to support guidelines and standards for this category. These plants were selected to be representative of the industry, based on information obtained during the telephone survey. Considerations included how well each facility represented the subcategory as indicated by available data, potential problems in meeting technology-based standards, differences in production processes used, and wastewater treatment-in-place. With the exception of the uranium forming subcategory, at least one plant in every subcategory was sampled. Two plants provided data for more than one subcategory.

As indicated in Table V-1, the plants selected for sampling were typically plants with multiple forming operations and associated surface and heat treatment operations. The flow rates and pollutant concentrations in the wastewaters discharged from the manufacturing operations at these plants are believed to be representative of the flow rates and pollutant concentrations which would be found in wastewaters generated by similar operations at any plant in the nonferrous metals forming industry. The 17 sampled plants have a variety of treatment systems in place, ranging from plants with no treatment to plants using the advanced technologies considered as the basis for regulation.

Field Sampling. After selection of the plants to be sampled, each plant was contacted by telephone, and sent a letter notifying the plant when a visit would be expected as authorized by Section 308 of the Clean Water Act. In most cases, a preliminary visit was made to the plant to select the sources of wastewater to be sampled. The sample points included, but were not limited to, untreated and treated discharges, process wastewater, partially treated wastewater, and intake water. The actual sampling visit was also scheduled during the preliminary visit.

Sample Collection, Preservation, and Transportation. Collection, preservation, and transportation of samples were accomplished in accordance with procedures outlined in Appendix III of "Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants" (published by the Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, March 1977, revised, April 1977), "Sampling Screening Procedure for the Measurement of Priority Pollutants" (published by the EPA Effluent Guidelines Division, Washington, D.C., October 1976), and in the proposed 304(h) methods (44 FR 69464, December 3, 1979). The procedures are summarized in the paragraphs that follow.

Whenever practical, samples were taken from mid-channel at mid-depth in a turbulent, well-mixed portion of the waste stream. Periodically, the temperature and pH of each waste stream sampled were measured on-site.

Each large composite (Type 1) sample was collected in a 9-liter, wide-mouth pickle jar that had been washed with detergent and water, rinsed with tap water, rinsed with distilled water, and air dried at room temperature.

Before collection of Type 1 samples, new Tygon® tubing was cut to minimum lengths and installed on the inlet and outlet (suction and discharge) fittings of the automatic sampler. Two liters (2.1 quarts) of blank water, known to be free of organic compounds and brought to the sampling site from the analytical laboratory, were pumped through the sampler and its attached tubing; the water was then discarded.

A blank (control sample) was produced by pumping an additional 2 liters of blank water through the sampler and into the original blank water bottle. The blank sample was sealed with a Teflon®-lined cap, labeled, and packed in ice in a plastic foam-insulated chest. This sample was subsequently analyzed to determine any contamination contributed by the automatic sampler.

During collection of each Type 1 sample, the pickle jar was packed in ice in a plastic foam-insulated container to cool the sample. After the complete composite sample had been collected, it was mixed and a 1-liter aliquot to be used for metals analysis was dispensed into a plastic bottle. The aliquot was preserved on-site by the addition of nitric acid to pH less than 2. Metals samples were stored at room temperature until the end of the sampling trip at which time they were shipped to the appropriate laboratory for analysis.

After removal of the 1-liter metals aliquot, the balance of the composite sample was divided into aliquots to be used for analysis of nonvolatile organics, conventional parameters, and nonconventional parameters. If a portion of the composite sample was

requested by a representative of the sampled plant for independent analysis, an aliquot was placed in a sample container supplied by the representative.

Water samples to be analyzed for cyanide, total phenol, oil and grease, and volatile organics were not obtained from the composite sample. Water samples for these analyses were taken as one-time grab samples during the time that the composite sample was collected.

The cyanide, total phenol, and oil and grease samples were stored in new bottles which had been iced and labeled, 1-liter (33.8 ounce) plastic bottles for the cyanide sample, 0.95-liter (1 quart) amber glass bottles for the total phenol sample, and 0.95-liter (1 quart) wide-mouth glass bottles with a Teflon® lid liner for the oil and grease sample. The samples were preserved as described below.

Sodium hydroxide was added to each sample to be analyzed for cyanide, until the pH was elevated to 12 or more (as measured using pH paper). Where the presence of chlorine was suspected, the sample was tested for chlorine (which would decompose most of the cyanide) by using potassium iodide/starch paper. If the paper turned blue (indicating chlorine was present), ascorbic acid crystals were slowly added and dissolved until a drop of the sample produced no change in the color of the test paper. An additional 0.6 gram (0.021 ounce) of ascorbic acid was added, and the sample bottle was sealed (by a Teflon®-lined cap), labeled, iced, and shipped for analysis.

Sulfuric acid was added to each sample to be analyzed for total phenol, until the pH was reduced to 2 or less (as measured using pH paper). The sample bottle was sealed, labeled, iced, and shipped for analysis.

Sulfuric acid was added to each sample to be analyzed for oil and grease, until the pH was reduced to 2 or less (as measured using pH test paper). The sample bottle was sealed (by a Teflon® lid liner), labeled, iced, and shipped for analysis.

Each sample to be analyzed for volatile organic pollutants was stored in a new 125-ml (4.2-ounce) glass bottle that had been rinsed with tap water and distilled water, heated to 105°C (221°F) for one hour, and cooled. This method was also used to prepare the septum and lid for each bottle. When used, each bottle was filled to overflowing, sealed with a Teflon®-faced silicone septum (Teflon® side down), capped, labeled, and iced. Hermetic sealing was verified by inverting and tapping the sealed container to confirm the absence of air bubbles. (If bubbles were found, the bottle was opened, a few additional drops of

sample were added, and a new seal was installed.) Samples were maintained hermetically sealed and iced until analyzed.

Sample Analysis. Samples were sent by air to one of the laboratories listed in Table V-2. The samples were analyzed for 21 metals, including seven of the priority metal pollutants (beryllium, cadmium, chromium, copper, nickel, lead, and zinc) using inductively-coupled argon plasma emission spectroscopy (ICAPES) as proposed in 44 FR 69464, December 3, 1979. The remaining six priority metal pollutants, with the exception of mercury, were analyzed by atomic absorption spectroscopy (AA) as described in 40 CFR Part 136. Mercury analysis was performed by automated cold vapor atomic absorption. Analysis for the seven toxic metals analyzed by ICAPES was also performed by AA on 10 percent of the samples to determine test comparability. Because the results showed no significant differences in detection or quantification levels, ICAPES data were used for the seven toxic metals.

Metals Analyzed by ICAP

Calcium	Iron
Magnesium	Manganese
Sodium	Molybdenum
Aluminum	*Nickel
Boron	*Lead
Barium	Tin
*Beryllium	Titanium
*Cadmium	Vanadium
Cobalt	Yttrium
*Chromium	*Zinc
*Copper	

Metals Analyzed by AA

*Antimony
*Arsenic
*Selenium
*Thallium
*Mercury
*Silver

*Toxic metals.

Analyses for the organic toxic pollutants were performed by Arthur D. Little, ERCO, IT, S-Cubed, and West Coast Technical Service. Analyses for the toxic metal pollutants were performed by CENTEC, Radian, Versar, and NUS. Radian, ARO, and NUS performed analyses for cyanide, conventional and nonconventional pollutants.

EPA did not expect to find any asbestos in nonferrous metals forming wastewaters because this category only includes metals that have already been refined from ores that might contain asbestos. Therefore, analysis for asbestos fibers was not performed.

Pesticide priority pollutants were also not expected to be significant in the nonferrous metals forming industry. Samples from one facility were analyzed for pesticide priority pollutants by electron capture-gas chromatography by the method specified in 44 FR 69464, December 3, 1979. Pesticides were not detected in these samples, so no other samples were analyzed for these pollutants.

Analyses for the remaining organic priority pollutants (volatile fraction, base/neutral, and acid compounds) were conducted using an isotope dilution method which is a modification of the analytical techniques specified in 44 FR 69464, December 3, 1979. The isotope dilution method has been recently developed to improve the accuracy and reliability of the analysis. A copy of the method is in the record of rulemaking for this proposed regulation. However, no standard was used in the analysis of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD, pollutant 129). Instead, screening for this compound was performed by comparing analytical results to EPA's gas chromatography/mass spectroscopy (GC/MS) computer file.

Analysis for cyanide used methods specified in 40 CFR Part 136 and described in "Methods for Chemical Analysis for Water and Wastes," EPA-600/4-79-020 (March 1979).

Past studies by EPA and others have identified many nontoxic pollutant parameters useful in characterizing industrial wastewaters and in evaluating treatment process removal efficiencies. Some of these pollutants may also be selected as reliable indicators of the presence of specific toxic pollutants. For these reasons, a number of nontoxic pollutants were studied for the nonferrous metals forming category. These pollutants may be divided into two general groups as shown in Table V-3. Analyses for these pollutants were performed by the methods specified in 40 CFR Part 136 and described in EPA-600/4-79-020.

The analytical quantification levels used in evaluation of the sampling data reflect the accuracy of the analytical methods employed. Below these concentrations, the identification of the individual compounds is possible, but quantification is difficult. Pesticides and PCB's can be analytically quantified at concentrations above 0.005 mg/l, and other organic toxic levels above 0.010 mg/l. Levels associated with toxic metals are as follows: 0.010 mg/l for antimony; 0.010 mg/l for arsenic; 1 x

10^7 fibers/l for asbestos; 0.005 mg/l for beryllium; 0.020 mg/l for cadmium; 0.020 mg/l for chromium; 0.050 mg/l for copper; 0.02 mg/l for cyanide; 0.050 mg/l for lead; 0.0002 mg/l for mercury; 0.050 mg/l for nickel; 0.010 mg/l for selenium; 0.010 mg/l for silver; 0.010 mg/l for thallium; and 0.020 mg/l for zinc.

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, daily operator-specific, and pollutant-specific factors. These factors can include day-to-day differences in machine calibration and variation in stock solutions, operators, and pollution sample matrices (i.e., presence of some chemicals will alter the detection of particular pollutants).

Quality Control. Quality control measures used in performing all analyses conducted for this program complied with the guidelines given in "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" (published by EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, 1976). As part of the daily quality control program, blanks (including sealed samples of blank water carried to each sampling site and returned unopened, as well as samples of blank water used in the field), standards, and spiked samples were routinely analyzed with actual samples. As part of the overall program, all analytical instruments (such as balances, spectrophotometers, and recorders) were routinely maintained and calibrated.

Historical Data

A useful source of long-term or historical data available for nonferrous metals forming plants are the Discharge Monitoring Reports (DMR's) completed as a part of the National Pollutant Discharge Elimination System (NPDES) and/or State Pollutant Discharge Elimination System (SPDES). DMR's were obtained through the EPA regional offices and state regulatory agencies for the years 1981 through the most recent date available. The DMR's present a summary of the analytical results from a series of samples taken during a given month for the pollutants designated in the plant's permit. In general, minimum, maximum, and average values, in mg/l or lbs/day, are presented for such pollutants as total suspended solids, oil and grease, pH, chromium, and zinc. The samples were collected from the plant outfall(s), which represents the discharge(s) from the plant. For facilities with wastewater treatment, the DMR's provide a measure of the performance of the treatment system. In theory, these data could serve as a basis for characterizing treated wastewater from nonferrous metals forming plants. However, there is no information on concentration of pollutants in wastewater prior to treatment

and too little information on the performance of the plant at the time the samples were collected to use these data in evaluating the performance of various levels of treatment. The data reported in DMR's could be used to compare the treatment performance of actual plants to the treatment effectiveness concentrations presented in Section VII. However, it was not possible to perform this comparison in the limited time available between receipt of the DMR's and the Court Ordered deadline for proposal of this regulation.

The DMR data for uranium forming plants included the toxic metals cadmium, copper, and nickel. The data were used to select the pollutants proposed for regulation in the uranium forming subcategory.

WATER USE AND WASTEWATER CHARACTERISTICS

Water use, wastewater discharge, and analytical sampling data for each subcategory are presented in the administrative record which accompanies this rulemaking package. These data (listed by waste stream) were collected from the dcp's and during field sampling. They include source water concentrations and current recycle practices.

Analytical sampling data are summarized in Tables V-4 through V-14. These tables present the concentration range of regulated pollutants detected in the waste streams sampled in each subcategory. Selection of regulated pollutants is discussed in Section VI.

As indicated in Table V-1, not every waste stream generated by nonferrous metals forming operations was sampled during the screen sampling program. However, in order to evaluate the applicability of the various treatment technologies to non-sampled waste streams, the physical and chemical characteristics of these streams were extrapolated from similar sampled streams. This extrapolation was also necessary to estimate the costs of the various treatment technologies, as discussed in Section VIII. Extrapolation of sampling data from sampled to non-sampled waste streams was not used to select pollutants for regulation in this category (see Section VI).

Waste streams generated by similar physical processes using similar process chemicals will have very similar physical and chemical characteristics. For example, water used to cool extrusions will have low concentrations of all pollutants. This is demonstrated by the results of the chemical analyses of lead and nickel extrusion press and solution heat treatment contact cooling water (Table V-15). The major difference between these two waste streams is that the concentration of lead is higher in the

lead cooling water (0.13 mg/l vs. not detected) and the concentration of nickel is higher in the nickel cooling water (0.14 mg/l vs. 0.007 mg/l). This pattern will be repeated whenever water, without additives, is used to cool hot metal.

In contrast, spent rolling emulsions have high concentrations of several pollutants. The results of chemical analyses of lead, nickel, and precious metals rolling spent emulsions are presented in Table V-16. All three waste streams have high concentrations of oil and grease, total suspended and dissolved solids, and several metals. The lead rolling spent emulsion has a high concentration of lead (29.0 mg/l), the nickel rolling spent emulsion has high concentrations of nickel and chrome (8.95 mg/l and 1.27 mg/l, respectively), and the precious metals rolling spent emulsion has high concentrations of copper, silver, and zinc (25.0 mg/l, 0.13 mg/l, and 6.00 mg/l, respectively). It is not surprising to find chromium in nickel rolling spent emulsions and copper and zinc in precious metals rolling spent emulsions because chromium is a common alloy of nickel and copper and zinc are common alloys of precious metals. Thus, the major difference between the three waste streams is the presence of the metals formed in the operation generating the waste stream.

From the discussion above, it follows that refractory metals, zirconium, and uranium extrusion press and solution heat treatment contact cooling water will have chemical characteristics similar to lead and nickel extrusion press and solution heat treatment contact cooling water. The major difference between the waste streams will be the concentration of the metal cooled. Similarly, zinc and refractory metals rolling spent emulsions will have chemical characteristics similar to lead, nickel and precious metals rolling spent emulsions, except for the concentration of the metal rolled. However, because zinc and lead are rolled at lower temperatures than nickel and refractory metals, zinc rolling spent emulsions may be more like lead rolling spent emulsions and refractory metals rolling spent emulsions may be more like nickel rolling spent emulsions.

Arguments analogous to those presented above were used to estimate the physical and chemical characteristics of all non-sampled waste streams. These estimations, and summaries of sampling data, are presented below.

Lead/Tin/Bismuth Forming Subcategory

Rolling Spent Emulsions. As discussed in Section III, oil-in-water emulsions are used as coolants and lubricants. Rolling emulsions are typically recycled using in-line filtration and periodically batch discharged when spent.

One sample of rolling spent emulsions was collected at one plant. Elevated concentrations of lead (29 mg/l), zinc (1.4 mg/l), oil and grease (270 mg/l), and TSS (480 mg/l) were detected in the sample.

Rolling Spent Soap Solutions. As discussed in Section III, soap solutions can be used as lubricants and coolants in rolling. Of the plants surveyed, only one plant reported the use of soap solutions in rolling.

No samples of rolling spent soap solutions were collected during the sceen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning rinsewater in this subcategory. Spent soap solutions contain the same process chemicals as alkaline cleaning baths, at mass loadings (mg/kkg) similar to the concentrations found in alkaline cleaning rinses. Therefore, the pollutants present and the mass loadings of pollutants present in rolling spent soap solutions and alkaline cleaning rinses are expected to be similar.

Drawing Spent Neat Oils. As discussed in Section III, oil-based lubricants may be used in drawing operations to ensure uniform drawing temperatures and avoid excessive wear on dies and mandrels. Drawing oils are usually recycled until their lubricant properties are exhausted and are then contract hauled.

Since none of the plants surveyed reported discharging the drawing spent neat oils, no samples were collected.

Drawing Spent Emulsions. As discussed in Section III, oil-in-water emulsions can be used as drawing lubricants. The drawing emulsions are frequently recycled and batch discharged periodically after their lubricating properties are exhausted.

No samples of drawing spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling spent emulsions in this subcategory. These two waste streams are generated from similar physical processes which use similar process chemicals. Therefore, the pollutants present in each waste stream and the mass loading (mg/kkg product) at which they are present should be similar.

Drawing Spent Soap Solutions. As discussed in Section III, soap solutions can be used as drawing lubricants. The drawing soap solutions are frequently recycled and batch discharged periodically after their lubricating properties are exhausted.

No samples of drawing spent soap solutions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning rinsewater in this subcategory. Spent soap solutions contain the same process chemicals as alkaline cleaning baths, at concentrations similar to the concentrations found in alkaline cleaning rinses. Therefore, the pollutants present and the mass loadings at which they are present in drawing spent soap solutions and alkaline cleaning rinses are expected to be similar.

Extrusion Press and Solution Heat Treatment Contact Cooling Water. As discussed in Section III, heat treatment of lead/tin/bismuth products frequently involves the use of a water quench in order to achieve desired metallic properties. Eleven plants reported 16 extrusion press and solution heat treatment processes that involve water quenching either by spraying water onto the metal as it emerges from the die or press or by direct quenching into a contact water bath.

One sample of extrusion press and solution heat treatment contact cooling water was collected at one plant. Elevated concentrations of chromium (4.6 mg/l) were detected in the sample.

Extrusion Press Hydraulic Fluid Leakage. As discussed in Section III, due to the large force applied by a hydraulic extrusion press, hydraulic fluid leakage is unavoidable.

No samples of extrusion press hydraulic fluid leakage were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to press hydraulic fluid leakage in the nickel/cobalt subcategory. The pollutants present in these two waste streams are attributable to the hydraulic fluid used, not the metal formed. Therefore, the pollutants present and the concentration (mg/l) at which they are present should be similar.

Continuous Strip Casting Contact Cooling Water. As discussed in Section III, in continuous casting, no restrictions are placed on the length of the casting and it is not necessary to interrupt production to remove the cast product. Although the use of continuous casting techniques has been found to significantly reduce or eliminate the use of contact cooling water and oil lubricants, five plants reported the use of continuous strip contact cooling water.

One sample of continuous strip casting contact cooling water was collected at one plant. Elevated concentrations of lead (1.2 mg/l) and zinc (3.1 mg/l) were detected in the sample.

Semi-Continuous Ingot Casting Contact Cooling Water. As discussed in Section III, semi-continuous ingot casting may require the use of contact cooling water in order to achieve the desired physical properties of the metal.

Two samples of semi-continuous ingot casting contact cooling water were collected from one stream at one plant. Elevated concentrations of lead (1.10 mg/l) and TSS (80 mg/l) were detected in the samples.

Shot Casting Contact Cooling Water. As discussed in Section III, contact cooling water is required to cool the cast lead shot so that it will not reconsolidate as well as to achieve the desired metallic properties.

Three samples of shot casting contact cooling water were collected from one stream at one plant. Elevated concentrations of lead (52.2 mg/l), antimony (3.30 mg/l), tin (10.5 mg/l), oil and grease (22 mg/l), and TSS (420 mg/l) were detected in the samples.

Shot-Forming Wet Air Pollution Control Blowdown. As discussed in Section III, shot-forming may require wet air pollution control in order to meet air quality standards. Of the plants surveyed, only one reported the use of wet air pollution control on a shot-forming operation.

No samples of shot-forming wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to shot casting contact cooling water in this subcategory. The pollutants in each of these waste streams derive from contact of the water with particles of metal, so the pollutants present are expected to be similar. However, because the air pollution control device is designed to capture small particles (dust), the mass loading of total suspended solids is expected to be higher in shot-forming wet air pollution control blowdown than in shot casting contact cooling water.

Swaging Spent Emulsions. As discussed in Section III, oil-in-water emulsions can be used as swaging lubricants. The swaging emulsions are frequently recycled and batch discharged periodically after their lubricating properties are exhausted.

No samples of swaging spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling spent emulsions in this subcategory. These two waste streams are generated from operations using similar process chemicals (oil-in-water emulsions) for similar purposes (lubrication). Therefore, the pollutants present in each waste stream and the mass

loading (mg/kkg product) at which they are present should be similar.

Alkaline Cleaning Spent Baths. As discussed in Section III, alkaline cleaning is commonly used to clean lead/tin/bismuth surfaces. Products can be cleaned with an alkaline solution either by immersion or spray.

One sample of an alkaline cleaning spent bath was collected at one plant. Elevated concentrations of lead (183 mg/l), antimony (7.30 mg/l), oil and grease (600 mg/l), and TSS (560 mg/l) were detected in the sample.

Alkaline Cleaning Rinsewater. As discussed in Section III, rinsing, usually with warm water, should follow the alkaline cleaning process to prevent the solution from drying on the product.

Four samples of alkaline cleaning rinsewater were collected from two streams at one plant. Elevated concentrations of lead (40.8 mg/l), antimony (1.10 mg/l), and TSS (260 mg/l) were detected in the samples.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degrasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Miscellaneous Nondescript Wastewater Sources. Several low volume sources of wastewater were reported on the dcp's and observed during the site and sampling visits. These sources are maintenance and cleanup, autoclave contact cooling water, final product lubrication, and product degreasing rinsewater. Because they generally represent low volume periodic discharges applicable to most plants, the Agency is including an allowance for all of

these streams under the miscellaneous nondescript wastewater sources waste stream.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater either because they are dry or because they use noncontact cooling water only:

Continuous Wheel Casting
Continuous Sheet Casting
Stationary Casting
Shot Pressing
Forging
Stamping
Pointing
Punching
Shot Blasting
Slug Forming
Powder Metallurgy Operations (Pressing, Sintering, Sizing)
Powder Tumbling
Melting
Solder Cream Making
Annealing
Tumble Cleaning
Slitting
Sawing
Coiling, Spooling
Trimming

Nickel/Cobalt Forming Subcategory

Rolling Spent Neat Oils. As described in Section III, the rolling of nickel/cobalt products typically requires the use of mineral oil lubricants. The oils are usually recycled with in-line filtration and periodically disposed of by sale to an oil reclaimer or by incineration. Because discharge of this stream is not practiced, limited flow data were available for analysis.

Since none of the plants surveyed reported discharging the rolling spent neat oils, no samples of this waste stream were collected.

Rolling Spent Emulsions. As discussed in Section III, oil-in-water emulsions are used in rolling operations as coolants and lubricants. Rolling emulsions are typically recycled using in-line filtration with periodic batch discharge of the spent emulsion.

Twelve samples of rolling spent emulsions were collected from six streams at two plants. Elevated concentrations of nickel (34.2 mg/l), zinc (6.70 mg/l), oil and grease (7,600 mg/l), and TSS (6,800 mg/l) were detected in the samples.

Rolling Contact Lubricant-Coolant Water. As discussed in Section III, it is necessary to use a lubricant-coolant during rolling to prevent excessive wear on the rolls, to prevent adhesion of metal to the rolls, and to maintain a suitable and uniform rolling temperature. Water is one type of lubricant-coolant which may be used.

One sample of rolling contact lubricant-coolant water was collected at one plant. Elevated concentrations of copper (1.3 mg/l), fluoride (2,000 mg/l), oil and grease (22 mg/l), and TSS (63 mg/l) were detected in the sample.

Rolling Solution Heat Treatment Contact Cooling Water. As discussed in Section III, solution heat treatment can be used after most forming operations in order to improve mechanical properties by maximizing the concentration of hardening contaminants in the solid metal solution. Solution heat treatment typically involves significant quantities of contact cooling water.

No samples of rolling solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to extrusion press and solution heat treatment contact cooling water in this subcategory. These two waste streams are generated from operations using water for an identical purpose: to cool hot metal. In addition, no process chemicals are added to either type of cooling water. Therefore, both the pollutants present and the mass loadings of pollutants present in these two waste streams are expected to be similar.

Tube Reducing Spent Lubricants. As discussed in Section III, tube reducing, much like rolling, may require a lubricating compound in order to prevent excessive wear of the tube reducing rolls, prevent adhesion of metal to the rolls, and to maintain a suitable and uniform tube reducing temperature.

One sample of tube reducing spent lubricants was collected from one stream at one plant. Elevated concentrations of nickel (58.0 mg/l), copper (43.5 mg/l), lead (47.6 mg/l), zinc (63.1 mg/l), and oil and grease (200,000 mg/l) were detected in the sample. In addition, the sample had elevated concentrations of the toxic organics 1,1,1-trichloroethane (33 mg/l) and N-nitrosodiphenylamine (28.2 mg/l).

Drawing Spent Neat Oils. As discussed in Section III, oil-based lubricants may be required in draws which have a high reduction

in diameter. Drawing oils are usually recycled, with in-line filtration, until their lubricating properties are exhausted.

Since none of the plants surveyed reported discharging the drawing spent neat oils, no samples were collected.

Drawing Spent Emulsions. As discussed in Section III, oil-in-water emulsions are often used as coolants and lubricants in drawing. The drawing emulsions are frequently recycled and batch discharged periodically after their lubricating properties are exhausted.

No samples of drawing spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling spent emulsions in this subcategory. These two waste streams are generated from operations using similar process chemicals (oil-in-water emulsions) for similar purposes (lubrication). Therefore, the pollutants present and the mass loadings of pollutants present in these two waste streams are expected to be similar.

Extrusion Spent Lubricants. As discussed in Section III, the extrusion process requires the use of a lubricant to prevent adhesion of the metal to the die and ingot container walls.

Since none of the plants surveyed reported wastewater discharge values for extrusion spent lubricants, no samples of this waste stream were collected.

Extrusion Press and Solution Heat Treatment Contact Cooling Water. As discussed in Section III, heat treatment is frequently used after extrusion to attain the desired mechanical properties in the extruded metal. Contact cooling of the extrusion, sometimes called press heat treatment, can be accomplished with a water spray near the die or by immersion in a water tank adjacent to the runout table.

One sample of extrusion press heat treatment contact cooling water was collected at one plant. Elevated concentrations of chromium (0.130 mg/l) were detected in the sample.

Forging, Extrusion, and Isostatic Press Hydraulic Fluid Leakage. As discussed in Section III, due to the large force applied by a hydraulic press, hydraulic fluid leakage is unavoidable.

Three samples of extrusion press hydraulic fluid leakage were collected at one plant and one sample of forging press hydraulic fluid leakage was collected at another plant. Elevated concentrations of nickel (1.30 mg/l), oil and grease (420 mg/l), and TSS (500 mg/l) were detected in the samples.

Forging Equipment Cleaning Wastewater. Forging equipment may be periodically cleaned in order to prevent the excessive build-up of oil and grease on the forging die.

No samples of forging equipment cleaning wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to forging die contact cooling water in this subcategory. These two waste streams are generated from similar physical processes (flushing a forging die with water), so the pollutants present are expected to be similar. However, the water is used for different purposes, in one case to cool a hot die, in the other, to remove built-up contaminants. Therefore, the mass loadings of oil and grease are expected to be higher in forging equipment cleaning wastewater than in forging die contact cooling water.

Forging Die Contact Cooling Water. As discussed in Section III, forging dies may require cooling to maintain the proper die temperature between forgings, or to cool the dies prior to removal from the forge hammer.

One sample of forging die contact cooling water was collected at one plant. Elevated concentrations of nickel (16 mg/l), copper (3.4 mg/l) and TSS (1,800 mg/l) were detected in the sample.

Forging and Swaging Spent Neat Oils. As described in Section III, an oil medium can be used for proper lubrication of forging and swaging dies. Of the plants surveyed reporting the use of forging and swaging neat oils, all recycle the oils until their lubricating properties are exhausted, at which time the oils are contract hauled.

Since none of the plants surveyed reported discharging the forging and swaging spent neat oils, no samples of this waste stream were collected.

Stationary and Direct Chill Casting Contact Cooling Water. As discussed in Section III, contact cooling water is a necessary part of direct chill casting and is sometimes used in stationary casting. The cooling water may be contaminated by lubricants applied to the mold before and during the casting process and by the cast metal itself.

No samples of stationary and direct chill casting contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling contact lubricant-coolant water in this subcategory. These two waste streams are generated from operations using water for similar purposes (to cool hot

metal). In addition, no process chemicals are added to either type of cooling water. Therefore, both the pollutants present and the mass loadings of pollutants present in the two streams are expected to be similar.

Vacuum Melting Steam Condensate. As discussed in Section III, nickel/cobalt may be melted by an operation known as vacuum melting. The high pressure steam used to create the vacuum condenses to an extent as it produces the vacuum. Although this water does not come in contact with the metal product, it may potentially be contaminated with metal fines or components of lubricant compounds volatilized in the furnace if scrap is being melted.

One sample of vacuum melting steam condensate was collected at one plant. No pollutants were detected in the sample at elevated concentrations.

Metal Powder Production Atomization Wastewater. As discussed in Section III, metal powder is commonly produced through wet atomization of a molten metal. Of the plants surveyed, three reported the use of water in atomization of molten nickel.

One sample of metal powder production atomization wastewater was collected at one plant. Elevated concentrations of chromium (1.0 mg/l), cobalt (5.2 mg/l), TSS (63 mg/l), and oil and grease (22 mg/l) were detected in the sample.

Annealing Solution Heat Treatment Contact Cooling Water. As discussed in Section III, solution heat treatment is implemented after annealing operations to improve mechanical properties by maximizing the concentration of hardening contaminants in the solid metal solution. Solution heat treatment typically involves significant quantities of contact cooling water.

Two samples of solution heat treatment contact cooling water were collected from two streams at two plants. Elevated concentrations of nickel (6.80 mg/l), copper (2.92 mg/l), oil and grease (40 mg/l), and TSS (78 mg/l) were detected in the samples.

Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are required to control air pollution from some operations. Scrubbers are frequently necessary over pickling operations to control fumes and over shot blasting operations to control particulates.

Two samples of wet air pollution control blowdown were collected. Blowdown from a scrubber on a pickling operation was sampled at one plant and on a shot blasting operation at another plant. Elevated concentrations of nickel (20.0 mg/l), copper (2.85 mg/l), chromium (1.75 mg/l), and TSS (130 mg/l) were detected in the samples.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical surface treatments may be applied after the forming of nickel/cobalt products. Although spent surface treatment baths are often discharged, two out of 22 plants reporting surface treatment baths have the spent baths contract hauled.

Samples of five spent surface treatment baths were collected at two plants. Very high concentrations of nickel (193,000 mg/1), copper (4,800 mg/1), cobalt (4,000 mg/1), chromium (3,600 mg/1), fluoride (94,000 mg/1), and TSS (5,800 mg/1) were detected in the samples.

Surface Treatment Rinsewater. As discussed in Section III, rinsing follows the surface treatment process to prevent the surface treatment solution from affecting the surface of the metal beyond the desired amount.

Twenty-three samples of surface treatment rinsewater were collected from eight streams at three plants. Elevated concentrations of nickel (364 mg/1), copper (87.4 mg/1), chromium (18.8 mg/1), cobalt (4.0 mg/1), zinc (2.36 mg/1), oil and grease (130 mg/1), and TSS (760 mg/1) were detected in the samples.

Alkaline Cleaning Spent Baths. As discussed in Section III, alkaline cleaners are formulations of alkaline salts, water, and surfactants. Spent solutions are discharged from alkaline cleaning processes.

Three samples of alkaline cleaning spent baths were collected from three streams at two plants. Elevated concentrations of nickel (122 mg/1), copper (39.2 mg/1), zinc (3.9 mg/1), chromium (3.59 mg/1), oil and grease (49 mg/1), and TSS (4,000 mg/1) were detected in the samples.

Alkaline Cleaning Rinsewater. As discussed in Section III, metal parts are usually rinsed following alkaline cleaning to remove the cleaning solution and any solubilized contaminants.

Four samples of alkaline cleaning rinsewater were collected from three streams at two plants. Elevated concentrations of nickel (5.58 mg/1), mg/1), oil and grease (26 mg/1), and TSS (190 mg/1) were detected in the samples.

Molten Salt Spent Baths. As discussed in Section III, molten salt baths are used to descale nickel and cobalt alloys. Formed parts to be descaled are immersed in the bath for up to 15 minutes, removed, and water-quenched.

When removed from the heated bath container, the molten salt bath solution solidifies and is no longer a liquid waste stream. The solidified spent salt bath is usually discarded as a hazardous

waste because it contains high concentrations of hexavalent chromium. Therefore, no samples of molten salt baths were collected.

Molten Salt Rinsewater. As discussed in Section III, when molten salt baths are used to descale nickel and cobalt alloys, they are generally followed by a water quench/rinse step.

Seven samples of molten salt rinsewater were collected from three streams at three plants. Elevated concentrations of nickel (14 mg/l), copper (8.05 mg/l), cobalt (2.8 mg/l), chromium (1,100. mg/l), and TSS (4,200 mg/l) were detected in the samples.

Ammonia Rinse Wastewater. As discussed in Section III, an ammonia rinse may be used after acid pickling of nickel/cobalt products to neutralize the acid prior to further rinsing. The ammonia rinse is periodically batch discharged when spent.

One sample of ammonia rinse wastewater was collected at one plant. Elevated concentrations of nickel (456 mg/l), copper (54.0 mg/l), chromium (108 mg/l), zinc (32.0 mg/l), and TSS (9,000 mg/l) were detected in the sample.

Sawing/Grinding Spent Lubricants. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant.

Ten samples of sawing/grinding spent lubricants were collected from 10 streams at two plants. Elevated concentrations of nickel (116 mg/l), copper (16.5 mg/l), cobalt (3.3 mg/l), chromium (24.0 mg/l), oil and grease (16,000 mg/l), and TSS (2,440 mg/l) were detected in the samples.

Steam Cleaning Condensate. As discussed in Section III, steam cleaning may be used to remove oil and grease from the surface of metal. Steam is condensed as it hits the surface of the relatively cooler metal and is then discharged.

No samples of steam cleaning condensate were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling contact lubricant-coolant water in this subcategory. These two waste streams are generated in processes in which water, without any added process chemicals, contacts metal. In the case of contact lubricant-coolant water, the metal is hot and the water (relatively) cool. In the case of steam cleaning condensate, the water/steam is hot and the metal (relatively) cool. However, the pollutants present and the mass loadings of pollutants present in the two streams are expected to be similar.

Hydrostatic Tube Testing Wastewater. As discussed in Section III, hydrostatic testing operations are used to check nonferrous metals parts for surface defects or subsurface imperfections. Hydrostatic testing operations are sources of wastewater because the spent water bath or test media must be periodically discarded due to the transfer into the testing media of oil and grease, solids, and suspended and dissolved metals from each product tested.

No samples of hydrostatic tube testing wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling contact lubricant-coolant water in this subcategory. These two waste streams are generated in processes in which water, without any added process chemicals, contacts metal. Therefore, the pollutants present in each waste stream and the mass loading (mg/kkg) at which they are present should be similar.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Miscellaneous Nondescript Wastewater Sources. Several low volume sources of wastewater were reported on the dcp and observed during the site and sampling visits. These sources are maintenance and cleanup, final product lubrication, and product degreasing rinsewater. Because they generally represent low volume periodic discharges applicable to most plants, the Agency is including an allowance for all of these streams under the miscellaneous nondescript wastewater sources waste stream.

Operations Which Do Not Use Process Water. The agency proposes a discharge allowance of zero for operations which do not generate

process wastewater. The following operations generate no process wastewater, either because they are dry or because they use noncontact cooling water only:

Powder Metallurgy Operations (Compacting, Sintering, Sizing)
Powder Blending
Powder Ball Milling
Powder Attrition
Powder Extrusion
Hot Isostatic Pressing
Grit, Sand, Shot Blasting
Welding
Plasma Torch Cutting
Gas Cleaning
Coil Buildup, Coiling
Straightening
Electroflux Remelting

Zinc Forming Subcategory

Rolling Spent Neat Oils. As described in Section III, mineral oil or kerosene-based lubricants can be used in the rolling of zinc products. The oils are usually recycled with in-line filtration and periodically disposed of by sale to an oil reclaimer or by incineration.

Since none of the plants surveyed reported discharging the rolling spent neat oils, no samples were collected.

Rolling Spent Emulsions. As discussed in Section III, oil-in-water emulsions are used in rolling operations as coolants and lubricants. Rolling emulsions are typically recycled using in-line filtration treatment, with periodic batch discharge of the recycled emulsion.

No samples of rolling spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling spent emulsions in the lead/tin/bismuth subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference should be the identity of metals present. The mass loading (mg/kkg) of zinc in zinc rolling spent emulsions should be similar to the mass loading of lead in lead rolling spent emulsions, and vice versa. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Rolling Contact Lubricant-Coolant Water. As discussed in Section III, it is necessary to use a lubricant-coolant during rolling to prevent excessive wear on the rolls, to prevent adhesion of metal

to the rolls, and to maintain a suitable and uniform rolling temperature. Water is one type of lubricant-coolant which may be used.

No samples of rolling contact lubricant-coolant water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to casting contact cooling water in the lead/tin/bismuth subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zinc in zinc rolling contact lubricant-coolant water should be similar to the mass loading of lead in lead casting contact cooling water, and vice versa. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Drawing Spent Emulsions. As discussed in Section III, oil-in-water emulsions are used for many drawing applications in order to ensure uniform drawing temperatures and avoid excessive wear on the dies and mandrels used. The drawing emulsions are frequently recycled and batch discharged periodically after their lubricating properties are exhausted.

No samples of drawing spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling spent emulsions in the lead/tin/bismuth subcategory. These waste streams are generated from operations using similar process chemicals (oil-in-water emulsions) for similar purposes (lubrication). The only difference should be the metals present. The mass loading (mg/kkg) of zinc in zinc drawing spent emulsions should be similar to the mass loading of lead in lead rolling spent emulsions, and vice versa. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Direct Chill Casting Contact Cooling Water. As discussed in Section III, contact cooling water is a necessary part of direct chill casting. The cooling water may be contaminated by lubricants applied to the mold before and during the casting process. The cooling water may be recycled.

No samples of direct chill casting contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to semicontinuous ingot casting contact cooling water in the lead/tin/bismuth subcategory. These two waste streams are generated by using water, without additives, to cool

cast metal. Since lubricants may be applied to the casting molds in both processes, both streams may be contaminated by these lubricants. The only difference between the waste streams should be the metals present. The mass loading (mg/kkg) of zinc in zinc direct chill casting contact cooling water should be similar to the mass loading of lead in lead semicontinuous ingot casting contact cooling water, and vice versa. The other pollutants present and the mass loading at which they are present should be similar.

Stationary Casting Contact Cooling Water. As discussed in Section III, lubricants and cooling water are usually not required in stationary casting. Since molten metal is poured into the molds, if contact cooling water is used, it is frequently lost due to evaporation.

Since none of the plants surveyed reported discharging the stationary casting contact cooling water, no samples were collected.

Solution Heat Treatment Contact Cooling Water. As discussed in Section III, solution heat treatment is implemented after most forming operations to improve mechanical properties by maximizing the concentration of hardening contaminants in solid solution. Solution heat treatment typically involves significant quantities of contact cooling water.

No samples of solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to continuous sheet casting contact cooling water in the lead/tin/bismuth subcategory. These two waste streams derive from the use of water, without additives, to cool hot metal. The only difference should be the metals present. The mass loading (mg/kkg) of zinc in zinc solution heat treatment contact cooling water should be similar to the mass loading of lead in lead continuous sheet casting contact cooling water, and vice versa. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Surface Treatment Rinsewater. As discussed in Section III, rinsing follows the surface treatment process to prevent the solution from affecting the surface of the metal beyond the desired amount.

One sample of surface treatment rinsewater was collected at one plant. Elevated concentrations of zinc (42.3 mg/l), chromium (0.160 mg/l), nickel (8.10 mg/l), and TSS (20 mg/l) were detected in the sample.

Alkaline Cleaning Spent Baths. As discussed in Section III, alkaline cleaners are formulations of alkaline salts, water, and surfactants. Spent solutions are discharged from alkaline cleaning processes after their properties are exhausted.

No samples of alkaline cleaning spent baths were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning rinsewater in this subcategory. As a zinc piece is removed from an alkaline cleaning bath, it carries a small volume of the bath with it. The rinsewater used to remove the carried-over bath solution from the formed piece will contain the same pollutants as the bath, only diluted. Therefore, the pollutants present in zinc alkaline cleaning baths are expected to be identical to the pollutants present in zinc alkaline cleaning rinsewater, except that the mass loadings of oil and grease and dissolved metals are expected to be higher in the spent baths than in the rinsewater while the mass loading of total suspended solids is expected to be much higher in the baths than in the rinsewater.

Alkaline Cleaning Rinsewater. As discussed in Section III, following alkaline treating, metal parts are rinsed. Rinses are discharged from alkaline cleaning processes.

One sample of alkaline cleaning rinsewater was collected at one plant. Elevated concentrations of zinc (1.12 mg/l), cyanide (1.3 mg/l), oil and grease (23 mg/l), and TSS (90 mg/l) were detected in the sample.

Sawing/Grinding Spent Lubricants. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant.

No samples of sawing/grinding spent lubricants were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to sawing/grinding spent lubricants in the nickel/cobalt subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference should be the metals present. The mass loading (mg/kkg) of zinc in zinc sawing/grinding spent lubricants should be similar to the mass loading of nickel in nickel sawing/grinding spent lubricants, and vice versa. The mass loading of chromium in zinc sawing/grinding spent lubricants should be insignificant, since chromium is often alloyed with nickel but not with zinc. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater, either because they are dry operations or because they use only noncontact cooling water:

Continuous Casting
Melting
Slitting
Stamping
Sawing
Homogenizing
Printing
Coating
Drying
Metal Powder Production

Beryllium Forming Subcategory

Area Cleaning Wastewater. Due to the toxicity of beryllium, it is necessary to keep forming areas reasonably clean. After the operations of a shift, areas need to be hosed down.

No samples of area cleaning wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to billet washing wastewater in this subcategory. These two waste streams are generated in washing/cleaning operations. Therefore, the pollutants present in beryllium area cleaning wastewater are

expected to be identical to the pollutants present in beryllium billet washing wastewater, except that mass loadings of oil and grease and total suspended solids are expected to be higher in the area cleaning wastewater.

Billet Washing Wastewater. Beryllium billets are washed after vacuum casting and sintering to remove an oxide layer on the billet formed at the elevated casting and sintering temperatures. Billets are washed using a high pressure spray nozzle to blast off the oxide layer. In the plant surveyed, the wastewater is not recirculated.

Two samples of billet washing wastewater were collected from two streams at one plant. Elevated concentrations of beryllium (82 mg/l), copper (0.75 mg/l), and TSS (160 mg/l) were detected in the samples.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical treatments may be applied after the forming of nonferrous metals products. Beryllium products are commonly etched with a nitric acid-hydrofluoric acid solution. The acid bath is used until its etching properties have been diminished and fresh chemicals are needed.

One sample of a surface treatment spent bath was collected at one plant. Elevated concentrations of beryllium (15,000 mg/l), chromium (3.0 mg/l), zinc (2.0 mg/l), nickel (2.4 mg/l), fluoride (79,000 mg/l), and TSS (240 mg/l) were detected in the sample.

Surface Treatment Rinsewater. As discussed in Section III, after a surface treatment bath, the nonferrous metal product must be rinsed in order to stop the surface reaction from proceeding beyond the desired amount. An overflow rinse tank is used after the beryllium etching bath in the plant surveyed.

Two samples of surface treatment rinsewater were collected from one stream at one plant. Elevated concentrations of beryllium (35 mg/l), copper (6.1 mg/l), and TSS (18 mg/l) were detected in the samples.

Sawing/Grinding Spent Lubricants. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant.

One sample of sawing/grinding spent lubricants was collected at one plant. Elevated concentrations of beryllium (17 mg/l), zinc (0.86 mg/l), copper (1.5 mg/l), cyanide (1.1 mg/l), oil and grease (21,000 mg/l), and TSS (19 mg/l) were detected in the sample.

Inspection/Testing Wastewater. As discussed in Section III, product testing operations are used to check nonferrous metals parts for surface defects, subsurface imperfections, and product density. Product testing operations are usually sources of wastewater because the spent water bath or test media must be periodically discarded due to the transfer into the testing media of oil and grease, solids, and suspended and dissolved metals from each product tested. Toxic organics may also be present, originating in the lubricants used in preceding forming operations. Beryllium products are washed before undergoing density testing, therefore, no pollutants are expected in this waste stream. The testing water is used indefinitely at the plant surveyed.

One sample of inspection/testing wastewater was collected at one plant. No pollutants were detected at elevated concentrations in the sample.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater, either because they are dry or because they use only noncontact cooling water:

Billet Chipping
Powder Metallurgy Operations (Pressing, Sintering)

Precious Metals Forming Subcategory

Rolling Spent Emulsions. As discussed in Section III, oil-in-water emulsions are used in rolling operations as coolants and lubricants. Rolling emulsions are typically recycled using in-line filtration with periodic batch discharge of the recycled emulsion as it loses its lubricating properties.

One sample of rolling spent emulsions was collected at one plant. Elevated concentrations of silver (0.130 mg/l), copper (25.0 mg/l), lead (1.00 mg/l), nickel (1.00 mg/l), oil and grease (1,500 mg/l), and TSS (500 mg/l) were detected in the sample.

Rolling Solution Heat Treatment Contact Cooling Water. As discussed in Section III, solution heat treatment can be used after most forming operations in order to improve mechanical properties by maximizing the concentration of hardening contaminants in solid solution. Solution heat treatment typically involves significant quantities of contact cooling water.

No samples of rolling solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to semi-continuous and continuous casting contact cooling water in this subcategory. These two waste streams are generated by the use of water, without additives, to cool hot metal. Therefore, the pollutants present in each waste stream and the mass loading at which they are present, should be similar.

Drawing Spent Neat Oils. As discussed in Section III, oil-based lubricants may be required in draws which have a high reduction in diameter. Drawing oils are usually recycled until their lubricating properties are exhausted.

Since none of the plants surveyed reported discharging the drawing spent neat oils, no samples were collected.

Drawing Spent Emulsions. As discussed in Section III, oil-in-water emulsions may be used as coolants and lubricants in drawing. The drawing emulsions are frequently recycled and batch discharged periodically after their lubricating properties are exhausted.

One sample of drawing spent emulsions was collected at one plant. Elevated concentrations of copper (46.4 mg/l), zinc (5.18 mg/l), lead (1.05 mg/l), and oil and grease (33,000 mg/l) were detected in the sample.

Drawing Spent Soap Solutions. As discussed in Section III, soap solutions can be used as drawing lubricants. The drawing soap solutions may be recycled and batch discharged periodically after their lubricating properties are exhausted.

No samples of drawing spent soap solutions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling spent emulsions in this subcategory. These two waste streams are generated from operations using similar process chemicals for similar purposes (lubrication). Therefore, the pollutants present and the mass loading at which they are present should be similar.

Extrusion Solution Heat Treatment Contact Cooling Water. As discussed in Section III, solution heat treatment can be used after most forming operations in order to improve mechanical properties by maximizing the concentration of hardening contaminants in solid solution. Solution heat treatment typically involves significant quantities of contact cooling water.

No samples of extrusion solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to semi-continuous and continuous contact cooling water in this subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. Therefore, the pollutants present in each waste stream and the mass loading at which they are present should be similar.

Semi-Continuous and Continuous Casting Contact Cooling Water. As discussed in Section III, a number of different continuous casting processes are currently being used in industry. The use of continuous casting techniques has been found to significantly reduce or eliminate the use of contact cooling water and oil lubricants.

One sample of semi-continuous and continuous casting contact cooling water was collected at one plant. Elevated concentrations of cyanide (0.50 mg/l) and TSS (43 mg/l) were detected in the sample.

Stationary Casting Contact Cooling Water. As discussed in Section III, stationary casting of metal ingots is practiced at many nonferrous metals forming plants. Lubricants and cooling water are usually not required, however, two of the plants surveyed reported the use and discharge of stationary casting contact cooling water.

No samples of stationary casting contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to semi-continuous and continuous casting contact cooling water in this subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. Therefore, the pollutants present in each waste stream and the mass loading at which they are present should be similar.

Direct Chill Casting Contact Cooling Water. As discussed in Section III, contact cooling water is a necessary part of direct chill casting. The cooling water may be contaminated by lubricants applied to the mold before and during the casting process.

No samples of direct chill casting contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to semi-continuous and continuous casting contact cooling water in this subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. Therefore, the pollutants present in each waste stream and the mass loading at which they are present should be similar.

Shot Casting Contact Cooling Water. As discussed in Section III, during shot casting, a tank of contact cooling water, either stagnant or circulating, is necessary for quick quenching of cast shot.

Two samples of shot casting contact cooling water were collected from one stream at one plant. Elevated concentrations of cadmium (9.88 mg/l), copper (0.600 mg/l), zinc (5.66 mg/l), and oil and grease (54 mg/l) were detected in the samples.

Casting Wet Air Pollution Control Blowdown. As discussed in Section III, casting may require wet air pollution control in order to meet air quality standards. Of the plants surveyed, two reported the use of wet air pollution control on a casting operation.

No samples of casting wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to shot casting contact cooling water in this subcategory. The pollutants in each of these waste streams derive from the contact of the water with particles of metal, so the pollutants present are expected to be similar. However, because the air pollution control device is designed to capture small particles and gases (dust and fumes) generated during the casting process, the mass loadings of total suspended solids and total dissolved solids are expected to be higher in casting wet air

pollution control blowdown than in shot casting contact cooling water.

Metal Powder Production Atomization Wastewater. As discussed in Section III, metal powder is commonly produced through wet atomization of a molten metal. Water is removed after the atomization step, commonly by settling, then discharged.

No samples of metal powder production atomization wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to shot casting contact cooling water in this subcategory. These two waste streams are generated by using water to cool molten metal. Therefore, the pollutants present in each waste stream and the mass loading (mg/kkg) at which they are present should be similar.

Metal Powder Production Ball Milling Wastewater. As discussed in Section III, metal powders can be produced by milling with water, most commonly wet ball milling. After the wet milling operation, excess water is extracted from the metal powder, commonly by settling, and then discharged.

No samples of metal powder production ball milling wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to tumbling wastewater in this subcategory. These two waste streams are generated from similar physical processes using water for similar purposes, so the pollutants present are expected to be similar. However, because process chemicals (rust inhibitors, detergents) are sometimes added to tumbling water, the mass of loadings of total dissolved solids are expected to be higher in tumbling wastewater than in metal powder production ball milling wastewater.

Pressure Bonding Contact Cooling Water. As discussed in Section III, metals can be bonded together through the use of pressure applied onto the desired forms. Cooling water may be applied after the bonding operation to facilitate handling of the bonded product.

One sample of pressure bonding contact cooling water was collected at one plant. Elevated concentrations of zinc (3.42 mg/l) and copper (7.85 mg/l) were detected in the sample.

Annealing Contact Cooling Water. As discussed in Section III, annealing is used by plants in the nonferrous metals forming category to remove the effects of strain hardening or solution heat treatment. Once removed from the annealing furnace, it is essential that the heat-treatable alloys be cooled at a controlled rate. Contact cooling water may be used for this purpose.

No samples of annealing contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to semi-continuous and continuous casting contact cooling water in this subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. Therefore, the pollutants present in each waste stream and the mass loading at which they are present should be similar.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical treatments may be applied after the forming of precious metals products. The surface treatment baths must be periodically discharged after their properties are exhausted.

No samples of surface treatment spent baths were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to surface treatment rinsewater in this subcategory. As a precious metal piece is removed from a surface treatment bath, it carries with it a small volume of the bath. The rinsewater used to remove the carried-over bath solution from the formed piece will contain the same pollutants as the bath, only at lower concentration. Therefore, the pollutants present in precious metals surface treatment baths are expected to be identical to the pollutants in precious metals surface treatment rinsewater, except that the mass loadings of dissolved metals and total suspended solids are expected to be higher in surface treatment spent baths than in surface treatment rinsewater.

Surface Treatment Rinsewater. As discussed in Section III, rinsing follows the surface treatment process to prevent the solution from affecting the surface of the metal beyond the desired amount.

Four samples of surface treatment rinsewater were collected from two streams at two plants. Elevated concentrations of silver (6.70 mg/l), zinc (4.66 mg/l), cadmium (11.1 mg/l), copper (60.6 mg/l), and TSS (3,000 mg/l) were detected in the samples.

Alkaline Cleaning Spent Baths. As discussed in Section III, alkaline cleaners are formulations of alkaline salts, water, and surfactants. Spent solutions are discharged from alkaline cleaning processes after their properties are exhausted.

No samples of alkaline cleaning spent baths were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning spent baths in the nickel/cobalt subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference

should be the metals present. The mass loading of precious metals in precious metals alkaline cleaning spent baths should be similar to the mass loading of nickel in nickel alkaline cleaning baths, and vice versa. Also, chromium should not be present in significant amounts. The other pollutants present in each waste stream, and the mass loading at which they are present, should be similar.

Alkaline Cleaning Rinsewater. As discussed in Section III, following alkaline treating, metal parts are rinsed. Rinses are discharged from alkaline cleaning processes.

No samples of alkaline cleaning rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning rinsewater in the nickel/cobalt subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference should be the metals present. The mass loading of precious metals in precious metals alkaline cleaning rinsewater should be similar to the mass loading of nickel in nickel alkaline cleaning rinsewater, and vice versa. Also, chromium should not be present in significant amounts. The other pollutants present in each waste stream, and the mass loading at which they are present, should be similar.

Prebonding Cleaning Wastewater. As discussed in Section III, prior to bonding, metal surfaces must be cleaned in order to obtain a good bond. The main source of process water in metal cladding operations is in cleaning the metal surfaces prior to bonding. Acid, caustic, or detergent cleaning can be performed depending on the metal type. For small batch operations, the cleaning steps can involve dipping the metal into small cleaning bath tanks and hand rinsing the metal in a sink. For larger continuous operations, the metal may be cleaned in a power scrubline In a typical scrubline, the strip passes through a detergent bath, spray rinse, acid bath, spray rinse, rotating abrasive scrub brushes, and a final rinse. The metal may then pass through a heated drying chamber or may air dry.

Eight samples of prebonding cleaning wastewater were collected from three streams at two plants. Elevated concentrations of silver (0.100 mg/l), zinc (2.32 mg/l), copper (5.95 mg/l), cyanide (0.28 mg/l), nickel (3.60 mg/l), oil and grease (16 mg/l), and TSS (400 mg/l) were detected in the samples.

Tumbling Wastewater. As discussed in Section III, tumbling is a controlled method of processing parts to remove burrs, scale, flash, and oxides as well as to improve surface finish of formed metal parts. Water is commonly added to the tumbling container and later discharged.

Four samples of tumbling wastewater were collected from two streams at two plants. Elevated concentrations of silver (0.220 mg/l), lead (1.85 mg/l), zinc (3.16 mg/l), iron (7,850 mg/l), copper (142 mg/l), nickel (3.25 mg/l), chromium (3.18 mg/l), oil and grease (40 mg/l), and TSS (110 mg/l) were detected in the samples.

Burnishing Wastewater. As discussed in Section III, burnishing is the process of finish sizing or smooth finishing a workpiece (previously machined or ground) by displacement, rather than removals of minute surface irregularities. Water is commonly used to aid in this operation.

No samples of burnishing wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to tumbling wastewater in this subcategory. These two waste streams are generated from similar physical processes which use water for similar purposes. Therefore, the pollutants present in each waste stream and the mass loading (mg/kkg) at which they are present should be similar.

Sawing/Grinding Spent Emulsions. As discussed in Section III, the rolls used in rolling operations obtain surface abrasions after repeated use. The rolls must be surface ground in order to obtain a smooth rolling surface. The rolled product will not be formed properly if the rolls are not adequately smooth. Roll grinding and other sawing and grinding operations generally require a lubricant to minimize friction and act as a coolant. Oil-in-water emulsions are commonly used for this purpose. The emulsions are typically recycled using in-line filtration and batch discharged periodically after their lubricating properties are exhausted.

A sample of roll grinding spent emulsions was collected at one plant. Elevated concentrations of zinc (0.920 mg/l), chromium (0.240 mg/l), and oil and grease (500 mg/l) were detected in the sample.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent

selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater, either because they use only noncontact cooling water or because they use no water at all:

Forging, Swaging
Punching, Stamping
Welding
Soldering
Melting, Screening
Sawing
Slitting
Metal Powder Production

Metal Powder Production and Powder Metallurgy Iron, Copper, and Aluminum Subcategory

Metal Powder Production Atomization Wastewater. As discussed in Section III, wet atomization is a method of producing metal powder in which a stream of water impinges upon a molten metal stream, breaking it into droplets which solidify as powder particles. Water atomization is used to produce irregularly shaped particles, required for powder metallurgy applications in which a powder is cold pressed into a compact. Because cooling times play an important role in determining particle configuration, the atomized metal droplets are sometimes rapidly cooled by falling into a water bath. Atomization and quench water are separated from the metal powder by gravity settling or filtration and discharged.

No samples of iron, copper or aluminum atomization wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to tumbling, burnishing, and cleaning wastewater in this subcategory. These two waste streams are generated from operations using water, usually without added process chemicals, in contact with finely divided metal. The pollutants present in each waste stream and the mass loading at which they are present should be similar, except for total suspended solids and oil and

grease. Oil and grease, present in high concentrations in cleaning wastewater, is not expected to be present in significant concentrations in metal powder production atomization wastewater. Because metal powders are more finely divided than the parts tumbled and in higher concentration than the metal fines produced during tumbling, the mass loading of total suspended solids is expected to be higher in metal powder production atomization wastewater than in tumbling, burnishing, and cleaning wastewater.

Metal Powder Production Milling Wastewater. As discussed in Section III, metal powders are also produced by mechanical reduction. The most common pieces of mechanical reduction equipment are ball mills, vortex mills, hammer mills, disc mills, and roll mills.

Water or other liquids may be used to aid in the milling operation or to facilitate handling after powder is milled.

No samples of metal powder production milling wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to tumbling, burnishing, and cleaning wastewater in this subcategory. These two waste streams are generated from operations using water, usually without added process chemicals, in contact with finely divided metal. The pollutants present in each waste stream and the mass loading at which they are present, should be similar, except for total suspended solids and oil and grease. Oil and grease, present in high concentrations in cleaning wastewater, is not expected to be present in significant concentrations in metal powder production milling wastewater. Metal powders are more finely divided than tumbled parts. Powders are also present in higher concentration than the metal fines produced during tumbling. Therefore, the mass loading of total suspended solids is expected to be higher in metal powder production milling wastewater than in tumbling, burnishing, and cleaning wastewater.

Metal Powder Production Wet Air Pollution Control Blowdown. As discussed in Section III, during the production of metal powders, particulates may become airborne. The use of wet air pollution control may be necessary in order to meet particulate air quality standards.

No samples of metal powder production wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to blowdown from air pollution control scrubbers used to control particulate emissions in the nickel/cobalt subcategory. The only difference between the wastewater characteristics of the two streams should be the metals present.

The mass loading (mg/kkg) of iron, copper and/or aluminum in iron, copper and aluminum metal powder production wet air pollution control scrubber blowdown should be similar to the nickel mass loading in nickel air pollution control scrubber blowdown, and vice versa. The other pollutants present in each waste stream and the mass loading at which they are present, should be similar.

Sizing/Repressing Spent Lubricants. As discussed in Section III, powder metallurgy parts may be sized or repressed after sintering to increase the density of the part and/or to bring the part closer to required tolerances. Lubricants, such as turbine oil, may be used to prevent the adhesion of the part to the sizing die. Since none of the plants surveyed reported discharging sizing spent lubricants (they are completely consumed in the process), no samples were collected.

Oil-Resin Impregnation Wastewater. As discussed in Section III, porous parts pressed from metal powders may be impregnated with oils or resins. Following impregnation, the parts may be rinsed with water to remove excess oil or resin and the rinsewater may be discharged.

No samples of oil-resin impregnation wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to tumbling, burnishing, and cleaning wastewater in this subcategory. These two waste streams are generated from similar physical processes in which water is used to clean formed parts. Therefore, the pollutants present in each waste stream and the mass loading (mg/kkg) at which they are present should be similar.

Steam Treatment Wet Air Pollution Control Blowdown. As discussed in Section III, steam treatment operations may require the use of wet air pollution control devices in order to meet air quality standards.

Three samples of steam treatment wet air pollution control blowdown were collected from one stream at one plant. Elevated concentrations of oil and grease (42 mg/l) and TSS (200 mg/l) were detected in the samples.

Tumbling, Burnishing, and Cleaning Wastewater. As discussed in Section III, tumbling is an operation in parts pressed from metal powder are rotated in a barrel with ceramic or metal slugs or abrasives to remove scale, fins, or burrs. It may be done dry or with an aqueous solution. Burnishing is a surface finishing process in which minute surface irregularities are displaced rather

than removed. It also can be done by dry or in an aqueous solution. Pressed parts can also be cleaned in hot soapy water to remove excess oil from oil quenching operations.

Six samples of tumbling wastewater were collected from three streams at one plant. Four samples of cleaning wastewater were collected from one stream at one plant. Elevated concentrations of iron (211 mg/l), copper (253 mg/l), aluminum (34.3 mg/l), cyanide (1.8 mg/l), lead (45.1 mg/l), nickel (3.00 mg/l), zinc (9.56 mg/l), boron (440 mg/l), tin (15.8 mg/l), titanium (2.50 mg/l), oil and grease (2,100 mg/l), and TSS (3,000 mg/l) were detected in the samples.

Sawing/Grinding Spent Lubricants. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant.

Two samples of sawing/grinding lubricants were collected from two streams at one plant. Elevated concentrations of iron (176 mg/l), copper (1.55 mg/l), aluminum (7.00 mg/l), zinc (3.26 mg/l), boron (166 mg/l), cyanide (2.5 mg/l), oil and grease (720 mg/l), and TSS (120 mg/l) were detected in the samples.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of metals during powder metallurgy operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater because they use only noncontact cooling water or because they use no water at all:

Powder Metallurgy Operations (Compacting, Sintering)
Sanding
Rolling
Machining
Screening
Blending
Briquetting
Crushing, Pulverizing

Titanium Forming Subcategory

Cold Rolling Spent Lubricants. As discussed in Section III, mineral oil or kerosene-based lubricants are typically used in cold rolling. However, water soluble lubricants are also used in titanium cold rolling.

No samples of cold rolling spent lubricants were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling spent emulsions in the nickel/cobalt subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference should be the metals present. The mass loading (mg/kkg) of titanium in titanium cold rolling spent lubricants should be similar to the mass loading of nickel in nickel rolling spent emulsions, and vice versa. Also, the mass loading of chromium should be insignificant because titanium is seldom alloyed with chromium. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Hot Rolling Contact Lubricant-Coolant Water. As discussed in Section III, it is necessary to use a lubricant-coolant during rolling to prevent excessive wear on the rolls, to prevent adhesion of metal to the rolls, and to maintain a suitable and uniform rolling temperature. Water is one type of lubricant-coolant which may be used.

No samples of hot rolling contact lubricant-coolant water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to rolling contact lubricant-coolant water in the nickel/cobalt subcategory. These two waste streams are generated by using water, without additives, to cool and lubricate metal during the rolling process. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of titanium in titanium hot rooling contact lubricant-coolant water should be similar to the mass loading of nickel in nickel rolling contact lubricant-coolant water, and vice versa. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Extrusion Spent Lubricants. As discussed in Section III, the extrusion process requires the use of a lubricant to prevent adhesion of the metal to the die and ingot container walls.

No samples of extrusion spent lubricants were collected during the screen sampling program. However, the Agency believes that discharged titanium extrusion lubricants will have wastewater characteristics similar to rolling spent emulsions in the nickel/cobalt subcategory. These two waste streams are generated from operations which use similar process chemicals for similar purposes (lubrication). The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of titanium in titanium extrusion spent lubricants should be similar to the mass loading of nickel in nickel rolling spent emulsions, and vice versa. Also, the mass loading of chromium should be insignificant because titanium is seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Forging Spent Lubricants. As discussed in Section III, either a water or oil medium can be sprayed onto forging dies for proper lubrication.

Since none of the plants surveyed reported wastewater discharge values for forging spent lubricants, no samples were collected.

Forging Die Contact Cooling Water. As discussed in Section III, forging dies may require cooling to maintain the proper die temperature between forgings.

No samples of forging contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to forging die contact cooling water in the nickel/cobalt subcategory. These two waste streams are generated by using water, without additives, to cool forging dies. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of titanium in titanium forging die contact cooling water should be similar to the mass loading of nickel in nickel forging die contact cooling water, and vice versa. Also, the mass loading of chromium should be insignificant because titanium is seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Forging Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to control air pollution from some operations. For instance, scrubbers may be needed over forging operations where partial combustion of oil-based lubricants may generate particulates and smoke.

No samples of forging wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to surface treatment wet air pollution control blowdown in this subcategory. These two waste streams are generated by devices designed to control emission of airborne pollutants. However, because airborne particulates are generated at higher concentration from forging operations than surface treatment operations, the mass loading of total suspended solids is expected to be higher in forging wet air pollution control blowdown than in surface treatment wet air pollution control blowdown. The other pollutants present in each waste stream, and the concentration at which they are present, are expected to be similar.

Heat Treatment Contact Cooling Water. As discussed in Section III, heat treatment is used by plants in the nonferrous metals forming category to give the metal the desired mechanical properties. After heat treatment, the metals must be cooled at a controlled rate. Contact cooling water may be used for this purpose.

No samples of heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to annealing contact cooling water in the nickel/cobalt subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of titanium in titanium heat treatment contact cooling water should be similar to the mass loading of nickel in nickel annealing contact cooling water, and vice versa. Also, the mass loading of chromium should be insignificant because titanium is seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical treatments may be applied after the forming of titanium products. The surface treatment baths must be periodically discharged after their properties are exhausted.

Two samples of surface treatment spent baths were collected from two streams at one plant. Elevated concentrations of titanium (44,100 mg/l), aluminum (4,170 mg/l), iron (17,020 mg/l), fluoride (86,000 mg/l), and TSS (1,920 mg/l) were detected in the samples.

Surface Treatment Rinsewater. As discussed in Section III, rinsing follows the surface treatment process to prevent the solution from affecting the surface of the metal beyond the desired amount.

Seven samples of surface treatment rinsewater were collected from three streams at one plant. Elevated concentrations of titanium (55.3 mg/l), iron (124 mg/l), fluoride (85.0 mg/l), and TSS (40 mg/l) were detected in the samples.

Surface Treatment Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices must accompany some operations in order to meet air quality standards.

One sample of surface treatment wet air pollution control blowdown was collected. Elevated concentrations of titanium (2.750 mg/l), iron (1.800 mg/l), fluoride (33 mg/l), and TSS (40 mg/l) were detected in the samples.

Alkaline Cleaning Spent Baths. As discussed in Section III, alkaline cleaning is commonly used to clean formed metal parts. Products can be cleaned with an alkaline solution either by immersion or spray.

No samples of alkaline cleaning spent baths were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning spent baths in the nickel/cobalt subcategory. These two waste streams are generated from operations using similar process chemicals to clean formed metal products. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of titanium in titanium alkaline cleaning spent baths should be similar to the mass loading of nickel in nickel alkaline cleaning spent baths, and vice versa. Also, the mass loading of chromium should be insignificant because titanium is seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Alkaline Cleaning Rinsewater. As discussed in Section III, rinsing follows the alkaline cleaning process to prevent the solution from drying on the product.

No samples of alkaline cleaning rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning rinsewater in the nickel/cobalt subcategory. These two waste streams are generated from using water to remove alkaline cleaning solutions from cleaned metal. The only difference between the wastewater characteristics of the two streams

should be the metals present. The mass loading (mg/kkg) of titanium in titanium alkaline cleaning rinsewater should be similar to the mass loading of nickel in nickel alkaline cleaning rinsewater, and vice versa. Also, the mass loading of chromium should be insignificant because titanium is seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Tumbling Wastewater. As described in Section III, tumbling is an operation in which forgings are rotated in a barrel with ceramic or metal slugs or abrasives to remove scale, fins, oxides, or burrs. It may be done dry, with water, or an aqueous solution containing cleaning compounds, rust inhibitors or other additives.

One sample of tumbling wastewater was collected. Elevated concentrations of titanium (156 mg/l), iron (111 mg/l), aluminum (182 mg/l), boron (116 mg/l), fluoride (110 mg/l), ammonia (34 mg/l), cyanide (4.0 mg/l), oil and grease (17 mg/l), and TSS (6,800 mg/l) were detected in the sample.

Sawing/Grinding Spent Lubricants. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant.

One sample of sawing/grinding spent lubricant was collected. Elevated concentrations of titanium (6.00 mg/l), iron (17.5 mg/l), aluminum (33.0 mg/l), fluoride (110 mg/l), cyanide (3.8 mg/l), oil and grease (34 mg/l), and TSS (244 mg/l) were detected in the sample.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater, because they use only noncontact cooling water or because they use no water at all:

Casting
Shot Blasting
Grit Blasting
Machining
Torching
Deoxidizing
Straightening
Trimming
Piercing
Shearing

Refractory Metals Forming Subcategory

Rolling Spent Neat Oils. As discussed in Section III, the rolling of refractory metal products typically requires the use of mineral oil lubricants. The oils are usually recycled with in-line filtration and periodically disposed of by sale to an oil reclaimer or by incineration. Because discharge of this stream is not practiced, flow data were not available for analysis. Only one plant surveyed reported using neat oil rolling lubricants, but this plant did not report the quantity of lubricant used.

Since none of the plants surveyed reported discharging the rolling spent neat oils, no samples were collected.

Rolling Spent Emulsions. As discussed in Section III, oil-in-water emulsions are used in rolling operations as coolants and lubricants. Rolling emulsions are typically recycled using in-line filtration treatment and batch discharged periodically when the lubricating properties of the emulsions are exhausted.

No samples of rolling spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt rolling spent emulsions. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals rolling spent emulsions should be similar to the mass loading of nickel in nickel rolling spent emulsions, and vice versa. In addition, the mass loading of chromium in refractory metals rolling spent emulsions should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Drawing Spent Lubricants. As discussed in Section III, a wide variety of drawing lubricants are used in order to ensure uniform drawing temperatures and avoid excessive wear on the dies and mandrels. Drawing lubricants are usually recycled until no longer effective.

Since none of the plants surveyed reported discharging the drawing spent lubricants, no samples were collected.

Extrusion Press and Solution Heat Treatment Contact Cooling Water. As discussed in Section III, heat treatment is frequently used after extrusion to attain the desired mechanical properties. Heat treated products are primarily cooled by contact with water.

No samples of extrusion heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt press and solution heat treatment contact cooling water. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals extrusion press and solution heat treatment contact cooling water should be similar to the mass loading of nickel in nickel extrusion press and solution heat treatment contact cooling water, and vice versa. In addition, the mass loading of chromium in refractory metals extrusion press and solution heat treatment contact cooling water should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Extrusion Press Hydraulic Fluid Leakage. As discussed in Section III, due to the large force applied by a hydraulic press, hydraulic fluid leakage is unavoidable.

One sample of extrusion press hydraulic fluid leakage was collected during the screen sampling program. Elevated concentrations of copper (21 mg/l), molybdenum (20 mg/l), oil and grease (44,000 mg/l), and total suspended solids (19,000 mg/l) were detected in the sample.

Forging Spent Lubricants. As discussed in Section III, proper lubrication of the dies is essential in forging refractory metals. Of the plants surveyed reporting the use of forging lubricants, both reported total consumption due to evaporation and drag-out.

Since none of the plants surveyed reported discharging the forging spent lubricants, no samples were collected.

Forging Solution Heat Treatment Contact Cooling Water. As discussed in Section III, heat treatment is frequently used after forging to attain the desired mechanical properties in the forged metal. Contact cooling water may be used to cool the alloy at a controlled rate after heat treatment.

No samples of forging solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt extrusion press and solution heat treatment contact cooling water. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals forging solution heat treatment contact cooling water should be similar to the mass loading of nickel in nickel extrusion press and solution heat treatment contact cooling water, and vice versa. Also, the mass loading of chromium should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Extrusion and Forging Equipment Cleaning Wastewater. As discussed in Section III, extrusion and forging equipment should be periodically cleaned in order to prevent the excessive build-up of oil and grease on the dies.

No samples of extrusion and forging equipment cleaning wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel forging die contact cooling water. These two waste streams are generated from similar physical processes (flushing a forging die with water) so the pollutants present are expected to be similar. However, the water is used for different purposes, in one case to cool a hot die, in the other, to remove built-up contaminants. Therefore, the mass loadings of oil and grease are expected to be higher in forging equipment cleaning wastewater than in forging die contact cooling water. In addition, the metals present in the two waste streams are expected to differ. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals extrusion and forging equipment cleaning wastewater should be similar to the mass loading of nickel in nickel forging die contact cooling water, and vice versa. Also, the mass loading of chromium should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Metal Powder Production Wastewater. As discussed in Section III, refractory metal powders are frequently produced by mechanical reduction. The most common pieces of mechanical reduction equipment are ball mills, vortex mills, hammer mills, disc mills, and roll mills. Water or other liquids may be used to aid in the milling operation or to facilitate handling after powder is milled. One plant reported discharging wastewater from a ball milling operation.

No samples of metal powder production milling wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to tumbling/burnishing wastewater in this subcategory. These two waste streams are generated from operations using water, often without added process chemicals, in contact with finely divided metal. The pollutants present in each waste stream and the mass loading at which they are present, should be similar, except for total suspended solids. Metal powders are more finely divided than tumbled parts. Powders are also present in higher concentration than the metal fines produced during tumbling. Therefore, the mass loading of total suspended solids is expected to be higher in metal powder production milling wastewater than in tumbling/burnishing wastewater.

Metal Powder Production Wet Air Pollution Control Blowdown. As discussed in Section III, particulates may become airborne during the production of metal powders. Wet air pollution control equipment may be necessary to capture these particles in order to meet particulate air quality standards.

No samples of metal powder production wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to blowdown from air pollution control scrubbers used to control particulates in the nickel/cobalt subcategory. These two waste streams are generated by air pollution devices used to remove particulate contaminants from air. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals powder production wet air pollution control scrubber blowdown should be similar to the nickel mass loading in nickel shot blaster scrubber blowdown, and vice versa. In addition, the mass loading of chromium should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants present in each waste stream and the mass loading at which they are present should be similar.

Metal Powder Pressing Spent Lubricants. As discussed in Section III, lubricants may be needed in the fabrication step in which

metal powders are compacted in a closed die to produce a final shape. Since none of the plants surveyed reported discharging metal powder pressing spent lubricants, no samples were collected.

Casting Contact Cooling Water. As discussed in Section III, casting may require the use of contact cooling water in order to achieve the desired physical properties of the metal. Since the one plant reporting the use of casting contact cooling water reported complete evaporation, no samples were collected.

Post-Casting Billet Washwater. Refractory metals billets may be washed after casting to remove an oxide layer on the billet formed at the elevated casting temperatures. The one surveyed plant reporting the use of post-casting washwater did not recirculate the water.

No samples of post-casting washwater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to beryllium billet washing wastewater. These two waste streams are generated by using water, without additives, to clean a cast billet. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals post-casting billet washwater should be similar to the mass loading of beryllium in beryllium billet washing wastewater, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical treatments may be applied after the forming of refractory metal products. The surface treatment baths must be periodically discharged after their properties are exhausted.

One sample of surface treatment spent baths was collected. Elevated concentrations of nickel (12.4 mg/1), copper (6.3 mg/1), silver (6.1 mg/1), and TSS (140 mg/1) were detected in the sample.

Surface Treatment Rinsewater. As discussed in Section III, rinsing follows the surface treatment process to prevent the solution from affecting the surface of the metal beyond the desired amount.

Four samples of surface treatment rinsewater were collected from four streams at three plants. Elevated concentrations of aluminum (6.8 mg/1), fluoride (1,018 mg/1), and TSS (80 mg/1) were detected in the samples.

Surface Treatment Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to accompany some operations in order to meet quality standards.

One sample of surface treatment wet air pollution control blowdown was collected. Elevated concentrations of fluoride (130 mg/l) and TSS (150 mg/l) were detected in the sample.

Surface Coating Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to control air pollution from some operations.

No samples of coating wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to surface treatment wet air pollution control blowdown in this subcategory. These two waste streams derive from air pollution control operations used to collect and concentrate airborne contaminants. The contaminants generated by surface coating are expected to be similar to the contaminants generated by other surface treatments. Therefore, the pollutants present in each waste stream, and the mass loading at which they are present, should be similar.

Alkaline Cleaning Spent Baths. As discussed in Section III, alkaline cleaners are formulations of alkaline salts, water, and surfactants. Spent solutions are discharged from alkaline cleaning processes.

No samples of alkaline cleaning spent baths were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning spent baths in the nickel/cobalt subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals alkaline cleaning spent baths should be similar to the mass loading of nickel in nickel alkaline cleaning spent baths, and vice versa. Also, the mass loading of chromium should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Alkaline Cleaning Rinsewater. As discussed in Section III, following alkaline treating, metal parts are rinsed. Rinses are discharged from alkaline cleaning processes.

No samples of alkaline cleaning rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning rinsewater in the nickel/cobalt subcategory. These two waste streams are generated by using water to remove alkaline cleaning solutions from cleaned metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals alkaline cleaning rinsewater should be similar to the mass loading of nickel in nickel alkaline cleaning rinsewater, and vice versa. Also, the mass loading of chromium should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Molten Salt Spent Baths. As discussed in Section III, molten salt baths are used to descale refractory metal alloys. Formed parts to be descaled are immersed in the bath for up to 15 minutes, removed, and water-quenched. Since none of the plants surveyed reported discharging the molten salt spent baths, no samples were collected.

Molten Salt Rinsewater. As discussed in Section III, when molten salt baths are used to descale refractory metal alloys, they are generally followed by a water quench/rinse step.

Four samples of molten salt rinsewater were collected from two streams at one plant. Elevated concentrations of boron (7.0 mg/l), and TSS (285 mg/l) were detected in the samples.

Tumbling/Burnishing Wastewater. As discussed in Section III, tumbling is a controlled method of processing parts to remove burrs, scale, flash, and oxides as well as to improve surface finish. Burnishing is the process of finish sizing or smooth finishing a workpiece (previously machined or ground) by displacement, rather than removal, of minute surface irregularities. Water is used to facilitate tumbling and burnishing.

Five samples of tumbling/burnishing wastewater were collected from three streams at one plant. Elevated concentrations of nickel (35.9 mg/l), copper (4.16 mg/l), aluminum (13.1 mg/l), and TSS (1,860 mg/l) were detected in the samples.

Sawing/Grinding Spent Neat Oils. As discussed in Section III, sawing/grinding operations may use mineral-based oils or heavy grease as the lubricant required to minimize friction and act as a coolant. Normally, saw oils are not discharged as a wastewater stream. Since none of the plants surveyed reported discharging the sawing spent neat oils, no samples were collected.

Sawing/Grinding Spent Emulsions. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant. Oil-in-water emulsions are frequently used to lubricate sawing and grinding operations. The emulsions are usually recycled with in-line filtration to remove swarf and batch discharged periodically as their lubricating properties are exhausted.

No samples of sawing/grinding spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt sawing/grinding spent lubricants in this subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of refractory metals in refractory metals sawing/grinding spent emulsions should be similar to the mass loading of nickel and cobalt in nickel/cobalt sawing/grinding spent emulsions, and vice versa. Also, the mass loading of chromium in this waste stream should be insignificant because refractory metals are seldom alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Sawing/Grinding Contact Lubricant-Coolant Water. As discussed in Section III, a lubricant-coolant is frequently needed during sawing/grinding. Water is one type of lubricant-coolant which may be used.

Two samples of sawing/grinding contact lubricant-coolant water were collected from two streams at two plants. Elevated concentrations of molybdenum (5,470 mg/l), iron (13.0 mg/l), and TSS (310 mg/l) were detected in the samples.

Sawing/Grinding Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to accompany some operations in order to meet quality standards.

No samples of sawing/grinding wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to surface treatment wet air pollution control blowdown in this subcategory. These two waste streams derive from air pollution control operations used to collect and concentrate airborne contaminants. Since sawing/grinding operations are expected to generate more airborne particulates than surface treatment, the mass loading of total suspended solids is expected to be higher in sawing/grinding wet air pollution control blowdown than in surface treatment wet air pollution control blowdown. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Post-Sawing/Grinding Rinsewater. As discussed in Section III, the formed metals may be rinsed following sawing/grinding to remove the lubricants and saw chips for reprocessing.

No samples of post-sawing/grinding rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to sawing/grinding contact lubricant-coolant water in this subcategory. Since the pollutants in each of these waste streams are generated from sawing and grinding operations, the pollutants present in each waste stream and the mass loading at which they are present should be similar.

Product Testing Wastewater. As described in Section III, testing operations are used to check nonferrous metals parts for surface defects or subsurface imperfections. Testing operations are sources of wastewater because the spent water bath or test media must be periodically discarded due to the transfer into the testing media of oil and grease, solids, and suspended and dissolved metals from each product tested.

One sample of product testing wastewater was collected during the screen sampling program. Elevated concentrations of nickel (1.6 mg/l), oil and grease (72 mg/l), and total suspended solids (22 mg/l) were detected in the sample.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process

wastewater, because they use only noncontact cooling water or because they use no water at all:

Powder Metallurgy Operations (Pressing, Sintering)
Annealing
Soldering
Welding
Screening
Blending
Straightening
Blasting

Zirconium/Hafnium Forming Subcategory

Drawing Spent Lubricants. As discussed in Section III, a suitable lubricant is required to ensure uniform drawing temperatures and avoid excessive wear on the dies and mandrels used. A wide variety of lubricants can be used.

Since none of the plants surveyed reported discharging the drawing spent lubricants, no samples were collected.

Extrusion Spent Emulsions. As discussed in Section III, the extrusion process requires the use of a lubricant to prevent adhesion of the metal to the die and ingot container walls.

No samples of extrusion spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt rolling spent emulsions. These two waste streams are generated from operations which use similar process chemicals for similar purposes (lubrication). The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium extrusion spent emulsions should be similar to the mass loading of nickel/cobalt in nickel/cobalt rolling spent emulsions, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Extrusion Press Hydraulic Fluid Leakage. As discussed in Section III, due to the large force applied by a hydraulic press, hydraulic fluid leakage is unavoidable.

No samples of extrusion press hydraulic fluid leakage were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt forging, extrusion, and isostatic press hydraulic fluid leakage. The pollutants present in these two waste streams are attributable to the hydraulic fluid used, not

the metal formed. Therefore, the pollutants present, and the concentration (mg/l) at which they are present, should be similar.

Extrusion Heat Treatment Contact Cooling Water. As discussed in Section III, heat treatment is frequently used after extrusion to attain the desired mechanical properties in the extruded metal. Contact cooling water may be sprayed onto the metal as it emerges from the die or press, or be contained in a bath for direct quenching.

No samples of extrusion heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt extrusion press and solution heat treatment contact cooling water. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium extrusion press and solution heat treatment contact cooling water should be similar to the mass loading of nickel/cobalt in nickel/cobalt extrusion press and solution heat treatment contact cooling water, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Tube Reducing Spent Lubricants. As discussed in Section III, tube reducing, much like rolling, may require a lubricating compound in order to prevent excessive wear of the tube reducing equipment, prevent adhesion of metal to the tube reducing equipment, and maintain a suitable and uniform tube reducing temperature.

No samples of tube reducing spent lubricants were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt tube reducing spent lubricants. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium tube reducing spent lubricants should be simlar to the mass loading of nickel/cobalt in nickel/cobalt tube reducing spent lubricants, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Forging Solution Heat Treatment Contact Cooling Water. As discussed in Section III, forging dies may require cooling such that the proper die temperature is maintained between forgings.

No samples of forging solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt extrusion press and solution heat treatment contact cooling water. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium forging solution heat treatment contact cooling water should be similar to the mass loading of nickel/cobalt in nickel/cobalt extrusion press and solution heat treatment contact cooling water, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical treatments may be applied after the forming of zirconium/hafnium products including pickling and coating. The surface treatment baths must be periodically discharged after their properties are exhausted.

Two samples of forging surface treatment spent baths were collected from two streams at one plant. Elevated concentrations of antimony (5.5 mg/l), cyanide (0.273 mg/l), chromium (18 mg/l), fluoride (11,800 mg/l), and ammonia (392.5 mg/l) were detected in the samples.

Surface Treatment Rinsewater. As discussed in Section III, rinsing follows the surface treatment process to prevent the solution from affecting the surface of the metal beyond the desired amount.

No samples of surface treatment rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to surface treatment spent baths in this subcategory. As a zirconium or hafnium piece is removed from a surface treatment bath, it carries a small volume of the bath with it. The rinsewater used to remove the carried over bath solution from the formed metal piece will contain the same pollutants as the bath, only in lower concentration. Therefore, the pollutants present in zirconium/hafnium surface treatment rinsewater are expected to be identical to the pollutants present in zirconium/hafnium surface treatment baths, except that the mass loadings of the pollutants are expected to be lower.

Alkaline Cleaning Spent Baths. As discussed in Section III, alkaline cleaners are formulations of alkaline salts, water, and surfactants. Spent solutions are discharged from the alkaline cleaning processes.

No samples of alkaline cleaning spent baths were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt alkaline cleaning spent baths. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium alkaline cleaning spent baths should be similar to the mass loading of nickel/cobalt in nickel/cobalt alkaline cleaning spent baths, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Alkaline Cleaning Rinsewater. As discussed in Section III, following alkaline cleaning, metal parts are rinsed. Rinses are discharged from alkaline cleaning processes.

No samples of alkaline cleaning rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt alkaline cleaning rinsewater. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium alkaline cleaning rinsewater should be similar to the mass loading of nickel/cobalt in nickel/cobalt alkaline cleaning rinsewater, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Sawing/Grinding Spent Lubricants. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant.

No samples of sawing/grinding spent lubricants were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt sawing/grinding spent lubricants. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium sawing/grinding spent lubricants should be similar to the mass loading of nickel/cobalt in nickel/cobalt sawing/grinding spent lubricants, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Sawing/Grinding Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to control air pollution from some operations. Scrubbers are frequently necessary over sawing/grinding operations where particulates are a problem.

Since none of the plants surveyed reported discharging the sawing/grinding wet air pollution control blowdown, no samples were collected.

Degreasing Spent Baths. As discussed in Section III, immersion-vapor degreasing is used to clean metal parts coated with large quantities of oil, grease, or hard-to-remove soil. Solvents used are the same as those used in straight vapor degreasing. Solutions of organic solvent in water are also used for degreasing.

Since none of the plants surveyed reported discharging the degreasing spent baths, no samples were collected.

Degreasing Rinsewater. As discussed in Section III, it is sometimes necessary to rinse degreased parts with water to meet certain product specifications.

No samples of degreasing rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to nickel/cobalt alkaline cleaning rinsewater. These two waste streams are generated from rinsing formed parts which have been cleaned or degreased. Each rinsewater will contain the same process chemicals as the bath which it follows, plus contaminants introduced into the bath by the cleaned or degreased metal piece. Degreasing rinsewater may contain organic pollutants at low mass loading; nickel/cobalt alkaline cleaning rinsewater will not. In addition, the two waste streams will differ in metals present. The mass loading (mg/kkg) of zirconium/hafnium in zirconium/hafnium degreasing rinesewater should be similar to the mass loading of nickel/cobalt in nickel/cobalt alkaline cleaning rinsewater, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater, because they use only noncontact cooling water or because they use no water at all:

Rolling
Casting
Annealing
Shot Blasting

Grit Blasting
Bead Blasting
Polishing
Straightening
Cutting, Trimming
Deburring, Sanding

Magnesium Forming Subcategory

Rolling Spent Emulsions. As discussed in Section III, oil-in-water emulsions are used in rolling operations as coolants and lubricants. Rolling emulsions are typically recycled using in-line filtration treatment.

Since none of the plants surveyed reported wastewater discharge values for rolling spent em lsions, no samples were collected.

Forging Spent Lubricants. As discussed in Section III, either water, oil, or granulated carbon can be applied to forging dies for proper lubrication. Since none of the plants surveyed reported wastewater discharge values for forging spent lubricants, no samples were collected.

Forging Solution Heat Treatment Contact Cooling Water. As discussed in Section III, solution heat treatment is implemented after forging to improve mechanical properties by maximizing the concentration of hardening contaminants in solid solution. Solution heat treatment typically involves significant quantities of contact cooling water.

No samples of forging solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to extrusion press and solution heat treatment contact cooling water in the lead/tin/bismuth subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of magnesium in magnesium forging solution heat treatment contact cooling water should be similar to the mass loading of lead in lead/tin/bismuth extrusion press and solution heat treatment contact cooling water, and vice versa. Also, there should be no significant mass loading of antimony in magnesium forging solution heat treatment contact cooling water because magnesium is not commonly alloyed with antimony. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Forging Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to

control air pollution from some operations. For instance, scrubbers may be necessary when particulates and smoke are generated from the partial combustion of oil-based lubricants as they contact the hot forging dies.

No samples of forging wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to wet air pollution control blowdown in the nickel/cobalt forming subcategory. These two waste streams derive from air pollution control devices used to collect and concentrate airborne contaminants, both gaseous and particulate. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of magnesium in magnesium forging wet air pollution control blowdown should be similar to the mass loading of nickel in nickel wet air pollution control blowdown, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Forging Equipment Cleaning Wastewater. As discussed in Section III, forging equipment should be periodically cleaned in order to prevent the excessive buildup of oil, grease, and caked-on solid lubricants on the forging die.

No samples of forging equipment cleaning wastewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to alkaline cleaning rinsewater in the lead/tin/bismuth subcategory. These two waste streams are generated by cleaning operations which use similar process chemicals. Since granulated coal and graphite suspensions are frequently used to lubricate magnesium forging operations, magnesium forging equipment cleaning wastewater may contain higher mass loadings of total suspended solids. In addition, the metals present in the two waste streams should differ. The mass loading (mg/kkg) of magnesium in magnesium forging equipment cleaning wastewater should be similar to the mass loading of lead in lead/tin/bismuth alkaline cleaning rinsewater, and vice versa. Also, there should be no significant concentration of antimony in magnesium forging equipment cleaning wastewater because magnesium is not commonly alloyed with antimony. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Direct Chill Casting Contact Cooling Water. As discussed in Section III, contact cooling water is a necessary part of direct chill casting. The cooling water may be contaminated by lubricants applied to the mold before and during the casting process. The one plant reporting the use of direct chill casting contact cooling water discharges no water, therefore no samples of this waste stream were collected.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical treatments may be applied after the forming of magnesium products. The surface treatment baths must be periodically discharged after their properties are exhausted.

Three samples of surface treatment spent baths were collected from three streams at one plant. Elevated concentrations of magnesium (9,150 mg/l), chromium (28,000 mg/l), zinc (89.0 mg/l), aluminum (64 mg/l), ammonia (97 mg/l), oil and grease (47,000 mg/l), and TSS (160 mg/l) were detected in the samples.

Surface Treatment Rinsewater. As discussed in Section III, rinsing follows the surface treatment process to prevent the solution from affecting the surface of the metal beyond the desired amount.

Twelve samples of surface treatment rinsewater were collected from eight streams at one plant. Elevated concentrations of magnesium (148 mg/l), zinc (2.1 mg/l), chromium (516 mg/l), ammonia (81 mg/l), oil and grease (16 mg/l), and TSS (97 mg/l) were detected in the samples.

Sawing/Grinding Spent Lubricants. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant. Since none of the plants surveyed reported wastewater discharge values for sawing/grinding spent lubricants, no samples of this waste stream were collected.

Sanding and Repairing Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to control air pollution from some operations. For instance, scrubbers are frequently necessary over sanding and repairing operations where particulates are a problem.

No samples of sanding and repairing wet air pollution control blowdown were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to shot blaster wet air pollution control blowdown in the nickel/cobalt subcategory. These two waste streams derive from air pollution control devices used to collect and concentrate airborne particulates. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of magnesium in mangesium sanding and repairing wet air pollution control blowdown should be similar to the mass loading of nickel in nickel shot blaster wet air pollution control blowdown, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater, because they use only noncontact cooling water or because they use no water at all:

Extrusion
Shot Blasting
Powder Atomization
Screening
Turning

Uranium Forming Subcategory

Extrusion Spent Lubricants. As discussed in Section III, the extrusion process requires the use of a lubricant to prevent adhesion of the metal to the die and ingot container walls.

Since none of the plants surveyed reported wastewater discharge values for extrusion spent lubricants, no samples were collected.

Extrusion Tool Contact Cooling Water. As discussed in Section III, following an extrusion, the dummy block drops from the press and is cooled before being used again. Water is sometimes used to quench the extrusion tools.

No samples of extrusion tool contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to

forging die contact cooling water in the nickel/cobalt subcategory. These two waste streams are generated by using water, without added process chemicals, to cool metal forming equipment. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of uranium in uranium extrusion tool contact cooling water should be similar to the mass loading of nickel in nickel/cobalt forging die contact cooling water, and vice versa. Also, there should be no significant mass loading of chromium in uranium extrusion tool contact cooling water because uranium is not commonly alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Extrusion Press and Solution Heat Treatment Contact Cooling Water. As discussed in Section III, heat treatment is frequently used after extrusion to attain the desired mechanical properties in the extruded metal. Contact cooling of the extrusion can be accomplished in one of three ways: with a water spray near the die, by immersion in a water tank adjacent to the runout table, or by passing the metal through a water mill.

No samples of extrusion solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to extrusion press and solution heat treatment contact cooling water in the nickel/cobalt subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of uranium in uranium extrusion press and solution heat treatment contact cooling water should be similar to the mass loading of nickel in nickel extrusion press and solution heat treatment contact cooling water, and vice versa. Also, there should be no significant mass loading of chromium in uranium extrusion press and solution heat treatment contact cooling water because uranium is not commonly alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Forging Spent Lubricants. As discussed in Section III, proper lubrication of the dies is essential in forging nonferrous metals. A colloidal graphite lubricant is commonly sprayed onto the dies for this purpose.

Since none of the plants surveyed reported wastewater discharge values for forging spent lubricants, no samples were collected.

Forging Solution Heat Treatment Contact Cooling Water. As discussed in Section III, forging dies may require cooling to maintain the proper die temperature between forgings.

No samples of forging solution heat treatment contact cooling water were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to extrusion press and solution heat treatment contact cooling water in the nickel/cobalt subcategory. These two waste streams are generated by using water, without additives, to cool hot metal. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of uranium in uranium extrusion press and solution heat treatment contact cooling water should be similar to the mass loading of nickel in nickel extrusion press and solution heat treatment contact cooling water, and vice versa. Also, the mass loading of chromium in uranium forging solution heat treatment contact cooling water should be insignificant because uranium is not commonly alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Surface Treatment Spent Baths. As discussed in Section III, a number of chemical treatments may be applied after forming uranium products. The surface treatment baths must be periodically discharged after their properties are exhausted.

No samples of surface treatment spent baths were collected during the screen sampling program. However, one plant supplied a partial analysis of its spent surface treatment baths on its dcp. Elevated concentrations of uranium (266,162 mg/l), titanium (3,353 mg/l), magnesium (246 mg/l), fluoride (231 mg/l), and barium (1,272 mg/l) were reported.

Surface Treatment Rinsewater. As discussed in Section III, rinsing should follow the surface treatment process to prevent the solution from affecting the surface of the metal beyond the desired amount.

No samples of surface treatment rinsewater were collected during the screen sampling program. However, one plant supplied a partial analysis of surface treatment rinsewater on its dcp. Elevated concentrations of uranium (1,250 mg/l), titanium (18 mg/l), and barium (41 mg/l) were reported.

Surface Treatment Wet Air Pollution Control Blowdown. As discussed in Section III, wet air pollution control devices are needed to control air emissions from some operations in order to meet air quality standards. Scrubbers are frequently needed to control acid fumes from surface treatment operations.

No samples of surface treatment wet air pollution control blowdown were collected during the screen sampling program. However,

the Agency believes that this stream will have wastewater characteristics similar to surface treatment wet air pollution control blowdown in the titanium forming subcategory. These two waste streams derive from air pollution control devices used to collect and concentrate acid fumes. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of uranium in uranium surface treatment wet air pollution control blowdown should be similar to the mass loading of titanium in titanium surface treatment wet air pollution control scrubber blowdown, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Sawing/Grinding Spent Emulsions. As discussed in Section III, sawing/grinding operations generally require a lubricant in order to minimize friction and act as a coolant. The emulsions are typically recirculated, with in-line filtration to remove swarf, and periodically batch discharged as the lubricating properties are exhausted.

No samples of sawing/grinding spent emulsions were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to sawing/grinding spent lubricants in the nickel/cobalt subcategory. These two waste streams are generated by identical physical processes which use similar process chemicals. The only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of uranium in uranium sawing/grinding spent emulsions should be similar to the mass loading of nickel in nickel sawing/grinding spent emulsions, and vice versa. Also, the mass loading of chromium in uranium sawing/grinding spent emulsions should be insignificant because uranium is not commonly alloyed with chromium. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Post-Sawing/Grinding Rinsewater. As discussed in Section III, following the sawing/grinding operations, the lubricant and particulates occasionally need to be rinsed off the formed metal.

No samples of post-sawing/grinding rinsewater were collected during the screen sampling program. However, the Agency believes that this stream will have wastewater characteristics similar to sawing/grinding contact lubricant-coolant water in the refractory metals subcategory. These waste streams are both derived from sawing/grinding operations, so the only difference between the wastewater characteristics of the two streams should be the metals present. The mass loading (mg/kkg) of uranium in uranium post-sawing/grinding rinsewater should be similar to the mass loading of refractory metals in refractory metals sawing/grinding

contact lubricant-coolant water, and vice versa. The other pollutants in each waste stream, and the mass loading at which they are present, should be similar.

Degreasing Spent Solvents. As described in Section III, solvent cleaners are used to remove lubricants (oils and greases) applied to the surface of nonferrous metals during mechanical forming operations. Basic solvent cleaning methods include straight vapor degreasing, immersion-vapor degreasing, spray-vapor degreasing, ultrasonic vapor degreasing, emulsified solvent degreasing, and cold cleaning.

Solvents most commonly used for all types of vapor degreasing are trichloroethylene, 1,1,1-trichloroethane, methylene chloride, perchloroethylene, and various chlorofluorocarbons. Solvent selection depends on the required process temperature (solvent boiling point), product dimension, and metal characteristics. Contaminated vapor degreasing solvents are frequently recovered by distillation. The sludge residue generated is toxic and may be flammable, requiring appropriate handling and disposal procedures.

Since none of the plants surveyed reported discharging the vapor degreasing spent solvents, no samples were collected.

Operations Which Do Not Use Process Water. The Agency proposes a discharge allowance of zero for operations which do not generate process wastewater. The following operations generate no process wastewater, because they use only noncontact cooling water or because they use no water at all:

Stationary Casting
Direct Chill Casting
Salt Solution Heat Treatment

Table V-1

NUMBER OF SAMPLES PER WASTE STREAM, BY SUBCATEGORY

Waste Stream	Lead/Tin/Bismuth	Nickel/Cobalt	Zinc	Beryllium	Precious Metals	Iron/Copper/Aluminum	Titanium	Refractory Metals	Zirconium/Hafnium	Magnesium	Uranium	Total
Rolling spent neat oils		*	*				*	*				0
Rolling spent emulsions	1	12	*		1			*		*		14
Rolling contact lubricant-coolant water		1	*				*					1
Rolling spent soap solutions	*											0
Rolling solution heat treatment contact cooling water		*			*							0
Drawing spent neat oils	*	*			*							0
Drawing spent emulsions	*	*	*		1							1
Drawing spent lubricants							*	*				0
Drawing spent soap solutions	*				*							0
Extrusion spent emulsions								*				0
Extrusion spent lubricants		*					*				*	0
Extrusion press and solution heat treatment contact cooling water	1	1			*			*	*		*	2
Extrusion and forging press hydraulic fluid leakage	*	4					1	*				5
Extrusion tool contact cooling water											*	0
Forging, swaging spent neat oils		*										0
Forging, swaging spent emulsions	*											0
Forging spent lubricants							*	*		*	*	0
Forging solution heat treatment contact cooling water							*	*	*	*	*	0
Forging die contact cooling water		1					*					1
Forging wet air pollution control blowdown							*			*		0
Forging equipment cleaning wastewater		*						*		*		0
Pressing spent lubricants								*				0
Tube reducing spent lubricants		1							*			1
Metal powder production wet atomization wastewater		1			*	*						1
Metal powder production milling wastewater					*	*						0
Metal powder production wet air pollution control blowdown						*		*				0
Metal powder production wastewater								*				0
Continuous strip casting contact cooling water	1											1
Semi-continuous ingot casting contact cooling water	2											2
Direct chill casting contact cooling water			*		*					*		0
Shot casting contact cooling water	3				2							5
Casting contact cooling water								*				0

Table V-1 (Continued)

NUMBER OF SAMPLES PER WASTE STREAM, BY SUBCATEGORY

Waste Stream	Lead/Tin/Bismuth	Nickel/Cobalt	Zinc	Beryllium	Precious Metals	Iron/Copper/Aluminum	Titanium	Refractory Metals	Zirconium/Hafnium	Magnesium	Uranium	Total
Post-casting billet washwater							*					0
Stationary and direct chill casting contact cooling water		*										0
Stationary casting contact cooling water			*		*							0
Semi-continuous and continuous casting contact cooling water					1							1
Casting vacuum melting steam condensate		1										1
Casting wet air pollution control blowdown					*							0
Post-casting washwater							*					0
Solution heat treatment contact cooling water		2	*		*		*					2
Surface treatment spent baths		5	*	1	*		2	1	2	3	*	14
Surface treatment rinsewater		23	1	2	4		7	4	*	12	*	53
Ammonia rinsewater		1										1
Surface treatment wet air pollution control blowdown							1	1			*	2
Coating wet air pollution control blowdown								*				0
Alkaline cleaning spent baths	1	3	*		*		*	*	*			4
Alkaline cleaning rinsewater	4	4	1		*		*	*	*			9
Prebonding cleaning wastewater					8							8
Molten salt spent baths		*						*				0
Molten salt rinsewater		7						4				11
Tumbling, milling, burnishing wastewater					4	10	1	5				20
Sawing/grinding spent emulsions					1			*			*	1
Sawing/grinding lubricant-coolant water								2				2
Sawing/grinding spent lubricants		10	*	1		2	1		*	*		14
Sawing/grinding spent neat oils								*				0
Sawing/grinding wet air pollution control blowdown							*	*		*		0
Post-sawing, grinding rinsewater								*			*	0
Hydrostatic tube testing wastewater		*										0
Inspection, testing wastewater				1								1
Product testing wastewater								1				1
Shot-forming wet air pollution control blowdown	*											0
Steam cleaning condensate		*										0
Billet washing wastewater				2								2
Area cleaning wastewater				*								0
Pressure bonding contact cooling water					1							1

Table V-1 (Continued)

NUMBER OF SAMPLES PER WASTE STREAM, BY SUBCATEGORY

Waste Stream	Lead/Tin/Bismuth	Nickel/Cobalt	Zinc	Beryllium	Precious Metals	Iron/Copper/Aluminum	Titanium	Refractory Metals	Zirconium/Hafnium	Magnesium	Uranium	Total
Sizing spent lubricants					*							0
Steam treatment wet air pollution control blowdown					3							3
Oil-resin impregnation wastewater					*							0
Miscellaneous nondescript wastewater	*	*										0
Degreasing spent solvents	*	*	*	*	*	*	*	*	*	*	*	0
Wet air pollution control blowdown		3										3
Degreasing rinsewater								*				0

*This waste stream was reported in dcp responses for plants in this subcategory, but no raw wastewater samples were analyzed.

**Number of samples of this waste stream analyzed.

Table V-2

SAMPLE ANALYSIS LABORATORIES

Laboratory	Pollutants Analyzed			
	Organics	Metals	Conventional	Nonconventional
ARO, Inc.; Tullahoma, TN			X	X
Arthur D. Little; Cambridge, MA	X			
CENTEC; Salem, VA		X		
ERCO; Cambridge, MA	X			
IT Analytical Services; Knoxville, TN	X			
Radian Corp.; Austin, TX		X	X	X
S-Cubed; San Diego, CA	X			
Versar, Inc.; Springfield, VA		X		
West Coast Technical Service, Inc.; Cerritos, CA	X			
NUS Corp.; Pittsburgh, PA		X	X	X

Table V-3

NONTOXIC POLLUTANTS

Conventional

total suspended solids (TSS)
oil and grease
pH

Nonconventional

acidity
alkalinity
aluminum
ammonia nitrogen
barium
boron
calcium
chemical oxygen demand (COD)
chloride
cobalt
fluoride
iron
magnesium
manganese
molybdenum
phenolics
phosphate
sodium
sulfate
tin
titanium
total dissolved solids (TDS)
total organic carbon (TOC)
total solids (TS)
vanadium
yttrium

Table V-4

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
LEAD/TIN/BISMUTH FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Antimony (mg/l)	Lead (mg/l)
Rolling spent emulsions*	270	480	7.92	<0.003	29
Extrusion press and solution heat treatment contact cooling water*	3	5	7.60	<0.003	0.13
Continuous strip casting contact cooling water*	6	8	8	N/A**	1.2
Semi-continuous ingot casting contact cooling water	<1-4	<1-80	7.82-8.20	0.180-0.290	0.850-1.100
Shot casting contact cooling water	9-22	210-420	8.82-9.20	2.80-3.30	15.6-52.2
Alkaline cleaning spent baths*	600	560	8.31	7.30	183
Alkaline cleaning rinsewater	5-13	<1-260	9.21-10.0	0.440-1.100	8.850-40.8

*Only one sample value available.

**Pollutant not analyzed.

Table V-5

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
NICKEL/COBALT FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Chromium (mg/l)	Nickel (mg/l)	Fluoride (mg/l)
Rolling spent emulsions	37-2,600	25-6,800	5.63-7.73	<0.100-5.200	0.180-34.2	1.1-10.2
Rolling contact lubricant-coolant water*	22	63	8.50	0.024	0.067	2,000
Tube reducing spent lubricant*	200,000	<1	6.10	0.680	58.0	N/A**
Extrusion press and solution heat treatment contact cooling water*	7	3.0	7.39	0.130	0.140	0.83
Forging, extrusion, and isostatic press hydraulic fluid leakage	17-420	33.0-500	6.12-6.91	<0.100-0.19	<0.100-1.300	0.39-0.97
Forging die contact cooling water*	<1	1,800	7.63	0.69	16	0.81
Metal powder production atomization wastewater	<1-22	<1-63	5.54-8.50	1.0*	0.42*	11*
Annealing solution heat treatment contact cooling water	7-40	33-78	7.00-7.37	<0.10-<0.100	0.49-6.800	0.43-9.6
Casting vacuum melting steam condensate*	6	4.3	6.20	<0.100	<0.100	1.7
Surface treatment spent baths	<1-170	340-920	0.89-12.80	38.00-940.00	0.1-193,000	1.9-94,000
Surface treatment rinsewater	<1-130	3.3-760	2.33-8.70	<0.100-18.80	0.300-364	0.26-91

Table V-5 (Continued)

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
NICKEL/COBALT FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Chromium (mg/l)	Nickel (mg/l)	Fluoride (mg/l)
Molten salt rinsewater	<1-38	21-4,200	10.19-12.84	10.4-1,100	<0.100-14	0.49-740
Ammonia rinse wastewater	<1	9,000	7.90	108	456	1.5
Wet APC blowdown	<1-3	<1-15	2.63-8.14	0.10-0.14	0.24-0.86	0.61-700
Alkaline cleaning spent baths	22-49	640-4,000	2.30-9.52	1.0-0.410	4.8-122	0.43-7.7
Alkaline cleaning rinsewater	<1-26	8.6-190	6.65-9.02	<0.100-0.270	0.050-5.580	1.0-1.8
Sawing/grinding spent lubricants	3-16,000	46-2,440	7.20-8.54	<0.100-24.00	0.870-116	1.2-720

*Only one sample value available.

Table V-6

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
ZINC FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Chromium (mg/l)	Cyanide (mg/l)	Zinc (mg/l)
Alkaline cleaning rinsewater*	23	90	7.55	<0.020	1.3	1.12
Surface treatment rinsewater*	<1	20	5.72	0.160	0.03	42.3

*Only one sample value available.

Table V-7

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
BERYLLIUM FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Beryllium (mg/l)	Copper (mg/l)	Cyanide (mg/l)	Fluoride (mg/l)
Billet washing wastewater	<1*	55-160	8.67-8.73	5.8-82	0.43-0.75	<0.01-0.10	1.2-6.8
Sawing/grinding spent lubricants*	21,000	19	9.39	17	1.5	1.1	1.6
Inspection/testing wastewater*	<1	<1	5.58	0.099	0.36	<0.02	0.22
Surface treatment spent baths*	<1	240	0.32	15,000	0.18	0.04	79,000
Surface treatment rinsewater	<1-4	<1-18	2.01-5.36	17-35	0.81-6.1	<0.02-0.09	0.89-12

*Only one sample value available.

Table V-8

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
PRECIOUS METALS FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Cadmium (mg/l)	Copper (mg/l)	Cyanide (mg/l)	Silver (mg/l)
Pressure bonding contact cooling water*	10	4	7.90	0.060	7.85	<0.02	0.050
Tumbling wastewater	<1-40	10-110	2.52-8.70	0.060-0.720	5.10-142	<0.02-0.08	0.070-0.220
Alkaline cleaning prebonding cleaning wastewater	<1-16	<1-400	2.30-7.90	<0.020-0.420	0.600-5.95	<0.02-0.28	<0.010-0.100
Surface treatment rinsewater	<1-8	<1-3,000	1.30-2.50	<0.020-11.1	1.80-60.6	<0.02*	<0.010-6.70
Shot casting contact cooling water	<1-54	<1-91	6.34-6.70	0.040-9.88	0.500-0.600	<0.02*	0.040-0.050
Rolling spent emulsions*	1,500	500	8.70	0.200	25.0	<0.02	0.130
Drawing spent emulsions*	33,000	<1	8.20	<0.020	46.4	0.02	0.090
Sawing/grinding spent emulsions*	500	<1	7.50	0.020	0.550	0.02	<0.010
Semi-continuous and continuous casting contact cooling water*	6	43	6.30	0.020	0.100	0.50	0.010

*Only one sample value available.

Table V-9

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND METAL POWDER METALLURGY SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Copper (mg/l)	Cyanide (mg/l)	Lead (mg/l)	Aluminum (mg/l)	Iron (mg/l)
Tumbling, burnishing, and cleaning wastewater	4-2,100	49-3,000	6.20-9.60	<0.050-253	0.02-1.8	<0.050-45.1	0.200-34.3	0.100-211
Sawing/grinding spent lubricants	2-720	92-120	2.80-9.13	<0.500-1.55	<0.02-2.5	0.200-<0.500	1.60-7.00	16.2-176
Steam treatment wet APC blowdown	31-42	15-200	5.81-6.21	<0.050*	<0.02-0.13	<0.050*	0.200-0.300	0.050-0.100

*Only one sample value available.

Table V-10

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
TITANIUM FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Cyanide (mg/l)	Lead (mg/l)	Zinc (mg/l)	Ammonia (mg/l)	Fluoride (mg/l)	Titanium (mg/l)
Surface treatment rinsewater	N/A**	<1-66	0.53-6.90	<0.02*	0.050-5.90	<0.020-0.660	1.7-52	1.1-215	3.55-186
Surface treatment spent baths	N/A**	480-3,360	1.80-2.20	N/A**	65.0-214	<2.0-166	N/A**	74,000-98,000	27,900-60,300
Surface treatment wet APC blowdown*	N/A**	40	9.81	N/A**	0.100	0.300	0.15	33	2.75
Grinding, sawing spent lubricants*	34	244	10.30	3.8	<0.500	0.400	3.8	110	6.00
Tumbling wastewater*	17	6,800	10.50	4.1	22.0	0.800	34	110	156

*Only one sample value available.

**No data available.

Table V-11

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
REFRACTORY METALS FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Copper (mg/l)	Nickel (mg/l)	Fluoride (mg/l)	Molybdenum (mg/l)
Surface treatment spent baths*	<1	140	0.80	6.300	12.4	0.27	0.050
Surface treatment rinse-water	<1-6	8.0-140	1.50-2.10	0.035-0.400	0.016-10.2	1.1-3,000	<0.050-5.2
Surface treatment wet APC blowdown*	<1	150	6.60	0.050	<0.050	130	<0.050
Molten salt cleaning rinse-water	<1*	130-540	11.80-11.90	0.050*	<0.050-<0.200	0.65-0.82	<0.050-<5.00
Tumbling/burnishing waste-water	<1-1.3	200-2,700	6.40-10.00	<0.100-8.65	<0.100-103	0.78-2.2	<0.050-4.45
Sawing/grinding contact lubricant-coolant water	2.9-7.3	240-380	5.7-6.40	0.050-0.21	<0.050-1.0	1.5*	<0.100-5,470
Extrusion press hydraulic fluid leakage*	44,000	19,000	8.5	21	0.44	N/A**	20
Product testing wastewater*	72	22	7.5	0.28	1.6	N/A**	0.50

*Only one sample value available.

**Pollutant not analyzed.

Table V-12

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Chromium (mg/l)	Cyanide (mg/l)	Zinc (mg/l)	Ammonia (mg/l)	Fluoride (mg/l)
Surface treatment spent baths	1.87-83.7	8.70-12.6	<1-3.9	12-24	0.118-0.356	0.17-7.5	104-681	6,500-17,100

Table V-13

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN SAMPLED WASTE STREAMS
MAGNESIUM FORMING SUBCATEGORY

Waste Stream	Oil and Grease (mg/l)	Total Suspended Solids (mg/l)	pH	Chromium (mg/l)	Zinc (mg/l)	Ammonia (mg/l)	Fluoride (mg/l)	Magnesium (mg/l)
Surface treatment rinsewater	<1-26	5-210	4.60-10.50	<0.020-516	0.020-8.42	0.1-81	0.27-2.1	1.80-4,500
Surface treatment spent baths	<1->100,000	70-270	0.80-12.60	0.350-83,600	8.00-138	0.3-97	1.6-126	<1.00-12,700

Table V-14

CONCENTRATION RANGE OF REGULATED POLLUTANTS IN WASTE STREAMS*
URANIUM FORMING SUBCATEGORY

Waste Stream	Uranium (mg/l)	Titanium (mg/l)	Magnesium (mg/l)	Fluoride (mg/l)	Barium (mg/l)
Surface treatment spent baths**	266,162	3,353	246	231	1,272
Surface treatment rinsewater	1,250	18	7	3	41

*Data reported in plant dcp response.

**Average concentrations.

Table V-15

RESULTS OF CHEMICAL ANALYSES OF SAMPLED
LEAD AND NICKEL EXTRUSION PRESS AND SOLUTION HEAT TREATMENT
CONTACT COOLING WATER

Parameter	Lead (mg/l)	Nickel (mg/l)	Treatment Effectiveness LS&F Technology (mg/l)*
Oil and grease	3	7	10
TSS	5	3	2.6
pH	7.6	7.4	
Antimony	--**	--	0.47
Arsenic	--	--	0.34
Beryllium	0.001	--	0.20
Cadmium	0.005	--	0.049
Chromium	--	--	0.07
Copper	0.024	0.05	0.39
Lead	0.13	--	0.08
Nickel	0.007	0.14	0.22
Silver	--	--	0.07
Zinc	--	0.07	0.23
Cyanide	0.08	--	0.047
Acidity	--	--	
Alkalinity	170	55	
Aluminum	--	--	1.49
Ammonia	0.08	0.13	32.2
Fluoride	0.22	0.83	9.67
Iron	0.023	--	0.28
Magnesium	--	--	
Sulfate	--	--	
Titanium	0.084	--	
Total dissolved solids	--	--	

*From Table VII-9.

**--Not detected or not detected above concentration detected in source water.

Table V-16

RESULTS OF CHEMICAL ANALYSES OF SAMPLED
LEAD, NICKEL, AND PRECIOUS METALS ROLLING SPENT EMULSIONS

Parameter	Lead (mg/l)	Nickel (mg/l)	Precious Metals (mg/l)	Treatment Effectiveness LS&F Technology (mg/l)*
Oil and grease	270	1,095	1,500	10
TSS	480	191	500	2.6
pH	7.92	6.77	8.7	
Antimony	--**	--	--	0.47
Arsenic	--	0.006	--	0.34
Beryllium	--	--	--	0.20
Cadmium	--	0.02	0.2	0.049
Chromium	--	1.27	--	0.07
Copper	0.25	1.17	25.0	0.39
Lead	29.0	1.06	1.00	0.08
Nickel	0.003	8.95	1.00	0.22
Silver	--	0.002	0.13	0.07
Zinc	1.4	1.95	6.00	0.23
Cyanide	--	--	--	0.047
Acidity	--	--	20	
Alkalinity	310	--	2,100	
Aluminum	0.35	--	--	1.49
Ammonia	0.15	0.83	0.4	32.2
Fluoride	0.82	2.70	0.29	9.67
Iron	7.3	20.86	26.5	0.28
Magnesium	--	--	--	
Sulfate	59	--	8,500	
Total dissolved solids	1,020	2,040	32,000	
Chemical oxygen demand	15,000	17,584	900	
Total organic carbon	1,700	1,203	43	

*From Table VII-9.

**--Not detected or not detected above concentration detected in source water.

Section VI

SELECTION OF POLLUTANT PARAMETERS

The Agency has studied nonferrous metals forming wastewaters to determine the presence or absence of toxic, conventional, and selected nonconventional pollutants. The toxic and nonconventional pollutants are subject to BPT and BAT effluent limitations, as well as NSPS, PSES, and PSNS. The conventional pollutants are subject to BPT and BCT effluent limitations, as well as NSPS.

One hundred and twenty-nine toxic pollutants (known as the 129 priority pollutants) were studied pursuant to the requirements of the Clean Water Act of 1977 (CWA). These pollutant parameters, which are listed in Table VI-1, are members of the 65 pollutants and classes of toxic pollutants referred to as Table 1 in Section 307(a)(1) of the CWA.

From the original list of 129 pollutants, three pollutants have been deleted in two separate amendments to 40 CFR Subchapter N, Part 401. Dichlorodifluoromethane and trichlorofluoromethane were deleted first (46 FR 2266, January 8, 1981) followed by the deletion of bis-(chloromethyl) ether (46 FR 10723, February 4, 1981).

Past studies by EPA and others have identified many nontoxic, nonconventional pollutant parameters useful in characterizing industrial wastewaters and in evaluating treatment process removal efficiencies. Certain of these and other parameters may also be selected as reliable indicators of the presence of specific toxic pollutants. For these reasons, a number of nontoxic pollutants were also studied for the nonferrous metals forming category.

The conventional pollutants considered (total suspended solids, oil and grease, and pH) traditionally have been studied to characterize industrial wastewaters. These parameters are especially useful in evaluating the effectiveness of wastewater treatment processes.

Several nonconventional pollutants were considered. As discussed in Section V, raw wastewater samples were analyzed for the following: acidity, alkalinity, aluminum, ammonia nitrogen, barium, boron, calcium, chemical oxygen demand (COD), chloride, cobalt, fluoride, iron, magnesium, manganese, molybdenum, total phenols, phosphate, sodium, sulfate, tin, titanium, total dissolved solids (TDS), total organic carbon (TOC), total solids (TS), vanadium,

and yttrium. Several other nonconventional pollutants were also considered for limitation in particular subcategories where they would be expected to be found at significant concentrations, although no raw waste data were available for them prior to proposal. These pollutants include columbium, hafnium, radium, tantalum, tungsten, uranium, and zirconium.

RATIONALE FOR SELECTION OF POLLUTANT PARAMETERS

Exclusion of Toxic Pollutants

The Settlement Agreement in Natural Resources Defense Council, Inc. vs. Train, 8 ERC 2120 (D.D.C. 1976), modified 12 ERC 1833 (D.D.C. 1979), modified by orders of October 26, 1982, August 2, 1983, and January 6, 1984, which preceded the Clean Water Act, contains provisions authorizing the exclusion from regulation in certain instances of particular pollutants, categories, and subcategories.

Paragraph 8(a)(iii) of the Settlement Agreement allows the Administrator to exclude from regulation toxic pollutants not detectable by Section 304(h) analytical methods or other state-of-the-art methods. Pollutants that were never detected, or that were never found above their analytical quantification level, are proposed for exclusion. The analytical quantification level for a pollutant is the minimum concentration at which that pollutant can be reliably measured. For the toxic pollutants in this study, the analytical quantification levels are: 0.005 mg/l for pesticides, PCB's, and beryllium; 0.010 mg/l for antimony, arsenic, selenium, silver, thallium, and the remaining organic toxic pollutants; 0.020 mg/l for cadmium, chromium, cyanide, and zinc; 0.050 mg/l for copper, lead, and nickel; and 0.0002 mg/l for mercury.

Since there was no reason to expect TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin) in nonferrous metals forming process water, EPA decided that maintenance of a TCDD standard in analytical laboratories was too hazardous. Consequently, TCDD was analyzed by GC/MS screening, and compared to EPA's GC/MS computer file. Samples collected by the Agency's contractor were not analyzed for asbestos. Asbestos is not expected to be a part of nonferrous metals forming wastewater since the category only includes metals that have already been refined from any ores that might contain asbestos. In addition, asbestos is not known to be present in any process chemicals used in any forming operations.

Paragraph 8(a)(iii) also allows the Administrator to exclude from regulation toxic pollutants detected in amounts too small to be effectively reduced by technologies known to the Administrator. Pollutants which were detected below levels considered to be

achievable by specific available treatment methods are proposed for exclusion. For the toxic metals, the chemical precipitation, sedimentation, and filtration technology treatment effectiveness values, which are presented in Section VII were used. For the toxic organic pollutants detected above their analytical quantification level, treatment effectiveness values for activated carbon technology were used. These treatment effectiveness values represent the most stringent treatment options considered for pollutant removal. This allows for the most conservative exclusion for pollutants detected below treatable levels.

In addition to the provisions outlined above, Paragraph 8(a)(iii) of the Settlement Agreement (1) allows the Administrator to exclude from regulation toxic pollutants detectable in the effluent from only a small number of sources within the subcategory because they are uniquely related to those sources, and (2) allows the Administrator to exclude from regulation toxic pollutants which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or by pretreatment standards. Such compounds are proposed for exclusion.

The toxic pollutants proposed for regulation are those found at the highest concentration in untreated wastewater in each subcategory. The lime and settle and lime, settle, filter technologies were selected as the bases for BPT and BAT because they control these pollutants. Because the lime and settle and lime, settle, filter technologies will also control toxic pollutants found at lower concentrations, those pollutants are not specifically regulated. The description of the pollutant selection for each subcategory, below, lists the toxic metals found at highest cocentrations and which are, thus, regulated. The toxic metals found at lower concentrations are also listed. These toxic metals were not regulated because adequate control of the regulated pollutants will also control the toxic metals found in lower concentrations.

Waste streams in the nonferrous metals forming category have been grouped together by the subcategorization scheme described in Section IV. The pollutant exclusion procedure was applied for each of the following subcategories:

(1) Lead/Tin/Bismuth Forming

(2) Nickel/Cobalt Forming

(3) Zinc Forming

(4) Beryllium Forming

(5) Precious Metals Forming

(6) Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy

(7) Titanium Forming

(8) Refractory Metals Forming

(9) Zirconium/Hafnium Forming

(10) Magnesium Forming

Toxic pollutants remaining after the application of the above exclusion process were selected for specific regulation.

Paragraph 8 criteria were not used in the selection of pollutant parameters in the uranium forming subcategory. No analyses were made of wastewater generated by operations in this subcategory prior to proposal of these guidelines and standards.

Regulation of Nonconventional Pollutants

In each subcategory, the metal present at highest concentration is the metal being subjected to the forming operations. In several subcategories the metal present in the greatest amount is a toxic metal (nickel in the nickel forming subcategory, for example). In other subcategories the metal present in the greatest amount is a nonconventional pollutant (titanium in the titanium forming subcategory, for example). In these cases, the nonconventional metal was selected for regulation to ensure that all the toxic metals are adequately removed from the wastewater by the treatment system. Regulation of only two or three toxic metals in these subcategories would not ensure adequate control of all toxic metals because the toxic metals are present at relatively low concentrations. The Agency believes that control of the nonconventional metals formed in the magnesium, refractory metals, titanium, uranium, and zirconium/hafnium forming subcategories is necessary to ensure adequate removal of all toxic metals, both toxic and nonconventional.

Radium has been selected for regulation in the uranium forming subcategory, in addition to toxic metals and uranium, because radium is a contaminant of uranium and would be expected to be present in uranium forming process wastewater.

In addition, the nonconventional pollutants ammonia and fluoride were selected for regulation in subcategories where these pollutants are found at treatable levels.

DESCRIPTION OF POLLUTANT PARAMETERS

A description of the pollutant parameters detected above their analytical quantification level in any sample of nonferrous metals forming wastewater is included in the administrative record which accompanies this rulemaking package. The description of each pollutant provides the following information: the source of the pollutant; whether it is a naturally occurring element, processed metal, or 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 a POTW at concentrations that might be expected from industrial discharges.

POLLUTANT SELECTION BY SUBCATEGORY

Section V of this development document presented a summary of data collected during nonferrous metals forming plant sampling visits and subsequent chemical analyses. This section examines that data and discusses the selection or exclusion of pollutants for limitation.

Pollutant Selection for Lead/Tin/Bismuth Forming

Conventional and Nonconventional Pollutant Parameters

This study analyzed samples from the lead/tin/bismuth forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH

No nonconventional pollutants or pollutant parameters are selected for limitation in this subcategory. Although these pollutants are not selected in establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations for bismuth and tin.

Toxic Pollutants

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-2. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-2 is based on the raw wastewater sampling data.

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 limitation:

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidene
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
12. hexachlorethane
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
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene
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-choroethoxy) methane
44. methylene chloride
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
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
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo(a)anthracene
73. benzo(a)pyrene
74. benzo(b)fluoranthene
75. benzo(b)fluoranthene
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene
80. fluorene
82. dibenzo(a,h)anthracene
83. ideno(1,2,3-cd)pyrene
84. pyrene
85. tetrachloroethylene
86. toluene
87. trichloroethylene
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
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
116. asbestos
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

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 limitation:

4. benzene
6. carbon tetrachloride
11. 1,1,1-trichloroethane
125. selenium
126. silver
127. thallium

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

15. 1,1,2,2-tetrachloroethane
22. parachlorometa cresol
23. chloroform
38. ethylbenzene
115. arsenic
117. beryllium
118. cadmium
123. mercury
124. nickel

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 are not selected for limitation on this basis:

65. phenol
66. bis(2-ethylhexyl) phthalate
81. phenanthrene
119. chromium
120. copper
121. cyanide

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

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines Are Based Upon. As discussed above, paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutant is not selected for limitation on this basis:

128. zinc

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

114. antimony
122. lead

Pollutant Selection for Nickel/Cobalt Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the nickel/cobalt forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH
fluoride

Although no other nonconventional pollutants are selected in establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations for cobalt and iron.

Toxic Pollutants

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-3. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-3 is based on the raw wastewater sampling data.

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 limitation:

2. acrolein
3. acrylonitrile
6. carbon tetrachloride
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane
17. bis (chloromethyl) ether
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene
35. 2,4-dinitrotoluene
38. ethylbenzene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl)ether
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane

51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
56. nitrobenzene
59. 2,4-dinitrophenol
74. benzo(b)fluoranthene
79. benzo(ghi)perylene
82. dibenzo (a,h)anthracene
85. tetrachloroethylene
87. trichloroethylene
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
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
116. asbestos
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

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 limitation:

37. 1,2-diphenylhydrazine
43. bis(2-ethylhexyl) phthalate
61. N-nitrosodimethylamine
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo(a)anthracene
75. benzo(k)fluoranthene
76. chrysene
77. acenaphthylene
78. anthracene
83. indeno(1,2,3-cd)pyrene

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

4. benzene
12. hexachloroethane
23. chloroform
29. 1,1-dichloroethylene
86. toluene
123. mercury

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 are not selected for limitation on this basis:

1. acenaphthene
5. benzidene
11. 1,1,1-trichloroethane
13. 1,1-dichloroethane
22. parachlorometa cresol
28. 3,3'-dichloroenzidine
34. 2,4-dimethylphenol
36. 2,6-dinitrotoluene
39. fluoranthene
44. methylene chloride
55. naphthalene
57. 2-nitrophenol
58. 4-nitrophenol
60. 4,6-dinitro-o-cresol
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
73. benzo(a)pyrene
80. fluorene
81. phenanthrene
84. pyrene
114. antimony
115. arsenic
117. beryllium
121. cyanide
125. selenium
126. silver
127. thallium

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

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines are Based Upon. As discussed above, paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which other effluent limitations and guidelines, or pretreatment standards are based. The following pollutants are not selected for limitation on this basis:

118. cadmium
120. copper
122. lead
128. zinc

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

119. chromium
124. nickel

Pollutant Selection for Zinc Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the zinc forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH

No nonconventional pollutants or pollutant parameters are selected for limitation in this subcategory.

Toxic Pollutants

Raw wastewater samples collected during the sampling program were analyzed for the acid extractable, base neutral, and volatile toxic organic pollutants. However, the results of the analysis for these pollutants were not received prior to proposal. There is no reason to expect that the presence of organic toxic pollutants in the zinc forming subcategory would be different than the presence of organic toxic pollutants in the eight subcategories for which analytical results have been received. In those eight subcategories, only insignificant amounts of toxic organic pollutants were found. Therefore, EPA is not selecting organic toxic pollutants for limitation in the zinc forming subcategory. However, if the analytical results, when received, show significant, treatable concentrations of organic toxic pollutants, the Agency would modify this proposal.

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-4. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-4 is based on the raw wastewater sampling data.

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 limitation:

114.	antimony	122.	lead
115.	arsenic	123.	mercury
117.	beryllium	125.	selenium
118.	cadmium	126.	silver
120.	copper	127.	thallium

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines Are Based Upon. As discussed above, paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutant is not selected for limitation on this basis:

124. nickel

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

119. chromium
121. cyanide
128. zinc

Pollutant Selection for Beryllium Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the beryllium forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH
fluoride

Toxic Pollutants

Raw wastewater samples collected during the sampling program were analyzed for the acid extractable, base neutral, and volatile toxic organic pollutants. However, the results of the analysis for these pollutants were not received prior to proposal. There is no reason to expect that the presence of organic toxic pollutants in the beryllium forming subcategory would be different than the presence of organic toxic pollutants in the eight subcategories for which analytical results have been received. In those eight subcategories only insignificant amounts of toxic organic pollutants were found. Therefore, EPA is not selecting organic toxic pollutants for limitation in the beryllium forming subcategory. However, if the analytical results, when received, show significant, treatable concentrations of organic toxic pollutants, the Agency would modify this proposal.

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-5. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-5 is based on the raw wastewater sampling data.

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 limitation:

114. antimony
115. arsenic
122. lead
125. selenium
127. thallium

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 limitation because they were

not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

123. mercury
126. silver

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines Are Based Upon. As discussed above, paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutants are not selected for limitation on this basis:

118. cadmium
119. chromium
124. nickel
128. zinc

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

117. beryllium
120. copper
121. cyanide

Pollutant Selection for Precious Metals Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the precious metals forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH

No nonconventional pollutants or pollutant parameters are selected 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-6. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-6 is based on the raw wastewater sampling data.

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 limitation:

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidene
6. carbon tetrachloride
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
12. hexachlorethane
13. 1,1-dichloroethane
15. 1,1,2,2-tetrachloroethane
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
23. chloroform
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. 1,2-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-choroethoxy) methane
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
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
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo(a)anthracene
73. benzo(a)pyrene
74. benzo(b)fluoranthene
75. benzo(b)fluoranthene

76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene
80. fluorene
81. phenanthrene
82. dibenzo (a,h)anthracene
83. indeno (1,2,3-cd)pyrene
84. 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
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
116. asbestos
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

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 limitation:

14. 1,1,2-trichloroethane
115. arsenic
117. beryllium
125. selenium
127. thallium

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

66. bis (2-ethylhexyl) phthalate
85. tetrachloroethylene
114. antimony
123. mercury

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 are not selected for limitation on this basis:

4. benzene
11. 1,1,1-trichloroethane
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
44. methylene chloride
45. methyl chloride
65. phenol
86. toluene
87. trichloroethylene

Although these pollutants are 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.

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines Are Based Upon. As discussed above, paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutants are not selected for limitation on this basis:

119. chromium
122. lead
124. nickel
128. zinc

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

118. cadmium
120. copper
121. cyanide
126. silver

Pollutant Selection for Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH
aluminum
iron

Although no other nonconventional pollutants are selected in establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations for boron, magnesium, manganese, molybdenum, tin, and titanium.

Toxic Pollutants

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-7. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-7 is based on the raw wastewater sampling data.

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 limitation:

1. acenaphthene
2. acrolein
3. acrylonitrile
5. benzidene
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
12. hexachlorethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
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
23. chloroform
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-choroethoxy) methane
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
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
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo(a)anthracene
73. benzo(a)pyrene
74. benzo(b)fluoranthene
75. benzo(b)fluoranthene
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene
80. fluorene
81. phenanthrene
82. dibenzo (a,h)anthracene
83. indeno (1,2,3-cd)pyrene
84. pyrene
85. tetrachloroethylene
87. trichloroethylene
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
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
116. asbestos
129. 2,3,7,8-tetra chlorodi-benzo-p-dioxin (TCDD)

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 limitation:

4. benzene
117. beryllium
118. cadmium
123. mercury
125. selenium
126. silver

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

6. carbon tetrachloride
44. methlyene chloride
86. toluene
114. antimony
115. arsenic
127. thallium

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 pollutant is not selected for limitation on this basis:

11. 1,1,1-trichloroethane

Although this pollutant is not selected for establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations.

Toxic Pollutants Effectively Controlled By Technologies which Other Effluent Limitations and Guidelines Are Based Upon. As discussed above, Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutants are not selected for limitation on this basis:

119. chromium
124. nickel
128. zinc

Toxic Pollutants Selected for Further Consideration for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

120. copper
121. cyanide
122. lead

Pollutant Selection for Titanium Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the titanium forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH
ammonia
fluoride
titanium

Although no other nonconventional pollutants are selected in establishing nationwide limitations, it may be appropriate, on a case-by-case basis, for the local permitter to specify effluent limitations for aluminum, boron, cobalt, iron, manganese, molybdenum, and vanadium.

Toxic Pollutants

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-8. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-8 is based on the raw wastewater sampling data.

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 limitation:

1. acenaphthene
2. acrolein
3. acrylonitrile
4. benzene
5. benzidene
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
11. 1,1,1-trichloroethane
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane
17. bis (chloromethyl) ether
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. parachlorometa cresol
23. chloroform
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-choroethoxy) methane
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
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
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate

68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo (a)anthracene
73. benzo (a)pyrene
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene
80. fluorene
81. phenanthrene
82. dibenzo (a,h)anthracene
83. indeno (1,2,3-cd)pyrene
84. pyrene
85. tetrachloroethylene
86. toluene
87. trichloroethylene
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
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
114. antimony
115. arsenic
116. asbestos
117. beryllium
118. cadmium
119. chromium
120. copper
121. cyanide
122. lead
123. mercury
124. nickel
125. selenium
126. silver
127. thallium
128. zinc
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

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 limitation:

6. carbon tetrachloride
44. methylene chloride
117. beryllium
118. cadmium
125. selenium
126. silver

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

114. antimony
115. arsenic
123. mercury
127. thallium

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines Are Based Upon. As discussed above, paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutants are not selected for limitation on this basis:

119. chromium
120. copper
124. nickel

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

121. cyanide
122. lead
128. zinc

Pollutant Selection for Refractory Metals Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the refractory metals forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH
fluoride
molybdenum
vanadium
tungsten
tantalum
columbium

Toxic Pollutants

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-9. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-9 is based on the raw wastewater sampling data.

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 limitation:

1. acenaphthene
2. acrolein
3. acrylonitrile
4. benzene
5. benzidene
6. carbon tetrachloride
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
12. hexachloroethane
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
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
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-choroethoxy) methane
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone

58. 4-nitrophenol
59. 2,4-dinitrophenol
61. N-nitrosodimethylamine
64. pentachlorophenol
71. dimethyl phthalate
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
86. toluene
87. trichloroethylene
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
103. beta-BHC
105. delta-BHC
106. PCB-1242
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
116. asbestos
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

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 limitation:

13. 1,1-dichloroethane
15. 1,1,2,2-tetrachloroethane
23. chloroform
24. 2-chlorophenol
29. 1,1-dichloroethylene
84. pyrene
95. alpha-endosulfan
102. alpha-BHC
104. gamma-BHC
125. selenium

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

33. 1,2-dichloropropylene
34. 2,4-dimethylphenol
56. nitrobenzene
114. antimony
115. arsenic
117. beryllium
123. mercury
127. thallium

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 are not selected for limitation on this basis:

11. 1,1,1-trichloroethane
39. fluoranthene
44. methylene chloride
55. naphthalene
57. 2-nitrophenol
60. 4,6-dinitro-o-cresol
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
65. phenol
66. bis (2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
72. benzo(a)anthracene
76. chrysene
77. acenaphthylene
78. anthracene
80. fluorene
81. phenanthrene
85. tetrachloroethylene
121. cyanide
122. lead

Although these pollutants are 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.

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines are Based Upon. As discussed above, Paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively conntrolled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutants are not selected for limitation on this basis:

118. cadmium
119. chromium
126. silver
128. zinc

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

120. copper
124. nickel

Pollutant Selection for Zirconium/Hafnium Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the zirconium/hafnium forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH
ammonia
fluoride
zirconium
hafnium

Toxic Pollutants

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-10. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-10 is based on the raw wastewater sampling data.

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 limitation:

1. acenaphthene
3. acrylonitrile
5. benzidene
6. carbon tetrachloride
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
12. hexachloroethane
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. 1,2-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-choroethoxy) methane
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
56. nitrobenzene
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
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
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
116. asbestos
129. 2,3,7,8-tetra chlorodi-benzo-p-dioxin (TCDD)

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 limitation:

4. benzene
7. chlorobenzene
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
39. fluoranthene
51. chlorodibromomethane
57. 2-nitrophenol
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
78. anthracene
81. phenanthrene
84. pyrene
87. trichloroethylene
117. beryllium
125. selenium
126. silver

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

10. 1,2-dichloroethane
23. chloroform
38. ethylbenzene
86. toluene
123. mercury

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 are not selected for limitation on this basis:

2. acrolein
11. 1,1,1-trichloroethane
13. 1,1-dichloroethane
29. 1,1-dichloroethylene
44. methylene chloride
66. bis (2-ethylhexyl) phthalate
85. tetrachloroethylene
88. vinyl chloride
118. cadmium
120. copper
127. thallium
128. zinc

Although these pollutants are 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.

Toxic Pollutants Effectively Controlled by Technologies Which Other Effluent Limitations and Guidelines are Based Upon. As discussed above, paragraph 8(a)(iii) allows for the exclusion of a toxic pollutant which will be effectively controlled by the technologies upon which are based other effluent limitations and guidelines, or pretreatment standards. The following pollutants are not selected for limitation on this basis:

114. antimony
115. arsenic
122. lead

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

119. chromium
121. cyanide
124. nickel

Pollutant Selection for Magnesium Forming

Conventional and Nonconventional Pollutant Parameters

This study considered samples from the magnesium forming subcategory for three conventional pollutant parameters and 26 nonconventional pollutant parameters.

Conventional and Nonconventional Pollutant Parameters Selected for Limitation. The conventional and nonconventional pollutants and pollutant parameters selected for limitation in this subcategory are:

total suspended solids (TSS)
oil and grease
pH
ammonia
fluoride
magnesium

Toxic Pollutants

The frequency of occurrence of the toxic pollutants in the wastewater samples taken is presented in Table VI-11. These data provide the basis for the categorization of specific pollutants, as discussed below. Table VI-11 is based on the raw wastewater sampling data.

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 limitation:

1. acenaphthene
2. acrolein
3. acrylonitrile
4. benzene
5. benzidene
6. carbon tetrachloride
7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene
10. 1,2-dichloroethane
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane
17. bis (chloromethyl) ether
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. parachlorometa cresol
23. chloroform
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3'-dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,2-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-choroethoxy) methane
45. methyl chloride
46. methyl bromide
47. bromoform
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
56. nitrobenzene
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
66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate

68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate
72. benzo (a)anthracene
73. benzo (a)pyrene
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene
80. fluorene
81. phenanthrene
82. dibenzo (a,h)anthracene
83. indeno (1,2,3-cd)pyrene
84. pyrene
85. tetrachloroethylene
86. toluene
87. trichloroethylene
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
107. PCB-1254
108. PCB-1221
109. PCB-1232
110. PCB-1248
111. PCB-1260
112. PCB-1016
113. toxaphene
116. asbestos
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

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 limitation:

115. arsenic
118. cadmium
124. nickel
125. selenium
127. thallium

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 limitation because they were not found in any wastewater samples from this subcategory above concentrations considered achievable by existing or available treatment technologies:

11. 1,1,1-trichloroethane
57. 2-nitrophenol
65. phenol
114. antimony
120. copper
123. mercury
126. silver

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 are not selected for limitation on this basis:

44. methylene chloride
117. beryllium
121. cyanide
122. lead

Although these pollutants are 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.

Toxic Pollutants Selected for Limitation. The toxic pollutants listed below are selected for limitation for this subcategory because they were detected at treatable concentrations in untreated wastewater:

119. chromium
128. zinc

Pollutant Selection for Uranium Forming

No raw wastewater samples were collected from uranium forming facilities prior to proposal. The Agency intends to obtain data on toxic pollutants in wastewater at uranium forming plants after proposal. These data will be added to the record of rulemaking when they become available and will be considered in promulgating the final effluent limitations and standards.

However, based on long-term data from DMR's from one direct discharger and raw wastewater sampling data provided in dcp's, the following conventional, nonconventional, and toxic pollutants are selected for limitation in this subcategory:

total suspended solids (TSS)
oil and grease
pH
fluoride
radium
uranium
118. cadmium
120. copper
124. nickel

Table VI-1

LIST OF 129 TOXIC POLLUTANTS

Compound Name

1. acenaphthene
2. acrolein
3. acrylonitrile
4. benzene
5. benzidene
6. carbon tetrachloride (tetrachloromethane)

Chlorinated benzenes (other than dichlorobenzenes)

7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene

Chlorinated ethanes (including 1,2-dichloroethane, 1,1,1-trichloroethane, and hexachloroethane)

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

Chloroalkyl ethers (chloromethyl, chloroethyl, and mixed ethers)

17. bis (chloromethyl) ether
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether (mixed)

Chlorinated naphthalene

20. 2-chloronaphthalene

Chlorinated phenols (other than those listed elsewhere; includes trichlorophenols and chlorinated cresols)

21. 2,4,6-trichlorophenol
22. parachlorometa cresol
23. chloroform (trichloromethane)
24. 2-chlorophenol

Table VI-1 (Continued)

LIST OF 129 TOXIC POLLUTANTS

Dichlorobenzenes

25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene

Dichlorobenzidine

28. 3,3'-dichlorobenzidine

Dichloroethylenes (1,1-dichloroethylene and 1,2-dichloroethylene)

29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol

Dichloropropane and dichloropropene

32. 1,2-dichloropropane
33. 1,2-dichloropropylene (1,3-dichloropropene)
34. 2,4-dimethylphenol

Dinitrotoluene

35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene

Haloethers (other than those listed elsewhere)

40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-choroethoxy) methane

Halomethanes (other than those listed elsewhere)

44. methylene chloride (dichloromethane)
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
47. bromoform (tribromomethane)
48. dichlorobromomethane

Table VI-1 (Continued)

LIST OF 129 TOXIC POLLUTANTS

Halomethanes (other than those listed elsewhere) (Cont.)

49. trichlorofluoromethane
50. dichlorodifluoromethane
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
56. nitrobenzene

Nitrophenols (including 2,4-dinitrophenol and dinitrocresol)

57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol

Nitrosamines

61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol

Phthalate esters

66. bis(2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate

Polynuclear aromatic hydrocarbons

72. benzo(a)anthracene (1,2-benzanthracene)
73. benzo(a)pyrene (3,4-benzopyrene)
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene (11,12-benzofluoranthene)
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene (1,11-benzoperylene)

Table VI-1 (Continued)

LIST OF 129 TOXIC POLLUTANTS

Polynuclear aromatic hydrocarbons (Cont.)

80. fluorene
81. phenanthrene
82. dibenzo(a,h)anthracene (1,2,5,6-dibenzanthracene)
83. indeno(1,2,3-cd)pyrene (w,e,-o-phenylenepyrene)
84. pyrene
85. tetrachloroethylene
86. toluene
87. trichloroethylene
88. vinyl chloride (chloroethylene)

Pesticides and metabolites

89. aldrin
90. dieldrin
91. chlordane (technical mixture and metabolites)

DDT and metabolites

92. 4,4'-DDT
93. 4,4'-DDE(p,p'DDX)
94. 4,4'-DDD(p,p'TDE)

Endosulfan and metabolites

95. a-endosulfan-Alpha
96. b-endosulfan-Beta
97. endosulfan sulfate

Endrin and metabolites

98. endrin
99. endrin aldehyde

Heptachlor and metabolies

100. heptachlor
101. heptachlor epoxide

Table VI-1 (Continued)

LIST OF 129 TOXIC POLLUTANTS

Hexachlorocyclohexane (all isomers)

102. a-BHC-Alpha
103. b-BHC-Beta
104. r-BHC (lindane)-Gamma
105. g-BHC-Delta

Polychlorinated biphenyls (PCB's)

106. PCB-1242 (Arochlor 1242)
107. PCB-1254 (Arochlor 1254)
108. PCB-1221 (Arochlor 1221)
109. PCB-1232 (Arochlor 1232)
110. PCB-1248 (Arochlor 1248)
111. PCB-1260 (Arochlor 1260)
112. PCB-1016 (Arochlor 1016)

Metals and Cyanide, and Asbestos

114. antimony
115. arsenic
116. asbestos (Fibrous)
117. beryllium
118. cadmium
119. chromium (Total)
120. copper
121. cyanide (Total)
122. lead
123. mercury
124. nickel
125. selenium
126. silver
127. thallium
128. zinc

Other

113. toxaphene
129. 2,3,7,8-tetra chlorodibenzo-p-dioxin (TCDD)

Table VI-2

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
LEAD/TIN/BISMUTH FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	7	12	12	0	0	0
2. acrolein	0.010	0.100	3	4	4	0	0	0
3. acrylonitrile	0.010	0.01	3	4	4	0	0	0
4. benzene	0.010	0.05 - 0.10	3	4	3	1	0	0
5. benzidine	0.010	0.01	7	12	12	0	0	0
6. carbon tetrachloride	0.010	0.05	3	4	3	1	0	0
7. chlorobenzene	0.010	0.025	3	4	4	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	7	12	12	0	0	0
9. hexachlorobenzene	0.010	0.01	7	12	12	0	0	0
10. 1,2-dichloroethane	0.010	0.1	3	4	4	0	0	0
11. 1,1,1-trichloroethane	0.010	0.01	3	4	3	1	0	0
12. hexachloroethane	0.010	0.01	7	12	12	0	0	0
13. 1,1-dichloroethane	0.010	0.01	3	4	4	0	0	0
14. 1,1,2-trichloroethane	0.010	0.1	3	4	4	0	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	3	4	3	0	1	0
16. chloroethane	0.010	0.01	3	4	4	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	3	4	4	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	7	12	12	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	3	4	4	0	0	0
20. 2-chloronaphthalene	0.010	0.01	7	12	12	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	7	12	12	0	0	0
22. parachlorometa cresol	0.010	0.05	7	12	11	0	1	0
23. chloroform	0.010	0.1	3	4	2	1	1	0
24. 2-chlorophenol	0.010	0.05	7	12	12	0	0	0
25. 1,2-dichlorobenzene	0.010	0.05	7	12	12	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	7	12	12	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	7	12	12	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	7	12	12	0	0	0
29. 1,1-dichloroethylene	0.010	0.1	3	4	4	0	0	0
30. 1,2-trans-dichloroethylene	0.010	0.1	3	4	4	0	0	0
31. 2,4-dichlorophenol	0.010	0.01	7	12	12	0	0	0
32. 1,2-dichloropropane	0.010	0.01	3	4	4	0	0	0
33. 1,2-dichloropropylene	0.010	0.01	3	4	4	0	0	0
34. 2,4-dimethylphenol	0.010	0.05	7	12	12	0	0	0
35. 2,4-dinitrotoluene	0.010	0.05	7	12	12	0	0	0

Table VI-2 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
LEAD/TIN/BISMUTH FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.05	7	12	12	0	0	0
37. 1,2-diphenylhydrazine	0.010	0.05	7	12	12	0	0	0
38. ethylbenzene	0.010	0.05	3	4	3	0	1	0
39. fluoranthene	0.010	0.01	7	12	12	0	0	0
40. 4-chlorophenyl phenyl ether	0.010	0.01	7	12	12	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	7	12	12	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	7	12	12	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	7	12	12	0	0	0
44. methylene chloride	0.010	0.10	3	4	4	0	0	0
45. methyl chloride	0.010	0.01	3	4	4	0	0	0
46. methyl bromide	0.010	0.01	3	4	4	0	0	0
47. bromoform	0.010	0.05	3	4	4	0	0	0
48. dichlorobromomethane	0.010	0.10	3	4	4	0	0	0
49. trichlorofluoromethane	0.010	0.01	3	4	4	0	0	0
50. dichlorodifluoromethane	0.010	0.01	3	4	4	0	0	0
51. chlorodibromomethane	0.010	0.10	3	4	4	0	0	0
52. hexachlorobutadiene	0.010	0.01	7	12	12	0	0	0
53. hexachlorocyclopentadiene	0.010	0.01	7	12	12	0	0	0
54. isophorone	0.010	0.05	7	12	12	0	0	0
55. naphthalene	0.010	0.05	7	12	12	0	0	0
56. nitrobenzene	0.010	0.05	7	12	12	0	0	0
57. 2-nitrophenol	0.010	0.01	7	12	12	0	0	0
58. 4-nitrophenol	0.010	0.05	7	12	12	0	0	0
59. 2,4-dinitrophenol	0.010	0.025	7	12	12	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	7	12	12	0	0	0
61. N-nitrosodimethylamine	0.010	0.01	7	12	12	0	0	0
62. N-nitrosodiphenylamine	0.010	0.01	7	12	12	0	0	0
63. N-nitrosodi-n-propylamine	0.010	0.01	7	12	12	0	0	0
64. pentachlorophenol	0.010	0.01	7	12	12	0	0	0
65. phenol	0.010	0.05	7	12	10	0	1	1
66. bis(2-ethylhexyl) phthalate	0.010	0.01	7	12	11	0	0	1
67. butyl benzyl phthalate	0.010	0.001 - 0.01	7	12	12	0	0	0
68. di-n-butyl phthalate	0.010	0.025	7	12	12	0	0	0
69. di-n-octyl phthalate	0.010	0.01	7	12	12	0	0	0

Table VI-2 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
LEAD/TIN/BISMUTH FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	7	12	12	0	0	0
71. dimethyl phthalate	0.010	0.025	7	12	12	0	0	0
72. benzo(a)anthracene	0.010	0.01	7	12	12	0	0	0
73. benzo(a)pyrene	0.010	0.01	7	12	12	0	0	0
74. 3,4-benzofluoranthene	0.010	0.01	7	12	12	0	0	0
75. benzo(k)fluoranthene	0.010	0.01	7	12	12	0	0	0
76. chrysene	0.010	0.001	7	12	12	0	0	0
77. acenaphthylene	0.010	0.01	7	12	12	0	0	0
78. anthracene	0.010	0.01	7	12	12	0	0	0
79. benzo(ghi)perylene	0.010	0.01	7	12	12	0	0	0
80. fluorene	0.010	0.01	7	12	12	0	0	0
81. phenanthrene	0.010	0.01	7	12	11	0	0	1
82. dibenzo(a,h)anthracene	0.010	0.01	7	12	12	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	7	12	12	0	0	0
84. pyrene	0.010	0.001 - 0.01	7	12	12	0	0	0
85. tetrachloroethylene	0.010	0.05	3	4	4	0	0	0
86. toluene	0.010	0.05	3	4	4	0	0	0
87. trichloroethylene	0.010	0.01	3	4	4	0	0	0
88. vinyl chloride	0.010	0.01	3	4	4	0	0	0
89. aldrin	0.005	0.001	0					
90. dieldrin	0.005	0.01	0					
91. chlordane	0.005	0.01	0					
92. 4,4'-DDT	0.005	0.01	0					
93. 4,4'-DDE	0.005	0.01	0					
94. 4,4'-DDD	0.005	0.01	0					
95. alpha-endosulfan	0.005	0.001	0					
96. beta-endosulfan	0.005	0.01	0					
97. endosulfan sulfate	0.005	0.01	0					
98. endrin	0.005	0.01	0					
99. endrin aldehyde	0.005	0.01	0					
100. heptachlor	0.005	0.01	0					
101. heptachlor epoxide	0.005	0.01	0					
102. alpha-BHC	0.005	0.01	0					

Table VI-2 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
LEAD/TIN/BISMUTH FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
103. beta-BHC	0.005	0.01	0					
104. gamma-BHC	0.005	0.01	0					
105. delta-BHC	0.005	0.01	0					
106. PCB-1242	0.005	0.001	0					
107. PCB-1254	0.005	0.001	0					
108. PCB-1221	0.005	0.001	0					
109. PCB-1232	0.005	0.001	0					
110. PCB-1248	0.005	0.001	0					
111. PCB-1260	0.005	0.001	0					
112. PCB-1016	0.005	0.001	0					
113. toxaphene	0.005	0.01	0					
114. antimony	0.100	0.47	7	12	0	2	3	7
115. arsenic	0.010	0.34	7	12	0	3	9	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	8	13	0	12	1	0
118. cadmium	0.002	0.049	8	13	0	11	2	0
119. chromium	0.005	0.07	8	13	0	11	1	1
120. copper	0.009	0.39	8	13	0	8	4	1
121. cyanide (c)	0.02	0.047	6	11	0	10	0	1
122. lead	0.020	0.08	8	13	0	0	0	13
123. mercury	0.0001	0.036	7	12	0	7	5	0
124. nickel	0.005	0.22	8	13	0	10	3	0
125. selenium	0.01	0.20	7	12	0	12	0	0
126. silver	0.02	0.07	7	12	0	12	0	0
127. thallium	0.100	0.34	7	12	0	12	0	0
128. zinc	0.050	0.23	8	13	0	4	7	2
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

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

Table VI-3

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
NICKEL/COBALT FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	34	43	42	0	0	1
2. acrolein	0.010	0.100	28	36	36	0	0	0
3. acrylonitrile	0.010	0.01	28	36	36	0	0	0
4. benzene	0.010	0.05 - 0.10	28	36	34	1	1	0
5. benzidine	0.010	0.01	34	43	37	1	2	3
6. carbon tetrachloride	0.010	0.05	28	36	36	0	0	0
7. chlorobenzene	0.010	0.025	28	36	36	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	34	43	43	0	0	0
9. hexachlorobenzene	0.010	0.01	34	43	43	0	0	0
10. 1,2-dichloroethane	0.010	0.1	28	36	36	0	0	0
11. 1,1,1-trichloroethane	0.010	0.01	28	36	14	1	3	18
12. hexachloroethane	0.010	0.01	34	43	40	0	3	0
13. 1,1-dichloroethane	0.010	0.01	28	36	29	0	3	4
14. 1,1,2-trichloroethane	0.010	0.1	28	36	36	0	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	28	36	36	0	0	0
16. chloroethane	0.010	0.01	28	36	36	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	28	36	36	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	34	43	43	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	28	36	36	0	0	0
20. 2-chloronaphthalene	0.010	0.01	34	43	43	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	34	43	43	0	0	0
22. parachlorometa cresol	0.010	0.05	34	43	39	1	1	2
23. chloroform	0.010	0.1	28	36	34	0	2	0
24. 2-chlorophenol	0.010	0.05	34	43	43	0	0	0
25. 1,2-dichlorobenzene	0.010	0.05	34	43	43	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	34	43	43	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	34	43	43	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	34	43	40	0	0	3
29. 1,1-dichloroethylene	0.010	0.1	28	36	34	1	1	0
30. 1,2-trans-dichloroethylene	0.010	0.1	28	36	36	0	0	0
31. 2,4-dichlorophenol	0.010	0.01	34	43	43	0	0	0
32. 1,2-dichloropropane	0.010	0.01	28	36	36	0	0	0
33. 1,2-dichloropropylene	0.010	0.01	28	36	36	0	0	0
34. 2,4-dimethylphenol	0.010	0.05	34	43	39	2	0	2
35. 2,4-dinitrotoluene	0.010	0.05	34	43	43	0	0	0

Table VI-3 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
NICKEL/COBALT FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.05	34	43	37	5	0	1
37. 1,2-diphenylhydrazine	0.010	0.05	34	43	39	4	0	0
38. ethylbenzene	0.010	0.05	28	36	36	0	0	0
39. fluoranthene	0.010	0.01	34	43	39	3	0	1
40. 4-chlorophenyl phenyl ether	0.010	0.01	34	43	43	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	34	43	43	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	34	43	43	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	34	43	40	3	0	0
44. methylene chloride	0.010	0.10	28	36	9	8	5	14
45. methyl chloride	0.010	0.01	28	36	36	0	0	0
46. methyl bromide	0.010	0.01	28	36	36	0	0	0
47. bromoform	0.010	0.05	28	36	36	0	0	0
48. dichlorobromomethane	0.010	0.10	28	36	36	0	0	0
49. trichlorofluoromethane	0.010	0.01	28	36	36	0	0	0
50. dichlorodifluoromethane	0.010	0.01	28	36	36	0	0	0
51. chlorodibromomethane	0.010	0.10	28	36	36	0	0	0
52. hexachlorobutadiene	0.010	0.01	34	43	43	0	0	0
53. hexachlorocyclopentadiene	0.010	0.01	34	43	43	0	0	0
54. isophorone	0.010	0.05	34	43	43	0	0	0
55. naphthalene	0.010	0.05	34	43	32	6	1	4
56. nitrobenzene	0.010	0.05	34	43	43	0	0	0
57. 2-nitrophenol	0.010	0.01	34	43	42	0	0	1
58. 4-nitrophenol	0.010	0.05	34	43	41	1	0	1
59. 2,4-dinitrophenol	0.010	0.025	34	43	43	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	34	43	42	0	0	1
61. N-nitrosodimethylamine	0.010	0.01	34	43	38	5	0	0
62. N-nitrosodiphenylamine	0.010	0.01	34	43	41	0	0	2
63. N-nitrosodi-n-propylamine	0.010	0.01	34	43	37	0	0	6
64. pentachlorophenol	0.010	0.01	34	43	38	0	0	5
65. phenol	0.010	0.05	34	43	23	6	5	9
66. bis(2-ethylhexyl) phthalate	0.010	0.01	34	43	26	9	4	4
67. butyl benzyl phthalate	0.010	0.001 - 0.01	34	43	38	4	0	1
68. di-n-butyl phthalate	0.010	0.025	34	43	40	2	0	1
69. di-n-octyl phthalate	0.010	0.01	34	43	41	2	0	0

Table VI-3 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
NICKEL/COBALT FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	34	43	40	3	0	0
71. dimethyl phthalate	0.010	0.025	34	43	41	2	0	0
72. benzo(a)anthracene	0.010	0.01	34	43	42	1	0	0
73. benzo(a)pyrene	0.010	0.01	34	43	42	0	0	1
74. 3,4-benzofluoranthene	0.010	0.01	34	43	43	0	0	0
75. benzo(k)fluoranthene	0.010	0.01	34	43	42	1	0	0
76. chrysene	0.010	0.001	34	43	42	1	0	0
77. acenaphthylene	0.010	0.01	34	43	42	1	0	0
78. anthracene	0.010	0.01	34	43	41	2	0	0
79. benzo(ghi)perylene	0.010	0.01	34	43	43	0	0	0
80. fluorene	0.010	0.01	34	43	42	0	0	1
81. phenanthrene	0.010	0.01	34	43	32	3	0	8
82. dibenzo(a,h)anthracene	0.010	0.01	34	43	43	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	34	43	42	1	0	0
84. pyrene	0.010	0.001 - 0.01	34	43	39	3	0	1
85. tetrachloroethylene	0.010	0.05	28	36	36	0	0	0
86. toluene	0.010	0.05	28	36	34	1	1	0
87. trichloroethylene	0.010	0.01	28	36	36	0	0	0
88. vinyl chloride	0.010	0.01	28	36	36	0	0	0
89. aldrin	0.005	0.001	1	2	2	0	0	0
90. dieldrin	0.005	0.01	1	2	2	0	0	0
91. chlordane	0.005	0.01	1	2	2	0	0	0
92. 4,4'-DDT	0.005	0.01	1	2	2	0	0	0
93. 4,4'-DDE	0.005	0.01	1	2	2	0	0	0
94. 4,4'-DDD	0.005	0.01	1	2	2	0	0	0
95. alpha-endosulfan	0.005	0.001	1	2	2	0	0	0
96. beta-endosulfan	0.005	0.01	1	2	2	0	0	0
97. endosulfan sulfate	0.005	0.01	1	2	2	0	0	0
98. endrin	0.005	0.01	1	2	2	0	0	0
99. endrin aldehyde	0.005	0.01	1	2	2	0	0	0
100. heptachlor	0.005	0.01	1	2	2	0	0	0
101. heptachlor epoxide	0.005	0.01	1	2	2	0	0	0
102. alpha-BHC	0.005	0.01	1	2	2	0	0	0

Table VI-3 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
NICKEL/COBALT FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
103. beta-BHC	0.005	0.01	1	2	2	0	0	0
104. gamma-BHC	0.005	0.01	1	2	2	0	0	0
105. delta-BHC	0.005	0.01	1	2	2	0	0	0
106. PCB-1242	0.005	0.001	1	2	2	0	0	0
107. PCB-1254	0.005	0.001	1	2	2	0	0	0
108. PCB-1221	0.005	0.001	1	2	2	0	0	0
109. PCB-1232	0.005	0.001	1	2	2	0	0	0
110. PCB-1248	0.005	0.001	1	2	2	0	0	0
111. PCB-1260	0.005	0.001	1	2	2	0	0	0
112. PCB-1016	0.005	0.001	1	2	2	0	0	0
113. toxaphene	0.005	0.01	1	2	2	0	0	0
114. antimony	0.100	0.47	53	81	0	51	29	1
115. arsenic	0.010	0.34	53	81	0	60	20	1
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	53	81	0	70	10	1
118. cadmium	0.002	0.049	53	81	0	58	8	15
119. chromium	0.005	0.07	53	81	0	19	1	61
120. copper	0.009	0.39	53	81	0	2	31	48
121. cyanide (c)	0.02	0.047	35	59	0	59	0	0
122. lead	0.020	0.08	53	81	0	55	0	26
123. mercury	0.0001	0.036	53	81	0	78	3	0
124. nickel	0.005	0.22	53	81	0	3	7	71
125. selenium	0.01	0.20	53	81	0	74	6	1
126. silver	0.02	0.07	53	81	0	61	19	1
127. thallium	0.100	0.34	53	81	0	68	12	1
128. zinc	0.050	0.23	53	81	0	5	31	45
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

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

Table VI-4

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
ZINC FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	2	2				
2. acrolein	0.010	0.100	2	2				
3. acrylonitrile	0.010	0.01	2	2				
4. benzene	0.010	0.05 - 0.10	2	2				
5. benzidine	0.010	0.01	2	2				
6. carbon tetrachloride	0.010	0.05	2	2				
7. chlorobenzene	0.010	0.025	2	2				
8. 1,2,4-trichlorobenzene	0.010	0.01	2	2				
9. hexachlorobenzene	0.010	0.01	2	2				
10. 1,2-dichloroethane	0.010	0.1	2	2				
11. 1,1,1-trichloroethane	0.010	0.01	2	2				
12. hexachloroethane	0.010	0.01	2	2				
13. 1,1-dichloroethane	0.010	0.01	2	2				
14. 1,1,2-trichloroethane	0.010	0.1	2	2				
15. 1,1,2,2-tetrachloroethane	0.010	0.05	2	2				
16. chloroethane	0.010	0.01	2	2				
17. bis(chloromethyl) ether	0.010	0.01	2	2				
18. bis(2-chloroethyl) ether	0.010	0.01	2	2				
19. 2-chloroethyl vinyl ether	0.010	0.01	2	2				
20. 2-chloronaphthalene	0.010	0.01	2	2				
21. 2,4,6-trichlorophenol	0.010	0.025	2	2				
22. parachlorometa cresol	0.010	0.05	2	2				
23. chloroform	0.010	0.1	2	2				
24. 2-chlorophenol	0.010	0.05	2	2				
25. 1,2-dichlorobenzene	0.010	0.05	2	2				
26. 1,3-dichlorobenzene	0.010	0.01	2	2				
27. 1,4-dichlorobenzene	0.010	0.01	2	2				
28. 3,3'-dichlorobenzidine	0.010	0.01	2	2				
29. 1,1-dichloroethylene	0.010	0.1	2	2				
30. 1,2-trans-dichloroethylene	0.010	0.1	2	2				
31. 2,4-dichlorophenol	0.010	0.01	2	2				
32. 1,2-dichloropropane	0.010	0.01	2	2				
33. 1,2-dichloropropylene	0.010	0.01	2	2				
34. 2,4-dimethylphenol	0.010	0.05	2	2				
35. 2,4-dinitrotoluene	0.010	0.05	2	2				

Table VI-4 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
ZINC FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.05	2	2				
37. 1,2-diphenylhydrazine	0.010	0.05	2	2				
38. ethylbenzene	0.010	0.05	2	2				
39. fluoranthene	0.010	0.01	2	2				
40. 4-chlorophenyl phenyl ether	0.010	0.01	2	2				
41. 4-bromophenyl phenyl ether	0.010	0.01	2	2				
42. bis(2-chloroisopropyl) ether	0.010	0.01	2	2				
43. bis(2-chloroethoxy) methane	0.010	0.01	2	2				
44. methylene chloride	0.010	0.10	2	2				
45. methyl chloride	0.010	0.01	2	2				
46. methyl bromide	0.010	0.01	2	2				
47. bromoform	0.010	0.05	2	2				
48. dichlorobromomethane	0.010	0.10	2	2				
49. trichlorofluoromethane	0.010	0.01	2	2				
50. dichlorodifluoromethane	0.010	0.01	2	2				
51. chlorodibromomethane	0.010	0.10	2	2				
52. hexachlorobutadiene	0.010	0.01	2	2				
53. hexachlorocyclopentadiene	0.010	0.01	2	2				
54. isophorone	0.010	0.05	2	2				
55. naphthalene	0.010	0.05	2	2				
56. nitrobenzene	0.010	0.05	2	2				
57. 2-nitrophenol	0.010	0.01	2	2				
58. 4-nitrophenol	0.010	0.05	2	2				
59. 2,4-dinitrophenol	0.010	0.025	2	2				
60. 4,6-dinitro-o-cresol	0.010	0.025	2	2				
61. N-nitrosodimethylamine	0.010	0.01	2	2				
62. N-nitrosodiphenylamine	0.010	0.01	2	2				
63. N-nitrosodi-n-propylamine	0.010	0.01	2	2				
64. pentachlorophenol	0.010	0.01	2	2				
65. phenol	0.010	0.05	2	2				
66. bis(2-ethylhexyl) phthalate	0.010	0.01	2	2				
67. butyl benzyl phthalate	0.010	0.001 - 0.01	2	2				
68. di-n-butyl phthalate	0.010	0.025	2	2				
69. di-n-octyl phthalate	0.010	0.01	2	2				

Table VI-4 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
ZINC FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	2	2				
71. dimethyl phthalate	0.010	0.025	2	2				
72. benzo(a)anthracene	0.010	0.01	2	2				
73. benzo(a)pyrene	0.010	0.01	2	2				
74. 3,4-benzofluoranthene	0.010	0.01	2	2				
75. benzo(k)fluoranthene	0.010	0.01	2	2				
76. chrysene	0.010	0.001	2	2				
77. acenaphthylene	0.010	0.01	2	2				
78. anthracene	0.010	0.01	2	2				
79. benzo(ghi)perylene	0.010	0.01	2	2				
80. fluorene	0.010	0.01	2	2				
81. phenanthrene	0.010	0.01	2	2				
82. dibenzo(a,h)anthracene	0.010	0.01	2	2				
83. indeno(1,2,3-cd)pyrene	0.010	0.01	2	2				
84. pyrene	0.010	0.001 - 0.01	2	2				
85. tetrachloroethylene	0.010	0.05	2	2				
86. toluene	0.010	0.05	2	2				
87. trichloroethylene	0.010	0.01	2	2				
88. vinyl chloride	0.010	0.01	2	2				
89. aldrin	0.005	0.001	0					
90. dieldrin	0.005	0.01	0					
91. chlordane	0.005	0.01	0					
92. 4,4'-DDT	0.005	0.01	0					
93. 4,4'-DDE	0.005	0.01	0					
94. 4,4'-DDD	0.005	0.01	0					
95. alpha-endosulfan	0.005	0.001	0					
96. beta-endosulfan	0.005	0.01	0					
97. endosulfan sulfate	0.005	0.01	0					
98. endrin	0.005	0.01	0					
99. endrin aldehyde	0.005	0.01	0					
100. heptachlor	0.005	0.01	0					
101. heptachlor epoxide	0.005	0.01	0					
102. alpha-BHC	0.005	0.01	0					
103. beta-BHC	0.005	0.01	0					
104. gamma-BHC	0.005	0.01	0					

Table VI-4 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
ZINC FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
105. delta-BHC	0.005	0.01	0					
106. PCB-1242	0.005	0.001	0					
107. PCB-1254	0.005	0.001	0					
108. PCB-1221	0.005	0.001	0					
109. PCB-1232	0.005	0.001	0					
110. PCB-1248	0.005	0.001	0					
111. PCB-1260	0.005	0.001	0					
112. PCB-1016	0.005	0.001	0					
113. toxaphene	0.005	0.01	0					
114. antimony	0.100	0.47	2	2	0	2	0	0
115. arsenic	0.010	0.34	2	2	0	2	0	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	2	2	0	2	0	0
118. cadmium	0.002	0.049	2	2	0	2	0	0
119. chromium	0.005	0.07	2	2	0	1	0	1
120. copper	0.009	0.39	2	2	0	2	0	0
121. cyanide (d)	0.02	0.047	2	2	0	0	1	1
122. lead	0.020	0.08	2	2	0	2	0	0
123. mercury	0.0001	0.036	2	2	0	2	0	0
124. nickel	0.005	0.22	2	2	0	1	0	1
125. selenium	0.01	0.20	2	2	0	2	0	0
126. silver	0.02	0.07	2	2	0	2	0	0
127. thallium	0.100	0.34	2	2	0	2	0	0
128. zinc	0.050	0.23	2	2	0	0	0	2
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

(c) Samples were analyzed for toxic organic pollutants; however, the results were not received prior to proposal.

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

Table VI-5

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BERYLLIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	6	7				
2. acrolein	0.010	0.100	6	7				
3. acrylonitrile	0.010	0.01	6	7				
4. benzene	0.010	0.05 - 0.10	6	7				
5. benzidine	0.010	0.01	6	7				
6. carbon tetrachloride	0.010	0.05	6	7				
7. chlorobenzene	0.010	0.025	6	7				
8. 1,2,4-trichlorobenzene	0.010	0.01	6	7				
9. hexachlorobenzene	0.010	0.01	6	7				
10. 1,2-dichloroethane	0.010	0.1	6	7				
11. 1,1,1-trichloroethane	0.010	0.01	6	7				
12. hexachloroethane	0.010	0.01	6	7				
13. 1,1-dichloroethane	0.010	0.01	6	7				
14. 1,1,2-trichloroethane	0.010	0.1	6	7				
15. 1,1,2,2-tetrachloroethane	0.010	0.05	6	7				
16. chloroethane	0.010	0.01	6	7				
17. bis(chloromethyl) ether	0.010	0.01	6	7				
18. bis(2-chloroethyl) ether	0.010	0.01	6	7				
19. 2-chloroethyl vinyl ether	0.010	0.01	6	7				
20. 2-chloronaphthalene	0.010	0.01	6	7				
21. 2,4,6-trichlorophenol	0.010	0.025	6	7				
22. parachlorometa cresol	0.010	0.05	6	7				
23. chloroform	0.010	0.1	6	7				
24. 2-chlorophenol	0.010	0.05	6	7				
25. 1,2-dichlorobenzene	0.010	0.05	6	7				
26. 1,3-dichlorobenzene	0.010	0.01	6	7				
27. 1,4-dichlorobenzene	0.010	0.01	6	7				
28. 3,3'-dichlorobenzidine	0.010	0.01	6	7				
29. 1,1-dichloroethylene	0.010	0.1	6	7				
30. 1,2-trans-dichloroethylene	0.010	0.1	6	7				
31. 2,4-dichlorophenol	0.010	0.01	6	7				
32. 1,2-dichloropropane	0.010	0.01	6	7				
33. 1,2-dichloropropylene	0.010	0.01	6	7				
34. 2,4-dimethylphenol	0.010	0.05	6	7				
35. 2,4-dinitrotoluene	0.010	0.05	6	7				

Table VI-5 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BERYLLIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.05	6	7				
37. 1,2-diphenylhydrazine	0.010	0.05	6	7				
38. ethylbenzene	0.010	0.05	6	7				
39. fluoranthene	0.010	0.01	6	7				
40. 4-chlorophenyl phenyl ether	0.010	0.01	6	7				
41. 4-bromophenyl phenyl ether	0.010	0.01	6	7				
42. bis(2-chloroisopropyl) ether	0.010	0.01	6	7				
43. bis(2-chloroethoxy) methane	0.010	0.01	6	7				
44. methylene chloride	0.010	0.10	6	7				
45. methyl chloride	0.010	0.01	6	7				
46. methyl bromide	0.010	0.01	6	7				
47. bromoform	0.010	0.05	6	7				
48. dichlorobromomethane	0.010	0.10	6	7				
49. trichlorofluoromethane	0.010	0.01	6	7				
50. dichlorodifluoromethane	0.010	0.01	6	7				
51. chlorodibromomethane	0.010	0.10	6	7				
52. hexachlorobutadiene	0.010	0.01	6	7				
53. hexachlorocyclopentadiene	0.010	0.01	6	7				
54. isophorone	0.010	0.05	6	7				
55. naphthalene	0.010	0.05	6	7				
56. nitrobenzene	0.010	0.05	6	7				
57. 2-nitrophenol	0.010	0.01	6	7				
58. 4-nitrophenol	0.010	0.05	6	7				
59. 2,4-dinitrophenol	0.010	0.025	6	7				
60. 4,6-dinitro-o-cresol	0.010	0.025	6	7				
61. N-nitrosodimethylamine	0.010	0.01	6	7				
62. N-nitrosodiphenylamine	0.010	0.01	6	7				
63. N-nitrosodi-n-propylamine	0.010	0.01	6	7				
64. pentachlorophenol	0.010	0.01	6	7				
65. phenol	0.010	0.05	6	7				
66. bis(2-ethylhexyl) phthalate	0.010	0.01	6	7				
67. butyl benzyl phthalate	0.010	0.001 - 0.01	6	7				
68. di-n-butyl phthalate	0.010	0.025	6	7				
69. di-n-octyl phthalate	0.010	0.01	6	7				

Table VI-5 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BERYLLIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	6	7				
71. dimethyl phthalate	0.010	0.025	6	7				
72. benzo(a)anthracene	0.010	0.01	6	7				
73. benzo(a)pyrene	0.010	0.01	6	7				
74. 3,4-benzofluoranthene	0.010	0.01	6	7				
75. benzo(k)fluoranthene	0.010	0.01	6	7				
76. chrysene	0.010	0.001	6	7				
77. acenaphthylene	0.010	0.01	6	7				
78. anthracene	0.010	0.01	6	7				
79. benzo(ghi)perylene	0.010	0.01	6	7				
80. fluorene	0.010	0.01	6	7				
81. phenanthrene	0.010	0.01	6	7				
82. dibenzo(a,h)anthracene	0.010	0.01	6	7				
83. indeno(1,2,3-cd)pyrene	0.010	0.01	6	7				
84. pyrene	0.010	0.001 - 0.01	6	7				
85. tetrachloroethylene	0.010	0.05	6	7				
86. toluene	0.010	0.05	6	7				
87. trichloroethylene	0.010	0.01	6	7				
88. vinyl chloride	0.010	0.01	6	7				
89. aldrin	0.005	0.001	0					
90. dieldrin	0.005	0.01	0					
91. chlordane	0.005	0.01	0					
92. 4,4'-DDT	0.005	0.01	0					
93. 4,4'-DDE	0.005	0.01	0					
94. 4,4'-DDD	0.005	0.01	0					
95. alpha-endosulfan	0.005	0.001	0					
96. beta-endosulfan	0.005	0.01	0					
97. endosulfan sulfate	0.005	0.01	0					
98. endrin	0.005	0.01	0					
99. endrin aldehyde	0.005	0.01	0					
100. heptachlor	0.005	0.01	0					
101. heptachlor epoxide	0.005	0.01	0					
102. alpha-BHC	0.005	0.01	0					
103. beta-BHC	0.005	0.01	0					
104. gamma-BHC	0.005	0.01	0					

Table VI-5 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
BERYLLIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed(c)	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
105. delta-BHC	0.005	0.01	0					
106. PCB-1242	0.005	0.001	0					
107. PCB-1254	0.005	0.001	0					
108. PCB-1221	0.005	0.001	0					
109. PCB-1232	0.005	0.001	0					
110. PCB-1248	0.005	0.001	0					
111. PCB-1260	0.005	0.001	0					
112. PCB-1016	0.005	0.001	0					
113. toxaphene	0.005	0.01	0					
114. antimony	0.100	0.47	6	7	0	7	0	0
115. arsenic	0.010	0.34	6	7	0	7	0	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	6	7	0	0	1	6
118. cadmium	0.002	0.049	6	7	0	3	3	1
119. chromium	0.005	0.07	6	7	0	3	3	1
120. copper	0.009	0.39	6	7	0	0	2	5
121. cyanide (d)	0.02	0.047	6	7	0	3	1	3
122. lead	0.020	0.08	6	7	0	7	0	0
123. mercury	0.0001	0.036	6	7	0	5	2	0
124. nickel	0.005	0.22	6	7	0	3	3	1
125. selenium	0.01	0.20	6	7	0	7	0	0
126. silver	0.02	0.07	6	7	0	4	3	0
127. thallium	0.100	0.34	6	7	0	7	0	0
128. zinc	0.050	0.23	6	7	0	0	4	3
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

(c) Samples were analyzed for toxic organic pollutants; however, the results were not received prior to proposal.

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

Table VI-6

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
PRECIOUS METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	10	20	20	0	0	0
2. acrolein	0.010	0.100	10	20	20	0	0	0
3. acrylonitrile	0.010	0.01	10	20	20	0	0	0
4. benzene	0.010	0.05 - 0.10	10	20	19	0	0	1
5. benzidine	0.010	0.01	10	20	20	0	0	0
6. carbon tetrachloride	0.010	0.05	10	20	20	0	0	0
7. chlorobenzene	0.010	0.025	10	20	20	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	10	20	20	0	0	0
9. hexachlorobenzene	0.010	0.01	10	20	20	0	0	0
10. 1,2-dichloroethane	0.010	0.1	10	20	20	0	0	0
11. 1,1,1-trichloroethane	0.010	0.01	10	20	8	0	4	8
12. hexachloroethane	0.010	0.01	10	20	20	0	0	0
13. 1,1-dichloroethane	0.010	0.01	10	20	20	0	0	0
14. 1,1,2-trichloroethane	0.010	0.1	10	20	17	3	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	10	20	20	0	0	0
16. chloroethane	0.010	0.01	10	20	20	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	10	20	20	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	10	20	20	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	10	20	20	0	0	0
20. 2-chloronaphthalene	0.010	0.01	10	20	20	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	10	20	20	0	0	0
22. parachlorometa cresol	0.010	0.05	10	20	20	0	0	0
23. chloroform	0.010	0.1	10	20	20	0	0	0
24. 2-chlorophenol	0.010	0.05	10	20	20	0	0	0
25. 1,2-dichlorobenzene	0.010	0.05	10	20	20	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	10	20	20	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	10	20	20	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	10	20	20	0	0	0
29. 1,1-dichloroethylene	0.010	0.1	10	20	18	0	1	1
30. 1,2-trans-dichloroethylene	0.010	0.1	10	20	15	0	4	1
31. 2,4-dichlorophenol	0.010	0.01	10	20	20	0	0	0
32. 1,2-dichloropropane	0.010	0.01	10	20	20	0	0	0
33. 1,2-dichloropropylene	0.010	0.01	10	20	20	0	0	0
34. 2,4-dimethylphenol	0.010	0.05	10	20	20	0	0	0
35. 2,4-dinitrotoluene	0.010	0.05	10	20	20	0	0	0

Table VI-6 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
PRECIOUS METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.05	10	20	20	0	0	0
37. 1,2-diphenylhydrazine	0.010	0.05	10	20	20	0	0	0
38. ethylbenzene	0.010	0.05	10	20	20	0	0	0
39. fluoranthene	0.010	0.01	10	20	20	0	0	0
40. 4-chlorophenyl phenyl ether	0.010	0.01	10	20	20	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	10	20	20	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	10	20	20	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	10	20	20	0	0	0
44. methylene chloride	0.010	0.10	10	20	0	2	9	9
45. methyl chloride	0.010	0.01	10	20	19	0	0	1
46. methyl bromide	0.010	0.01	10	20	20	0	0	0
47. bromoform	0.010	0.05	10	20	20	0	0	0
48. dichlorobromomethane	0.010	0.10	10	20	20	0	0	0
49. trichlorofluoromethane	0.010	0.01	10	20	20	0	0	0
50. dichlorodifluoromethane	0.010	0.01	10	20	20	0	0	0
51. chlorodibromomethane	0.010	0.10	10	20	20	0	0	0
52. hexachlorobutadiene	0.010	0.01	10	20	20	0	0	0
53. hexachlorocyclopentadiene	0.010	0.01	10	20	20	0	0	0
54. isophorone	0.010	0.05	10	20	20	0	0	0
55. naphthalene	0.010	0.05	10	20	20	0	0	0
56. nitrobenzene	0.010	0.05	10	20	20	0	0	0
57. 2-nitrophenol	0.010	0.01	10	20	20	0	0	0
58. 4-nitrophenol	0.010	0.05	10	20	20	0	0	0
59. 2,4-dinitrophenol	0.010	0.025	10	20	20	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	10	20	20	0	0	0
61. N-nitrosodimethylamine	0.010	0.01	10	20	20	0	0	0
62. N-nitrosodiphenylamine	0.010	0.01	10	20	20	0	0	0
63. N-nitrosodi-n-propylamine	0.010	0.01	10	20	20	0	0	0
64. pentachlorophenol	0.010	0.01	10	20	20	0	0	0
65. phenol	0.010	0.05	10	20	14	0	2	4
66. bis(2-ethylhexyl) phthalate	0.010	0.01	10	20	18	0	2	0
67. butyl benzyl phthalate	0.010	0.001 - 0.01	10	20	20	0	0	0
68. di-n-butyl phthalate	0.010	0.025	10	20	20	0	0	0
69. di-n-octyl phthalate	0.010	0.01	10	20	20	0	0	0

Table VI-6 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
PRECIOUS METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	10	20	20	0	0	0
71. dimethyl phthalate	0.010	0.025	10	20	20	0	0	0
72. benzo(a)anthracene	0.010	0.01	10	20	20	0	0	0
73. benzo(a)pyrene	0.010	0.01	10	20	20	0	0	0
74. 3,4-benzofluoranthene	0.010	0.01	10	20	20	0	0	0
75. benzo(k)fluoranthene	0.010	0.01	10	20	20	0	0	0
76. chrysene	0.010	0.001	10	20	20	0	0	0
77. acenaphthylene	0.010	0.01	10	20	20	0	0	0
78. anthracene	0.010	0.01	10	20	20	0	0	0
79. benzo(ghi)perylene	0.010	0.01	10	20	20	0	0	0
80. fluorene	0.010	0.01	10	20	20	0	0	0
81. phenanthrene	0.010	0.01	10	20	20	0	0	0
82. dibenzo(a,h)anthracene	0.010	0.01	10	20	20	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	10	20	20	0	0	0
84. pyrene	0.010	0.001 - 0.01	10	20	20	0	0	0
85. tetrachloroethylene	0.010	0.05	10	20	16	0	4	0
86. toluene	0.010	0.05	10	20	10	0	8	2
87. trichloroethylene	0.010	0.01	10	20	11	0	0	9
88. vinyl chloride	0.010	0.01	10	20	20	0	0	0
89. aldrin	0.005	0.001	0					
90. dieldrin	0.005	0.01	0					
91. chlordane	0.005	0.01	0					
92. 4,4'-DDT	0.005	0.01	0					
93. 4,4'-DDE	0.005	0.01	0					
94. 4,4'-DDD	0.005	0.01	0					
95. alpha-endosulfan	0.005	0.001	0					
96. beta-endosulfan	0.005	0.01	0					
97. endosulfan sulfate	0.005	0.01	0					
98. endrin	0.005	0.01	0					
99. endrin aldehyde	0.005	0.01	0					
100. heptachlor	0.005	0.01	0					
101. heptachlor epoxide	0.005	0.01	0					
102. alpha-BHC	0.005	0.01	0					

Table VI-6 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
PRECIOUS METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
103. beta-BHC	0.005	0.01	0					
104. gamma-BHC	0.005	0.01	0					
105. delta-BHC	0.005	0.01	0					
106. PCB-1242	0.005	0.001	0					
107. PCB-1254	0.005	0.001	0					
108. PCB-1221	0.005	0.001	0					
109. PCB-1232	0.005	0.001	0					
110. PCB-1248	0.005	0.001	0					
111. PCB-1260	0.005	0.001	0					
112. PCB-1016	0.005	0.001	0					
113. toxaphene	0.005	0.01	0					
114. antimony	0.100	0.47	13	23	0	21	2	0
115. arsenic	0.010	0.34	13	23	0	23	0	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	13	23	0	23	0	0
118. cadmium	0.002	0.049	13	23	0	9	2	12
119. chromium	0.005	0.07	13	23	0	14	2	7
120. copper	0.009	0.39	13	23	0	1	1	21
121. cyanide (c)	0.02	0.047	13	23	0	19	0	4
122. lead	0.020	0.08	13	23	0	9	3	11
123. mercury	0.0001	0.036	13	23	0	19	4	0
124. nickel	0.005	0.22	13	23	0	3	8	12
125. selenium	0.01	0.20	13	23	0	23	0	0
126. silver	0.02	0.07	13	23	0	7	9	7
127. thallium	0.100	0.34	13	23	0	23	0	0
128. zinc	0.050	0.23	13	23	0	1	6	16
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

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

Table VI-7

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	7	15	15	0	0	0
2. acrolein	0.010	0.100	6	14	14	0	0	0
3. acrylonitrile	0.010	0.01	6	14	14	0	0	0
4. benzene	0.010	0.05 - 0.10	6	14	10	4	0	0
5. benzidine	0.010	0.01	7	15	15	0	0	0
6. carbon tetrachloride	0.010	0.05	6	14	5	3	6	0
7. chlorobenzene	0.010	0.025	6	14	14	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	7	15	15	0	0	0
9. hexachlorobenzene	0.010	0.01	7	15	15	0	0	0
10. 1,2-dichloroethane	0.010	0.1	6	14	14	0	0	0
11. 1,1,1-trichloroethane	0.010	0.01	6	14	3	4	2	5
12. hexachloroethane	0.010	0.01	7	15	15	0	0	0
13. 1,1-dichloroethane	0.010	0.01	6	14	14	0	0	0
14. 1,1,2-trichloroethane	0.010	0.1	6	14	14	0	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	6	14	14	0	0	0
16. chloroethane	0.010	0.01	6	14	14	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	6	14	14	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	7	15	15	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	6	14	14	0	0	0
20. 2-chloronaphthalene	0.010	0.01	7	15	15	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	7	15	15	0	0	0
22. parachlorometa cresol	0.010	0.05	7	15	15	0	0	0
23. chloroform	0.010	0.1	6	14	14	0	0	0
24. 2-chlorophenol	0.010	0.05	7	15	15	0	0	0
25. 1,2-dichlorobenzene	0.010	0.05	7	15	15	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	7	15	15	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	7	15	15	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	7	15	15	0	0	0
29. 1,1-dichloroethylene	0.010	0.1	6	14	14	0	0	0
30. 1,2-trans-dichloroethylene	0.010	0.1	6	14	14	0	0	0
31. 2,4-dichlorophenol	0.010	0.01	7	15	15	0	0	0
32. 1,2-dichloropropane	0.010	0.01	6	14	14	0	0	0

Table VI-7 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
33. 1,2-dichloropropylene	0.010	0.01	6	14	14	0	0	0
34. 2,4-dimethylphenol	0.010	0.05	6	14	14	0	0	0
35. 2,4-dinitrotoluene	0.010	0.05	7	15	15	0	0	0
36. 2,6-dinitrotoluene	0.010	0.05	7	15	15	0	0	0
37. 1,2-diphenylhydrazine	0.010	0.05	7	15	15	0	0	0
38. ethylbenzene	0.010	0.05	6	14	14	0	0	0
39. fluoranthene	0.010	0.01	7	15	15	0	0	0
40. 4-chlorophenyl phenyl ether	0.010	0.01	7	15	15	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	7	15	15	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	7	15	15	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	7	15	15	0	0	0
44. methylene chloride	0.010	0.10	6	14	9	4	1	0
45. methyl chloride	0.010	0.01	6	14	14	0	0	0
46. methyl bromide	0.010	0.01	6	14	14	0	0	0
47. bromoform	0.010	0.05	6	14	14	0	0	0
48. dichlorobromomethane	0.010	0.10	6	14	14	0	0	0
49. trichlorofluoromethane	0.010	0.01	6	14	14	0	0	0
50. dichlorodifluoromethane	0.010	0.01	6	14	14	0	0	0
51. chlorodibromomethane	0.010	0.10	6	14	14	0	0	0
52. hexachlorobutadiene	0.010	0.01	7	15	15	0	0	0
53. hexachlorocyclopentadiene	0.010	0.01	7	15	15	0	0	0
54. isophorone	0.010	0.05	7	15	15	0	0	0
55. naphthalene	0.010	0.05	7	15	15	0	0	0
56. nitrobenzene	0.010	0.05	5	11	11	0	0	0
57. 2-nitrophenol	0.010	0.01	7	15	15	0	0	0
58. 4-nitrophenol	0.010	0.05	7	15	15	0	0	0
59. 2,4-dinitrophenol	0.010	0.025	7	15	15	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	7	15	15	0	0	0
61. N-nitrosodimethylamine	0.010	0.01	7	15	15	0	0	0
62. N-nitrosodiphenylamine	0.010	0.01	7	15	15	0	0	0
63. N-nitrosodi-n-propylamine	0.010	0.01	7	15	15	0	0	0
64. pentachlorophenol	0.010	0.01	7	15	15	0	0	0
65. phenol	0.010	0.05	7	15	15	0	0	0
66. bis(2-ethylhexyl) phthalate	0.010	0.01	7	15	15	0	0	0

Table VI-7 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION
AND POWDER METALLURGY SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
67. butyl benzyl phthalate	0.010	0.001 - 0.01	7	15	15	0	0	0
68. di-n-butyl phthalate	0.010	0.025	7	15	15	0	0	0
69. di-n-octyl phthalate	0.010	0.01	7	15	15	0	0	0
70. diethyl phthalate	0.010	0.025	7	15	15	0	0	0
71. dimethyl phthalate	0.010	0.025	7	15	15	0	0	0
72. benzo(a)anthracene	0.010	0.01	7	15	15	0	0	0
73. benzo(a)pyrene	0.010	0.01	7	15	15	0	0	0
74. 3,4-benzofluoranthene	0.010	0.01	7	15	15	0	0	0
75. benzo(k)fluoranthene	0.010	0.01	7	15	15	0	0	0
76. chrysene	0.010	0.001	7	15	15	0	0	0
77. acenaphthylene	0.010	0.01	7	15	15	0	0	0
78. anthracene	0.010	0.01	6	13	13	0	0	0
79. benzo(ghi)perylene	0.010	0.01	7	15	15	0	0	0
80. fluorene	0.010	0.01	7	15	15	0	0	0
81. phenanthrene	0.010	0.01	7	15	15	0	0	0
82. dibenzo(a,h)anthracene	0.010	0.01	7	15	15	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	7	15	15	0	0	0
84. pyrene	0.010	0.001 - 0.01	7	15	15	0	0	0
85. tetrachloroethylene	0.010	0.05	6	14	14	0	0	0
86. toluene	0.010	0.05	6	14	8	5	1	0
87. trichloroethylene	0.010	0.01	6	14	14	0	0	0
88. vinyl chloride	0.010	0.01	6	14	14	0	0	0
89. aldrin	0.005	0.001	0					
90. dieldrin	0.005	0.01	0					
91. chlordane	0.005	0.01	0					
92. 4,4'-DDT	0.005	0.01	0					
93. 4,4'-DDE	0.005	0.01	0					
94. 4,4'-DDD	0.005	0.01	0					
95. alpha-endosulfan	0.005	0.001	0					
96. beta-endosulfan	0.005	0.01	0					
97. endosulfan sulfate	0.005	0.01	0					
98. endrin	0.005	0.01	0					
99. endrin aldehyde	0.005	0.01	0					
100. heptachlor	0.005	0.01	0					
101. heptachlor epoxide	0.005	0.01	0					

Table VI-7 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
102. alpha-BHC	0.005	0.01	0					
103. beta-BHC	0.005	0.01	0					
104. gamma-BHC	0.005	0.01	0					
105. delta-BHC	0.005	0.01	0					
106. PCB-1242	0.005	0.001	0					
107. PCB-1254	0.005	0.001	0					
108. PCB-1221	0.005	0.001	0					
109. PCB-1232	0.005	0.001	0					
110. PCB-1248	0.005	0.001	0					
111. PCB-1260	0.005	0.001	0					
112. PCB-1016	0.005	0.001	0					
113. toxaphene	0.005	0.01	0					
114. antimony	0.100	0.47	7	15	0	13	2	0
115. arsenic	0.010	0.34	7	15	0	13	2	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	7	15	0	15	0	0
118. cadmium	0.002	0.049	7	15	0	15	0	0
119. chromium	0.005	0.07	7	15	0	9	2	4
120. copper	0.009	0.39	7	15	0	7	0	8
121. cyanide (c)	0.02	0.047	7	15	0	5	2	8
122. lead	0.020	0.08	7	15	0	6	1	8
123. mercury	0.0001	0.036	7	15	0	15	0	0
124. nickel	0.005	0.22	7	15	0	8	1	6
125. selenium	0.01	0.20	7	15	0	15	0	0
126. silver	0.02	0.07	7	15	0	15	0	0
127. thallium	0.100	0.34	7	15	0	14	1	0
128. zinc	0.050	0.23	7	15	0	1	6	8
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

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

Table VI-8

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
TITANIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	1	1	1	0	0	0
2. acrolein	0.010	0.100	1	1	1	0	0	0
3. acrylonitrile	0.010	0.01	1	1	1	0	0	0
4. benzene	0.010	0.05 - 0.10	1	1	1	0	0	0
5. benzidine	0.010	0.01	1	1	1	0	0	0
6. carbon tetrachloride	0.010	0.05	1	1	0	1	0	0
7. chlorobenzene	0.010	0.025	1	1	1	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	1	1	1	0	0	0
9. hexachlorobenzene	0.010	0.01	1	1	1	0	0	0
10. 1,2-dichloroethane	0.010	0.1	1	1	1	0	0	0
11. 1,1,1-trichloroethane	0.010	0.01	1	1	1	0	0	0
12. hexachloroethane	0.010	0.01	1	1	1	0	0	0
13. 1,1-dichloroethane	0.010	0.01	1	1	1	0	0	0
14. 1,1,2-trichloroethane	0.010	0.1	1	1	1	0	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	1	1	1	0	0	0
16. chloroethane	0.010	0.01	1	1	1	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	1	1	1	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	1	1	1	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	1	1	1	0	0	0
20. 2-chloronaphthalene	0.010	0.01	1	1	1	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	1	1	1	0	0	0
22. parachlorometa cresol	0.010	0.05	1	1	1	0	0	0
23. chloroform	0.010	0.1	1	1	1	0	0	0
24. 2-chlorophenol	0.010	0.05	1	1	1	0	0	0
25. 1,2-dichlorobenzene	0.010	0.05	1	1	1	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	1	1	1	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	1	1	1	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	1	1	1	0	0	0
29. 1,1-dichloroethylene	0.010	0.1	1	1	1	0	0	0
30. 1,2-trans-dichloroethylene	0.010	0.1	1	1	1	0	0	0
31. 2,4-dichlorophenol	0.010	0.01	1	1	1	0	0	0
32. 1,2-dichloropropane	0.010	0.01	1	1	1	0	0	0
33. 1,2-dichloropropylene	0.010	0.01	1	1	1	0	0	0
34. 2,4-dimethylphenol	0.010	0.05	1	1	1	0	0	0
35. 2,4-dinitrotoluene	0.010	0.05	1	1	1	0	0	0

Table VI-8 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
TITANIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.05	1	1	1	0	0	0
37. 1,2-diphenylhydrazine	0.010	0.05	1	1	1	0	0	0
38. ethylbenzene	0.010	0.05	1	1	1	0	0	0
39. fluoranthene	0.010	0.01	1	1	1	0	0	0
40. 4-chlorophenyl phenyl ether	0.010	0.01	1	1	1	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	1	1	1	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	1	1	1	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	1	1	1	0	0	0
44. methylene chloride	0.010	0.10	1	1	0	1	0	0
45. methyl chloride	0.010	0.01	1	1	1	0	0	0
46. methyl bromide	0.010	0.01	1	1	1	0	0	0
47. bromoform	0.010	0.05	1	1	1	0	0	0
48. dichlorobromomethane	0.010	0.10	1	1	1	0	0	0
49. trichlorofluoromethane	0.010	0.01	1	1	1	0	0	0
50. dichlorodifluoromethane	0.010	0.01	1	1	1	0	0	0
51. chlorodibromomethane	0.010	0.10	1	1	1	0	0	0
52. hexachlorobutadiene	0.010	0.01	1	1	1	0	0	0
53. hexachlorocyclopentadiene	0.010	0.01	1	1	1	0	0	0
54. isophorone	0.010	0.05	1	1	1	0	0	0
55. naphthalene	0.010	0.05	1	1	1	0	0	0
56. nitrobenzene	0.010	0.05	1	1	1	0	0	0
57. 2-nitrophenol	0.010	0.01	1	1	1	0	0	0
58. 4-nitrophenol	0.010	0.05	1	1	1	0	0	0
59. 2,4-dinitrophenol	0.010	0.025	1	1	1	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	1	1	1	0	0	0
61. N-nitrosodimethylamine	0.010	0.01	1	1	1	0	0	0
62. N-nitrosodiphenylamine	0.010	0.01	1	1	1	0	0	0
63. N-nitrosodi-n-propylamine	0.010	0.01	1	1	1	0	0	0
64. pentachlorophenol	0.010	0.01	1	1	1	0	0	0
65. phenol	0.010	0.05	1	1	1	0	0	0
66. bis(2-ethylhexyl) phthalate	0.010	0.01	1	1	1	0	0	0
67. butyl benzyl phthalate	0.010	0.001 - 0.01	1	1	1	0	0	0
68. di-n-butyl phthalate	0.010	0.025	1	1	1	0	0	0
69. di-n-octyl phthalate	0.010	0.01	1	1	1	0	0	0

Table VI-8 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
TITANIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	1	1	1	0	0	0
71. dimethyl phthalate	0.010	0.025	1	1	1	0	0	0
72. benzo(a)anthracene	0.010	0.01	1	1	1	0	0	0
73. benzo(a)pyrene	0.010	0.01	1	1	1	0	0	0
74. 3,4-benzofluoranthene	0.010	0.01	1	1	1	0	0	0
75. benzo(k)fluoranthene	0.010	0.01	1	1	1	0	0	0
76. chrysene	0.010	0.001	1	1	1	0	0	0
77. acenaphthylene	0.010	0.01	1	1	1	0	0	0
78. anthracene	0.010	0.01	1	1	1	0	0	0
79. benzo(ghi)perylene	0.010	0.01	1	1	1	0	0	0
80. fluorene	0.010	0.01	1	1	1	0	0	0
81. phenanthrene	0.010	0.01	1	1	1	0	0	0
82. dibenzo(a,h)anthracene	0.010	0.01	1	1	1	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	1	1	1	0	0	0
84. pyrene	0.010	0.001 - 0.01	1	1	1	0	0	0
85. tetrachloroethylene	0.010	0.05	1	1	1	0	0	0
86. toluene	0.010	0.05	1	1	1	0	0	0
87. trichloroethylene	0.010	0.01	1	1	1	0	0	0
88. vinyl chloride	0.010	0.01	1	1	1	0	0	0
89. aldrin	0.005	0.001	0					
90. dieldrin	0.005	0.01	0					
91. chlordane	0.005	0.01	0					
92. 4,4'-DDT	0.005	0.01	0					
93. 4,4'-DDE	0.005	0.01	0					
94. 4,4'-DDD	0.005	0.01	0					
95. alpha-endosulfan	0.005	0.001	0					
96. beta-endosulfan	0.005	0.01	0					
97. endosulfan sulfate	0.005	0.01	0					
98. endrin	0.005	0.01	0					
99. endrin aldehyde	0.005	0.01	0					
100. heptachlor	0.005	0.01	0					
101. heptachlor epoxide	0.005	0.01	0					
102. alpha-BHC	0.005	0.01	0					
103. beta-BHC	0.005	0.01	0					
104. gamma-BHC	0.005	0.01	0					

Table VI-8 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
TITANIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
105. delta-BHC	0.005	0.01	0					
106. PCB-1242	0.005	0.001	0					
107. PCB-1254	0.005	0.001	0					
108. PCB-1221	0.005	0.001	0					
109. PCB-1232	0.005	0.001	0					
110. PCB-1248	0.005	0.001	0					
111. PCB-1260	0.005	0.001	0					
112. PCB-1016	0.005	0.001	0					
113. toxaphene	0.005	0.01	0					
114. antimony	0.100	0.47	8	12	0	9	3	0
115. arsenic	0.010	0.34	8	12	0	10	2	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	8	12	0	12	0	0
118. cadmium	0.002	0.049	8	12	0	12	0	0
119. chromium	0.005	0.07	8	12	0	4	3	5
120. copper	0.009	0.39	8	12	0	6	3	3
121. cyanide (c)	0.02	0.047	3	3	0	1	0	2
122. lead	0.020	0.08	8	12	0	1	1	10
123. mercury	0.0001	0.036	8	12	0	11	1	0
124. nickel	0.005	0.22	8	12	0	7	0	5
125. selenium	0.01	0.20	8	12	0	12	0	0
126. silver	0.02	0.07	8	12	0	12	0	0
127. thallium	0.100	0.34	8	12	0	11	1	0
128. zinc	0.050	0.23	8	12	0	4	2	6
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

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

Table VI-9

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
REFRACTORY METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	9	11	11	0	0	0
2. acrolein	0.010	0.100	9	11	11	0	0	0
3. acrylonitrile	0.010	0.01	9	11	11	0	0	0
4. benzene	0.010	0.05 - 0.10	9	11	11	0	0	0
5. benzidine	0.010	0.01	9	11	11	0	0	0
6. carbon tetrachloride	0.010	0.05	9	11	11	0	0	0
7. chlorobenzene	0.010	0.025	9	11	11	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	9	11	11	0	0	0
9. hexachlorobenzene	0.010	0.01	9	11	11	0	0	0
10. 1,2-dichloroethane	0.010	0.1	9	11	11	0	0	0
11. 1,1,1-trichloroethane	0.010	0.01	9	11	0	1	0	10
12. hexachloroethane	0.010	0.01	9	11	11	0	0	0
13. 1,1-dichloroethane	0.010	0.01	9	11	10	1	0	0
14. 1,1,2-trichloroethane	0.010	0.1	9	11	11	0	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	9	11	10	1	0	0
16. chloroethane	0.010	0.01	9	11	11	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	9	11	11	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	9	11	11	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	9	11	11	0	0	0
20. 2-chloronaphthalene	0.010	0.01	9	11	11	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	9	11	11	0	0	0
22. parachlorometa cresol	0.010	0.05	9	11	11	0	0	0
23. chloroform	0.010	0.1	9	11	7	4	0	0
24. 2-chlorophenol	0.010	0.05	9	11	10	1	0	0
25. 1,2-dichlorobenzene	0.010	0.05	9	11	11	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	9	11	11	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	9	11	11	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	9	11	11	0	0	0
29. 1,1-dichloroethylene	0.010	0.1	9	11	9	2	0	0
30. 1,2-trans-dichloroethylene	0.010	0.1	9	11	11	0	0	0
31. 2,4-dichlorophenol	0.010	0.01	9	11	11	0	0	0
32. 1,2-dichloropropane	0.010	0.01	9	11	11	0	0	0
33. 1,2-dichloropropylene	0.010	0.01	9	11	10	0	1	0
34. 2,4-dimethylphenol	0.010	0.05	9	11	10	0	1	0

Table VI-9 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
REFRACTORY METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
35. 2,4-dinitrotoluene	0.010	0.05	9	11	11	0	0	0
36. 2,6-dinitrotoluene	0.010	0.05	9	11	11	0	0	0
37. 1,2-diphenylhydrazine	0.010	0.05	9	11	11	0	0	0
38. ethylbenzene	0.010	0.05	9	11	11	0	0	0
39. fluoranthene	0.010	0.01	9	11	9	1	0	1
40. 4-chlorophenyl phenyl ether	0.010	0.01	9	11	11	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	9	11	11	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	9	11	11	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	9	11	11	0	0	0
44. methylene chloride	0.010	0.10	9	11	0	10	0	1
45. methyl chloride	0.010	0.01	9	11	11	0	0	0
46. methyl bromide	0.010	0.01	9	11	11	0	0	0
47. bromoform	0.010	0.05	9	11	11	0	0	0
48. dichlorobromomethane	0.010	0.10	9	11	11	0	0	0
49. trichlorofluoromethane	0.010	0.01	9	11	11	0	0	0
50. dichlorodifluoromethane	0.010	0.01	9	11	11	0	0	0
51. chlorodibromomethane	0.010	0.10	9	11	11	0	0	0
52. hexachlorobutadiene	0.010	0.01	9	11	11	0	0	0
53. hexachlorocyclopentadiene	0.010	0.01	9	11	11	0	0	0
54. isophorone	0.010	0.05	9	11	11	0	0	0
55. naphthalene	0.010	0.05	9	11	9	1	0	1
56. nitrobenzene	0.010	0.05	9	11	10	0	1	0
57. 2-nitrophenol	0.010	0.01	9	11	10	0	0	1
58. 4-nitrophenol	0.010	0.05	9	11	11	0	0	0
59. 2,4-dinitrophenol	0.010	0.025	9	11	11	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	9	11	10	0	0	1
61. N-nitrosodimethylamine	0.010	0.01	9	11	11	0	0	0
62. N-nitrosodiphenylamine	0.010	0.01	9	11	10	0	0	1
63. N-nitrosodi-n-propylamine	0.010	0.01	9	11	10	0	0	1
64. pentachlorophenol	0.010	0.01	9	11	11	0	0	0
65. phenol	0.010	0.05	9	11	7	0	2	2
66. bis(2-ethylhexyl) phthalate	0.010	0.01	9	11	4	4	0	3
67. butyl benzyl phthalate	0.010	0.001 - 0.01	9	11	10	0	0	1
68. di-n-butyl phthalate	0.010	0.025	9	11	9	1	0	1
69. di-n-octyl phthalate	0.010	0.01	9	11	8	2	0	1

Table VI-9 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
REFRACTORY METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	9	11	10	0	0	1
71. dimethyl phthalate	0.010	0.025	9	11	11	0	0	0
72. benzo(a)anthracene	0.010	0.01	9	11	10	0	0	1
73. benzo(a)pyrene	0.010	0.01	9	11	11	0	0	0
74. 3,4-benzofluoranthene	0.010	0.01	9	11	11	0	0	0
75. benzo(k)fluoranthene	0.010	0.01	9	11	11	0	0	0
76. chrysene	0.010	0.001	9	11	10	0	0	1
77. acenaphthylene	0.010	0.01	9	11	10	0	0	1
78. anthracene (c)	0.010	0.01	9	11	9	1	0	1
79. benzo(ghi)perylene	0.010	0.01	9	11	11	0	0	0
80. fluorene	0.010	0.01	9	11	10	0	0	1
81. phenanthrene (c)	0.010	0.01	9	11	10	0	0	1
82. dibenzo(a,h)anthracene	0.010	0.01	9	11	11	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	9	11	11	0	0	0
84. pyrene	0.010	0.001 - 0.01	9	11	10	1	0	0
85. tetrachloroethylene	0.010	0.05	9	11	8	1	1	1
86. toluene	0.010	0.05	9	11	11	0	0	0
87. trichloroethylene	0.010	0.01	9	11	11	0	0	0
88. vinyl chloride	0.010	0.01	9	11	11	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	2	1	0	0

Table VI-9 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
REFRACTORY METALS FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
103. beta-BHC	0.005	0.01	3	3	3	0	0	0
104. gamma-BHC	0.005	0.01	3	3	2	1	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	3	0	0	0
107. PCB-1254 (d)	0.005	0.001	3	3	3	0	0	0
108. PCB-1221 (d)	0.005	0.001	3	3	3	0	0	0
109. PCB-1232 (e)	0.005	0.001	3	3	3	0	0	0
110. PCB-1248 (e)	0.005	0.001	3	3	3	0	0	0
111. PCB-1260 (e)	0.005	0.001	3	3	3	0	0	0
112. PCB-1016 (e)	0.005	0.001	3	3	3	0	0	0
113. toxaphene	0.005	0.01	3	3	3	0	0	0
114. antimony	0.100	0.47	15	19	0	15	4	0
115. arsenic	0.010	0.34	15	19	0	18	1	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	15	19	0	17	2	0
118. cadmium	0.002	0.049	15	19	0	10	4	5
119. chromium	0.005	0.07	15	19	0	3	3	13
120. copper	0.009	0.39	15	19	0	3	9	7
121. cyanide (f)	0.02	0.047	13	17	0	16	0	1
122. lead	0.020	0.08	15	19	0	12	4	3
123. mercury	0.0001	0.036	15	19	0	15	4	0
124. nickel	0.005	0.22	15	19	0	7	2	10
125. selenium	0.01	0.20	15	19	0	19	0	0
126. silver	0.02	0.07	15	19	0	9	3	7
127. thallium	0.100	0.34	14	18	0	17	1	0
128. zinc	0.050	0.23	15	19	0	5	8	6
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

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

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

Table VI-10

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	3	3	3	0	0	0
2. acrolein	0.010	0.100	3	3	2	0	0	1
3. acrylonitrile	0.010	0.01	3	3	3	0	0	0
4. benzene	0.010	0.05 - 0.10	3	3	0	3	0	0
5. benzidine	0.010	0.01	3	3	3	0	0	0
6. carbon tetrachloride	0.010	0.05	3	3	3	0	0	0
7. chlorobenzene	0.010	0.025	3	3	1	2	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	3	2	0	1	0
11. 1,1,1-trichloroethane	0.010	0.01	3	3	0	0	0	3
12. hexachloroethane	0.010	0.01	3	3	3	0	0	0
13. 1,1-dichloroethane	0.010	0.01	3	3	1	1	0	1
14. 1,1,2-trichloroethane	0.010	0.1	3	3	1	2	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	3	3	2	1	0	0
16. chloroethane	0.010	0.01	3	3	3	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	3	3	3	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	3	3	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	3	0	2	1	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	3	2	0	0	1
30. 1,2-trans-dichloroethylene	0.010	0.1	3	3	3	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	3	3	0	0	0
33. 1,2-dichloropropylene	0.010	0.01	3	3	3	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

Table VI-10 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
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
38. ethylbenzene	0.010	0.05	3	3	1	0	2	0
39. fluoranthene	0.010	0.01	3	3	2	1	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	3	0	1	0	2
45. methyl chloride	0.010	0.01	3	3	3	0	0	0
46. methyl bromide	0.010	0.01	3	3	3	0	0	0
47. bromoform	0.010	0.05	3	3	3	0	0	0
48. dichlorobromomethane	0.010	0.10	3	3	3	0	0	0
49. trichlorofluoromethane	0.010	0.01	3	3	3	0	0	0
50. dichlorodifluoromethane	0.010	0.01	3	3	3	0	0	0
51. chlorodibromomethane	0.010	0.10	3	3	2	1	0	0
52. hexachlorobutadiene	0.010	0.01	3	3	3	0	0	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	3	0	0	0
56. nitrobenzene	0.010	0.05	3	3	3	0	0	0
57. 2-nitrophenol	0.010	0.01	3	3	1	2	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	2	0	1
67. butyl benzyl phthalate	0.010	0.001 - 0.01	3	3	2	1	0	0
68. di-n-butyl phthalate	0.010	0.025	3	3	0	3	0	0
69. di-n-octyl phthalate	0.010	0.01	3	3	2	1	0	0

Table VI-10 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	3	3	0	3	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
75. benzo(k)fluoranthene	0.010	0.01	3	3	3	0	0	0
76. chrysene	0.010	0.001	3	3	3	0	0	0
77. acenaphthylene	0.010	0.01	3	3	3	0	0	0
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	3	0	0	0
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	3	1	1	0	1
86. toluene	0.010	0.05	3	3	0	2	1	0
87. trichloroethylene	0.010	0.01	3	3	0	3	0	0
88. vinyl chloride	0.010	0.01	3	3	2	0	0	1
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	3	0	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

Table VI-10 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
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	3	0	0	0
107. PCB-1254 (d)	0.005	0.001	3	3	3	0	0	0
108. PCB-1221 (d)	0.005	0.001	3	3	3	0	0	0
109. PCB-1232 (e)	0.005	0.001	3	3	3	0	0	0
110. PCB-1248 (e)	0.005	0.001	3	3	3	0	0	0
111. PCB-1260 (e)	0.005	0.001	3	3	3	0	0	0
112. PCB-1016 (e)	0.005	0.001	3	3	3	0	0	0
113. toxaphene	0.005	0.01	3	3	3	0	0	0
114. antimony	0.100	0.47	3	3	0	1	0	2
115. arsenic	0.010	0.34	3	3	0	0	1	2
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	3	3	0	3	0	0
118. cadmium	0.002	0.049	3	3	0	2	0	1
119. chromium	0.005	0.07	3	3	0	0	0	3
120. copper	0.009	0.39	3	3	0	0	2	1
121. cyanide (f)	0.02	0.047	4	6	0	0	0	6
122. lead	0.020	0.08	3	3	0	0	1	2
123. mercury	0.0001	0.036	3	3	0	2	1	0
124. nickel	0.005	0.22	3	3	0	0	0	3
125. selenium	0.01	0.20	3	3	0	3	0	0
126. silver	0.02	0.07	3	3	0	3	0	0
127. thallium	0.100	0.34	3	3	0	2	0	1
128. zinc	0.050	0.23	3	3	0	0	2	1
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

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

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

Table VI-11

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
MAGNESIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
1. acenaphthene	0.010	0.010	3	4	4	0	0	0
2. acrolein	0.010	0.100	3	4	4	0	0	0
3. acrylonitrile	0.010	0.01	3	4	4	0	0	0
4. benzene	0.010	0.05 - 0.10	3	4	4	0	0	0
5. benzidine	0.010	0.01	3	4	4	0	0	0
6. carbon tetrachloride	0.010	0.05	3	4	4	0	0	0
7. chlorobenzene	0.010	0.025	3	4	4	0	0	0
8. 1,2,4-trichlorobenzene	0.010	0.01	3	4	4	0	0	0
9. hexachlorobenzene	0.010	0.01	3	4	4	0	0	0
10. 1,2-dichloroethane	0.010	0.1	3	4	4	0	0	0
11. 1,1,1-trichloroethane	0.010	0.01	3	4	1	3	0	0
12. hexachloroethane	0.010	0.01	3	4	4	0	0	0
13. 1,1-dichloroethane	0.010	0.01	3	4	4	0	0	0
14. 1,1,2-trichloroethane	0.010	0.1	3	4	4	0	0	0
15. 1,1,2,2-tetrachloroethane	0.010	0.05	3	4	4	0	0	0
16. chloroethane	0.010	0.01	3	4	4	0	0	0
17. bis(chloromethyl) ether	0.010	0.01	3	4	4	0	0	0
18. bis(2-chloroethyl) ether	0.010	0.01	3	4	4	0	0	0
19. 2-chloroethyl vinyl ether	0.010	0.01	3	4	4	0	0	0
20. 2-chloronaphthalene	0.010	0.01	3	4	4	0	0	0
21. 2,4,6-trichlorophenol	0.010	0.025	3	4	4	0	0	0
22. parachlorometa cresol	0.010	0.05	3	4	4	0	0	0
23. chloroform	0.010	0.1	3	4	4	0	0	0
24. 2-chlorophenol	0.010	0.05	3	4	4	0	0	0
25. 1,2-dichlorobenzene	0.010	0.05	3	4	4	0	0	0
26. 1,3-dichlorobenzene	0.010	0.01	3	4	4	0	0	0
27. 1,4-dichlorobenzene	0.010	0.01	3	4	4	0	0	0
28. 3,3'-dichlorobenzidine	0.010	0.01	3	4	4	0	0	0
29. 1,1-dichloroethylene	0.010	0.1	3	4	4	0	0	0
30. 1,2-trans-dichloroethylene	0.010	0.1	3	4	4	0	0	0
31. 2,4-dichlorophenol	0.010	0.01	3	4	4	0	0	0
32. 1,2-dichloropropane	0.010	0.01	3	4	4	0	0	0
33. 1,2-dichloropropylene	0.010	0.01	3	4	4	0	0	0
34. 2,4-dimethylphenol	0.010	0.05	3	4	4	0	0	0
35. 2,4-dinitrotoluene	0.010	0.05	3	4	4	0	0	0

Table VI-11 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
MAGNESIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
36. 2,6-dinitrotoluene	0.010	0.05	3	4	4	0	0	0
37. 1,2-diphenylhydrazine	0.010	0.05	3	4	4	0	0	0
38. ethylbenzene	0.010	0.05	3	4	4	0	0	0
39. fluoranthene	0.010	0.01	3	4	4	0	0	0
40. 4-chlorophenyl phenyl ether	0.010	0.01	3	4	4	0	0	0
41. 4-bromophenyl phenyl ether	0.010	0.01	3	4	4	0	0	0
42. bis(2-chloroisopropyl) ether	0.010	0.01	3	4	4	0	0	0
43. bis(2-chloroethoxy) methane	0.010	0.01	3	4	4	0	0	0
44. methylene chloride	0.010	0.10	3	4	0	3	0	1
45. methyl chloride	0.010	0.01	3	4	4	0	0	0
46. methyl bromide	0.010	0.01	3	4	4	0	0	0
47. bromoform	0.010	0.05	3	4	4	0	0	0
48. dichlorobromomethane	0.010	0.10	3	4	4	0	0	0
49. trichlorofluoromethane	0.010	0.01	3	4	4	0	0	0
50. dichlorodifluoromethane	0.010	0.01	3	4	4	0	0	0
51. chlorodibromomethane	0.010	0.10	3	4	4	0	0	0
52. hexachlorobutadiene	0.010	0.01	3	4	4	0	0	0
53. hexachlorocyclopentadiene	0.010	0.01	3	4	4	0	0	0
54. isophorone	0.010	0.05	3	4	4	0	0	0
55. naphthalene	0.010	0.05	3	4	4	0	0	0
56. nitrobenzene	0.010	0.05	3	4	4	0	0	0
57. 2-nitrophenol	0.010	0.01	3	4	3	1	0	0
58. 4-nitrophenol	0.010	0.05	3	4	4	0	0	0
59. 2,4-dinitrophenol	0.010	0.025	3	4	4	0	0	0
60. 4,6-dinitro-o-cresol	0.010	0.025	3	4	4	0	0	0
61. N-nitrosodimethylamine	0.010	0.01	3	4	4	0	0	0
62. N-nitrosodiphenylamine	0.010	0.01	3	4	4	0	0	0
63. N-nitrosodi-n-propylamine	0.010	0.01	3	4	4	0	0	0
64. pentachlorophenol	0.010	0.01	3	4	4	0	0	0
65. phenol	0.010	0.05	3	4	3	1	0	0
66. bis(2-ethylhexyl) phthalate	0.010	0.01	3	4	4	0	0	0
67. butyl benzyl phthalate	0.010	0.001 - 0.01	3	4	4	0	0	0
68. di-n-butyl phthalate	0.010	0.025	3	4	4	0	0	0
69. di-n-octyl phthalate	0.010	0.01	3	4	4	0	0	0

Table VI-11 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
MAGNESIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
70. diethyl phthalate	0.010	0.025	3	4	4	0	0	0
71. dimethyl phthalate	0.010	0.025	3	4	4	0	0	0
72. benzo(a)anthracene	0.010	0.01	3	4	4	0	0	0
73. benzo(a)pyrene	0.010	0.01	3	4	4	0	0	0
74. 3,4-benzofluoranthene	0.010	0.01	3	4	4	0	0	0
75. benzo(k)fluoranthene	0.010	0.01	3	4	4	0	0	0
76. chrysene	0.010	0.001	3	4	4	0	0	0
77. acenaphthylene	0.010	0.01	3	4	4	0	0	0
78. anthracene	0.010	0.01	3	4	4	0	0	0
79. benzo(ghi)perylene	0.010	0.01	3	4	4	0	0	0
80. fluorene	0.010	0.01	3	4	4	0	0	0
81. phenanthrene	0.010	0.01	3	4	4	0	0	0
82. dibenzo(a,h)anthracene	0.010	0.01	3	4	4	0	0	0
83. indeno(1,2,3-cd)pyrene	0.010	0.01	3	4	4	0	0	0
84. pyrene	0.010	0.001 - 0.01	3	4	4	0	0	0
85. tetrachloroethylene	0.010	0.05	3	4	4	0	0	0
86. toluene	0.010	0.05	3	4	4	0	0	0
87. trichloroethylene	0.010	0.01	3	4	4	0	0	0
88. vinyl chloride	0.010	0.01	3	4	4	0	0	0
89. aldrin	0.005	0.001	0					
90. dieldrin	0.005	0.01	0					
91. chlordane	0.005	0.01	0					
92. 4,4'-DDT	0.005	0.01	0					
93. 4,4'-DDE	0.005	0.01	0					
94. 4,4'-DDD	0.005	0.01	0					
95. alpha-endosulfan	0.005	0.001	0					
96. beta-endosulfan	0.005	0.01	0					
97. endosulfan sulfate	0.005	0.01	0					
98. endrin	0.005	0.01	0					
99. endrin aldehyde	0.005	0.01	0					
100. heptachlor	0.005	0.01	0					
101. heptachlor epoxide	0.005	0.01	0					
102. alpha-BHC	0.005	0.01	0					

Table VI-11 (Continued)

FREQUENCY OF OCCURRENCE OF TOXIC POLLUTANTS
MAGNESIUM FORMING SUBCATEGORY
RAW WASTEWATER

Pollutant	Analytical Quantification Concentration (mg/l)(a)	Treatable Concentration (mg/l)(b)	Number of Streams Analyzed	Number of Samples Analyzed	ND	Detected Below Quantification Concentration	Detected Below Treatable Concentration	Detected Above Treatable Concentration
103. beta-BHC	0.005	0.01	0					
104. gamma-BHC	0.005	0.01	0					
105. delta-BHC	0.005	0.01	0					
106. PCB-1242	0.005	0.001	0					
107. PCB-1254	0.005	0.001	0					
108. PCB-1221	0.005	0.001	0					
109. PCB-1232	0.005	0.001	0					
110. PCB-1248	0.005	0.001	0					
111. PCB-1260	0.005	0.001	0					
112. PCB-1016	0.005	0.001	0					
113. toxaphene	0.005	0.01	0					
114. antimony	0.100	0.47	11	15	0	14	1	0
115. arsenic	0.010	0.34	10	14	0	14	0	0
116. asbestos	10 MFL	10 MFL	0					
117. beryllium	0.010	0.20	11	15	0	11	3	1
118. cadmium	0.002	0.049	11	15	0	15	0	0
119. chromium	0.005	0.07	11	15	0	3	5	7
120. copper	0.009	0.39	11	15	0	14	1	0
121. cyanide (c)	0.02	0.047	11	14	0	11	1	2
122. lead	0.020	0.08	11	15	0	14	0	1
123. mercury	0.0001	0.036	11	15	0	13	2	0
124. nickel	0.005	0.22	11	15	0	15	0	0
125. selenium	0.01	0.20	11	15	0	15	0	0
126. silver	0.02	0.07	11	15	0	14	1	0
127. thallium	0.100	0.34	11	15	0	15	0	0
128. zinc	0.050	0.23	11	15	0	0	6	9
129. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	--	--	0					

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

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

(c) 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.

SECTION VII

CONTROL AND TREATMENT TECHNOLOGY

This section describes the treatment techniques currently used or available to remove or recover wastewater pollutants normally generated by the nonferrous metals forming industrial point source category. Included are discussions of individual end-of-pipe treatment technologies and in-plant technologies. These treatment technologies are widely used in many industrial categories and data and information to support their effectiveness have been drawn from a similarly wide range of sources and data bases.

This discussion of control and treatment technology is divided into four parts: the major technologies; the effectiveness of major technologies; the minor technologies; and the in-plant technologies.

END-OF-PIPE TREATMENT TECHNOLOGIES

Individual recovery and treatment technologies are described which are used or are suitable for use in treating wastewater discharges from nonferrous metals forming facilities. Each description includes a functional description and discussions of application and performance, advantages and limitations, operational factors (reliability, maintainability, solid waste aspects), and demonstration status. The treatment processes described include both technologies presently demonstrated within the nonferrous metals forming category, and technologies demonstrated in treatment of similar wastes in other industries.

Nonferrous metals forming wastewater streams characteristically contain significant levels of toxic inorganic pollutants. Antimony, cadmium, chromium, copper, cyanide, lead, nickel, and zinc are found in nonferrous metals forming wastewater streams at substantial concentrations. These toxic inorganic pollutants constitute the most significant wastewater pollutants in this category. Oils and emulsions are also present in waste streams emanating from operations using oil-based lubricants and emulsions. Ammonia is present in waste streams associated with pickling operations where ammonium bifluoride is used. One plant reported the use of ammonia in a pickling rinse operation as well.

In general, these pollutants are removed by oil removal (skimming and emulsion breaking), ammonia stripping, hexavalent chromium reduction, chemical precipitation and sedimentation, or filtration. Most of them may be effectively removed by precipitation of metal hydroxides or carbonates utilizing the reaction with lime, sodium hydroxide, or sodium carbonate.

MAJOR TECHNOLOGIES

In Sections IX, X, XI, and XII, the rationale for selecting treatment systems is discussed. The individual technologies used in the system are described here. The major end-of-pipe technologies are: chemical emulsion breaking, oil skimming, ammonia steam stripping, hexavalent chromium reduction, cyanide precipitation, chemical precipitation and sedimentation, and multimedia filtration. In practice, precipitation of metals and settling of the resulting precipitates is often a unified two-step operation. Suspended solids originally present in raw wastewaters are not appreciably affected by the precipitation operation and are removed with the precipitated metals in the settling operations. Settling operations can be evaluated independently of hydroxide or other chemical precipitation operations, but hydroxide and other chemical precipitation operations can only be evaluated in combination with a solids removal operation.

Chemical Emulsion Breaking

Chemical treatment is often used to break stable oil-in-water (O-W) emulsions. An O-W emulsion consists of oil dispersed in water, stabilized by electrical charges and emulsifying agents. A stable emulsion will not separate or break down without some form of treatment.

Once an emulsion is broken, the difference in specific gravities allows the oil to float to the surface of the water. Solids usually form a layer between the oil and water, since some oil is retained in the solids. The longer the retention time, the more complete and distinct the separation between the oil, solids, and water will be. Often other methods of gravity differential separation, such as air flotation or rotational separation (e.g., centrifugation), are used to enhance and speed separation. A schematic flow diagram of one type of application is shown in Figure VII-1.

The major equipment required for chemical emulsion breaking includes: reaction chambers with agitators, chemical storage tanks, chemical feed systems, pumps, and piping.

Emulsifiers may be used in the plant to aid in stabilizing or forming emulsions. Emulsifiers are surface-active agents which alter the characteristics of the oil and water interface. These surfactants have rather long polar molecules. One end of the molecule is particularly soluble in water (e.g., carboxyl, sulfate, hydroxyl, or sulfonate groups) and the other end is readily soluble in oils (an organic group which varies greatly with the different surfactant type). Thus, the surfactant emulsifies or suspends the organic material (oil) in water. Emulsifiers also

lower the surface tension of the O-W emulsion as a result of solvation and ionic complexing. These emulsions must be destabilized in the treatment system.

Application and Performance. Emulsion breaking is applicable to waste streams containing emulsified oils or lubricants such as rolling and drawing emulsions.

Treatment of spent O-W emulsions involves the use of chemicals to break the emulsion followed by gravity differential separation. Factors to be considered for breaking emulsions are type of chemicals, dosage and sequence of addition, pH, mechanical shear and agitation, heat, and retention time.

Polymers, alum, ferric chloride, and organic emulsion breakers break emulsions by neutralizing repulsive charges between particles, precipitating or salting out emulsifying agents, or altering the interfacial film between the oil and water so it is readily broken. Reactive cations (e.g., H(+1), Al(+3), Fe(+3), and cationic polymers) are particularly effective in breaking dilute O-W emulsions. Once the charges have been neutralized or the interfacial film broken, the small oil droplets and suspended solids wil be adsorbed on the surface of the floc that is formed, or break out and float to the top. Various types of emulsion-breaking chemicals are used for the various types of oils.

If more than one chemical is required, the sequence of addition can make quite a difference in both breaking efficiency and chemical dosages.

Wastewater pH plays an important role in emulsion breaking, especially if cationic inorganic chemicals, such as alum, are used as coagulants. A depressed pH in the range of 2 to 4 keeps the aluminum ion in its most positive state where it can function most effectively for charge neutralization. After some of the oil is broken free and skimmed, raising the pH into the 6 to 8 range with lime or caustic will cause the aluminum to hydrolyze and precipitate as aluminum hydroxide. This floc entraps or adsorbs destabilized oil droplets which can then be separated from the water phase. Cationic polymers can break emulsions over a wider pH range and thus avoid acid corrosion and the additional sludge generated from neutralization; however, an inorganic flocculant is usually required to supplement the polymer emulsion breaker's adsorptive properties.

Mixing is important in breaking O-W emulsions. Proper chemical feed and dispersion is required for effective results. Mixing also causes collisions which help break the emulsion, and subsequently helps to agglomerate droplets.

In all emulsions, the mix of two immiscible liquids has a specific gravity very close to that of water. Heating lowers the viscosity and increases the apparent specific gravity differential between oil and water. Heating also increases the frequency of droplet collisions, which helps to rupture the interfacial film.

Chemical emulsion breaking can be used with oil skimming to achieve the treatment effectiveness concentrations that oil skimming alone will achieve for non-emulsified streams. This type of treatment is proven to be reliable and is considered state-of-the-art for nonferrous metals forming emulsified oily wastewaters.

Advantages and Limitations. Advantages gained from the use of chemicals for breaking O-W emulsions are the high removal efficiency potential and the possibility of reclaiming the oily waste. Disadvantages are corrosion problems associated with acid-alum systems, skilled operator requirements for batch treatment, and chemical sludges produced.

Operational Factors. Reliability: Chemical emulsion breaking is a very reliable process. The main control parameters, pH and temperature, are fairly easy to control.

Maintainability: Maintenance is required on pumps, motors, and valves, as well as periodic cleaning of the treatment tank to remove any accumulated solids. Energy use is limited to mixers and pumps.

Solid Waste Aspects: The surface oil and oily sludge produced are usually hauled away by a licensed contractor. If the recovered oil has a sufficiently low percentage of water, it may be burned for its fuel value or processed and reused.

Demonstration Status. Twelve plants in the nonferrous metals forming category currently break emulsions with chemicals.

Skimming

Pollutants with a specific gravity less than water will often float unassisted to the surface of the wastewater. Skimming removes these floating wastes. Skimming normally takes place in a tank designed to allow the floating material to rise and remain on the surface, while the liquid flows to an outlet located below the floating layer. Skimming devices are therefore suited to the removal of non-emulsified oils from raw waste streams. Common skimming mechanisms include the rotating drum type, which picks up oil from the surface of the water as it rotates. A blade

scrapes oil from the drum and collects it in a trough for disposal or reuse. The water portion is allowed to flow under the rotating drum. Occasionally, an underflow baffle is installed after the drum; this has the advantage of retaining any floating oil which escapes the drum skimmer. The belt type skimmer is pulled vertically through the water, collecting oil which is scraped off from the surface and collected in a drum. Gravity separators (Figure VII-2), such as the API type, utilize overflow and underflow baffles to skim a floating oil layer from the surface of the wastewater. An overflow-underflow baffle allows a small amount of wastewater (the oil portion) to flow over into a trough for disposition or reuse while the majority of the water flows underneath the baffle. This is followed by an overflow baffle, which is set at a height relative to the first baffle such that only the oil bearing portion will flow over the first baffle during normal plant operation. A diffusion device, such as a vertical slot baffle, aids in creating a uniform flow through the system and increasing oil removal efficiency.

Application and Performance. Skimming is applicable to any waste stream containing pollutants which float to the surface. It is commonly used to remove free oil, grease, and soaps. Skimming may be used in conjunction with air flotation or clarification in order to increase its effectiveness.

The removal efficiency of a skimmer is partly a function of the retention time of the water in the tank. Larger, more buoyant particles require less retention time than smaller particles. Thus, the efficiency also depends on the composition of the waste stream. The retention time required to allow phase separation and subsequent skimming varies from 1 to 15 minutes, depending on the wastewater characteristics.

API or other gravity-type separators tend to be more suitable for use where the amount of surface oil flowing through the system is continuous and substantial. Drum and belt type skimmers are applicable to waste streams which evidence smaller amounts of floating oil and where surges of floating oil are not a problem. Using an API separator system in conjunction with a drum type skimmer would be a very effective method of removing floating contaminants from non-emulsified oily waste streams.

The sampling and analytical data described in Section V show low concentrations, generally 50 ug/l or less, of toxic organic pollutants. When the toxic organics are present, they are found in or are commingled with oil-containing waste streams. The toxic organics are soluble in the oil and will therefore be removed from the water through oil skimming. The Agency has not established effluent limitations and standards for the few toxic

organics found at quantifiable concentrations because the concentrations are low and when present they will be effectively removed by oil skimming.

Advantages and Limitations. Skimming as a pretreatment is effective in removing naturally floating waste material. It also improves the performance of subsequent downstream treatments.

Many pollutants, particularly dispersed or emulsified oil, will not float "naturally" but require additional treatment. Therefore, skimming alone may not remove all the pollutants capable of being removed by air flotation or other more sophisticated technologies.

Operational Factors. Reliability: Because of its simplicity, skimming is a very reliable technique, requiring little operator supervision.

Maintainability: The skimming mechanism requires periodic lubrication, adjustment, and replacement of worn parts.

Solid Waste Aspects: The collected layer of debris is disposed of by contractor removal, landfill, incineration or it may be re-refined. One plant reported that oil was reclaimed through distillation on-site. Because relatively large quantities of water are present in the collected wastes, incineration is not always a viable disposal method.

Demonstration Status. Skimming is a common operation utilized extensively by industrial waste treatment systems. It is operated in 30 plants in this category.

Ammonia Stripping

Ammonia, often used as a process reagent, is very soluble in water. Ammonia dissolves in water to an extent governed by the partial pressure of the gas in contact with the liquid. The ammonia may be removed from process wastewaters by stripping with air or steam.

Air stripping takes place in a packed or lattice tower; air is blown through the packed bed or lattice, over which the ammonia-laden stream flows. Usually, the wastewater is heated prior to delivery to the tower, and air is used at ambient temperature.

The term "ammonia steam stripping" refers to the process of desorbing aqueous ammonia by contacting the liquid with a sufficient amount of ammonia-free steam. The steam is introduced countercurrent to the wastewater to maximize removal of ammonia. The operation is commonly carried out in packed bed or tray columns, and the pH is adjusted to 12 or more with lime or

caustic. Simple tray designs (such as disk and doughnut trays) are used in steam stripping because of the presence of appreciable suspended solids and the scaling produced by lime. These allow easy cleaning of the tower, at the expense of somewhat lower steam water contact efficiency, necessitating the use of more trays for the same removal efficiency.

Application and Performance. The evaporation of water and the volatilization of ammonia generally produces a drop in both temperature and pH, which ultimately limit the removal of ammonia in a single air stripping tower. However, high removals are favored by:

1. High pH values, which shift the equilibrium from ammonium toward free ammonia;

2. High temperature, which decreases the solubility of ammonia in aqueous solutions; and

3. Intimate and extended contact between the wastewater to be stripped and the stripping gas.

Of these factors, pH and temperature are generally less costly to optimize than increasing contact time by an increase in contact tank volume or recirculation ratio. The temperature will, to some extent, be controlled by the climatic conditions; the pH of the wastewater can be adjusted to assure optimum stripping.

Steam stripping offers better ammonia removal (99 percent or better) than air stripping for high-ammonia wastewaters found in this category. The performance of an ammonia stripping column is influenced by a number of important variables that are associated with the wastewater being treated and column design. Brief discussions of these variables follow.

Wastewater pH: Ammonia in water exists in two forms, NH_3 and NH_4^+, the distribution of which is pH dependent. Since only the molecular form of ammonia (NH_3) can be stripped, increasing the fraction of NH_3 by increasing the pH enhances the rate of ammonia desorption.

Column temperature: The temperature of the stripping column affects the equilibrium between gaseous and dissolved ammonia, as well as the equilibrium between the molecular and ionized forms of ammonia in water. An increase in the temperature reduces the ammonia solubility and increases the fraction of aqueous ammonia that is in the molecular form, both exhibiting favorable effects on the desorption rate.

Steam rate: The rate of ammonia transfer from the liquid to gas phase is directly proportional to the degree of ammonia undersaturation in the desorbing gas. Increasing the rate of steam supply, therefore, increases undersaturation and ammonia transfer.

Column design: A properly designed stripper column achieves uniform distribution of the feed liquid across the cross section of the column, rapid renewal of the liquid-gas interface, and extended liquid-gas contacting area and time.

Steam stripping can recover significant quantities of reagent ammonia from wastewater containing extremely high initial ammonia concentrations, which partially offsets the capital and energy costs of the technology.

Advantages and Limitations. Strippers are widely used in industry to remove a variety of materials, including hydrogen sulfide and volatile organics as well as ammonia, from aqueous streams. The basic techniques have been applied both in process and in wastewater treatment applications and are well understood. The use of steam strippers with and without pH adjustment is standard practice for the removal of hydrogen sulfide and ammonia in the petroleum refining industry and has been studied extensively in this context. Air stripping has treated municipal and industrial wastewater and is recognized as an effective technique of broad applicability. Both air and steam stripping have successfully treated ammonia-laden wastewater within the nonferrous forming category and closely related industries. Four primary tungsten plants in the nonferrous metals manufacturing category use steam stripping to recover ammonia from process wastewater and reuse the ammonia in the manufacture of ammonium paratungstate. The condensed ammonia may be reused in nonferrous metals forming, incinerated or sold for reuse.

The major drawback of air stripping is the reduced efficiency in cold weather and the possibility of freezing within the tower. Because lime may cause scaling problems and the types of towers used in air stripping are not easily cleaned, caustic soda can be used to raise the feed pH. Air stripping simply transfers the ammonia from one medium to another, whereas steam stripping allows for recovery and, if so desired, reuse of ammonia. The two major limitations of steam strippers are the critical column design required for proper operation and the operational problems associated with fouling of the packing material.

Operational Factors. Reliability and Maintainability: Strippers are relatively easy to operate. The most complicated part of a steam stripper is the boiler. Periodic maintenance will prevent unexpected shutdowns of the boiler.

Packing fouling interferes with the intimate contacting of liquid-gas, thus decreasing the column efficiency, and eventually leads to flooding. The stripper column is periodically taken out of service and cleaned with acid and water with air sparging. Column cutoff is predicated on a maximum allowable pressure drop across the packing. Although packing fouling may not be completely avoidable due to endothermic $CaSO_4$ precipitation, column runs could be prolonged by a preliminary treatment step designed to remove suspended solids originally present in the feed and those precipitated after lime addition.

Demonstration Status. Steam stripping has proved to be an efficient, reliable process for the removal of ammonia from many types of industrial wastewaters that contain high concentrations of ammonia. Industries using ammonia steam stripping technology include the fertilizer industry, iron and steel, petroleum refining, organic chemicals manufacturing, and nonferrous metals manufacturing. There is currently one plant operating a steam stripping unit on nonferrous metals forming wastewater.

Cyanide Precipitation

Cyanide precipitation can be used to treat cyanide-containing wastewater. The treatment occurs in two steps: reaction with ferrous sulfate or zinc sulfate at an alkaline pH to form iron or zinc cyanide complexes followed by reaction at a low pH with additional ferrous sulfate or ferric chloride to form insoluble iron cyanide precipitates. Cyanide precipitation is applicable to all cyanide-containing wastewater and, unlike many oxidation technologies, is not limited by the presence of complexed cyanides. The oxidation technologies discussed later in this section are applicable for waste streams containing only non-complexed cyanides. Cyanide precipitation has been selected as the technology basis for cyanide control because of the presence of iron, nickel, and zinc in wastewaters in this category. These toxic metals are known to form stable complexes with cyanide.

Cyanide-containing wastewater is introduced into a mixing chamber where ferrous sulfate (as the heptahydrate ($FeSO_4 \cdot 7H_2O$)), is added to form a hexacyanoferrate complex. The hexacyanoferrate complex is most stable at a pH of 9 (standard units) (1). Thus, the complexation reaction is performed at pH 9. The amount or dosage of ferrous sulfate is dependent upon the chemical form of the cyanide in the wastewater. Cyanide may be present in one of two forms, free or complexed (sometimes referred to as fixed). Various analytical methods to determine the portions of free and complexed cyanides in wastewater have been presented in the literature (2, 3, 4). Free cyanide, which refers to the portion of total cyanide that freely dissociates in water (e.g., HCN), reacts with the ferrous sulfate to form the complex, according to:

$$FeSO_4 + 6CN^- \rightarrow Fe(CN)_6^{4-} + SO_4^{2-}$$ (complexation reaction)

Complexed cyanide, present as the hexacyanoferrate or metallocyanide complexes, is already in the desired chemical form. In theory, the ferrous sulfate dosage is determined by calculating the stoichiometric equivalent required for the free cyanide present, that is, one mole of ferrous sulfate per six moles of cyanide. In actual practice, the dosage requirements are greater than the stoichiometric equivalent (5, 6). One reason that excess ferrous sulfate is required is that the complexation reaction is very slow and the excess of reactants increases the reaction rate. Another reason is that in treatment systems, where lime or other sources of hydroxide ions are added to raise the pH to 9, some of the lime will react with the ferrous sulfate to form calcium sulfate.

After forming the complex, the wastewater is then mixed with ferric chloride or additional ferrous sulfate and the pH adjusted using acid (e.g., H_2SO_4) in the range of 2 to 4. The ferric chloride or ferrous sulfate reacts with the hexacyanoferrate to form ferrihexacyanoferrate or ferrohexacyanoferrate, respectively, according to:

$$4FeCl_3 + 3Fe(CN)_6^{4-} \rightarrow Fe_4(Fe(CN)_6)_3$$

$$2FeSO_4 + Fe(CN)_6^{4-} \rightarrow Fe_2(Fe(CN)_6)$$

The wastewater is then introduced into a clarifier to allow these insoluble precipitates to settle.

Application and Performance. Cyanide precipitation can be used when cyanide destruction is not feasible because of the presence of cyanide complexes which are difficult to destroy. Effluent concentrations of cyanide well below 0.07 mg/l are possible.

Advantages and Limitations. Cyanide precipitation is an inexpensive method of treating cyanide. Problems may occur when metal ions, such as cadmium, interfere with the formation of the complexes. The sludge formed as a result of the precipitation of cyanide is hazardous and must be handled appropriately.

Demonstration Status. Although no plants currently use cyanide precipitation to treat nonferrous metals forming wastewaters, it is used in at least six coil coating plants, two of which have both aluminum forming and aluminum coil coating operations.

The Agency believes that the technology is transferable to the nonferrous metals forming category because untreated (raw) wastewater cyanide concentrations are of the same order of magnitude

as those observed in coil coating wastewater. In general, the concentrations of cyanide found in nonferrous metals forming wastewater are within the range of concentrations found in coil coating wastewaters. In that this technology converts all cyanide species (that is, the entire range of cyanide species present) to complex cyanides, it is reasonable to assume that the technology would achieve the same performance in both categories.

In assessing the homogeneity of the combined metals data base (CMDB) discussed in detail later in this section, the Agency compared raw waste concentrations for metals among all of the categories considered, including nonferrous metals forming and coil coating. Raw wastewaters from both categories are homogeneous with respect to mean pollutant concentrations. Consequently, to the extent that there are metals present that interfere with the performance of this technology, they are accounted for in the performance data used in developing the coil coating treatment effectiveness concentrations. Therefore, nonferrous metals forming plants using this technology would be expected to achieve performance comparable to that experienced by plants in the coil coating category.

Chemical Reduction of Chromium

Description of the Process. Reduction is a chemical reaction in which electrons are transferred to the chemical being reduced from the chemical initiating the transfer (the reducing agent). Sulfur dioxide, sodium bisulfite, sodium metabisulfite, and ferrous sulfate form strong reducing agents in aqueous solution and are often used in industrial waste treatment facilities for the reduction of hexavalent chromium to the trivalent form. Hexavalent chromium is not precipitated as the hydroxide. The reduction allows removal of chromium from solution in conjunction with other metallic salts by alkaline precipitation.

Sulfur dioxide, sodium bisulfite, and sodium metabisulfite exist as sulfurous acid when introduced into water. The sulfurous acid reduces the hexavalent chromium to the trivalent form. The sulfur is in turn oxidized. When using ferrous sulfate, the chromium is reduced and the ferrous iron is oxidized to ferric iron. The reduction is favored by low pH and the rate of reaction even at low pH is slow. Operation at a pH of 2 to 3 with 30 to 45 minutes retention time is necessary for complete chromium reduction. At pH levels above 5, the reduction rate becomes even slower; and at a pH of > 7 dichromate is converted to chromate which cannot be reduced by the reducing agents discussed above. Oxidizing agents such as dissolved oxygen and ferric iron interfere with the reduction process by consuming the reducing agent.

A typical treatment consists of 45 minutes retention in a reaction tank. The reaction tank has an electronic recorder-controller device to control process conditions with respect to pH and oxidation-reduction potential (ORP). Gaseous sulfur dioxide is metered to the reaction tank to maintain the ORP within the range of 250 to 300 millivolts. Sulfuric acid is added to maintain a pH level of 2.5 standard units. The reaction tank is equipped with a propeller agitator designed to provide approximately one turnover per minute. Figure VII-3 shows a continuous chromium reduction system.

Application and Performance. Chromium reduction is used in nonferrous metals forming for treating rinses of chromic acid etching solutions used for magnesium and zinc. Cooling tower blowdown may also contain chromium as a biocide in waste streams. Electroplating and coil coating operations, frequently found on-site with nonferrous metals forming operations, are sometimes a source of chromium-bearing wastewaters. Reduction followed by chemical precipitation can achieve final total chromium concentrations of 0.05 mg/l, and concentrations of 0.01 mg/l are considered to be attainable by properly maintained and operated equipment.

Advantages and Limitations. The major advantage of chemical reduction to reduce hexavalent chromium is that it is a fully proven technology based on many years of experience. Operation at ambient conditions results in low energy consumption, and the process, especially when using sulfur dioxide, is well suited to automatic control. Furthermore, the equipment is readily obtainable from many suppliers, and operation is straightforward.

Barium chloride can be used to remove hexavalent chromium. Use of barium chloride is generally only economical if the product, barium chromate, can be sold for subsequent metal recovery. Barium chromate is hazardous and would not be suitable for disposal in landfills.

One limitation of chemical reduction of hexavalent chromium is that for high concentrations of chromium, the cost of treatment chemicals may be prohibitive. When this situation occurs, other treatment techniques are likely to be more economical. Chemical interference by oxidizing agents is possible in the treatment of mixed wastes, and the treatment itself may introduce pollutants if not properly controlled. Storage and handling of sulfur dioxide may be somewhat hazardous. Sodium bisulfite, sodium metabisulfite, and ferrous sulfate, which are purchased as solids, can be used instead of sulfur dioxide to avoid storage and handling problems. In fact, for lower flow systems, the sodium bisulfite, sodium metabisulfite, and ferrous sulfate are more economical than sulfur dioxide.

Operational Factors. Reliability: Maintenance consists of periodic removal of sludge, the frequency of which is a function of the input concentrations of detrimental constituents.

Solid Waste Aspects: Pretreatment to eliminate substances which will interfere with the process may often be necessary. This process produces trivalent chromium which can be controlled by further treatment. There may, however, be small amounts of sludge collected due to minor shifts in the solubility of the contaminants. This sludge can be processed by the main sludge treatment equipment.

Demonstration Status. The reduction of chromium waste by sulfur dioxide or sodium bisulfite is a classic process and is used by numerous plants which have hexavalent chromium compounds in wastewaters from operations such as inorganic chemicals, metal finishing, electroplating, and coil coating. Six nonferrous metals forming plants report the use of chromium reduction to treat chromic acid etching baths and rinses.

Chemical Precipitation

Dissolved toxic metal ions and certain anions may be chemically precipitated for removal by physical means such as sedimentation, filtration, or centrifugation. Precipitation is sometimes confused with coagulation, which is the destabilization (a surface charge phenomenon) of colloidal (very small) particles, or flocculation, which is the growth or aggregation of particles that results in material with better settling properties. These distinctions are frequently disregarded, since two and often all three processes occur in a single treatment sequence. Examples of coagulant aids include alum and ferric chloride, while polyelectrolytes are commonly used to enhance flocculation. Several reagents are commonly used to effect this precipitation.

1. Alkaline compounds such as lime or sodium hydroxide may be used to precipitate many toxic metal ions as metal hydroxides. Lime may be used to precipitate phosphates as insoluble calcium phosphate, fluorides as calcium fluoride, and arsenic and selenium as calcium arsenite or arsenate and calcium selinite or calcium selenate.

2. Both "soluble" sulfides such as sodium sulfide, sodium hydrosulfide, or hydrogen sulfide and "insoluble" sulfides such as ferrous sulfide may be used to precipitate many heavy metal ions as insoluble metal sulfides.

3. Ferrous sulfate, zinc sulfate, or both (as is required) may be used to precipitate cyanide as a ferro or zinc ferricyanide complex.

4. Carbonates may be used to precipitate metals as metal carbonates. Hydroxide ions are formed as a result of hydrolysis of water after carbonate addition, so that metal hydroxides are also formed through the use of carbonates.

In hydroxide precipitation, the reagents most commonly used are hydrated lime ($Ca(OH)_2$), quicklime (CaO), or caustic soda (NaOH). To illustrate the precipitation of a generic divalent metal ion, M^{2+}, the important chemical reactions are:

$$M^{2+} + Ca(OH)_2 \rightarrow M(OH)_2 + Ca^{2+}$$

$$M^{2+} + CaO + H_2O \rightarrow M(OH)_2 + Ca^{2+}$$

$$M^{2+} + 2NaOH \rightarrow M(OH)_2 + 2Na^{+}$$

The carbonate precipitation system most commonly uses soda ash (Na_2CO_3) as the carbonate-supplying reagent. The simplified reaction may be represented in the following manner:

$$M^{2+} + Na_2CO_3 \rightarrow MCO_3 + 2Na^{+}$$

These reactions replace calcium or sodium ions in the base with the metal ions, which are then removed from the wastewater through sedimentation or filtration. The calcium or sodium ions are usually left in solution, however, if appreciable amounts of sulfate, carbonate, or fluoride are present, calcium will combine with these ions to form insoluble precipitates which are also removed from solution. Sodium ions will not combine with anions in solution to form insoluble precipitants.

The equilibria indicated by these reaction equations can be strongly affected in metals processing wastewaters by complexation, chelation, and co-precipitation. Complexation is a general term which describes the tendency of most transition metal ions to react with ions or molecules in water to form stable species which usually are difficult to remove by chemical precipitation. The molecules or ions that bond with the centrally located metal ion are called ligands. Examples of ligands typically present in metals processing wastewaters include sulfate, halides, ammonia, and cyanide. The metal-ligand complexes that form are very important in the treatment of metals processing wastewaters. For instance, this phenomena is the basis of cyanide precipitation, which entails the capture of cyanide ions by addition of a complexing agent, such as iron or zinc ions, and sedimentation of the resulting complex. In most instances, however, complexing has a negative effect on treatment system performance. The complexation of cyanide by metals is the most significant complexation problem in this category. Complexed cyanide requires treatment with ferrous sulfate and ferric chloride and cannot be oxidized through conventional means.

Chelation is a special form of complexation that involves the formation of chemical bonds between a central metal ion and a ligand that contains two or more active sites (the ligands cited above usually contain only one active site, and are referred to as monodentate ligands). Those with multiple active sites are termed polydentate ligands. They are almost exclusively organic in nature, with active sites located on each end of the compound, and are collectively referred to as chelating agents. A characteristic number of these will bond with the ion and form a chelate, or complex, that is highly stable in solution. Chelation will occur in metals processing wastewaters when organic compounds are at a significant concentration. As discussed earlier, organics are not present at elevated concentrations and consequently, chelation is not likely to impact treatment system performance in this category.

Co-precipitation involves the simultaneous precipitation under alkaline conditions of certain metal ions with other metal ions, usually iron. Such reactions include atom replacement in the ferric hydroxide polymeric complex and physical entrapment or adsorption of the metal ion in a settling ferric hydroxide floc. As discussed in the major technology effectiveness section, this increased removal (often beyond solubility limits) of toxic metal ions in the presence of iron results in low concentrations of metal ions.

The concentrations attainable assuming equilibrium chemistry by hydroxide precipitation can be predicted from the knowledge of the pH of the water. Table VII-1 shows the solubility product constants for several toxic metal hydroxides. For comparison, the sulfide solubility product constants are shown as well. Figure VII-4 shows the theoretical solubility curves for toxic metals forming insoluble metal hydroxides.

As discussed later in this section, EPA did not base proposed limitations and standards on the theoretical equilibrium chemical assumptions. Rather, the limitations and standards were based on long-term data from full-scale plants with the technology operating. Data from actual operating systems take into acount equilibrium chemistry. They also take into account phenomena such as chelation, complexation, and co-precipitation that cannot be predicted reliably based on theory.

It can be seen from Figure VII-4 that from the range of optimum pH's illustrated for wastewaters containing more than one metal, no single optimum pH exists. In general, the optimum pH is seen to be in the range of 8.5 to 9.5 standard units. However, each plant should determine the optimum pH for their wastewater during the treatment system design. This is generally determined by conducting jar tests.(7)

The chemical feed system will typically include bulk storage tanks, a metering device and mixer and metering pump for slurry operations. A quicklime feed system is illustrated in Figure VII-5. A hydrated lime system would be similar but not require the slaker. A caustic soda feed system is much simpler, since the reagent is usually purchased as a 50 percent solution, while a soda ash feed system is very similar to the lime feed system, with the only difference being replacement of the slaker with a dissolver. Pumping requirements and feed system maintenance are less complicated with the soda ash system than the lime system because soda ash is very soluble in water. The soda ash solution is easier to pump and less susceptible to scaling.

The dosage of reagent required is commonly determined by conducting jar tests in the field or laboratory. In the absence of this information, a preliminary gross estimate may be made if the acidity and significant metals concentrations are known. The dosage rate may be calculated from stoichiometric relationships and a design excess value that may vary from 5 percent to 100 percent. This excess accounts for variability in raw wastewater characteristics, system inefficiencies, incomplete understanding of all occurring chemical reactions, net reaction rates, and complexation reactions. The dosage will require periodic retesting to account for daily, weekly, and seasonal variations in wastewater characteristics.

The chemical precipitant is metered into a rapid mix tank with a recycle sludge stream from the clarifier to provide sites for initiation of the precipitation reaction. Detention time in the mix tank is from 30 seconds to 5 minutes. In a sulfide precipitation system, the sulfide reagent may be added with an alkaline agent in the rapid mix tank or directly to the clarifier. The pH will be elevated to 9 to 11 by addition of alkaline chemicals.

The resulting precipitates may be coagulated and flocculated by addition of a coagulant aid in the flocculator before settling in the clarifier. Sludge is removed from the bottom of the clarifier and the clarifier overflow is discharged or routed to further treatment.

The choice and dosage of precipitating reagent is an important factor in system performance. Hydrated lime, which is introduced as an aqueous slurry or as a dry powder, combines ease of handling with reasonable cost and relatively rapid reactivity, which explain its wide use in metals processing treatment plants. Quicklime is slightly less expensive than hydrated lime but often requires slaking equipment within the lime feed system, adding to the initial cost. Caustic soda is much more expensive than either form of lime, but reacts rapidly and is easy to handle. The sludge formed is fluffy and gelatinous and difficult to

dewater (10). Larger clarifiers are also associated with the use of caustic. The hydroxide-based systems are widely demonstrated, achieve consistent performance, and generate stable sludges (i.e., sludges that do not degrade appreciably over time). Disadvantages include ineffective removal of some ions and complexes, increase in the total dissolved solids content, a poor settling sludge that is sometimes costly to dewater, and, with lime, calcium deposition problems.

Carbonate precipitation has the advantages of an easily settled or filtered precipitate, lower operating pH, safe handling, and particular effectiveness in precipitating lead. Another advantage is the generation of a dense sludge that is easily dewatered. Soda ash, however, is significantly more expensive than lime and reacts more slowly.

The chemistry of sulfide precipitation utilizes the low solubilities of many metallic sulfides to remove these ions from solution. Reagents supplying the sulfide ions are ferrous sulfide (FeS), sodium sulfide (Na_2S), and sodium hydrosulfide (NaHS). Their reactions with the divalent metal ion, M^{2+}, are as follows:

$$M^{2+} + FeS \rightarrow MS + Fe^{2+}$$

$$M^{2+} + Na_2S \rightarrow MS + 2Na^{+}$$

Hexavalent chromium is also reduced to the trivalent form in both the soluble and insoluble systems. In the insoluble sulfide process hexavalent chromium is reduced according to:

$$H_2CrO_4 + FeS + 4H_2O \rightarrow Cr(OH)_3\downarrow + Fe(OH)_3\downarrow + S\downarrow + 2H_2O$$

In the soluble sulfide process, the sulfide ion is capable of reducing hexavalent chromium as follows:

$$2H_2CrO_4 + 3NaHS + 8H_2O \rightarrow 2Cr(OH)_3\downarrow + 3S\downarrow + 7H_2O + 3NaOH$$

Ferrous sulfide is only slightly soluble in water, while sodium sulfide is totally water-soluble. This difference in solubilities results in different advantages and disadvantages for each of the two reagents. In the soluble system, dissolved sulfide concentrations are initially quite high, leading to rapid reaction rates with metal ions. This rapid precipitation may encourage the formation of finely divided (colloidal) particles that are more difficult to settle from solution. The excess sulfide, at certain pH conditions, can also react with hydrogen ions to form H_2S, a toxic gas.

These difficulties are partially overcome in the insoluble sulfide system. Only small amounts of sulfide ion are present in

solution at one time, so H_2S formation is greatly restricted. However, slower reaction rates are also a consequence of the low sulfide ion concentration. The ferrous ions liberated during sulfide precipitation are simultaneously precipitated at alkaline pH as ferrous hydroxide (11).

Application and Performance. Chemical precipitation is used in nonferrous metals forming for precipitation of dissolved metals. It can be used to remove metal ions such as aluminum, antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, tin, and zinc. The process is also applicable to any substance that can be transformed into an insoluble form such as fluorides, phosphates, soaps, sulfides, and others. Because it is simple and effective, chemical precipitation is extensively used for industrial waste treatment.

The performance of chemical precipitation depends on several variables. The most important factors affecting precipitation effectiveness are:

1. Maintenance of proper pH throughout the precipitation reaction and subsequent settling;

2. Addition of a sufficient excess of treatment ions to drive the precipitation reaction to completion;

3. Addition of an adequate supply of sacrificial ions (such as iron or aluminum), coagulant aids, and flocculants to ensure precipitation and removal of specific target ions; and

4. Effective removal of precipitated solids (see appropriate technologies discussed under "Sedimentation").

Control of pH. Irrespective of the solids removal technology employed, proper control of pH is absolutely essential for favorable performance of precipitation-sedimentation technologies because of the amphoteric nature of metal hydroxides (8, 9, 12, 13). The amphoteric properties of the metal hydroxides are clearly illustrated by solubility curves for selected metals hydroxides shown in Figure VII-5.

Co-precipitation with Iron - The presence of substantial quantities of iron in metal-bearing wastewaters before treatment has been shown to improve the removal of toxic metals. In some cases this iron is an integral part of the industrial wastewater; in other cases iron is deliberately added as a preliminary or first step of treatment. The iron functions to improve toxic metal removal by three mechanisms: the iron co-precipitates with toxic metals forming a stable precipitate which desolubilizes the toxic metal; the iron improves the settleability of the precipitate;

and the large amount of iron reduces the fraction of toxic metal in the precipitate. Co-precipitation with iron has been practiced for many years, incidentally when iron was a substantial constituent of raw wastewater, and intentionally when iron salts were added as a coagulant aid. Aluminum or mixed iron-aluminum salt also have been used.

Co-precipitation using large amounts of ferrous iron salts is known as ferrite co-precipitation because magnetic iron oxide or ferrite is formed. The addition of ferrous salts (sulfate) is followed by alkali precipitation and air oxidation. The resultant precipitate is easily removed by filtration and may be removed magnetically.

Advantages and Limitations. Chemical precipitation has proven to be an effective technique for removing many pollutants from industrial wastewater. It operates at ambient conditions and is well suited to automatic control. The use of chemical precipitation may be limited because of interference by chelating agents, because of possible chemical interference of mixed wastewaters and treatment chemicals, or because of the potentially hazardous situation involved with the storage and handling of those chemicals. Lime is usually added as a slurry when used in hydroxide precipitation. The slurry must be kept well mixed and the addition lines periodically checked to prevent blocking, which may result from a buildup of solids. Also, hydroxide precipitation usually makes recovery of the precipitated metals difficult, because of the heterogeneous nature of most hydroxide sludges.

The major advantage of the sulfide precipitation process is that the extremely low solubility of most metal sulfides promotes very high metal removal efficiencies; the sulfide process also has the ability to remove chromates and dichromates without preliminary reduction of the chromium to its trivalent state. In addition, sulfide can precipitate metals complexed with most complexing agents. The process demands care, however, in maintaining the pH of the solution at approximately 10 in order to prevent the generation of toxic hydrogen sulfide gas. For this reason, ventilation of the treatment tanks may be a necessary precaution in most installations. The use of insoluble sulfides reduces the problem of hydrogen sulfide evolution. As with hydroxide precipitation, excess sulfide ion must be present to drive the precipitation reaction to completion. Since the sulfide ion itself is toxic, sulfide addition must be carefully controlled to maximize heavy metals precipitation with a minimum of excess sulfide to avoid the necessity of post treatment. At very high excess sulfide levels and high pH, soluble mercury-sulfide compounds may also be formed. Where excess sulfide is present, aeration of the effluent stream can aid in oxidizing residual sulfide to the less harmful sodium sulfate (Na_2SO_4). The cost of sulfide precipitants is high in comparison with hydroxide precipitants, and

disposal of metallic sulfide sludges may pose problems. An essential element in effective sulfide precipitation is the removal of precipitated solids from the wastewater and proper disposal in an appropriate site. Sulfide precipitation will also generate a higher volume of sludge than hydroxide precipitation, resulting in higher disposal and dewatering costs. This is especially true when ferrous sulfide is used as the precipitant.

The use of sulfide precipitation prior to filtration was considered as a polishing step for further toxic pollutant removals. However, it was rejected because treatability studies performed on inorganic chemicals wastewater did not show significant improvement in toxic metals removals over those achieved by chemical precipitation and sedimentation alone.

Operational Factors. Reliability: Alkaline chemical precipitation is highly reliable, although proper monitoring and control are required.

Maintainability: Major maintenance involves periodic upkeep of monitoring equipment, automatic feeding equipment, mixing equipment, and other hardware. Removal of accumulated sludge is necessary for efficient operation of precipitation-sedimentation systems.

Solid Waste Aspects: Solids which precipitate out are removed in a subsequent treatment step. Ultimately, these solids require proper disposal.

Demonstration Status. Chemical precipitation of metal hydroxides is a classic waste treatment technology used in many industrial waste treatment systems designed to remove toxic metals. Chemical precipitation of metals in the carbonate form alone has been found to be feasible and is commercially used to permit metals recovery and water reuse. Forty-six plants in this category currently operate chemical precipitation (lime or caustic) systems.

Sedimentation

Settling is a process which removes solid particles from a liquid matrix by gravitational force. This is done by reducing the velocity of the feed stream in a large volume tank or lagoon so that gravitational settling can occur.

Settling is often preceded by chemical precipitation which converts dissolved pollutants to solid form and by coagulation which enhances settling by coagulating suspended precipitates into larger, faster settling particles.

If no chemical pretreatment is used, the wastewater is fed into a tank or lagoon where it loses velocity and the suspended solids are allowed to settle out. Long retention times are generally required. Accumulated sludge can be collected either periodically or continuously and either manually or mechanically. Simple settling, however, may require excessively large catchments, and long retention times (days as compared with hours) to achieve high removal efficiencies. Because of this, addition of settling aids such as alum or polymeric flocculants is often economically attractive.

In practice, chemical precipitation often precedes settling, and inorganic coagulants or polyelectrolytic flocculants are usually added as well. Common coagulants include sodium sulfate, sodium aluminate, ferrous or ferric sulfate, and ferric chloride. Organic polyelectrolytes vary in structure, but all usually form larger floc particles than coagulants used alone.

Following this pretreatment, the wastewater can be fed into a holding tank or lagoon for settling, but is more often piped into a clarifier for the same purpose. A clarifier reduces space requirements, reduces retention time, and increases solids removal efficiency. Conventional clarifiers generally consist of a circular or rectangular tank with a mechanical sludge collecting device or with a sloping funnel-shaped bottom designed for sludge collection. In advanced settling devices, inclined plates, slanted tubes, or a lamellar network may be included within the clarifier tank in order to increase the effective settling area, increasing capacity. A fraction of the sludge stream is often recirculated to the inlet, promoting formation of a denser sludge.

Application and Performance. Settling and clarification are used in the nonferrous metals forming category to remove precipitated metals. Settling can be used to remove most suspended solids in a particular waste stream; thus, it is used extensively by many different industrial waste treatment facilities. Because most metal ion pollutants are readily converted to solid metal hydroxide precipitates, settling is of particular use in those industries associated with metal production, metal forming, metal finishing, metal working, and any other industry with high concentrations of metal ions in their wastewaters. In addition to toxic metals, suitably precipitated materials effectively removed by settling include aluminum, iron, manganese, cobalt, molybdenum, fluoride, phosphate, and many others. The treatment effectiveness concentrations that can be achieved with the use of sedimentation in conjunction with chemical precipitation are discussed later in this section in Major Technology Effectiveness.

A properly operated settling system can efficiently remove suspended solids, precipitated metal hydroxides, and other impurities from wastewater. The performance of the process depends on a variety of factors, including the density and particle size of the solids, the effective charge on the suspended particles, and the types of chemicals used in pretreatment. The site of flocculant or coagulant addition also may significantly influence the effectiveness of clarification. If the flocculant is subjected to too much mixing before entering the clarifier, the complexes may be sheared and the settling effectiveness diminished. At the same time, the flocculant must have sufficient mixing and reaction time in order for effective set-up and settling to occur. Extensive operational experience has shown that the line or trough leading into the clarifier is often the most efficient site for flocculant addition. The performance of simple settling is a function of the retention time, particle size and density, and the surface area of the basin.

Advantages and Limitations. The major advantage of simple settling is its simplicity as demonstrated by the gravitational settling of solid particular waste in a holding tank or lagoon. The major problem with simple settling is the long retention time necessary to achieve an acceptable effluent, especially if the specific gravity of the suspended matter is close to that of water. Some materials cannot be effectively removed by simple settling alone.

Settling performed in a clarifier is effective in removing slow-settling suspended matter in a shorter time and in less space than a simple settling system. Also, effluent quality is often better from a clarifier. The cost of installing and maintaining a clarifier, however, is substantially greater than the costs associated with simple settling.

Inclined plate, slant tube, and lamellar settlers have been observed to achieve higher removal efficiencies than conventional clarifiers, and greater capacities per unit area are possible. Installed costs for these advanced clarification systems are claimed to be one half the cost of conventional systems of similar capacity. However, as discussed below they are prone to upsets and are sensitive to fluctuations in flow and waste loads. For plants with severe space limitations, these settling technologies used in conjunction with a filter offer an effective means of achieving the same performance of a conventional clarifier.

Operational Factors. Reliability: Settling can be a highly reliable technology for removing suspended solids. Sufficient retention time and regular sludge removal are important factors affecting the reliability of all settling systems. Proper control of pH adjustment, chemical precipitation, and coagulant or

flocculant addition are additional factors affecting settling efficiencies in systems (frequently clarifiers) where these methods are used.

Those advanced settlers using slanted tubes, inclined plates, or a lamellar network may require prescreening of the waste in order to eliminate any fibrous materials which could potentially clog the system. Some installations are especially vulnerable to shock loadings (e.g., storm water runoff not contacting process areas), but proper system design may alleviate this.

Maintainability: When clarifiers or other advanced settling devices are used, the associated system utilized for chemical pretreatment and sludge dragout must be maintained on a regular basis. Routine maintenance of mechanical parts is also necessary. Lagoons require little maintenance other than periodic sludge removal.

Demonstration Status. Settling represents the typical method of solids removal and is employed extensively in industrial waste treatment. The advanced clarifiers are just beginning to appear in significant numbers in commercial applications. Seventy-five nonferrous metals forming plants use sedimentation or clarification.

Granular Bed Filtration

Granular bed filtration may be used to further reduce suspended solids concentrations in wastewater exiting chemical precipitation and sedimentation systems. Filtration occurs in nature as the surface ground waters are cleansed by sand. Silica sand, anthracite coal, and garnet are common filter media used. These are usually supported by gravel. The media may be used singly or in combination. The multi-media filters may be arranged to maintain relatively distinct layers by balancing the forces of gravity, flow, and buoyancy on the individual particles. This is accomplished by selecting appropriate filter flow rates (gpm/sq-ft), media grain size, and density.

Granular bed filters may be classified in terms of filtration rate, filter media, flow pattern, or method of pressurization. Traditional rate classifications are slow sand, rapid sand, and high rate mixed media. In the slow sand filter, flux or hydraulic loading is relatively low, and removal of collected solids to clean the filter is therefore relatively infrequent. The filter is often cleaned by scraping off the inlet face (top) of the sand bed. In the higher rate filters, cleaning is frequent and is accomplished by a periodic backwash, opposite to the direction of normal flow.

A filter may use a single medium such as sand or diatomaceous earth (Figure VII-6a), but dual (Figure VII-6d) and mixed (multiple) media (Figure VII-6e) filters allow higher flow rates and efficiencies than single medium filters. The dual media filter usually consists of a fine bed of sand under a coarser bed of anthracite coal. The coarse coal removes most of the influent solids, while the fine sand performs a polishing function. At the end of the backwash, the fine sand settles to the bottom because it is denser than the coal, and the filter is ready for normal operation. The mixed media filter operates on the same principle, with the finer, denser media at the bottom and the coarser, less dense media at the top. The usual arrangement is garnet at the bottom (outlet end) of the bed, sand in the middle, and anthracite coal at the top. Some mixing of these layers occurs and is, in fact, desirable.

The flow pattern is usually top-to-bottom, but other patterns are sometimes used. Upflow filters (Figure VII-6b) are sometimes used, and in a horizontal filter the flow is horizontal. In a biflow filter (Figure VII-6c), the influent enters both the top and the bottom and exits laterally. The advantage of an upflow filter is that with an upflow backwash the particles of a single filter medium are distributed and maintained in the desired coarse-to-fine (bottom-to-top) arrangement. The disadvantage is that the bed tends to become fluidized, which lowers filtration efficiency. The biflow design is an attempt to overcome this problem.

The classic granular bed filter operates by gravity flow; however, pressure filters are fairly widely used. They permit higher solids loadings before cleaning and are advantageous when the filter effluent must be pressurized for further downstream treatment. In addition, pressure filter systems are often less costly for low to moderate flow rates.

Figure VII-7 depicts a high rate, dual media, gravity downflow granular bed filter, with self-stored backwash. Both filtrate and backwash are piped around the bed in an arrangement that permits gravity upflow of the backwash, with the stored filtrate serving as backwash.

Auxiliary filter cleaning is sometimes employed in the upper few inches of filter beds. This is conventionally referred to as surface wash and is accomplished by water jets just below the surface of the expanded bed during the backwash cycle. These jets enhance the scouring action in the bed by increasing the agitation.

An important feature for successful filtration and backwashing is the underdrain. This is the support structure for the bed. The underdrain provides an area for collection of the filtered water

without clogging from either the filtered solids or the media grains. In addition, the underdrain prevents loss of the media with the water, and during the backwash cycle it provides even flow distribution over the bed. Failure to dissipate the velocity head during the filter or backwash cycle will result in bed upset and the need for major repairs.

Several standard approaches are employed for filter underdrains. The simplest one consists of a parallel porous pipe imbedded under a layer of coarse gravel and manifolded to a header pipe for effluent removal. Other approaches to the underdrain system are known as the Leopold and Wheeler filter bottoms. Both of these incorporate false concrete bottoms with specific porosity configurations to provide drainage and velocity head dissipation.

Filter system operation may be manual or automatic. The filter backwash cycle may be on a timed basis, a pressure drop basis with a terminal value which triggers backwash, or a solids carryover basis from turbidity monitoring of the outlet stream. All of these schemes have been used successfully.

Application and Performance. Wastewater treatment plants often use granular bed filters for polishing after clarification, sedimentation, or other similar operations. Granular bed filtration thus has potential application to nearly all industrial plants. Chemical additives which enhance the upstream treatment equipment may or may not be compatible with or enhance the filtration process. Normal operation flow rates for various types of filters are as follows:

Slow Sand	2.04 - 5.30 1/sq m-hr
Rapid Sand	40.74 - 51.48 1/sq m-hr
High Rate Mixed Media	81.48 - 122.22 1/sq m-hr

Suspended solids are commonly removed from wastewater streams by filtering through a deep 0.3 to 0.9 m (1 to 3 feet) granular filter bed. The porous bed formed by the granular media can be designed to remove practically all suspended particles. Even colloidal suspensions (roughly 1 to 100 microns) are adsorbed on the surface of the media grains as they pass in close proximity in the narrow bed passages.

Properly operated filters following sedimentation to reduce suspended solids below 200 mg/l should produce water with less than 10 mg/l TSS as discussed later in this section in Major Technology Effectiveness. Data available for plants in this category show that several plants, using an additional pond, lagoon, or multiples of these, following chemical precipitation and sedimentation, are achieving the same treatment effectiveness concentrations as multimedia filters; however, filters are generally easier to operate and maintain. In many cases, polishing

lagoons do not achieve the treatment effectiveness realized by using a filter because they require special attention and careful control. However, the available data for the nonferrous metals forming category show that properly managed polishing lagoons or other multiple sedimentation treatment in this category are achieving the same performance as a filter. Filters are the obvious choice for plants with limited space availability. Ten plants in this category use multiple ponds and lagoons for solids removal after lime and settle treatment; three plants use multimedia filters.

Advantages and Limitations. The principal advantages of granular bed filtration are its comparatively (to other filters) low initial and operating costs, and reduced land requirements over other methods to achieve the same level of solids removal.

Operational Factors. Reliability: The recent improvements in filter technology have significantly improved filtration reliability. Control systems, improved designs, and good operating procedures have made filtration a highly reliable method of water treatment.

Maintainability: Deep bed filters may be operated with either manual or automatic backwash. In either case, they must be periodically inspected for media attrition, partial plugging, and leakage. Where backwashing is not used, collected solids must be removed by shoveling, and filter media must be at least partially replaced.

Solid Waste Aspects: Filter backwash is generally recycled within the wastewater treatment system, so that the solids ultimately appear in the clarifier sludge stream for subsequent dewatering. Alternatively, the backwash stream may be dewatered directly or, if there is no backwash, the collected solids may be disposed of in a suitable landfill. In either of these situations there is a solids disposal problem similar to that of clarifiers.

Demonstration Status. Deep bed filters are in common use in municipal treatment plants. Their use in polishing industrial clarifier effluent is increasing, and the technology is proven and conventional. Granular bed filtration is used in many manufacturing plants. The Agency is aware of three plants in this category with end-of-pipe filtration and 10 plants using multiple ponds or lagoons. Three of the 10 plants with multiple ponds or lagoons were sampled by the Agency, and over the sampling period all three achieved the filter treatment effectiveness concentrations. A fourth plant provided long-term data and it did not achieve the filter concentrations. Little data are available characterizing the effectiveness of filters presently in use within the nonferrous metals forming category. The Agency intends to obtain additional data after proposal.

Vacuum Filtration

In wastewater treatment plants, sludge dewatering by vacuum filtration generally uses cylindrical drum filters. These drums have a filter medium which may be cloth made of natural or synthetic fibers or a wire-mesh fabric. The drum is suspended above and dips into a vat of sludge. As the drum rotates slowly, part of its circumference is subject to an internal vacuum that draws sludge to the filter medium. Water is drawn through the porous filter cake thorugh the drum fabric to a discharge port, and the dewatered sludge, loosened by compressed air, is scraped from the filter mesh. Because the dewatering of sludge on vacuum filters is relatively expensive per kilogram of water removed, the liquid sludge is frequently thickened prior to processing. A vacuum filter is shown in Figure VII-8.

Application and Performance. Vacuum filters are frequently used both in municipal treatment plants and in a wide variety of industries. They are most commonly used in larger facilities, which may have a thickener to double the solids content of clarifier sludge before vacuum filtering. Often a precoat is used to inhibit filter blinding.

The function of vacuum filtration is to reduce the water content of sludge, so that the solids content increases from about 5 percent to between 20 and 30 percent, depending on the waste characteristics.

Advantages and Limitations. Although the initial cost and area requirement of the vacuum filtration system are higher than those of a centrifuge, the operating cost is lower, and no special provisions for sound and vibration protection need be made. The dewatered sludge from this process is in the form of a moist cake and can be conveniently handled.

Operational Factors. Reliability: Vacuum filter systems have proven reliable at many industrial and municipal treatment facilities. At present, the largest municipal installation is at the West Southwest wastewater treatment plant of Chicago, Illinois, where 96 large filters were installed in 1925, functioned approximately 25 years, and then were replaced with larger units. Original vacuum filters at Minneapolis-St. Paul, Minnesota now have over 28 years of continuous service, and Chicago has some units with similar or greater service life.

Maintainability: Maintenance consists of the cleaning or replacement of the filter media, drainage grids, drainage piping, filter pans, and other parts of the equipment. Experience in a number of vacuum filter plants indicates that maintenance consumes approximately 5 to 15 percent of the total time.

If intermittent operation is used, the filter equipment should be drained and washed each time it is taken out of service. An allowance for this wash time must be made in filtering schedules.

Solid Waste Aspects: Vacuum filters generate a solid cake which is usually trucked directly to landfill. All of the metals extracted from the plant wastewater are concentrated in the filter cake as hydroxides, oxides, sulfides, or other salts.

Demonstration Status. Vacuum filtration has been widely used for many years. It is a fully proven, conventional technology for sludge dewatering. Eighteen nonferrous metals forming plants report its use. Vacuum filters are selected over other sludge dewatering techniques for several reasons. First, the annualized cost in dollars per 1,000 gallons of sludge treated is lower than for centrifuges, plate-and-frame filter presses, or pressure belt filters. Second, a reasonably dry, easily handled metal hydroxide filter cake is produced. This type of sludge does not dewater as efficiently when using some of the alternative techniques. Third, downtime due to breakdown is less with vacuum filters than with centrifuges. Finally, the majority of plants in the nonferrous forming category with sludge dewatering equipment are using vacuum filters.

MAJOR TECHNOLOGY EFFECTIVENESS

The performance of individual treatment technologies was presented above. Performance of operating systems is discussed here. Two different systems are considered: L&S (hydroxide precipitation and sedimentation or lime and settle) and LS&F (hydroxide precipitation, sedimentation, and filtration or lime, settle, and filter). Subsequently, an analysis of effectiveness of such systems is made to develop one-day maximum and ten-day and thirty-day average concentration levels to be used in regulating pollutants. Evaluation of the L&S and the LS&F systems is carried out on the assumption that chemical reduction of hexavalent chromium, ammonia steam stripping, cyanide precipitation, oil skimming, and emulsion breaking are installed and operating properly where appropriate.

L&S Performance - Combined Metals Data Base (CMDB)

Chemical analysis data were collected on raw waste (treatment influent) and treated waste (treatment effluent) from 55 plants (126 data days) sampled by EPA (or its contractor) using EPA sampling and chemical analysis protocols. These data comprise the initial data base for determining the effectiveness of L&S technology in treating nine pollutants (cadmium, chromium, copper, lead, iron, nickel, manganese, zinc, and total suspended solids). Each of these plants belongs to at least one of the

following industry categories: aluminum forming, battery manufacturing, coil coating, copper forming, electroplating and porcelain enameling. All of the plants employ pH adjustment and hydroxide precipitation using lime or caustic, followed by settling (tank, lagoon or clarifier) for solids removal.

An analysis of this data was presented in the development document for the proposed regulations for coil coating and porcelain enameling (January 1981). Prior to analyzing the data, some values were deleted from the data base. These deletions were made to ensure that the data reflect properly operated treatment systems. Data were deleted if:

- They came from plants where malfunctioning processes or treatment systems at time of sampling were identified.

- They were taken on data days where pH was less than 7.0 for extended periods of time or TSS was greater than 50 mg/l. (These are prima facie indications of poor operation.)

In response to coil coating and porcelain enameling proposals, some commenters claimed that it was inappropriate to use data from some categories for regulation of other categories. In response to these comments, the Agency reanalyzed the data. An analysis of variance was applied to the data for the 126 days of sampling to test the hypothesis of homogeneous plant mean raw and treated effluent levels across categories by pollutant. This analysis is described in the report, "A Statistical Analysis of the Combined Metals Industries Effluent Data" which is in the administrative record supporting this rulemaking. The main conclusion drawn from the analysis of variance is that, with the exception of electroplating, the categories are generally homogeneous with regard to mean pollutant concentrations in both raw and treated effluent. That is, when data from electroplating facilities are included in the analysis, the hypothesis of homogeneity across categories is rejected. When the electroplating data are removed from the analysis the conclusion changes substantially and the hypothesis of homogeneity across categories is not rejected. On the basis of this analysis, the electroplating data were removed from the data base used to determine treatment effectiveness concentrations for the final coil coating, porcelain enameling, canmaking, copper forming, aluminum forming, and nonferrous metals manufacturing (phase I) regulations.

The statistical analysis provides support for the technical engineering judgement that electroplating wastewaters are sufficiently different from the wastewaters of other industrial categories in the data base to warrant removal of electroplating data from the data base used to determine treatment effectiveness. These differences may be further explained by differences

in the constituents and relative amounts of pollutants in the raw wastewaters. Therefore, the wastewater data derived from plants that only electroplate are not used in developing limitations for the nonferrous metals forming category.

For the purpose of determining treatment effectiveness, additional data were deleted from the combined metals data base. These deletions were made, almost exclusively, in cases where effluent data points were associated with low influent values. This was done in two steps. First, effluent values measured on the same day as influent values that were less than or equal to 0.1 mg/l were deleted. Second, the remaining data were screened for cases in which all influent values at a plant were low although slightly above the 0.1 mg/l value. These data were deleted not as individual data points but as plant clusters of data that were consistently low and thus not relevant to assessing treatment. A few data points were also deleted where malfunctions not previously identified were recognized.

The CMDB was used as the basis for limitations in nonferrous metals forming because the model treatment technology for nonferrous metals forming, lime and settle, is the same as for the categories represented in the CMDB. The selection of lime and settle was based on the judgment that the process steps and wastewater characteristics in nonferrous metals forming were similar to other categories that process metals for which lime and settle is an appropriate and demonstrated technology.

The basic approach in analyzing the combined metals data was to establish statistical homogeneity of the categories with respect to observed mean pollutant concentrations in both raw and treated effluent wastewater. For the proposed nonferrous metals forming regulation, the available wastewater sampling data from nonferrous metals forming facilities were analyzed along with the CMDB wastewater sampling data. In the homogeneity analysis, available nonferrous forming data were treated as one aggregate sample of data and compared to the homogeneous aggregate sample of CMDB data. The same general statistical approach, used to assess homogeneity of the combined metals categories, was used to compare the nonferrous metals forming data with the CMDB data.

Homogeneity is the absence of statistically discernible differences among categorical data groups of interest while heterogeneity is the opposite, i.e., the presence of statistically discernible differences.

The CMDB was reviewed following its use in a number of proposed regulations. Comments pointed out a few errors in the data and the Agency's review identified a few transcription errors and some data points that were appropriate for inclusion in the data

that had not been used previously because of errors in data record identification numbers. Documents in the record of this rulemaking identify all the changes, the reasons for the changes, and the effect of these changes on the data base. Other comments on the CMDB asserted that the data base was too small and that the statistical methods used were overly complex. Responses to specific comments are provided in a document included in the can-making rulemaking. The Agency believes that the combined metals data base is adequate to determine effluent concentrations achievable with lime and settle treatment. The statistical methods employed in the analysis are well known and appropriate statistical references are provided in the documents in the record that describe the analysis.

The revised data base was re-examined for homogeneity. The earlier conclusions were unchanged. The categories show good overall homogeneity with respect to concentrations of the nine pollutants in both raw and treated wastewaters with the exception of electroplating.

The same procedures used in developing proposed limitations from the combined metals data base were then used on the revised data base. That is, certain effluent data associated with low influent values were deleted, and then the remaining data were fit to a lognormal distribution to determine limitations values. The detection of data was done in two steps. First, effluent values measured on the same day as influent values that were less than or equal to 0.1 mg/l were deleted. Second, the remaining data were screened for cases in which all influent values at a plant were low although slightly above the 0.1 mg/l value. These data were deleted not as individual data points but as plant clusters of data that were consistently low and thus not relevant to assessing treatment.

The revised combined metals data base used for this proposal consists of 162 data points from 18 plants.

The pollutants compared in the combined metals data base and nonferrous metals forming data bases were cadmium, chromium, copper, iron, lead, nickel, zinc, and total suspended solids (TSS). In addition, nonferrous metals forming data for aluminum were compared to wastewater sampling data from the aluminum forming point source category. The details of these comparisons are documented in a technical memorandum available in the administrative record for this rulemaking.

For the influent comparisons, no statistical differences were found between the CMDB and nonferrous metals forming average concentrations for cadmium, iron, lead, TSS, and zinc. In addition, average influent aluminum concentrations for nonferrous metals

forming and aluminum forming plants also did not differ statistically (i.e., they were homogeneous). Influent average concentrations of chromium, copper, and nickel were statistically different (heterogeneous) for CMDB and nonferrous metals forming. However, comparison of the influent copper concentrations of the CMDB copper forming plants with the nonferrous metals forming copper levels revealed no significant difference in average influent copper concentrations between CMDB copper forming data and nonferrous metals forming copper data. As explained later, copper forming plants were used as the basis for the CMDB copper treatment effectiveness concentrations. The nonferrous metals forming nickel data initially included data from three nickel-cobalt forming plants; these plants had very high influent concentrations of nickel. Excluding the three nickel-cobalt facilities from the nonferrous metals forming nickel data for a recomparison with the CMDB nickel data resulted in no statistical difference between CMDB influent nickel data and this subset of nonferrous metals forming influent nickel data. While influent chromium concentrations between CMDB and nonferrous metals forming were statistically different (i.e., heterogeneous), the average effluent chromium concentration comparisons were not statistically different (i.e., CMDB and nonferrous metals forming were found to be homogeneous with respect to effluent chromium average concentrations).

For the effluent comparisons, no statistical differences (homogeneity) were found between the CMDB and nonferrous metals forming average concentrations for cadmium, chromium, iron, TSS, and zinc. In addition, no statistical difference was observed between the average effluent aluminum concentrations for nonferrous metals forming and aluminum forming. Effluent comparisons of copper, nickel, and lead revealed statistical differences (heterogeneity) in comparing average concentrations for CMDB and nonferrous metals forming. With respect to the significant effluent copper comparison, CMDB copper forming plant effluent copper averages were compared to nonferrous metals forming effluent copper averages. As with the analogous influent recomparison, no significant difference was determined between the CMDB subgroup of copper forming plants and the nonferrous metals forming plant group with respect to average effluent copper concentrations. Again recall that copper forming plants were used to determine the CMDB copper treatment effectiveness concentrations. Similarly, exclusion of the three nickel-cobalt plants' effluent nickel averages from the nonferrous metals forming group, resulted in the CMDB and nonferrous metals forming effluent nickel averages not being statistically different.

In examining the significant difference for lead, a subgroup of battery manufacturing plants from the revised CMDB was compared to the nonferrous metals forming plants with respect to their average influent and effluent lead concentrations. This subgroup

of CMDB plants was examined because battery manufacturing plant data from the revised CMDB contributed in part to the determination of lead limitations. The proposed lead limitations rely on battery manufacturing plant data from the revised CMDB and additional data submitted to the Agency. A technical memorandum is available in the administrative record for this rulemaking documenting the revised lead limitations. The influent comparison revealed no significant difference between average lead concentrations for battery manufacturing plants in the revised CMDB and nonferrous metals forming plants. The effluent comparison was inconclusive because of limited information for this subgroup of plants using only the revised CMDB information.

In general, the majority of CMDB and nonferrous metals forming influent and effluent pollutant comparisons were not found to be significantly different. For those pollutant comparisons where significant differences were found, recomparisons of meaningful subsets of plants usually eliminated the source of heterogeneity. For the most part, the available limited nonferrous forming sampling data are homogeneous with the CMDB sampling data.

Aluminum was not one of the pollutants included in the CMDB. Limitations for aluminum were developed from aluminum effluent data collected by EPA at three aluminum forming plants and one aluminum coil coating plant. The use of these aluminum data in nonferrous metals forming was supported by comparison with aluminum data collected by industry at nonferrous metals forming plants with appropriate lime and settle treatment. Comparison of the nonferrous metals forming effluent data (five plants, 15 observations) with the aluminum forming effluent data (four plants, 11 observations) showed no significant difference between the two groups. Also, comparison of nonferrous metals forming influent aluminum data and the influent aluminum data corresponding to the effluent data used to determine the aluminum limitations showed no significant difference among the two groups. The details of this comparison are also described in the nonferrous metals forming record.

One-Day Effluent Values

The basic assumption underlying the determination of treatment effectiveness is that the data for a particular pollutant are lognormally distributed by plant. The lognormal has been found to provide a satisfactory fit to plant effluent data in a number of effluent guidelines categories. In the case of the combined metals categories data base, there are too few data from any one plant to verify formally the lognormal assumption. Thus, measurements of each pollutant from a particular plant (denoted by X) were assumed to follow a lognormal distribution with a log mean μ and log variance σ^2. The mean, variance, and 99th percentile of X are then:

$$\text{mean of } X = E(X) = \exp(\mu + \sigma^2/2)$$

$$\text{variance of } X = V(X) = \exp(2\mu + \sigma^2)\,[\exp(\sigma^2) - 1]$$

$$99\text{th percentile} = X_{.99} = \exp(\mu + 2.33\sigma)$$

where exp is e, the base of the natural logarithm. The term lognormal is used because the logarithm of X has a normal distribution with mean μ and variance σ^2. Using the basic assumption of log normality, the actual treatment effectiveness was determined using a lognormal distribution that, in a sense, approximates the distribution of an average of the plants in the data base (i.e., an "average plant" distribution). The notion of an "average plant" distribution is not a strict statistical concept but is used here to determine limits that would represent the performance capability of an average of the plants in the data base.

This "average plant" distribution for a particular pollutant was developed as follows: the log mean was determined by taking the average of all the observations for the pollutant across plants. The log variance was determined by the pooled within-plant variance. This is the weighted average of the plant variances. Thus, the log mean represents the average of all the data for the pollutant and the log variance represents the average of the plant log variances or average plant variability for the pollutant.

The one-day effluent values were determined as follows:

Let X_{ij} = the jth observation on a particular pollutant at plant i where

$i = 1, \ldots, I$
$j = 1, \ldots, J_i$
I = total number of plants
j_i = number of observations at plant i.

Then $Y_{ij} = \ln X_{ij}$

where ln means the natural logarithm.

Then $\bar{y}$ = log mean over all plants

$$= \sum_{i=1}^{I} \sum_{j=1}^{J_i} y_{ij}/n$$

where n = total number of observations

$$= \sum_{i=1}^{I} J_i$$

and $V(y)$ = pooled log variance

$$= \frac{\sum_{i=1}^{I} (J_i-1)S_i^2}{\sum_{i=1}^{I} (J_i-1)}$$

where S_i^2 = log variance at plant i

$$= \sum_{J_i=1}^{J_i} (y_{ij}-\bar{y}_i)^2/(J_i-1)$$

$\bar{y}_i$ = log mean at plant i.

Thus, $\bar{y}$ and $V(y)$ are the log mean and log variance, respectively, of the lognormal distribution used to determine the treatment effectiveness. The estimated mean and 99th percentile of this distribution form the basis for the long term average and daily maximum effluent limitations, respectively. The estimates are

$$\text{mean} = \hat{E}(X) = \exp(\bar{y})\psi n(0.5V(y))$$

$$\text{99th percentile} = \hat{X}_{.99} = \exp[\bar{y} + 2.33\sqrt{V(y)}]$$

where $\psi(.)$ is a Bessel function and exp is e, the base of the natural logarithms (see Aitchison, J. and J. A. C. Brown, The Lognormal Distribution, Cambridge University Press, 1963). In cases where zeros or detection limit values were present in the data, a generalized form of the lognormal, known as the delta distribution was used (see Aitchison and Brown, op. cit., Chapter 9).

For certain pollutants, this approach was modified slightly to accommodate situations in which a category or categories stood out as being marginally different from the others. For instance, after excluding the electroplating data and other data that did not reflect pollutant removal or proper treatment, the effluent copper concentrations from the copper forming plants were statistically significantly greater than the copper concentrations from the other plants. Thus, copper effluent values shown in Table VII-2 are based only on the copper effluent data from the copper forming plants. That is, the log mean for copper is the mean of

the logs of all copper values from the copper forming plants only and the log variance is the pooled log variance of the copper forming plant data only. In the case of cadmium, after excluding the electroplating data and data that did not reflect removal or proper treatment, there were insufficient data to estimate the log variance for cadmium. The variance used to determine the values shown in Table VII-2 for cadmium was estimated by pooling the within plant variances for all the other metals. Thus, the cadmium variability is the average of the plant variability averaged over all the other metals. The log mean for cadmium is the mean of the logs of the cadmium observations only. As stated earlier, the CMDB lead concentrations have been revised to incorporate additional information received on battery manufacturing. A complete discussion of the data and calculations for all the metals is contained in the administrative record for this rulemaking.

Average Effluent Values

Average effluent values that form the basis for the monthly limitations were developed in a manner consistent with the method used to develop one-day treatment effectiveness in that the lognormal distribution used for the one-day effluent values was also used as the basis for the average values. That is, we assume a number of consecutive measurements are drawn from the distribution of daily measurements. The approach used for the 10 measurements values was employed previously for the electroplating category (see "Development Document for Existing Sources Pretreatment Standards for the Electroplating Point Source Category," EPA 440/1-79/003, U.S. Environmental Protection Agency, Washington, D.C., August, 1979). That is, the distribution of the average of 10 samples from a lognormal was approximated by another lognormal distribution. Although the approximation is not precise theoretically, there is empirical evidence based on effluent data from a number of categories that the lognormal is an adequate approximation for the distribution of small samples. In the course of previous work the approximation was verified in a computer simulation study. The average values were developed assuming independence of the observations although no particular sampling scheme was assumed.

Ten-Sample Average:

The formulas for the 10-sample limitations were derived on the basis of simple relationships between the mean and variance of the distributions of the daily pollutant measurements and the average of 10 measurements. We assume that the daily concentration measurements for a particular pollutant (denoted by X) follow a lognormal distribution with log mean and log variance denoted by μ and σ^2, respectively. Let $\bar{X}_{10}$ denote the mean

of 10 consecutive measurements. The following relationships then hold, assuming the daily measurements are independent:

$$\text{mean of } \bar{X}_{10} = E(\bar{X}_{10}) = E(X)$$

$$\text{variance of } \bar{X}_{10} = V(\bar{X}_{10}) = V(X) \div 10$$

where $E(X)$ and $V(X)$ are the mean and variance of X, respectively, defined above. We then assume that $\bar{X}_{10}$ follows a lognormal distribution with log mean μ_{10} and log standard deviation σ^2_{10}. The mean and variance of $\bar{X}_{10}$ are then

$$E(\bar{X}_{10}) = \exp(\mu_{10} + 0.5\sigma^2_{10})$$

$$V(\bar{X}_{10}) = \exp(2\mu_{10} + \sigma^2_{10})[\exp(\sigma^2_{10}) - 1].$$

Now, μ_{10} and σ^2_{10} can be derived in terms of μ and σ^2 as

$$\mu_{10} = \mu + \sigma^2/2 + 0.5\ln[1 + (\exp(\sigma^2 - 1)/N]$$

$$\sigma^2_{10} = \ln[1 + (\exp(\sigma^2) - 1)/N].$$

Therefore, μ_{10} and σ^2_{10} can be estimated using the above relationships and the estimates of μ and σ^2 obtained for the underlying lognormal distribution. The 10-sample limitation value was determined by the estimate of the approximate 99th percentile of the distribution of the 10 sample average given by

$$X_{10}(.99) = \exp(\hat{\mu}_{10} + 2.33\ \hat{\sigma}_{10})$$

where $\hat{\mu}_{10}$ and $\hat{\sigma}_{10}$ are the estimates of μ_{10} and σ_{10}, respectively.

30-Sample Average:

The average values based on 30 measurements are determined on the basis of a statistical result known as the Central Limit Theorem. This Theorem states that, under general and nonrestrictive assumptions, the distribution of a sum of a number of random variables, say n, is approximated by the normal distribution. The approximation improves as the number of variables, n, increases. The Theorem is quite general in that no particular distributional form is assumed for the distribution of the individual variables. In most applications (as in approximating the distribution of 30-day averages) the Theorem is used to approximate the distribution of the average of n observations of a random variable. The result makes it possible to compute approximate probability statements about the average in a wide range of cases. For instance, it is possible to compute a value below which a specified percentage (e.g., 99 percent) of the averages of n observations are likely to fall. Most textbooks

state that 25 or 30 observations are sufficient for the approximation to be valid. In applying the Theorem to the determination of 30-day average effluent values, we approximate the distribution of the average of 30 observations drawn from the distribution of daily measurements and use the estimated 99th percentile of this distribution. The monthly limitations based on 10 consecutive measurements were determined using the lognormal approximation described above because 10 measurements were, in this case, considered too small a number for use of the Central Limit Theorem.

30-Sample Average Calculation

The formulas for the 30-sample average were based on an application of the Central Limit Theorem. According to the Theorem, the average of 30 observations drawn from the distribution of daily measurements, denoted by $\bar{X}_{30}$, is approximately normally distributed. The mean and variance of $\bar{X}_{30}$ are

$$\text{mean of } \bar{X}_{30} = E(\bar{X}_{30}) = E(X)$$

$$\text{variance of } \bar{X}_{30} = V(\bar{X}_{30}) = V(X) \div 30.$$

The 30-sample average value was determined by the estimate of the approximate 99th percentile of the distribution of the 30-sample average given by

$$X_{30}(.99) = \hat{E}(X) + 2.33\sqrt{\hat{V}(X) \div 30}$$

where $\hat{E}(X) = \exp(\bar{y})\psi n(0.5V(y))$

and $\hat{V}(X) = \exp(2\bar{y})[\psi n(2V(y)) - \psi n\left[\left(\frac{n-2}{n-1}\right) V(y)\right]]$.

The formulas for $\hat{E}(X)$ and $\hat{V}(X)$ are estimates of $E(X)$ and $V(X)$, respectively, given in Aitchison, J. and J. A. C. Brown, The Lognormal Distribution, Cambridge University Press, 1963, page 45.

Application

In response to the proposed coil coating and porcelain enameling regulations, the Agency received comments pointing out that permits usually required less than 30 samples to be taken during a month while the monthly average used as the basis for permits and pretreatment requirements is based on the average of 30 samples.

In applying the treatment effectiveness values to regulations, the Agency has considered the comments, examined the sampling frequency required by many permits, and considered the change in

values of averages depending on the number of consecutive sampling days in the averages. The frequency of sampling required in permits is about one to four samples per month. The 99th percentiles of the distribution of averages of 10 consecutive sampling days are not substantially different from the 99th percentile of the distribution's 30-day average. (Compared to the one-day maximum, the 10-day average is about 80 percent of the difference between one and 30-day values). Hence, the 10-day average provides a reasonable basis for a monthly average and is typical of the sampling frequency required by existing permits.

The monthly average is to be achieved in all permits and pretreatment standards regardless of the number of samples required to be analyzed and averaged by the permit or the pretreatment authority.

Additional Pollutants

A number of other pollutant parameters were considered with regard to the performance of lime and settle treatment systems in removing them from industrial wastewater. Performance data for these parameters are not readily available, so data available to the Agency in other categories have been selectively used to determine the long-term average performance of lime and settle technology for each pollutant. These data indicate that the concentrations shown in Table VII-3 are reliably attainable with hydroxide precipitation and settling.

In establishing which data were suitable for use in Table VII-3 two factors were heavily weighed: (1) the nature of the wastewater; and (2) the range of pollutants or pollutant matrix in the raw wastewater. These data have been selected from processes that generate dissolved metals in the wastewater and which are generally free from complexing agents. The pollutant matrix was evaluated by comparing the concentrations of pollutants found in the raw wastewaters with the range of pollutants in the raw wastewaters of the combined metals data set. These data are displayed in Tables VII-4 and VII-5 and indicate that there is sufficient similarity in the raw wastes to logically assume transferability of the treated pollutant concentrations to the combined metals data base. The available data on these added pollutants do not allow a homogeneity analysis as was performed on the combined metals data base. The data source for each added pollutant is discussed separately.

Antimony (Sb) - The achievable performance for antimony is based on data from a battery and secondary lead plant. Both EPA sampling data and recent permit data (1978 - 1982) confirm the achievability of 0.7 mg/l in the battery manufacturing wastewater matrix included in the combined data set. The 0.7 mg/l concentration is achieved at a battery manufacturing and secondary lead

plant with the comparable untreated wastewater matrix shown in Table VII-6.

Beryllium (Be) - The treatability of beryllium is transferred from the nonferrous metals manufacturing industry. The 0.3 mg/l concentration is achieved at a beryllium plant with the comparable untreated wastewater matrix shown in Table VII-5.

Silver (Ag) - The treatability of silver is based on a 0.1 mg/l treatability estimate from the inorganic chemicals industry. Additional data supporting a treatability as stringent or more stringent than 0.1 mg/l are also available from seven nonferrous metals manufacturing plants. The untreated wastewater matrix for these plants is comparable and summarized in Table VII-5.

Fluoride (F) - The 14.5 mg/l treatability of fluoride is based on the mean performance of an electronics and electrical component manufacturing plant. The untreated wastewater matrix for this plant shown in Table VII-5 is comparable to the combined metals data set.

Radium^{226} (Ra^{226}) - The 5.0 picocuries per liter treatability is based on the water quality criterion for radium^{226}.

No treatment effectiveness concentrations are available for columbium, hafnium, magnesium, molybdenum, tantalum, titanium, uranium, vanadium, and zirconium, metals which are proposed for limitation in some subcategories. We believe that lime and settle technology will result in effluent concentrations of these metals of not more than 0.50 mg/l. This estimate is based on the ability of the lime and settle technology to reduce the concentration of the majority of the metals in the combined metals data base to this value or less. Sampling data from one nonferrous metals forming plant with significant titanium concentrations in the raw waste show that lime and settle treatment achieved a titanium effluent concentration of 0.5 mg/l or less at that plant. The Agency intends to obtain additional data on treatment effectiveness for these metals after proposal.

Ammonia Steam Stripping Performance

Chemical analysis data were collected of raw waste (treatment influent) and treated waste (treatment effluent) from one plant of the iron and steel 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.

An arithmetic mean of the treatment effluent data produced an ammonia long-term mean value of 32.2 mg/l. The one-day maximum, 10-day and 30-day average concentrations attainable by ammonia steam stripping were calculated using the long-term mean of the 32.2 mg/l and the variability factors developed for the combined metals data base. This produced ammonia concentrations of 133.3, 58.6 and 52.1 mg/l ammonia for the one-day maximum, 10-day and 30-day averages, respectively.

As discussed above under Demonstration Status for Ammonia Stripping, steam stripping is demonstrated at one plant within this category. EPA believes the performance data from the iron and steel category provide a valid measure of this technology's performance on nonferrous category wastewater due to similar (concentrations of the same order of magnitude) concentrations of ammonia in the respective raw wastewater matrices. A comparison of raw (untreated) wastewater samples from the nonferrous metals forming point source category and the iron and steel facility from which the ammonia data was transferred is contained in the public record.

The Agency has verified the proposed steam stripping performance values using steam stripping data collected at a zirconium-hafnium plant, a plant in the nonferrous category (phase II), which has raw ammonia concentrations as high as many in the nonferrous metals forming subcategories. Data collected by the plant represent almost two years of daily operations, and support the long-term mean and the variability factors used to establish treatment effectiveness.

LS&F Performance

Tables VII-6 and VII-7 show long-term data from two plants which have well operated precipitation-settling treatment followed by filtration. The wastewaters from both plants contain pollutants from metals processing and finishing operations (multi-category). Both plants reduce hexavalent chromium before neutralizing and precipitating metals with lime. A clarifier is used to remove much of the solids load and a filter is used to "polish" or complete removal of suspended solids. Plant A uses pressure filtration, while Plant B uses a rapid sand filter.

Raw waste data were collected only occasionally at each facility and are presented as an indication of the nature of the wastewater treated. Data from Plant A were received as a statistical

summary and are presented as received. Raw laboratory data were collected at Plant B and reviewed for spurious points and discrepancies. The method of treating the data base is discussed below under lime, settle, and filter treatment effectiveness.

Table VII-8 shows long-term data for zinc and cadmium removal at Plant C, a primary zinc smelter, which operates a LS&F system. These data represent about four months (103 data days) taken immediately before the smelter was closed, and have been arranged similarily to Plants A and B for comparison and use.

These data are presented to demonstrate the performance of precipitation-settling-filtration (LS&F) technology under actual operating conditions and over a long period of time.

It should be noted that the iron content of the raw waste of plants A and B is high while that for Plant C is low. This results, for plants A and B, in co-precipitation of toxic metals with iron. Precipitation using high-calcium lime for pH control yields the results shown in Table VII-8. Plant operating personnel indicate that this chemical treatment combination (sometimes with polymer assisted coagulation) generally produces better and more consistent metals removal than other combinations of sacrificial metal ions and alkalis.

The LS&F performance data presented here are based on systems that provide polishing filtration after effective L&S treatment. As previously shown, L&S treatment is equally applicable to wastewaters from the five categories because of the homogeneity of its raw and treated wastewaters, and other factors. Because of the similarity of the wastewaters after L&S treatment, the Agency believes these wastewaters are equally amenable to treatment using polishing filters added to the L&S treatment system. The Agency concludes the LS&F data based on porcelain enameling and nonferrous smelting and refining is also directly applicable to the nonferrous metals forming, aluminum forming, copper forming, battery manufacturing, coil coating, and metal molding and casting categories.

Analysis of Treatment System Effectiveness

Data are presented in Table VII-9 showing the mean, one-day, 10-day, and 30-day values for nine pollutants examined in the L&S metals data base. The mean variability factor for eight pollutants (excluding cadmium because of the small number of data points) was determined and is used to estimate one-day, 10-day, and 30-day values. (The variability factor is the ratio of the value of concern to the mean: the average variability factors are: one-day maximum - 4.100; ten-day average - 1.821; and

30-day average - 1.618.) For values not calculated from the common data base as previously discussed, the mean values for pollutants shown in Table VII-3 were multiplied by the variability factors to derive the value to obtain the one-, ten- and 30-day values. These are tabulated in Table VII-9.

LS&F technology data are presented in Tables VII-6 and VII-7. These data represent two operating plants (A and B) in which the technology has been installed and operated for some years. Plant A data were received as a statistical summary and are presented without change. Plant B data were received as raw laboratory analysis data. Discussions with plant personnel indicated that operating experiments and changes in materials and reagents and occasional operating errors had occurred during the data collection period. No specific information was available on those variables. To sort out high values probably caused by methodological factors from random statistical variability, or data noise, the Plant B data were analyzed. For each of the four pollutants (chromium, nickel, zinc, and iron), the mean and standard deviation (sigma) were calculated for the entire data set. A data day was removed from the complete data set when any individual pollutant concentration for that day exceeded the sum of the mean plus three sigma for that pollutant. Fifty-one data days (from a total of about 1,300) were eliminated by this method.

Another approach was also used as a check on the above method of eliminating certain high values. The minimum values of raw wastewater concentrations from Plant B for the same four pollutants were compared to the total set of values for the corresponding pollutants. Any day on which the pollutant concentration exceeded the minimum value selected from raw wastewater concentrations for that pollutant was discarded. Forty-five days of data were eliminated by that procedure. Forty-three days of data in common were eliminated by either procedures. Since common engineering practice (mean plus 3 sigma) and logic (treated waste should be less than raw waste) seem to coincide, the data base with the 51 spurious data days eliminated is the basis for all further analysis. Range, mean, standard deviation and mean plus two standard deviations are shown in Tables VII-6 and VII-7 for Cr, Cu, Ni, Zn, and Fe.

The Plant B data were separated into 1979, 1978, and total data base (six years) segments. With the statistical analysis from Plant A for 1978 and 1979 this in effect created five data sets in which there is some overlap between the individual years and total data sets from Plant B. By comparing these five parts it is apparent that they are quite similar and all appear to be from the same family of numbers. The largest mean found among the five data sets for each pollutant was selected as the long-term mean for LS&F technology and is used as the LS&F mean in Table VII-9.

Plant C data were used as a basis for cadmium removal performance and as a check on the zinc values derived from Plants A and B. The cadmium data is displayed in Table VII-8 and is incorporated into Table VII-9 for LS&F. The zinc data were analyzed for compliance with the one-day and 30-day values in Table VII-9; no zinc value of the 103 data points exceeded the one-day zinc value of 1.02 mg/l. The 103 data points were separated into blocks of 30 points and averaged. Each of the three full 30-day averages was less than the Table VII-9 value of 0.31 mg/l. Additionally, the Plant C raw wastewater pollutant concentrations (Table VII-8) are well within the range of raw wastewater concentrations of the combined metals data base (Table VII-2), further supporting the conclusion that Plant C wastewater data are compatible with similar data from Plants A and B.

Concentration values for regulatory use are displayed in Table VII-9. Mean one-day, ten-day, and 30-day values for L&S for nine pollutants were taken from Table VII-2; the remaining L&S values were developed using the mean values in Table VII-3 and the mean variability factors discussed above.

LS&F mean values for Cd, Cr, Ni, Zn, and Fe are derived from Plants A, B, and C as discussed above. One-, ten-, and 30-day values are derived by applying the variability factor developed from the pooled data base for the specific pollutant to the mean for that pollutant. Other LS&F values are calculated using the long-term average or mean and the appropriate variability factors. Mean values for LS&F for pollutants not already discussed are derived by reducing the L&S mean by one-third. The one-third reduction was established after examining the percent reduction in concentrations going from L&S to LS&F data for Cd, Cr, Ni, Zn, and Fe. The average reduction is 0.3338 or one-third.

Copper levels achieved at Plants A and B may be lower than generally achievable because of the high iron content and low copper content of the raw wastewaters. Therefore, the mean concentration value achieved is not used; LS&F mean used is derived from the L&S technology.

L&S cyanide mean levels shown in Table VII-9 are ratioed to one-day, ten-day, and 30-day values using mean variability factors. LS&F mean cyanide is calculated by applying the ratios of removals for L&S and LS&F as discussed previously for LS&F metals limitations. The cyanide performance was arrived at by using the average metal variability factors. The treatment method used here is cyanide precipitation. Because cyanide precipitation is limited by the same physical processes as the metal precipitation, it is expected that the variabilities will be similar.

Therefore, the average of the metal variability factors has been used as a basis for calculating the cyanide one-day, ten-day, and 30-day average treatment effectiveness values.

The filter performance for removing TSS as shown in Table VII-10 yields a mean effluent concentration of 2.61 mg/l and calculates to a ten-day average of 4.33, 30-day average of 3.36 mg/l, and a one-day maximum of 8.88. These calculated values more than amply support the classic values of 10 and 15, respectively, which are used for LS&F.

Although iron was reduced in some LS&F operations, some facilities using that treatment introduce iron compounds to aid settling. Therefore, the one-day, ten-day, and 30-day values for iron at LS&F were held at the L&S level so as to not unduly penalize the operations which use the relatively less objectionable iron compounds to enhance removals of toxic metals.

MINOR TECHNOLOGIES

Several other treatment technologies were considered and ultimately rejected for the basis of BPT, BAT, and NSPS. These technologies are presented here with a brief discussion of each of them.

Flotation

Flotation is the process of causing particles such as metal hydroxides or oil to float to the surface of a tank where they can be concentrated and removed. This is accomplished by releasing gas bubbles which attach to the solid particles, increasing their buoyancy and causing them to float. In principle, this process is the opposite of sedimentation.

This process may be performed in several ways: foam, dispersed air, dissolved air, gravity, and vacuum flotation are the most commonly used techniques. Chemical additives are often used to enhance the performance of the flotation process.

Flotation is generally applicable to streams characterized by heavy loads of finely divided suspended solids and widely dispersed oil droplets. These characteristics are not common in nonferrous metals forming wastewater and as such this technology would not achieve any more effective concentrations than sedimentation and oil skimming. Therefore, this technology was rejected as a basis for these technology-based limitations and standards.

Centrifugation

Centrifugation is the application of centrifugal force to separate solids and liquids in a liquid-solid mixture or to effect

concentration of the solids. The application of centrifugal force is effective because of the density differential normally found between the insoluble solids and the liquid in which they are contained. As a waste treatment procedure, centrifugation is most often applied to dewatering of sludges.

There are three common types of centrifuges: the disc, basket, and conveyor type. All three operate by removing solids under the influence of centrifugal force. The fundamental difference between the three types is the method by which solids are collected in and discharged from the bowl.

Special consideration must also be given to providing sturdy foundations and soundproofing because of the vibration and noise that result from centrifuge operation. Adequate electrical power must also be provided since large motors are required. Extensive operational experience also shows that vacuum filtration and plate and frame filtration are more appropriate sludge dewatering technologies for plants in this category. Because of the higher energy costs and prevalence of other technology, the Agency rejected this technology as the basis of these limitations and standards.

Coalescing

The basic principle of coalescence involves the preferential wetting of a coalescing medium by oil droplets which accumulate on the medium and then rise to the surface of the solution as they combine to form larger particles. The most important requirements for coalescing media are wettability for oil and large surface area. Monofilament line is sometimes used as a coalescing medium.

Coalescing stages may be integrated with a wide variety of gravity oil separation devices, and some systems may incorporate several coalescing stages. In general, a preliminary oil skimming step is desirable to avoid overloading the coalescer.

Coalescing allows removal of oil droplets too finely dispersed for conventional gravity separation-skimming technology. It also can significantly reduce the residence times (and therefore separator volumes) required to achieve separation of oil from some wastes. Most oily waste streams in this category are comprised of free floatable oils or emulsions. Coalescing is not generally effective in removing soluble or chemically stabilized emulsified oils. To avoid plugging, coalescers must be protected by pretreatment from the very high concentrations of free oil and grease and suspended solids. Frequent replacement of prefilters may be necessary when raw waste oil concentrations are high. While this technology may be applicable in some applications in

this category, oil skimming and chemical emulsion breaking are better suited to achieve effective oil removal in this category. Therefore, coalescing was not adopted as a treatment technology.

Cyanide Oxidation by Chlorine

Cyanide oxidation using chlorine is widely used in industrial waste treatment to oxidize cyanide. For applications in which the cyanide is present in a non-complexed form, this technology will achieve treatment effectiveness concentrations comparable to cyanide precipitation. Chlorine can be utilized in either the elemental or hypochlorite forms. This classic procedure can be illustrated by the following two step chemical reaction:

1. $Cl_2 + NaCN + 2NaOH \rightarrow NaCNO + 2NaCl + H_2O$

2. $3Cl_2 + 6NaOH + 2NaCNO \rightarrow 2NaHCO_3 + N_2 + 6NaCl + 2H_2O$

The reaction presented as equation (2) for the oxidation of cyanate is the final step in the oxidation of cyanide.

Cyanide oxidation by chlorine was not selected as the basis for these technology-based limitations and standards because the technology does not remove complexed cyanides which are known to be present in nonferrous forming wastewater. Plants with non-complexed cyanide could use this technology and achieve the same performance as cyanide precipitation.

Cyanide Oxidation by Ozone

Ozone is a highly reactive oxidizing agent which is approximately 10 times more soluble than oxygen on a weight basis in water. Ozone may be produced by several methods, but the silent electrical discharge method is predominant in the field. The silent electrical discharge process produces ozone by passing oxygen or air between electrodes separated by an insulating material.

Oxidation of cyanide to cyanate is illustrated below:

$$CN^- + O_3 \rightarrow CNO^- + O2$$

Continued exposure to ozone will convert the cyanate formed to carbon dioxide and ammonia; however, this is not economically practical.

Ozone oxidation of cyanide to cyanate requires 1.8 to 2.0 pounds ozone per pound of CN^-; complete oxidation requires 4.6 to 5.0 pounds ozone per pound of CN^-. Zinc, copper, and nickel cyanides are easily destroyed to a nondetectable level, but cobalt

and iron cyanides are more resistant to ozone treatment. Consequently, ozone technologies were not selected as the basis of these technology-based limitations and standards.

Cyanide Oxidation by Ozone with UV Radiation

One of the modifications of the ozonation process is the simultaneous application of ultraviolet light and ozone for the treatment of wastewater, including treatment of halogenated organics. The combined action of these two forms produces reactions by photolysis, photosensitization, hydroxylation, oxygenation, and oxidation. The process is unique because several reactions and reaction species are active simultaneously.

Ozonation is facilitated by ultraviolet absorption because both the ozone and the reactant molecules are raised to a higher energy state so that they react more rapidly. In addition, free radicals for use in the reaction are readily hydrolyzed by the water present. The energy and reaction intermediates created by the introduction of both ultraviolet and ozone greatly reduce the amount of ozone required compared with a system using ozone alone. A system to treat mixed cyanides requires preliminary treatment that involves chemical coagulation, sedimentation, clarification, equalization, and pH adjustment. Again, this technology was rejected because of the high capital expense.

Evaporation

Evaporation is a concentration process. Water is evaporated from a solution, increasing the concentration of solute in the remaining solution. If the resulting water vapor is condensed back to liquid water, the evaporation-condensation process is called distillation. However, to be consistent with industry terminology, evaporation is used in this report to describe both processes. Both atmospheric and vacuum evaporation are commonly used in industry today.

Both atmospheric and vacuum evaporation are used in many industrial plants, mainly for the concentration and recovery of process solutions. Many of these evaporators also recover water for rinsing in electroplating and metal finishing. Evaporation has also been applied to recovery of phosphate metal-cleaning solutions.

The major disadvantage is that the evaporation process consumes relatively large amounts of energy for the evaporation of water. The recovery of waste heat from many industrial processes (e.g., diesel generators, incinerators, boilers, and furnaces) should be considered as a source of this heat for a totally integrated evaporation system. Evaporation has not been included in the technology basis for this category because of the high energy

costs associated with it. However, some plants with excess waste heat available may choose to implement this technology to achieve the process wastewater flow reduction.

Gravity Sludge Thickening

In the gravity thickening process, dilute sludge is fed from a primary settling tank or clarifier to a thickening tank where rakes stir the sludge gently to densify it and to push it to a central collection well. The supernatant is returned to the primary settling tank. The thickened sludge that collects on the bottom of the tank is pumped to dewatering equipment or hauled away.

Thickeners are generally used in facilities where the sludge requires dewatering prior to entering by a compact mechanical device such as a vacuum filter or filter press. Extensive operating experience in this industry has shown that the sludges generated by wastewater treatment systems can be dewatered solely with a vacuum filter or filter press.

Ion Exchange

Ion exchange is a process in which ions, held by electrostatic forces to charged functional groups on the surface of the ion exchange resin, are exchanged for ions of similar charge from the solution in which the resin is immersed. This is classified as a sorption process because the exchange occurs on the surface of the resin, and the exchanging ion must undergo a phase transfer from solution phase to solid phase. Thus, ionic contaminants in a waste stream can be exchanged for the harmless ions of the resin.

Ion exchange is a versatile technology applicable to a great many situations. This flexibility, along with its compact nature and performance, makes ion exchange a very effective method of wastewater treatment. However, the resins in these systems can prove to be a limiting factor. The thermal limits of the anion resins, generally in the vicinity of 60°C, could prevent its use in certain situations. Similarly, nitric acid, chromic acid, and hydrogen peroxide can all damage the resins, as will iron, manganese, and copper when present with sufficient concentrations of dissolved oxygen. Removal of a particular trace contaminant may be uneconomical because of the presence of other ionic species that are preferentially removed. The regeneration of the resins presents its own problems. The cost of the regenerative chemicals can be high. In addition, the waste streams originating from the regeneration process are extremely high in pollutant concentrations, although low in volume. These must be further processed for proper disposal. As such, ion exchange has not been selected to form the basis of these technology-based limitations and standards.

Membrane Filtration

Membrane filtration is a treatment system for removing precipitated metals from a wastewater stream. It must therefore be preceded by those treatment techniques which will properly prepare the wastewater for solids removal. Typically, a membrane filtration unit is preceded by pH adjustment or sulfide addition for precipitation of the metals. These steps are followed by the addition of a proprietary chemical reagent which causes the precipitate to be non-gelatinous, easily dewatered, and highly stable. The resulting mixture of pretreated wastewater and reagent is continuously recirculated through a filter module and back into a recirculation tank. The filter module contains tubular membranes. While the reagent-metal hydroxide precipitate mixture flows through the inside of the tubes, the water and any dissolved salts permeate the membrane. When the recirculating slurry reaches a concentration of 10 to 15 percent solids, it is pumped out of the system as sludge.

Removal efficiencies are claimed to be excellent, even with sudden variation of pollutant input rates; however, the effectiveness of the membrane filtration system can be limited by clogging of the filters. Because pH changes in the waste stream greatly intensify clogging problems, the pH must be carefully monitored and controlled. Clogging can force the shutdown of the system and may interfere with production. In addition, the relatively high capital cost of this system may limit its use. As such, we have not selected this technology as the basis for these limitations and standards.

Reverse Osmosis

The process of osmosis involves the passage of a liquid through a semipermeable membrane from a dilute to a more concentrated solution. Reverse osmosis (RO) is an operation in which pressure is applied to the more concentrated solution, forcing the permeate to diffuse through the membrane and into the more dilute solution. This filtering action produces a concentrate and a permeate on opposite sides of the membrane. The concentrate can then be further treated or returned to the original production operation for continued use, while the permeate water can be recycled for use as clean water.

A limitation of the reverse osmosis process for treatment of process effluents is its limited temperature range for satisfactory operation. For cellulose acetate systems, the preferred limits are 18°C to 30°C (65°F to 85°F); higher temperatures will increase the rate of membrane hydrolysis and reduce system life, while lower temperatures will result in decreased fluxes with no damage to the membrane. Another limitation is inability to handle certain solutions. Strong oxidizing agents, strongly acidic

or basic solutions, solvents, and other organic compounds can cause dissolution of the membrane. Poor rejection of some compounds such as borates and low molecular weight organics is another problem. Fouling of membranes by slightly soluble components in solution or colloids has caused failures, and fouling of membranes by feed waters with high levels of suspended solids can be a problem. A final limitation is inability to treat or achieve high concentration with some solutions. Some concentrated solutions may have initial osmotic pressures which are so high that they either exceed available operating pressures or are uneconomical to treat. As such, we have not selected this technology as the basis for these limitations and standards.

Sludge Bed Drying

As a waste treatment procedure, sludge bed drying is employed to reduce the water content of a variety of sludges to the point where they are amenable to mechanical collection and removal to a landfill. These beds usually consist of 15 to 45 cm (6 to 18 in.) of sand over a 30 cm (12 in.) deep gravel drain system made up of 3 to 6 mm (1/8 to 1/4 in.) graded gravel overlying drain tiles.

Drying beds are usually divided into sectional areas approximately 7.5 meters (25 ft) wide x 30 to 60 meters (100 to 200 ft) long. The partitions may be earth embankments, but more often are made of planks and supporting grooved posts.

To apply liquid sludge to the sand bed, a closed conduit or a pressure pipeline with valved outlets at each sand bed section is often employed. Another method of application is by means of an open channel with appropriately placed side openings which are controlled by slide gates. With either type of delivery system, a concrete splash slab should be provided to receive the falling sludge and prevent erosion of the sand surface.

Its disadvantages are the large area of land required and long drying times that depend, to a great extent, on climate and weather. The full sludge drying bed must either be abandoned or the collected solids must be removed to a landfill. These solids contain whatever metals or other materials were settled in the clarifier. Metals will be present as hydroxides, oxides, sulfides, or other salts. They have the potential for leaching and contaminating ground water, whatever the location of the semidried solids. Thus the abandoned bed or landfill should include provision for runoff control and leachate monitoring. This technology was not selected as the basis for sludge treatment for these limitations and standards because vacuum filters provide a sludge that can be managed more safely and comply with provisions of RCRA.

Thermal Emulsion Breaking

Dispersed oil droplets in a spent emulsion can be destabilized by the application of heat to the waste. One type of technology commonly used in the metals and mechanical products industries is the evaporation-decantation-condensation process, also called thermal emulsion breaking (TEB), which separates the emulsion waste into distilled water, oils and other floating materials, and sludge.

Advantages of the thermal emulsion breaking process include high percentages of oil removal (at least 99 percent in most cases), the separation of floating oil from settleable sludge solids, and the production of distilled water which is available for process reuse. In addition, no chemicals are required and the operation is automated, factors which reduce operating costs. Disadvantages of the process are the high energy requirement for water evaporation and, if intermittently operated, the necessary installation of a large storage tank. This technology has not been selected as the basis of these limitations and standards because chemical emulsion breaking achieves comparable performance and at a lower cost.

Ultrafiltration

Ultrafiltration (UF) is a process which uses semipermeable polymeric membranes to separate emulsified or colloidal materials suspended in a liquid phase by pressurizing the liquid so that it permeates the membrane. The membrane of an ultrafilter forms a molecular screen which retains molecular particles based on their differences in size, shape, and chemical structure. The membrane permits passage of solvents and lower molecular weight molecules. At present, an ultrafilter is capable of removing materials with molecular weights in the range of 1,000 to 100,000 and particles of comparable or larger sizes. Most soluble materials in nonferrous forming wastewater including toxic metals have molecular weight much less than 1,000.

A limitation of ultrafiltration for treatment of process effluents is its narrow temperature range (18°C to 30°C) for satisfactory operation. Membrane life decreases with higher temperatures, but flux increases at elevated temperatures. Therefore, surface area requirements are a function of temperature and become a tradeoff between initial costs and replacement costs for the membrane. In addition, ultrafiltration cannot handle certain solutions. Strong oxidizing agents found in nonferrous metals forming wastewater could dissolve the membrane. EPA did not select ultrafiltration as the basis for these limitations and standards because chemical emulsion breaking and oil skimming are better suited for nonferrous metals forming wastewater and are less costly to operate and maintain.

IN-PLANT TECHNOLOGIES

The intent of in-plant technology for the nonferrous metals forming point source category is to reduce or eliminate the waste load requiring end-of-pipe treatment and thereby improve the efficiency of an existing wastewater treatment system or reduce the requirements of a new treatment system. In-plant technology involves improved rinsing, water conservation, process bath conservation, reduction of dragout, automatic controls, good housekeeping practices, recovery and reuse of process solutions, process modification, and waste treatment. Specific in-plant technologies applicable to this category are discussed below.

Process Water Recycle

Recycling of process water is the practice of recirculating water to be used again for the same purpose. An example of recycling process water is the return of casting contact cooling water to the casting process after the water passes through a cooling tower. Two types of recycle are possible--recycle with a bleed stream (blowdown) and total recycle. Total recycle may be prohibited by the presence of dissolved solids. Dissolved solids (e.g., sulfates and chlorides) entering a totally recycled waste stream may precipitate, forming scale if the solubility limits of the dissolved solids are exceeded. A bleed stream may be necessary to prevent maintenance problems (pipe plugging or scaling, etc.) that would be created by the precipitation of dissolved solids. While the volume of bleed required is a function of the amount of dissolved solids in the waste stream, 4 or 5 percent bleed is a common value for a variety of process waste streams in the nonferrous metals forming category. The recycle of process water is currently practiced where it reduces operating costs, where it is necessary due to water shortage, or where the local permitting authority has required it. Recycle, as compared to the once-through use of process water, is an effective method of conserving water.

Application and Performance. Required hardware necessary for recycle is highly site-specific. Basic items include pumps and piping. Additional materials are necessary if water treatment occurs before the water is recycled. These items will be discussed separately with each unit process. Chemicals may be necessary to control scale buildup, slime, and corrosion problems, especially with recycled cooling water. Maintenance and energy use are limited to that required by the pumps, and solid waste generation is dependent on the type of treatment system in place.

Recycling through cooling towers is the most common practice. One type of application is shown in Figure VII-8. Direct chill casting cooling water is recycled through a cooling tower with a blowdown discharge.

A cooling tower is a device which cools water by bringing the water into contact with air. The water and air flows are directed in such a way as to provide maximum heat transfer. The heat is transferred to air primarily by evaporation (about 75 percent), while the remainder is removed by sensible heat transfer.

Factors influencing the rate of heat transfer and, ultimately, the temperature range of the tower, include water surface area, tower packing and configuration, air flow, and packing height. A large water surface area promotes evaporation, and sensible heat transfer rates are lower in proportion to the water surface area provided. Packing (an internal latticework contact area) is often used to produce small droplets of water which evaporate more easily, thus increasing the total surface area per unit of throughput. For a given water flow, increasing the air flow increases the amount of heat removed by maintaining higher thermodynamic potentials. The packing height in the tower should be high enough so that the air leaving the tower is close to saturation.

A mechanical-draft cooling tower consists of the following major components:

(1) Inlet-water distributor
(2) Packing
(3) Air fans
(4) Inlet-air louvers
(5) Drift or carryover eliminators
(6) Cooled water storage basin.

Advantages and Limitations. Recycle offers economic as well as environmental advantages. Water consumption is reduced and wastewater handling facilities (pumps, pipes, clarifiers, etc.) can thus be sized for smaller flows. By concentrating the pollutants in a much smaller volume (the bleed stream), greater removal efficiencies can be attained by any applied treatment technologies. Recycle may require some treatment such as sedimentation or cooling of water before it is reused.

The ultimate benefit of recycling process water is the reduction in total wastewater discharge and the associated advantages of lower flow streams. A potential problem is the buildup of dissolved solids which could result in scaling. Scaling can usually be controlled by depressing the pH and increasing the bleed flow.

Operational Factors. Reliability and Maintainability: Although the principal construction material in mechanical-draft towers is wood, other materials are used extensively. For long life and minimum maintenance, wood is generally pressure-treated with a preservative. Although the tower structure is usually made of

treated redwood, a considerable amount of treated fir has been used in recent years. Sheathing and louvers are generally made of asbestos cement, and the fan stacks of fiberglass. There is a trend to use fire-resistant extracted PVC as fill which, at little or no increase in cost, offers the advantage of permanent fire-resistant properties.

The major disadvantages of wood are its susceptibility to decay and fire. Steel construction is occasionally used, but not to any great extent. Concrete may be used but has relatively high construction labor costs, although it does offer the advantage of fire protection.

Various chemical additives are used in cooling water systems to control scale, slime, and corrosion. The chemical additives needed depend on the character of the make-up water. All additives have definite limitations and cannot eliminate the need for blowdown. Care should be taken in selecting nontoxic or readily degraded additives, if possible.

Solid Waste Aspects: The only solid waste associated with cooling towers may be removed scale.

Demonstration Status. Many different types of streams in the nonferrous metals forming category are currently recycled. The degree of recycle of these streams is 50 percent or more, most commonly in the 96 to 100 percent range. Recycling process waters is a viable option for many nonferrous metals forming process wastewaters as shown by the current practices in the industry.

Most of the plants that use hot rolling oil emulsions and that gave enough information to calculate discharge rates reported using recycle of the emulsion with either a bleed stream or periodic discharge. The recycled flow would often pass through in-line filters to prevent the buildup of solids. Settling tanks and oil skimming devices were also used to separate spent and tramp oils from the emulsion.

Other nonferrous metals forming wastewaters may also be recycled in varying degrees, depending on the required quality of water necessary for a specific operation. Scrubber waters from casting, forging, etch lines, and annealing operations can be recycled because of the low water quality necessary as make-up water. Forging solution heat treatment contact cooling waters can be recycled in a manner similar to that used in casting contact cooling water.

Process Water Reuse

Reuse of process water is the practice of recirculating water used in one production process for subsequent use in a different production process.

Application and Performance and Demonstration Status. Reuse applications in the nonferrous metals forming category are varied. Water may be reused as cleaning or etching rinses following caustic and acidic baths, as scrubber liquor, as casting contact cooling water, or as heat treatment solution contact cooling water.

Advantages and Limitations. Advantages of reuse are similar to the advantages of recycle. Water consumption is reduced and wastewater treatment facilities can be sized for smaller flows. Also, in areas where water shortages occur, reuse is an effective means of conserving water.

Operational Factors. The hardware necessary for reuse of process wastewaters varies, depending on the specific application. The basic elements include pumps and piping. Chemical addition is not usually warranted, unless treatment is required prior to reuse. Maintenance and energy use are limited to that required by the pumps. Solid waste generated is dependent upon the type of treatment used and will be discussed separately with each unit process.

Countercurrent Cascade Rinsing

Rinsing is used to dilute the concentration of contaminants adhering to the surface of a workpiece to an acceptable level before the workpiece passes on to the next step in surface treatment operations. The amount of water required to dilute the rinse solution depends on the quantity of chemical drag-in from the upstream rinse or surface treatment tank, the allowable concentration of chemicals in the rinse water, and the contacting efficiency between the workpiece and the water.

Process variations such as countercurrent cascade rinsing may cause a decrease in process water use. This technique reduces water use by multiple stage rinsing with a water flow counter to the movement of the workpiece. Clean water contacts the metal in the last rinse stage. The water, somewhat more contaminated, is routed stage by stage up the rinsing line. After use in the first rinse stage, the contaminated water is discharged to treatment.

As an example, Figure VII-9 illustrates three rinsing operations, each designed to remove the residual acid in the water on the surface of a workpiece. In Figure VII-9 the piece is dipped into

one tank with continuously flowing water. In this case, the acid on the surface of the workpiece is essentially diluted to the required level.

In Figure VII-9, the first step towards countercurrent operation is taken with the addition of a second tank. The workpiece is now moving in a direction opposite to the rinse water. The piece is rinsed with fresh makeup water prior to moving down the assembly line. However, the fresh water from this final rinse tank is directed to a second tank, where it meets the incoming, more-contaminated workpiece. Fresh makeup water is used to give a final rinse to the article before it moves out of the rinsing section, but the slightly contaminated water is reused to clean the article just coming into the rinsing section. By increasing the number of stages, as shown in Figure VII-9, further water reduction can be achieved. Theoretically, the amount of water required is the amount of acid being removed by single-stage requirements divided by the highest tolerable concentration in the outgoing rinsewater. The actual flow reduction obtained is a function of the dragout and the type of contact occurring in the tanks. If reasonably good contact is maintained major reductions in water use are possible.

Application and Performance. As mentioned above, rinse water requirements and the benefits of countercurrent cascade rinsing may be influenced by the volume of solution dragout carried into each rinse stage by the material being rinsed, by the number of rinse stages used, by the initial concentrations of impurities being removed, and by the final product cleanliness required. The influence of these factors is expressed in the rinsing equation which may be stated simply as:

$$Vr = \left(\frac{Co}{Cf}\right)^{1/n} \times VD$$

Vr is the flow through each rinse stage.
Co is the concentration of the contaminant(s) in the initial process bath.
Cf is the concentration of the contaminant(s) in the final rinse to give acceptable product cleanliness.
n is the number of rinse stages employed.
VD is the dragout carried into each rinse stage, expressed as a flow.

For a multi-stage rinse, the total volume of rinse wastewater is equal to n times Vr while for a countercurrent rinse the total volume of wastewater discharge equals Vr.

To calculate the benefits of countercurrent rinsing for nonferrous metals forming, it can be assumed that a two-stage countercurrent cascade rinse is installed after surface treatment

operations. As an example, the flow reduction achieved for pickling a nickel sheet can be estimated. The mass of nickel in one square meter of sheet that is 6 mm (0.006 m) in thickness can be calculated using the density of nickel, 8.90 kkg/m^3 (556 lbs/cu ft), as follows:

= (0.006 m) x (8.90 kkg/m^3) = 0.053 kkg/m^2 of sheet.

Using the mean surface treatment rinsewater discharge, Vr can then be calculated as follows:

$$Vr = \left(0.053 \frac{kkg}{m^2}\right) x \left(10{,}600 \frac{1}{kkg}\right) = 561.8 \ 1/m^2 \text{ of sheet}$$

Drag-out is solution which remains on the surface of material being rinsed when it is removed from process baths or rinses. Without specific plant data available to determine drag-out, an estimate of rinsewater reduction to be achieved with two-stage countercurrent rinsing can be made by assuming a thickness of any process solution film as it is introduced into the rinse tank. If the film on a piece of nickel sheet is 0.015 mm (0.6 mil) thick, (equivalent to the film on a well-drained vertical surface) then the volume of process solution, VD, carried into the rinse tank on one square meter of sheet will be:

$$VD = (0.015 \text{ mm}) \times \left(\frac{1}{1000} \text{ m/mm}\right) \times (1000 \ 1/m^3)$$

$$= 0.015 \ 1/m^2 \text{ of sheet}$$

Let $r = \frac{Co}{Cf}$, then $r^{1/n} = \frac{Vr}{VD}$.

For single stage rinsing n = 1, therefore $r = \frac{Vr}{VD}$

and $r = \frac{561.8}{0.015} = 37{,}453$

For a 2-stage countercurrent cascade rinse to obtain the same r, that is the same product cleanliness,

$$\frac{Vr}{VD} = r^{1/2}, \text{ therefore } \frac{Vr}{VD} = 193.5$$

But VD = 0.015 $1/m^2$ of sheet; therefore, for 2-stage countercurrent cascade rinsing, Vr is:

$$Vr = 193.5 \times 0.015 = 2.90 \ 1/m^2 \text{ of sheet}$$

In this theoretical calculation, a flow reduction of greater than 99 percent can be achieved. The actual numbers may vary depending on efficiency of squeegees or air knives, and the rinse ratio desired.

Advantages and Limitations. Significant flow reductions can be achieved by the addition of only one other stage in the rinsing operation, as discussed above. The largest reductions are made by adding the first few stages. Additional rinsing stages cost additional money. The actual number of stages added depends on site-specific layout and operating conditions. With higher costs for water and waste treatment, more stages might be economical. With very low water costs, fewer stages would be economical. In considering retrofit applications, the space available for additional tanks is also important. After considering all of these points, the Agency believes that countercurrent cascade rinsing is an effective and economical means of reducing wastewater flow and consequently pollutant discharge. As such, EPA has considered this technology in establishing limitations and standards.

Operational Factors. If the flow from stage to stage can be effected by gravity, either by raising the latter rinse stage tanks or by varying the height of the overflow weirs, countercurrent cascade rinsing is usually quite economical. If, on the other hand, pumps and level controls must be used, then another method, such as spray rinsing, may be more feasible.

Another factor is the need for agitation, which will reduce short circuiting of the flow. Large amounts of short circuiting can reduce the flow reduction attained by adding more stages. In cases where water is cascading in enormous quantities over a workpiece, the high flow usually provides enough agitation. As more staging is applied to reduce the amount of water, the point will be reached where the flow of the water itself is not sufficient to provide agitation. This necessitates either careful baffling of the tanks or additional mechanical agitation.

Demonstration Status. Countercurrent cascade rinsing has been widely used as a flow reduction technique in the metal finishing industry. In aluminum conversion coating lines that are subject to the coil coating limitations, countercurrent cascade rinsing is currently used in order to reduce costs of wastewater treatment systems (through smaller systems) for direct dischargers and additionally to reduce sewer charges for indirect dischargers since those costs are based on flow.

Countercurrent cascade rinsing is currently practiced at 12 nonferrous metals forming plants.

Spray Rinsing

Spray rinsing is another method used to dilute the concentration of contaminants adhering to the surface of a workpiece. The basis of this approach is to spray water onto the surface of the workpiece as opposed to submerging it into a tank. The amount of water contacting the workpiece is minimized as is the amount of water discharged. The water use and discharge rates can be further reduced through recirculation of the rinse water.

The equipment required for spray rinsing includes piping, spray nozzles, a pump, a holding tank, and a collection basin. The holding tank may serve as the collection basin to collect the rinse water prior to recirculation as a method of space economization. Spray rinsing is demonstrated in plants in the nonferrous metals forming category.

Regeneration of Chemical Baths

Regeneration of chemical baths is used to remove contaminants and recover and reuse the bath chemicals, thus minimizing the chemical requirements of the bath while achieving zero discharge.

Application and Performance. Chemical bath regeneration is applicable to recover and reuse chemicals associated with caustic surface treatment baths, sulfuric acid surface treatment baths, chromic acid surface treatment baths, and alkaline cleaning baths.

Some metal salts can be precipitated out of chemical baths by applying a temperature change or shift to the bath. Once the metal salts are precipitated out of solution the chemical properties and utility of the bath can then be restored by adding fresh chemicals. The addition of lime may aid in precipitating dissolved metals by forming carbonates or hydroxides.

Ultrafiltration, previously discussed in this section, can be used to remove oils and particulates from alkaline cleaning baths, allowing the recovery of the water and alkali values to be reused in the make-up of fresh bath rather than treated and discharged.

Ultrafiltration membranes allow only low molecular weight solutes and water to pass through and return to the bath; particulates and oils are held back in a concentrated phase. The concentrated material is then disposed of separately as a solid waste.

Advantages and Limitations. The advantages of bath regeneration are: (1) it reduces the volume of discharge of the chemical bath water; (2) the surface treatment operations are made more efficient because the bath can be kept at a relatively constant

strength; (3) it results in reduced maintenance labor associated with the bath; and (4) it reduces chemical costs by recovering chemicals and increasing bath life.

Operational Factors. Reliability and Maintainability: Chemical bath regeneration results in lower maintenance labor because the bath life is extended. Regeneration also increases the process reliability in that it eliminates extended periods of downtime to dump the entire bath solution.

It may be necessary to allow baths normally operated at elevated temperatures to cool prior to regeneration. As an example, hot detergent baths will require cooling prior to introducing material into the ultrafiltration membrane.

Solid Waste Aspects: Regeneration of caustic, detergent, chromic acid, and sulfuric acid baths results in the formation of precipitates. These precipitates are collected, dewatered, if necessary, and then disposed of as solid wastes. The metal sulfate precipitate resulting from sulfuric acid baths may be commercially marketable. The solid waste aspects of wastewater treatment sludges similar to regeneration sludges are discussed in detail in Section VIII.

Demonstration Status. There are commercial processes available for regenerating baths which are patented or claimed confidential. In general, these regeneration processes are based on the fundamental concepts described above.

As discussed previously in this section, ultrafiltration is well developed and commercially available for recovery of high molecular weight liquids and solid contaminants. EPA is not aware of any nonferrous metals forming plants that have applied ultrafiltration for the purpose of regenerating bath materials. There are two aluminum forming plants using ultrafiltration to recover spent lubricant which is similar to the types of lubricants used in the nonferrous metals forming industry. Since alkaline cleaning baths are used to remove these lubricants from the aluminum surface prior to further processing, it is reasonable to assume that ultrafiltration will be equally applicable for separating these same lubricants from alkaline cleaning baths.

The Agency did not select regeneration of baths as an in-process modification to be part of these limitations and standards because it is not applicable on a nationwide basis. It may however, be applicable in specific applications in the nonferrous forming category.

Contract Hauling

Contract hauling refers to the industry practice of contracting a firm to collect and transport wastes for off-site disposal. This practice is particularly applicable to low-volume, high concentration waste streams. Examples of such waste streams in the nonferrous metals forming industry are pickling baths, drawing lubricants, and cold rolling lubricants.

The dcp data identified several waste solvent haulers most of whom haul solvent in addition to their primary business of hauling waste oils. The value of waste solvents seems to be sufficient to make waste solvent hauling a viable business. Telephone interviews conducted during the development of metal finishing regulations indicate that the number of solvent haulers is increasing and that their operations are becoming more sophisticated because of the increased value of waste solvent. In addition, a number of chemical suppliers include waste hauling costs in their new solvent price. Some of the larger solvent refiners make credit arrangements with their clientele; for example, it was reported that one supplier returns 50 gallons of refined solvent for every 100 gallons hauled.

Process Water Use Reduction

Process water use reduction is the decrease in the amount of process water used as an influent to a production process per unit of production. Section V discusses water use in detail for each nonferrous metals forming operation. A range of water use values taken from the data collection portfolios is presented for each operation. The range of values indicates that some plants use process water more efficiently than others for the same operation. Therefore, some plants can curb their water use; in some cases it may be as simple as turning down a few valves. Noncontact cooling water may replace contact cooling water in some applications; air cooling may also be an alternative to contact cooling water. Conversion to dry air pollution control equipment, discussed further on in this section, is another way to reduce water use.

Many production units in nonferrous metals forming plants operate intermittently or at widely varying production rates. The practice of shutting off process water streams during periods of low activity can prevent much unnecessary dilution of wastes and reduce the volume of water to be treated and discharged. Water may be shut off and adjusted manually or through automatically controlled valves. Manual adjustment involves minimal capital cost and can be just as reliable in actual practice. Automatic shut off valves are used in some nonferrous metals forming operations to turn off water flows when production units are inactive.

Automatic adjustment of flow rates according to production levels requires more sophisticated control systems incorporating temperature or conductivity sensors. Further reduction in water use may be made possible by changes in production techniques and equipment.

The potential for reducing the water use at many nonferrous metals forming facilities is evident in the water use and discharge data presented in Section V of this report. While it may be argued that variations in water flow per unit of production are the necessary result of variations in process conditions, on-site observations indicate that they are more frequently the result of imprecise control of water use. This is confirmed by analysis of data from surface treatment rinses which show a very wide range of the concentrations of materials removed from product surfaces, and by on-site temperature observations in contact cooling streams.

Reduction of water use in quenches may also significantly reduce discharge volumes. Design of spray quenches to ensure that a high percentage of the water contacts the product and adjustments of make-up water flow rates on quench baths and recirculating spray quench systems to the minimum practical value can significantly reduce effluent volumes.

Pollutant discharges from surface treatment operations may also be controlled through the use of drag-out reduction technologies. The volume of water used and discharged from rinsing operations may be substantially reduced without adversely affecting the surface condition of the product processed. Available technologies to achieve these reductions include techniques which limit the amount of material to be removed from product surfaces by rinsing.

On automatic lines which continuously process strip through surface treatment operations, measures are normally taken to reduce the amount of process bath solutions which are dragged out with the product into subsequent rinses. The most commonly used means of accomplishing this are through the use of squeegee rolls and air knives. Both mechanisms are found at the point at which the strip exits from the process bath. Squeegee rolls, one situated above the strip and another below, return process solutions as they apply pressure to both sides of the continuously moving strip. Air knives continuously force a jet of air across the width of each side of the strip, forcing solutions to remain in the process tank or chamber. These methods are also used to reduce drag-out from soap and other lubricant tanks which are often found as a final step in automatic strip lines.

Heating the tank containing the process bath can also help reduce drag-out of process solutions in two ways: by decreasing the viscosity and the surface tension of the solution. A lower viscosity allows the liquid to flow more rapidly and therefore drain at a faster rate from the product following application in a process bath, thereby reducing the amount of process solution which dragged out in succeeding rinses. Likewise, a higher temperature will result in lower surface tension in the solution. The amount of work required to overcome the adhesive force between a liquid film and a solid surface is a function of the surface tension of the liquid and the contact angle. Lowering the surface tension reduces the amount of work required to remove the liquid and reduces the edge effect (the bead of liquid adhering to the edges of a product).

Operator performance can have a substantial effect on the amount of drag-out which results from manual dip tank processes. Specifically, proper draining time and techniques can reduce the amount of process solution dragged out into rinses. After dipping the material into the process tank, drag-out can be reduced significantly by simply suspending the product above the process tank while solution drains off. Fifteen to 20 seconds generally seems sufficient to accomplish this. When processing tubing, especially, lowering one end of the load during this drain time allows solution to run off from inside the tubes.

All of the water use reduction techniques discussed in this section may be used at nonferrous metals forming plants to achieve the average production normalized flows at plants which presently discharge excessive amounts of wastewater to treatment.

Wastewater Segregation

Application and Performance. The segregation of process waste streams is a valuable control techology and may reduce treatment costs. Individual process waste streams may exhibit very different chemical characteristics, and separating the streams may permit applying the most effective method of treatment or disposal to each stream. Relatively clean waters should be kept segregated from contaminated streams. Dissimilar streams should not be combined; for example, an oily stream such as direct chill casting contact cooling water should not be combined with a non-oily stream such as surface treatment scrubber liquors. Segregation should be based on the type of treatment to be performed for a given pollutant, avoiding oversizing of equipment for treating flows unnecessarily.

Consider two waste streams, one high in chromium and other dissolved solids; the other, a noncontact cooling water without chromium. Significant advantages exist in segregating these two

waste streams. If the combined waste streams are being treated to reduce chromium, the resulting high treatment cost will be impractical. Also, if chromium removal by lime precipitation is being practiced, reduced removal efficiencies will result from combining the waste streams due to dilution of chromium concentration. In addition, recycle of the noncontact cooling water will be made difficult by mixing the relatively pure noncontact cooling water with the high dissolved solids stream. Many combinations of waste streams exist throughout the nonferrous metals forming industry where segregation affords distinct advantages.

Equipment necessary for wastewater segregation may include piping, curbing, and possibly pumping. Chemicals are not needed and maintenance and energy use is limited to the pumps.

Advantages. The segregation of stormwater runoff which has not come in contact with process materials from process-related streams can eliminate overloading of sewer and treatment facilities. Some plants located lower than the surrounding terrain have built flood control dams at higher elevations to minimize the passage of stormwater runoff onto plant property. The use of curbing is an excellent control practice for minimizing the commingling of runoff with process wastewaters. Also, retention ponds should be lined to minimize infiltration of spring water during periods of local flooding and exfiltration of the wastewaters to a nearby aquifer.

Lubricating Oil and Deoiling Solvent Recovery

Application and Performance. The recycle of lubricating oils is a common practice in the industry. The degree of recycle is dependent upon any in-line treatment (e.g., filtration to remove metal fines and other contaminants), and the useful life of the specific oil in its application. Usually, this involves continuous recirculation of the oil, with losses in the recycle loop from evaporation, oil carried off by the metal product, and minor losses from in-line treatment. Some plants periodically replace the entire batch of oil once its required properties are depleted. In other cases, a continuous bleed or blowdown stream of oil is withdrawn from the recycle loop to maintain a constant level of oil quality. Fresh make-up oil is added to compensate for the blowdown and other losses, and in-line filtration is used between cycles.

Reuse of oil from spent emulsions used in rolling and drawing is practiced at some plants. The free oil skimmed from gravity oil and water separation, following emulsion breaking, is valuable. This free oil contains some solids and water which must be removed before the oil can be reused. The traditional treatment involves acidifying the oil in a heated cooker, using steam coils

or live steam to heat the oil to a rolling boil. When the oil is sufficiently heated, the steam is shut off and the oil and water are permitted to separate. The collected floating oil layer is suitable for use as supplemental boiler fuel or for some other type of in-house reuse. Other plants choose to sell their oily wastes to oil scavengers, rather than reclaiming the oil themselves. The water phase from this operation is either sent to treatment or, if of a high enough quality, it can be recycled and used to make up fresh emulsion.

Advantages. Some plants collect and recycle rolling oils via mist eliminators. In the rolling process, oils are sprayed as a fine mist on the rollers for cooling and lubricating purposes, and some of this oil becomes airborne and may be lost via exhaust fans or volatilization. With the rising price of oils, it is becoming a more common practice to prevent these losses. Another reason for using hood and mist eliminators is the improvement in the working environment.

Demonstration Status and Operational Factors. Using organic solvents to deoil or degrease nonferrous metals is usually performed prior to sale or subsequent operations such as coating. Recycling the spent solvent can be economically attractive along with its environmental advantages. No plants are known to use distillation units to reclaim spent solvent for recycling in this category. Most plants in this category contract haul spent solvents or sell them to a reclaimer. No plants currently discharge spent solvents as a direct discharge. There are several plants that discharge spent solvents to a POTW; however, this practice is not widespread and is subject to strict controls by the POTW for those that do discharge. The Agency is establishing a no discharge requirement for this waste stream. This is discussed more fully in Sections IX through XIII.

Dry Air Pollution Control Devices

Application and Performance. The use of dry air pollution control devices would allow the elimination of waste streams with high pollution potentials. The choice of air pollution control equipment is complicated, and sometimes a wet system is the necessary choice. The important difference between wet and dry devices is that wet devices control gaseous pollutants as well as particulates.

Wet devices may be chosen over dry devices when any of the following factors are found: (1) the particle size is predominantly under 20 microns, (2) flammable particles or gases are to be treated at minimal combustion risk, (3) both vapors and particles are to be removed from the carrier medium, and (4) the gases are corrosive and may damage dry air pollution control devices.

Equipment for dry control of air emissions includes cyclones, dry electrostatic precipitators, fabric filters, and afterburners. These devices remove particulate matter, the first three by entrapment and the afterburners by combustion.

Afterburner use is limited to air emissions consisting mostly of combustible particles. Characteristics of the particulate-laden gas which affect the design and use of a device are gas density, temperature, viscosity, flammability, corrosiveness, toxicity, humidity, and dew point. Particulate characteristics which affect the design and use of a device are particle size, shape, density, resistivity, concentration, and other physiochemical properties.

Melting prior to casting requires wet air pollution control only when chlorine gas is present in the offgases. Dry air pollution control methods with inert gas or salt furnace fluxing have been demonstrated in the aluminum forming industry. It is possible to perform all the metal treatment tasks of removing hydrogen, non-metallic inclusions, and undesirable trace elements and meet the most stringent quality requirements without furnace fluxing, using only in-line metal treatment units. To achieve this, the molten aluminum is treated in the transfer system between the furnace and casting units by flowing the metal through a region of very fine, dense, mixed-gas bubbles generated by a spinning rotor or nozzle. No process wastewater is generated in this operation. Another similar alternate degassing method is to replace the chlorine-rich degassing agent with a mixture of inert gases and a much lower proportion of chlorine. The technique provides adequate degassing while permitting dry scrubbing.

Scrubbers must be used in forging because of the potential fire hazard of baghouses used in this capacity. The oily mist generated in this operation is highly flammable and also tends to plug and bind fabric filters, reducing their efficiency.

Caustic surface treatment wet air pollution control is necessary due to the corrosive nature of the gases.

Advantages and Limitations. Proper application of a dry control device can result in particulate removal efficiencies greater than 99 percent by weight for fabric filters, electrostatic precipitators, and afterburners, and up to 95 percent for cyclones.

Common wet air pollution control devices are wet electrostatic precipitators, venturi scrubbers, and packed tower scrubbers. Collection efficiency for gases will depend on the solubility of the contaminant in the scrubbing liquid. Depending on the contaminant removed, collection efficiencies usually approach 99 percent for particles and gases.

Demonstration Status. The nonferrous metals forming industry reports the use of dry air pollution controls for forging.

Good Housekeeping

Good housekeeping and proper equipment maintenance are necessary factors in reducing wastewater loads to treatment systems. Control of accidental spills of oils, process chemicals, and wastewater from washdown and filter cleaning or removal can aid in abating or maintaining the segregation of wastewater streams. Curbed areas should be used to contain or control these wastes.

Leaks in pump casings, process piping, etc., should be minimized to maintain efficient water use. One particular type of leakage which may cause a water pollution problem is the contamination of noncontact cooling water by hydraulic oils, especially if this type of water is discharged without treatment.

Good housekeeping is also important in chemical, solvent, and oil storage areas to preclude a catastrophic failure situation. Storage areas should be isolated from high fire-hazard areas and arranged so that if a fire or explosion occurs, treatment facilities will not be overwhelmed nor excessive groundwater pollution caused by large quantities of chemical-laden fire-protection water.

Bath or rinse waters that drip off the metal product while it is being transferred from one tank to another (dragout) should be collected and returned to their originating tanks. This can be done with simple drain boards.

A conscientiously applied program of water use reduction can be a very effective method of curtailing unnecessary wastewater flows. Judicious use of washdown water and avoidance of unattended running hoses can significantly reduce water use.

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(1) Reed, A. K., et. al., "An Investigation of Techniques for Removal of Cyanide from Electroplating Wastes," Battelle Columbus Laboratories, Columbus, Ohio, November 1971, NTIS PB-208 210, p. 45.

(2) Owerback, Daniel, "Analysis and Sample Stability of Cyanides in Industrial Effluents," Journal of the Water Pollution Control Federation, Volume 52, Number 11, November 1980, p. 2648.

(3) Drew, D. M., "Simultaneous Determinations of Ferrocyanide and Ferricyanide in Aqueous Solutions Using Infrared Spectrometry," Analytical Chemistry, Volume 45, p. 2262 (1973).

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(5) Southgate, B. A., Treatment and Disposal of Industrial Wastewaters, His Majesty's Stationary Office, London, 1948, pp. 169-172.

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(8) Shinskey, F. G., pH and pIon Control, John Wiley & Sons, Inc., New York, New York, 1973.

(9) Moore, Ralph L., Neutralization of Wastewater by pH Control, ISA Monograph Series #1, 1978.

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(11) Summary Report, Control and Treatment Technology for the Metal Finishing Industry - Sulfide Precipitation, EPA 625/8-80-003, IERL, Cincinnati, Ohio, April 1980.

(12) Process Design Manual for Suspended Solids Removal, USEPA Technology Transfer, EPA 625/1-75-003a, October 1975.

(13) Brautner, Karl A., and Edward J. Cichon, Heavy Metals Removal: Commparison of Alternative Precipitation Processes, proceedings of the Thirteenth Mid-Atlantic Conference - Industrial Waste, University of Delaware, 1981.

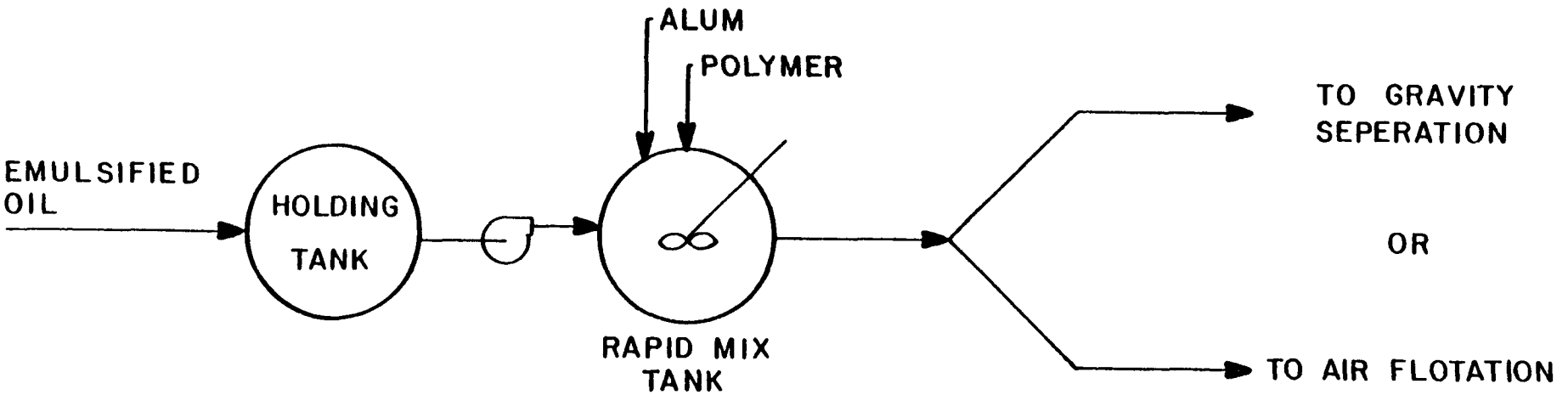


Figure VII-1

FLOW DIAGRAM FOR EMULSION BREAKING WITH CHEMICALS

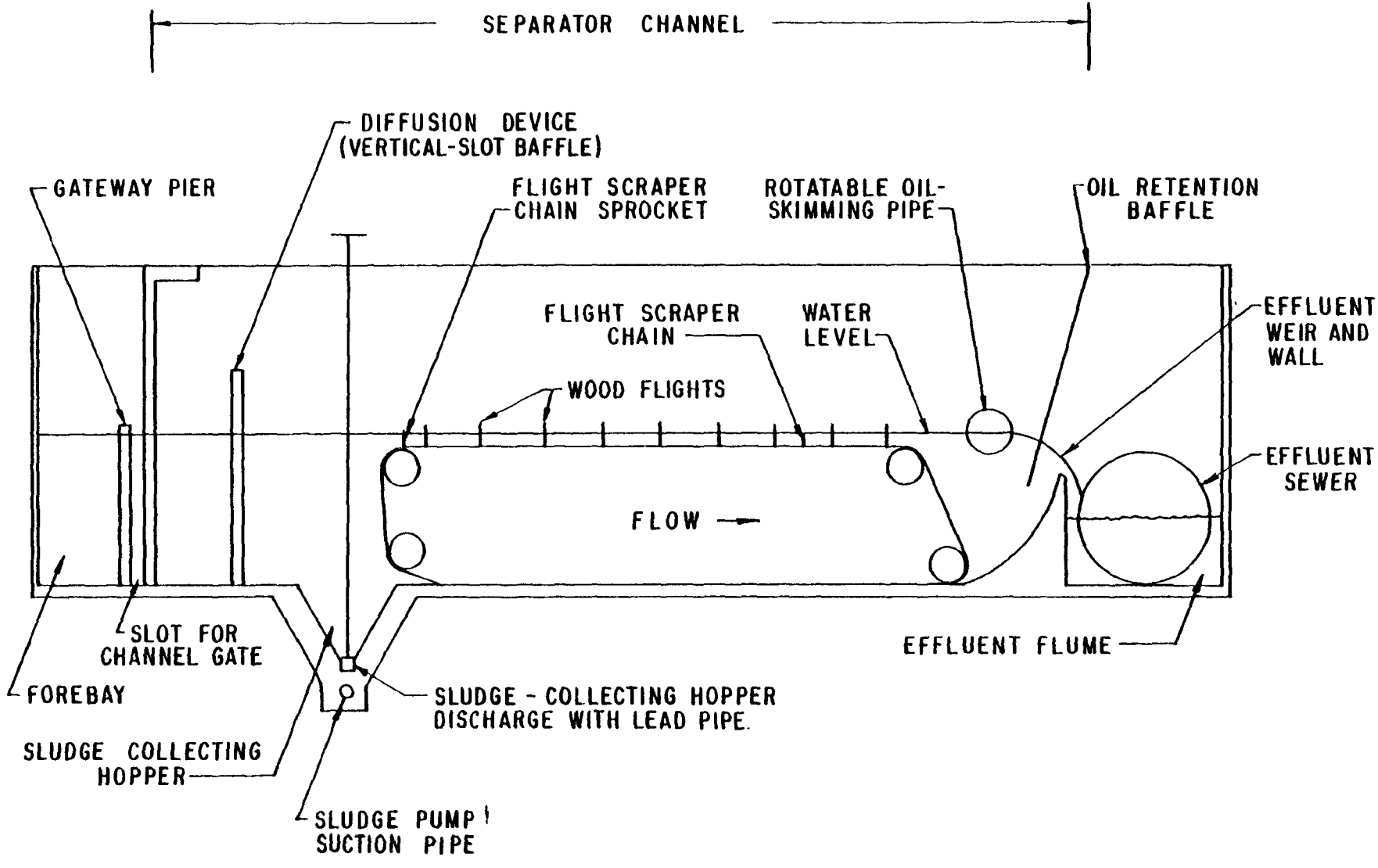


Figure VII-2

GRAVITY OIL/WATER SEPARATOR

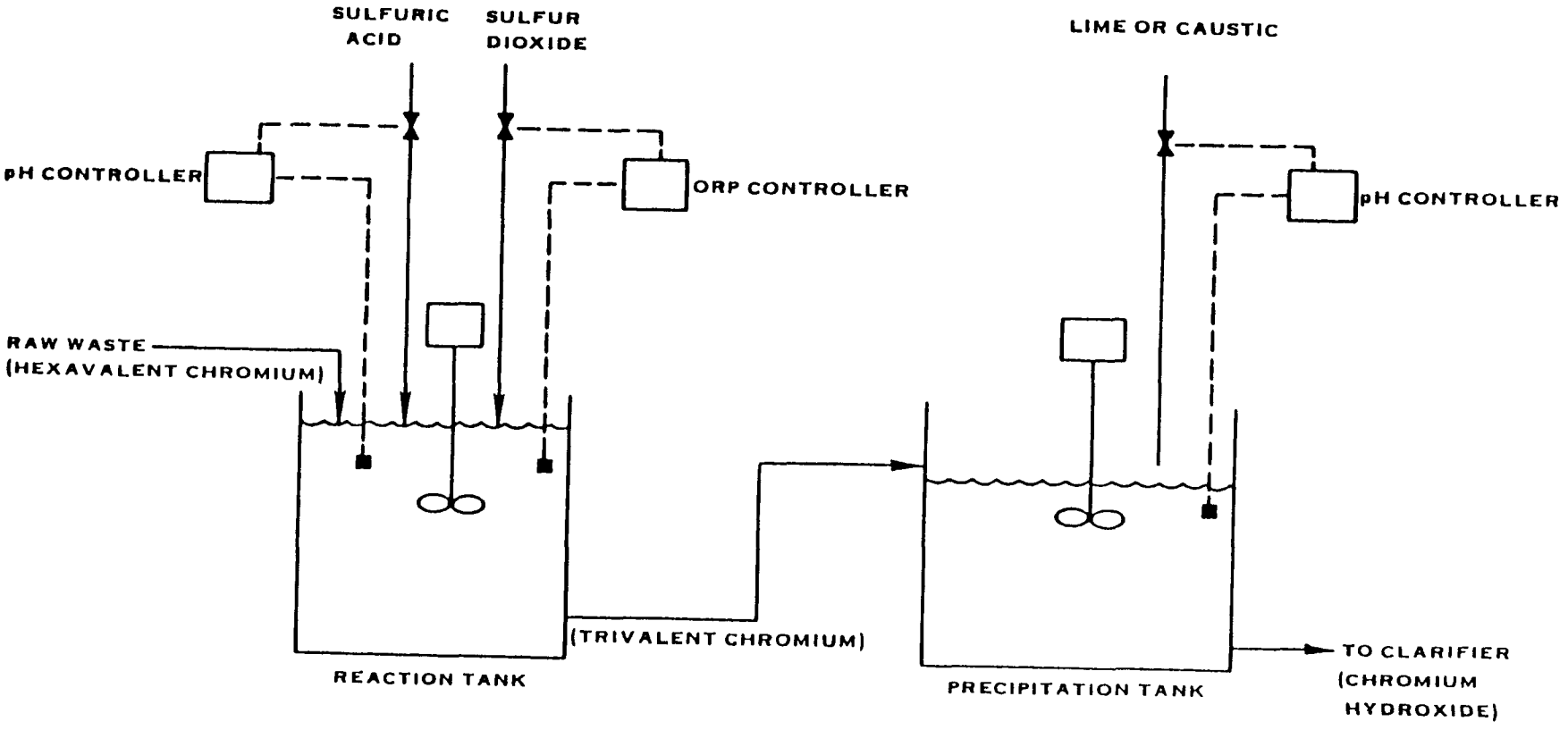
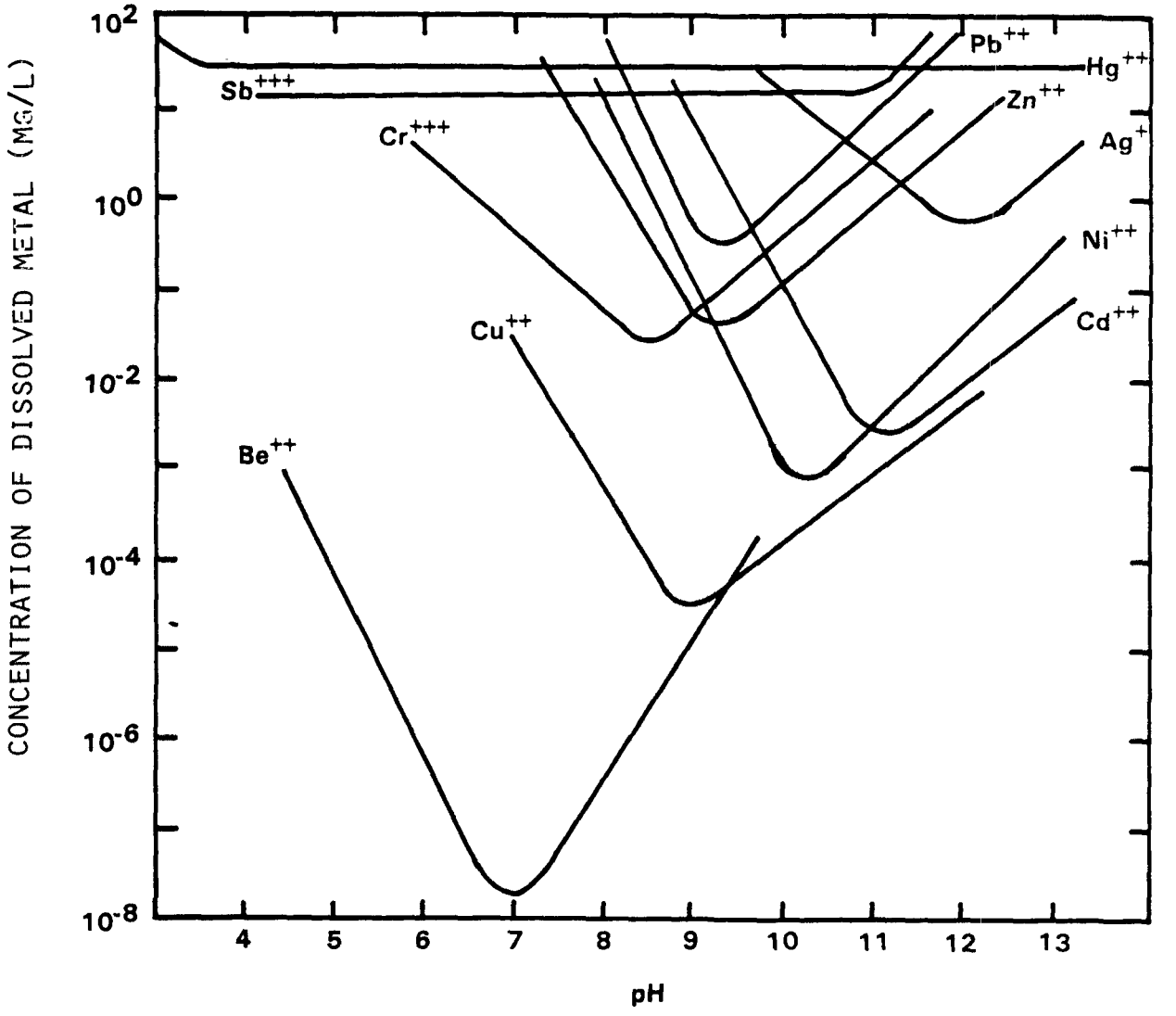


Figure VII-3

HEXAVALENT CHROMIUM REDUCTION WITH SULFUR DIOXIDE



Note: Solubilities of metal hydroxides/oxides are from data by M. Pourbaix, Atlas of Electrochemical Equilibria in Aqueous Solutions, Pergamon Press, Oxford, 1966.

Figure VII-4

THEORETICAL SOLUBILITIES OF TOXIC METAL HYDROXIDES/OXIDES AS A FUNCTION OF pH

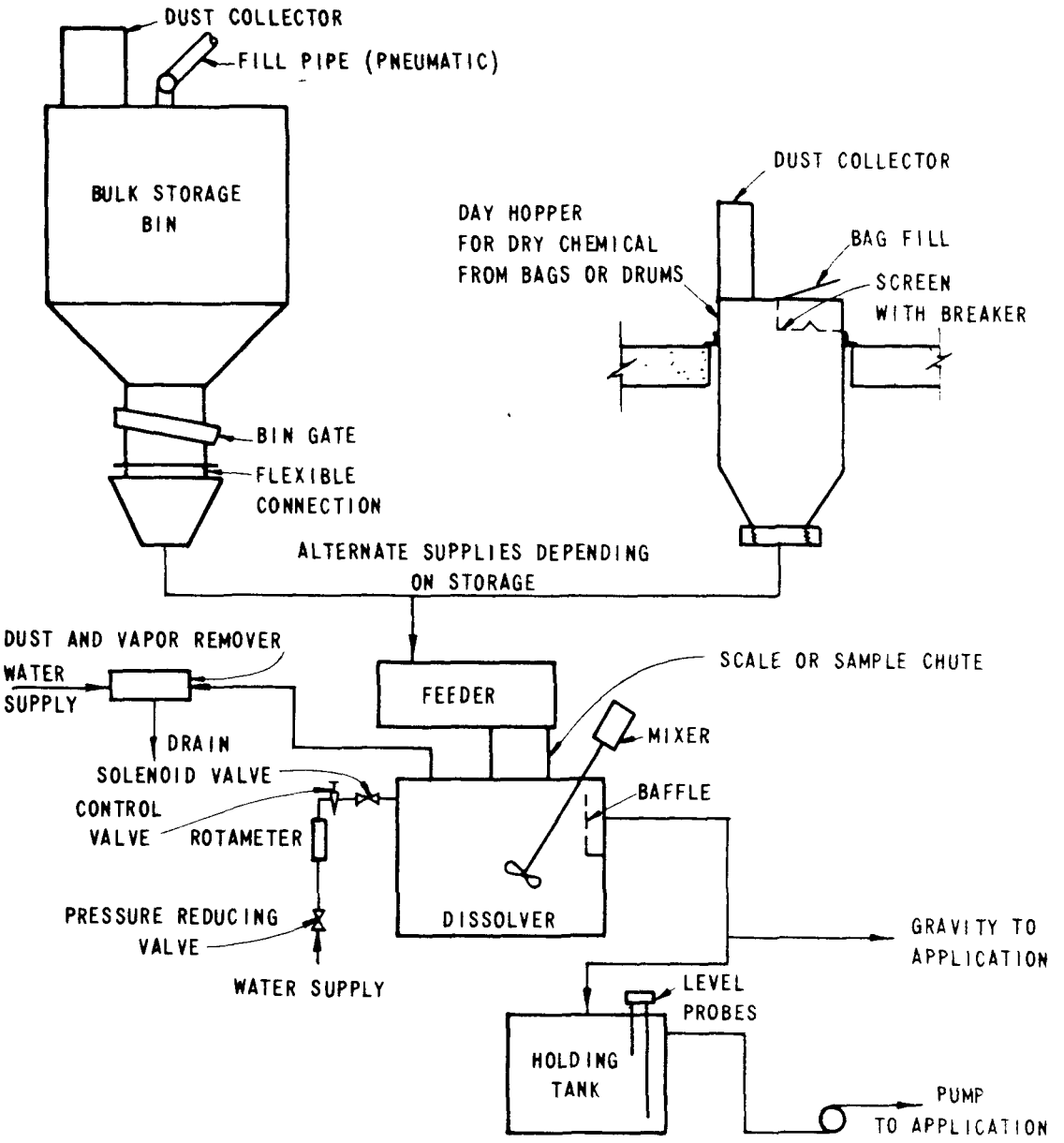
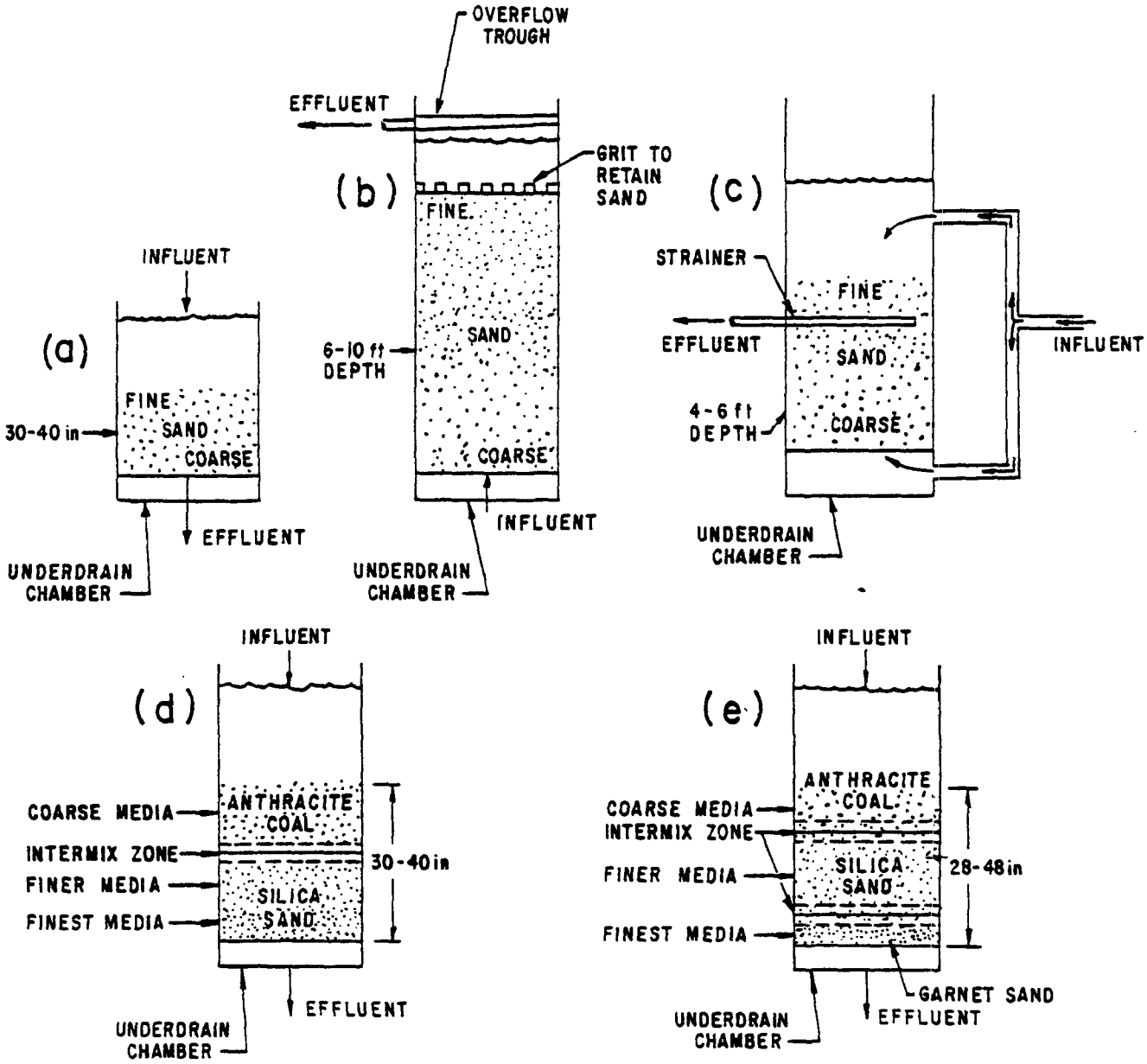


Figure VII-5

TYPICAL DRY FEED SYSTEM



(a) Single-Media Conventional Filter.
(b) Single-Media Upflow Filter.
(c) Single-Media Biflow Filter.
(d) Dual-Media Filter.
(e) Mixed-Media (Triple-Media) Filter.

Figure VII-6

FILTER CONFIGURATIONS

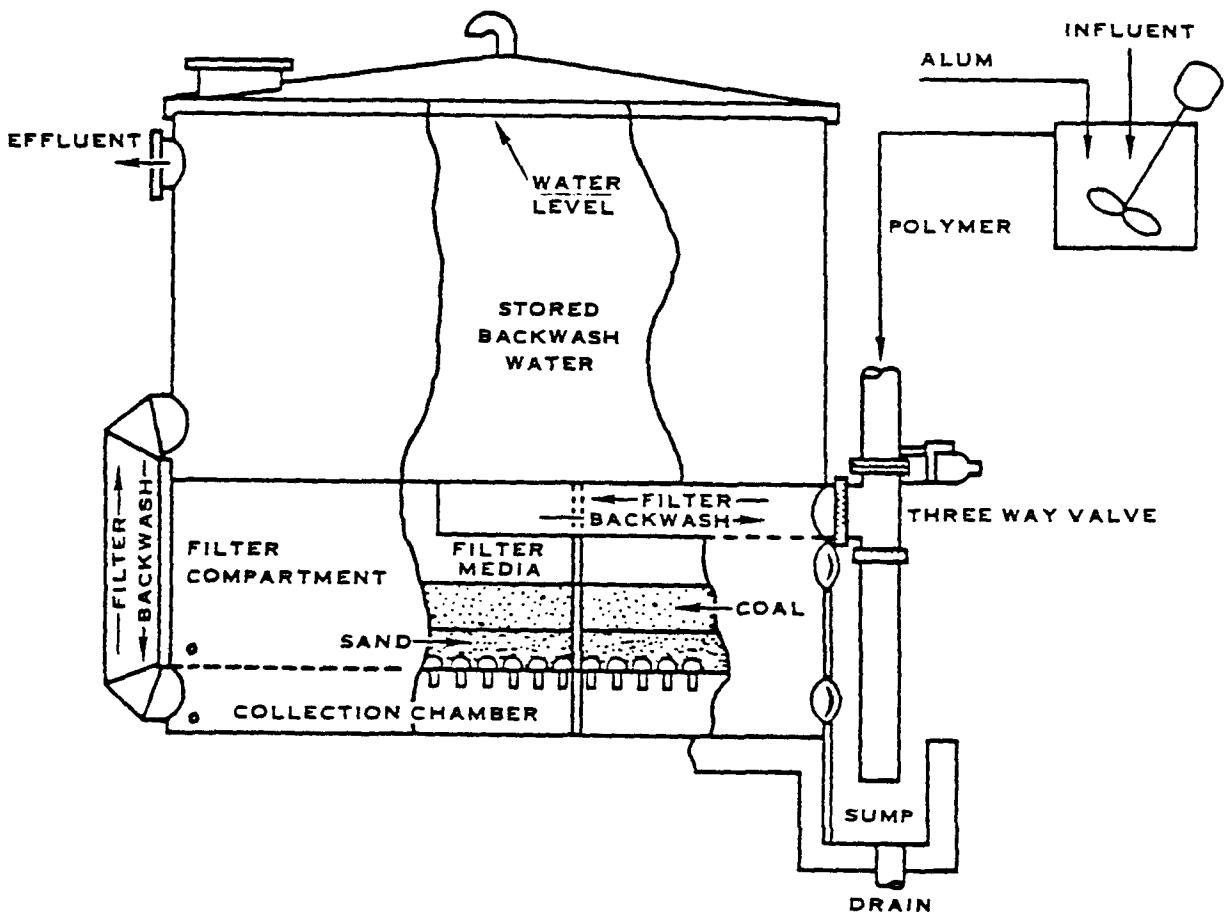


Figure VII-7

GRANULAR BED FILTRATION

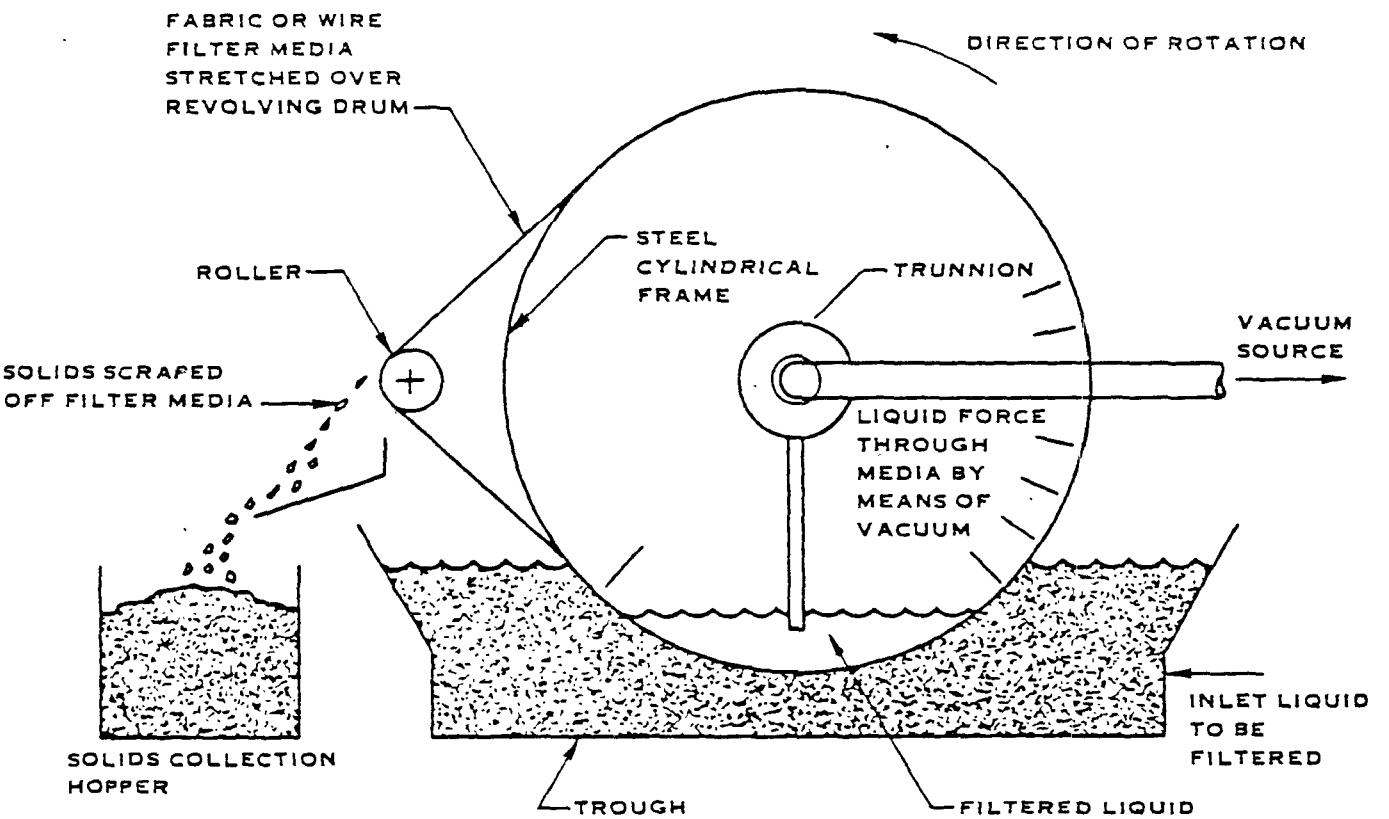


Figure VII-8

VACUUM FILTRATION

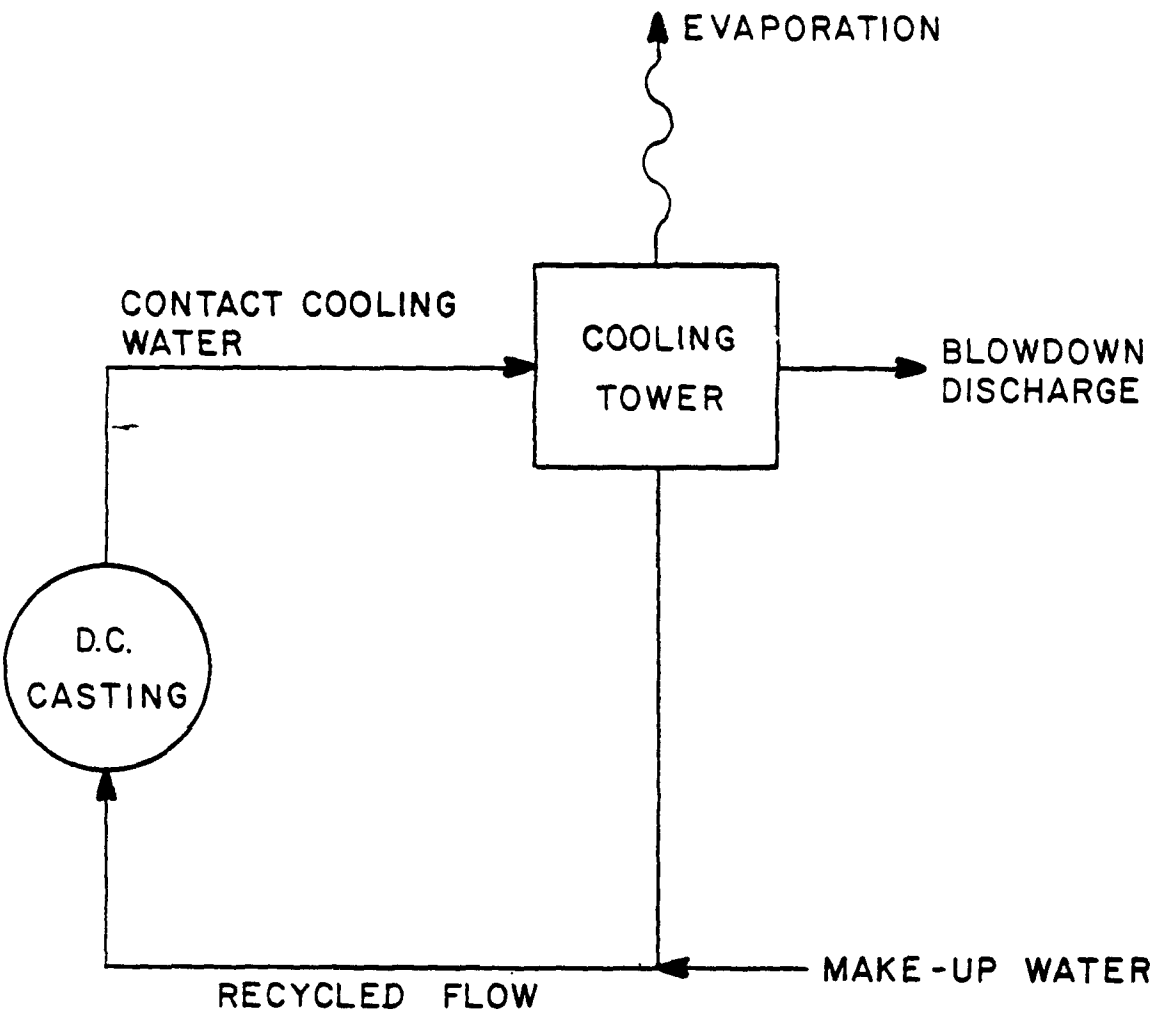
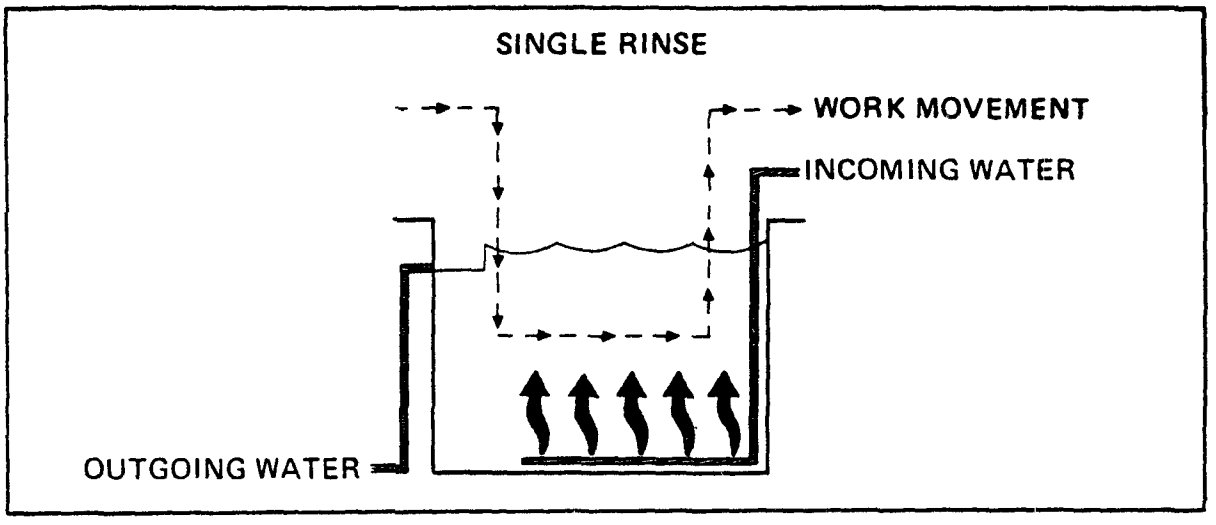


Figure VII-9

FLOW DIAGRAM FOR RECYCLING WITH A COOLING TOWER



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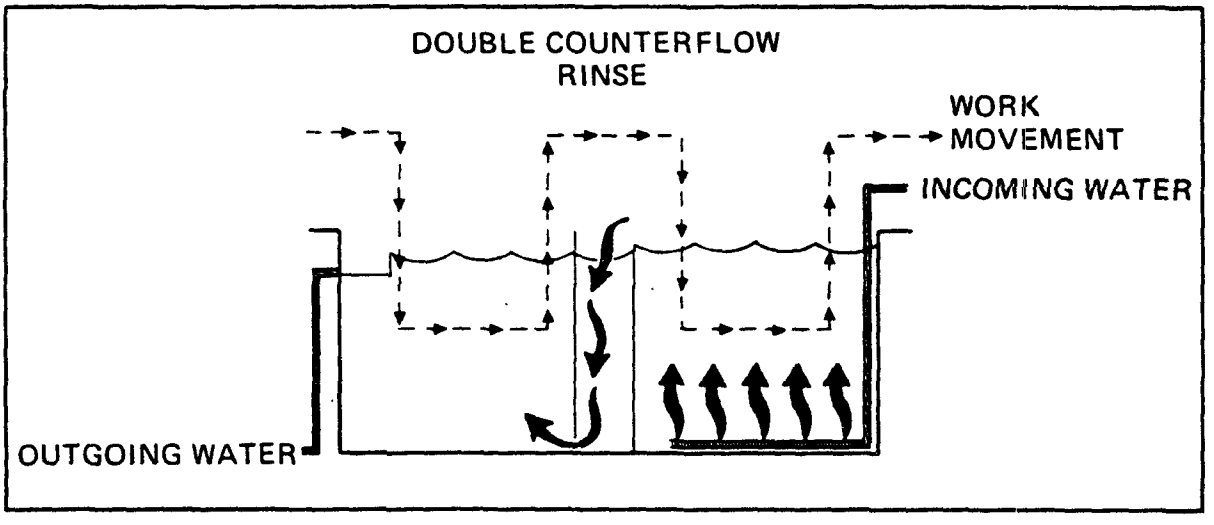

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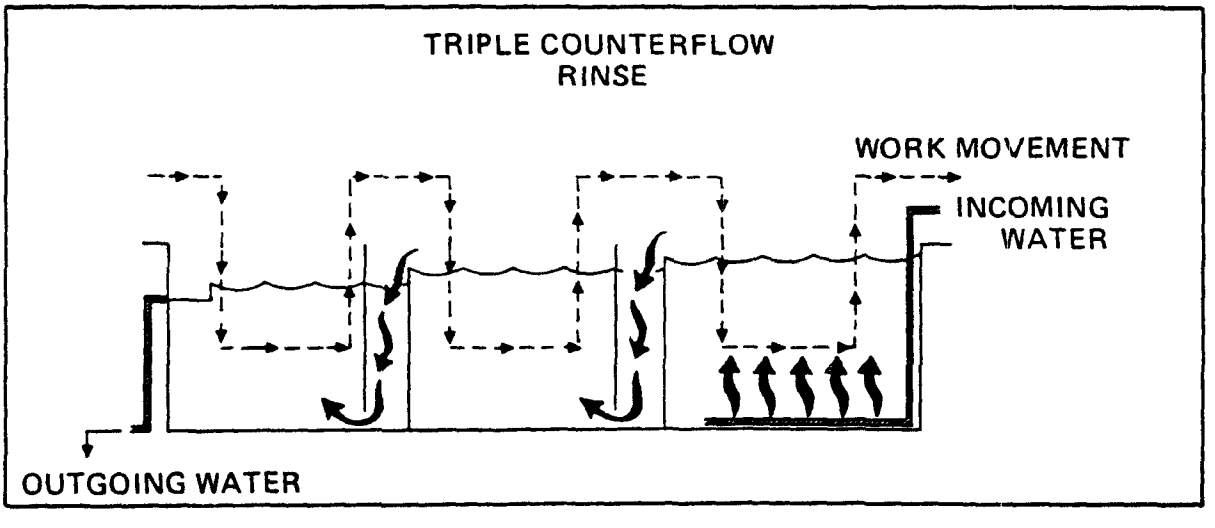


c

Figure VII-10
COUNTERCURRENT RINSING (TANKS)

Table VII-1

SOLUBILITY PRODUCTS OF TOXIC METALS

Metal	Solubility Product Constant (K_{sp}) Metal Hydroxide	Metal Sulfide
Antimony (III)	1.6×10^{-22} (1)	--
Arsenic	--	--
Beryllium	1.6×10^{-22} (1)	--
Cadmium	2.5×10^{-14} (1)	3.6×10^{-29} (2)
Chromium (III)	6.3×10^{-31} (1)	--
Copper	2.2×10^{-20} (1)	8.5×10^{-45} (2)
Lead	1.2×10^{-15} (1)	3.4×10^{-28} (2)
Mercury	3.0×10^{-26} (1)	2.0×10^{-49} (2)
Nickel	2.0×10^{-15} (1)	1.4×10^{-24} (2)
Selenium	--	--
Silver	2.0×10^{-8} (1)	1.6×10^{-49} (2)
Thallium (I)	--	5.0×10^{-21} (1)
Zinc	1.2×10^{-17} (1)	1.2×10^{-28} (2)

NOTE: References for above values are shown below.

(1) Dean, J. A., Ed., Lange's Handbook of Chemistry, 12th ed., McGraw-Hill Book Co., New York, 1979.

(2) Weast, R. C., Ed., Handbook of Chemistry and Physics, 57th ed., CRC Press, Cleveland, OH, 1976.

Table VII-2

COMBINED METALS DATA EFFLUENT VALUES (mg/l)

	Mean	One-Day Max.	10-Day Avg. Max.	30-Day Avg. Max.
Cd	0.079	0.34	0.15	0.13
Cr	0.084	0.44	0.18	0.12
Cu	0.58	1.90	1.00	0.73
Pb	0.12	0.15	0.13	0.12
Ni	0.74	1.92	1.27	1.00
Zn	0.33	1.46	0.61	0.45
Fe	0.41	1.23	0.63	0.51
Mn	0.21	0.43	0.34	0.27
TSS	12.0	41.0	20.0	15.5

Table VII-3

L&S PERFORMANCE
ADDITIONAL POLLUTANTS

Pollutant	Average Performance (mg/l)
Sb	0.70
Be	0.30
Ag	0.10
F	14.5
Mg	0.5
Nb	0.5
Mo	0.5
Ta	0.5
W	0.5
V	0.5
Ti	0.5
U	0.5
Hf	0.5
Zr	0.5
Radium^{226}	5.0 picocuries/liter

Table VII-4

COMBINED METALS DATA SET - UNTREATED WASTEWATER

Pollutant	Min. Conc. (mg/l)	Max. Conc. (mg/l)
Cd	<0.1	3.83
Cr	<0.1	116
Cu	<0.1	108
Pb	<0.1	29.2
Ni	<0.1	27.5
Zn	<0.1	337.
Fe	<0.1	263
Mn	<0.1	5.98
TSS	4.6	4,390

Table VII-5

MAXIMUM POLLUTANT LEVEL IN UNTREATED WASTEWATER
ADDITIONAL POLLUTANTS
(mg/l)

Pollutant	As & Se	Be	Ag	F	Sb
Be	--	10.24	--	--	<0.05
Cd	<0.1	--	<0.1	<0.1	2.0
Cr	0.18	8.60	0.23	22.8	<0.2
Cu	33.2	1.24	110.5	2.2	2.5
Pb	6.5	0.35	11.4	5.35	41.0
Ni	--	--	100.0	0.69	1.5
Ag	--	--	4.7	--	--
Zn	3.62	0.12	1,512.0	<0.1	10.8
F	--	--	--	760	--
Fe	--	646.0	--	--	54.5
O&G	16.9	--	16.0	2.8	12.0
TSS	352.0	796.0	587.8	5.6	200

-- Indicates not analyzed.

Table VII-6

PRECIPITATION-SETTLING-FILTRATION (LS&F) PERFORMANCE
PLANT A

Parameters	No. Points	Range mg/l	Mean ± Std. Dev.	Mean + 2 Std. Dev.
For 1979-Treated Wastewater				
Cr	47	0.015 - 0.13	0.045 ± 0.029	0.10
Cu	12	0.01 - 0.03	0.019 ± 0.006	0.03
Ni	47	0.08 - 0.64	0.22 ± 0.13	0.48
Zn	47	0.08 - 0.53	0.17 ± 0.09	0.35
Fe				
For 1978-Treated Wastewater				
Cr	47	0.01 - 0.07	0.06 ± 0.10	0.26
Cu	28	0.005 - 0.055	0.016 ± 0.010	0.04
Ni	47	0.10 - 0.92	0.20 ± 0.14	0.48
Zn	47	0.08 - 2.35	0.23 ± 0.34	0.91
Fe	21	0.26 - 1.1	0.49 ± 0.18	0.85
Raw Waste				
Cr	5	32.0 - 72.0		
Cu	5	0.08 - 0.45		
Ni	5	1.65 - 20.0		
Zn	5	33.2 - 32.0		
Fe	5	10.0 - 95.0		

Table VII-7

PRECIPITATION-SETTLING-FILTRATION (LS&F) PERFORMANCE
PLANT B

Parameters	No. Points	Range mg/l	Mean ± Std. Dev.	Mean + 2 Std. Dev.
For 1979-Treated Wastewater				
Cr	175	0.0 - 0.40	0.068 ± 0.075	0.22
Cu	176	0.0 - 0.22	0.024 ± 0.021	0.07
Ni	175	0.01 - 1.49	0.219 ± 0.234	0.69
Zn	175	0.01 - 0.66	0.054 ± 0.064	0.18
Fe	174	0.01 - 2.40	0.303 ± 0.398	1.10
TSS	2	1.00 - 1.00		
For 1978-Treated Wastewater				
Cr	144	0.0 - 0.70	0.059 ± 0.088	0.24
Cu	143	0.0 - 0.23	0.017 ± 0.020	0.06
Ni	143	0.0 - 1.03	0.147 ± 0.142	0.43
Zn	131	0.0 - 0.24	0.037 ± 0.034	0.11
Fe	144	0.0 - 1.76	0.200 ± 0.223	0.47
Total 1974-1979-Treated Wastewater				
Cr	1,288	0.0 - 0.56	0.038 ± 0.055	0.15
Cu	1,290	0.0 - 0.23	0.011 ± 0.016	0.04
Ni	1,287	0.0 - 1.88	0.184 ± 0.211	0.60
Zn	1,273	0.0 - 0.66	0.035 ± 0.045	0.13
Fe	1,287	0.0 - 3.15	0.402 ± 0.509	1.42
Raw Waste				
Cr	3	2.80 - 9.15	5.90	
Cu	3	0.09 - 0.27	0.17	
Ni	3	1.61 - 4.89	3.33	
Zn	2	2.35 - 3.39		
Fe	3	3.13 - 35.9	22.4	
TSS	2	177 - 446		

Table VII-8

PRECIPITATION-SETTLING-FILTRATION (LS&F) PERFORMANCE
PLANT C

Parameters	No. Points	Range mg/l	Mean ± Std. Dev.	Mean + 2 Std. Dev.
For Treated Wastewater				
Cd	103	0.010 - 0.500	0.049 ± 0.049	0.147
Zn	103	0.039 - 0.899	0.290 ± 0.131	0.552
TSS	103	0.100 - 5.00	1.244 ± 1.043	3.33
pH	103	7.1 - 7.9	9.2*	
For UnTreated Wastewater				
Cd	103	0.039 - 2.319	0.542 ± 0.381	1.304
Zn	103	0.949 - 29.8	11.009 ± 6.933	24.956
Fe	3	0.107 - 0.46	0.255	
TSS	103	0.80 - 19.6	5.616 ± 2.896	11.408
pH	103	6.8 - 8.2	7.6*	

*pH value is median of 103 values.

Table VII-9

SUMMARY OF TREATMENT EFFECTIVENESS (mg/l)

Pollutant Parameter	L&S Technology System				LS&F Technology System			
	Mean	One-Day Max.	10-Day Avg.	30-Day Avg.	Mean	One-Day Max.	10-Day Avg.	30-Day Avg.
114 Sb	0.70	2.87	1.28	1.14	0.47	1.93	0.86	0.76
117 Be	0.30	1.23	0.51	0.49	0.20	0.82	0.34	0.32
118 Cd	0.079	0.34	0.15	0.13	0.049	0.20	0.08	0.08
119 Cr	0.084	0.44	0.18	0.12	0.07	0.37	0.15	0.10
120 Cu	0.58	1.90	1.00	0.73	0.39	1.28	0.61	0.49
121 CN	0.07	0.29	0.12	0.11	0.047	0.20	0.08	0.08
122 Pb	0.12	0.15	0.13	0.12	0.08	0.28	0.13	0.11
124 Ni	0.74	1.92	1.27	1.00	0.22	0.55	0.37	0.29
126 Ag	0.10	0.41	0.17	0.16	0.07	0.29	0.12	0.10
128 Zn	0.33	1.46	0.61	0.45	0.23	1.02	0.42	0.31
Al	2.24	6.43	3.20	2.52	1.49	6.11	2.71	2.41
NH3	32.2	133.3	58.6	52.1	32.2	133.3	58.6	52.1
Co	0.05	0.21	0.09	0.08	0.034	0.14	0.07	0.06
F	14.5	59.5	26.4	23.5	14.5	59.5	26.4	23.5
Fe	0.41	1.20	0.61	0.50	0.28	1.20	0.61	0.50
O&G		20.0	12.0	10.0		10.0	10.0	10.0
TSS	12.0	41.0	19.5	15.5	2.6	15.0	12.0	10.0
Nb*	0.5	20.5	0.91	0.86	0.167	0.69	0.3	0.28

*The following pollutants are limited at the same concentrations: Hf, Mg, Mo, Ta, Ti, W, U, V, and Zr.

Table VII-10

MULTIMEDIA FILTER PERFORMANCE

Plant ID #	TSS Effluent Concentration, mg/l
06097	0.0, 0.0, 0.5
13924	1.8, 2.2, 5.6, 4.0, 4.0, 3.0, 2.2, 2.8 3.0, 2.0, 5.6, 3.6, 2.4, 3.4
18538	1.0
30172	1.4, 7.0, 1.0
36048	2.1, 2.6, 1.5
Mean	2.61

SECTION VIII

COST OF WASTEWATER TREATMENT AND CONTROL

This section presents estimates of the costs of implementing the major wastewater treatment and control technologies described in Section VII. These cost estimates, together with the estimated pollutant reduction performance for each treatment and control option presented in Sections IX, X, XI, and XII, provide a basis for evaluating the options presented and identification of the best practicable technology currently available (BPT), best available technology economically achievable (BAT), best conventional technology (BCT), best demonstrated technology (BDT), and the appropriate technology for pretreatment. The cost estimates also provide the basis for determining the probable economic impact on the nonferrous metals forming industry of regulation at different pollutant discharge levels. In addition, this section addresses nonwater quality environmental impacts of wastewater treatment and control alternatives, including air pollution, solid waste generation, and energy requirements.

The cost analysis performed for proposal of these guidelines and standards used compliance costs derived for 23 plants to estimate the total subcategory and category costs. The Agency intends to conduct a plant-by-plant cost analysis prior to final promulgation of these guidelines and standards.

The first part of this section describes the general methodology used to estimate compliance costs including selection of representative plants and the projection of the costs estimated for the representative plants to each subcategory and to the entire nonferrous metals forming category. The second part describes the methodology used to estimate costs for the representative plants. This part includes sources of cost data, components of cost, cost update factors, a description of the computer model used to estimate costs, and the methodology for costing individual treatment technologies. Finally, energy requirements and nonwater quality aspects of the regulation are considered.

GENERAL APPROACH

To estimate the costs of the selected treatment options for the nonferrous metals forming category, the total population of plants in the category discharging process wastewater was divided into costing groups. Compliance costs for a representative plant from each of these costing groups were calculated using a computer model. These calculated costs were used to estimate total category and subcategory compliance costs. This procedure is described in detail below.

Selection of Representative Plants

A total of 146 plants in the nonferrous metals forming category discharge process wastewater. For cost estimation, 23 of these plants were selected to represent 140 of the plants in the category. Information from one plant was not received in time to be included in cost estimation. Five plants would incur no costs from compliance with these guidelines because all of their nonferrous metals forming operations are also covered by the recently promulgated battery manufacturing guideline and therefore, costs for compliance were considered under the battery manufacturing guideline.

Division of the Category Into Costing Groups. The nonferrous metals forming category was divided into 22 homogeneous costing groups (see Table VIII-1) to adequately account for the variations within the category which affect treatment costs. The division of 140 of the 146 discharging plants into costing groups was based on the factors which significantly affect compliance costs:

1. Wastewater pollutant characteristics,
2. Wastewater flow, and
3. Wastewater treatment currently in-place.

Wastewater pollutant characteristics affect treatment costs because they dictate the choice and sequence of required treatment. Removal of dissolved metals from any nonferrous metals forming wastewater requires chemical precipitation of the metals with lime followed by gravity settling to separate the solid from liquid phase. Preliminary treatment required for a particular waste stream prior to lime and settle, however, can vary widely. For example, emulsified oily waste streams will typically require chemical emulsion breaking and oil/water separation, since oil is not effectively removed by lime and settle technology. Also, waste streams containing treatable levels of hexavalent chromium require treatment to reduce the chrome to trivalent chromium before precipitation as a hydroxide (with lime) can occur. Extensive pretreatment will result in significantly higher costs compared to lime and settle alone.

Plant wastewater flow affects both annual and capital treatment costs. Capital costs depend on equipment size, which is based on hydraulic flow. Annual costs include cost of treatment chemicals and wastewater pumping, both of which are affected by total plant wastewater flow. However, because of economies of scale, the relationship between flow and cost is not linear and the discharging plants were grouped to represent the range of flows found in the category.

Wastewater treatment in-place, when equivalent to that required by a treatment option, will reduce a plant's annual and capital cost for that option. Therefore, treatment in-place was considered in the selection of costing groups.

The selected costing groups did not always correspond to the subcategories described in Section IV. This is because the 11 nonferrous metals forming subcategories correspond to industry segments with different wastewater characteristics which, because of different pollutants present, will require distinct effluent limitations. In contrast, costing groups correspond to industry segments with different wastewater characteristics which result in different capital and annual costs of treatment.

Because both subcategories and costing groups are divisions based on wastewater characteristics and because it was necessary to estimate compliance costs for each subcategory, the subcategorization scheme developed in Section IV was followed in selecting costing groups, where appropriate. Adaptation of the subcategorization scheme for division into costing groups was necessary for several subcategories:

- The lead/tin/bismuth forming subcategory covers the manufacture of three distinct types of products - bullets; solder; and pipe, sheet and other products. Each of these types of products is manufactured with a distinct mix of lead/tin/bismuth forming operations. The plants within each costing group will generate waste streams with similar flows and requiring similar types of preliminary treatment. For this reason, the lead/tin/bismuth subcategory was divided into three costing groups based on product manufactured.

- Similarly, the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory covers the manufacture of two distinct types of products - metal powders and parts pressed from metal powder. Although the operations used to manufacture these products generate wastewater with similar characteristics, the operations have different water uses. Water is used to atomize molten metal and as a grinding slurry in the production of metal powders. No flow reduction technology has been identified for these operations. Therefore, costs of implementing some in-process wastewater control technology options will be different for metal powder production operations and powder metallurgy operations. For this reason the subcategory was divided into two costing groups based on product manufactured.

- Zirconium/hafnium forming, nickel/cobalt forming, titanium forming and refractory metal forming are distinct subcategories. However, these metals have similar properties, are formed by similar processes and thus generate wastewaters requiring the same types of treatment. Furthermore, a single plant will often form metals from more than one of these subcategories, commingling and co-treating the wastewater from the forming operations. Therefore, these subcategories were grouped together.

Adaptation of the beryllium, uranium, magnesium, and zinc forming subcategories, based on wastewater characteristics, was not necessary, because one plant generates the majority of wastewater discharged in each subcategory. Therefore, they were retained as separate costing groups. Adaptation of the precious metals subcategory based on wastewater characteristics was also not necessary.

Nine of the eleven groupings described above could be adequately represented by an average plant and required no further subdivision for use as costing groups. However, as shown on Table VIII-1, two of these groupings, precious metals forming and the zirconium/hafnium, nickel/ cobalt, refractory metals, titanium forming grouping required further subdivision. This subdivision was based on the two other factors, described above, which significantly affect compliance costs--treatment in place and wastewater flow.

The zirconium/hafnium, nickel/cobalt, refractory metals, and titanium grouping was split into two groups - plants with treatment in-place and plants without. Both of these groups were further divided into groups of extra small, small, medium, large, and extra large dischargers based on total nonferrous metals forming process wastewater flow.

Subdivision of the precious metals forming grouping was based on total nonferrous metals forming process wastewater flow. Three precious metals costing groups were created: small, medium, and large dischargers.

Each discharging plant was assigned to one of these costing groups, based on its subcategory, flow, and treatment-in-place. If a plant formed metals in more than one subcategory, it was assigned to the costing group based on the subcategory contributing the greatest proportion of wastewater flow. It was assumed that all wastewater generated by processes in the nonferrous metals forming category would be treated together. Therefore, when costing groups were based on flow, plants were assigned to a group based on total annual nonferrous metal forming process

wastewater flow. For example, if a plant discharged 10,000 gallons of wastewater per year from nickel forming operations and 30,000 gallons of wastewater per year from precious metals forming operations, it was assigned to a precious metals forming cost group. However, it was assigned to the small, medium, or large precious metals costing group based on its total nonferrous forming wastewater flow, 40,000 gallons per year.

No information on nonferrous metals forming wastewater flow was available for some plants. If the plant formed a metal whose costing groups were based on wastewater flow, the plant was assigned to a costing group with plants of similar productions (pounds of product). Based on information obtained from follow-up telephone calls, most plants that did not adequately complete the dcp are believed to have small wastewater flows. Therefore, if no production information was available, the plant was assigned to the extra-small flow costing group.

Selection of Representative Plants. One plant representing each costing group was selected for compliance cost estimation using the computer model described below. Two plants were selected to represent the powder metallurgy group because of the large number of plants in this group. Based on the combined treatment assumption described above, the arithmetic average of total annual nonferrous metals forming process wastewater flow was calculated for each costing group. Plants were selected for costing which had flow close to the group average. Treatment in place and manufacturing process were also considered in selecting a representative plant when they had not been used to define the group.

If several plants in a costing group had flows close to average, a plant that had been visited and sampled was preferentially selected for costing to take advantage of the detailed information obtained during the visit. However, several sampled plants had wastewater flows much larger than average and so were not selected for costing.

Costing the Representative Plants

Costs were estimated for each of the representative plants using the methodology described in the second part of this section. The computer model used for estimating costs requires pollutant concentrations for each treated waste stream. Pollutant concentrations used in estimating costs were based on sampling data obtained during visits to 17 nonferrous metal forming plants. See "Costing Input Data," below, for more details on the use of the sampling data.

The pollutant parameters in list B of Table VIII-2 were used to estimate the costs of the plant representing costing groups 6,

14, 17, 18, 22, and 23 (see Table VIII-1). The parameters in list A were used to estimate the costs of the plants representing the remaining cost groups.

Estimation of Subcategory and Total Category Costs

The plants assigned to a given costing group had operations in up to five nonferrous metals forming subcategories. In order to estimate subcategory compliance costs, the costs calculated for each costing group were apportioned to the subcategories present in that group based on mass of finished product produced.

Treatment costs would be most accurately apportioned based on wastewater flow generated by the nonferrous metals forming operations in each subcategory. However, in the limited time available between the receipt of the dcp's and the Court Ordered deadline for proposal of these guidelines this detailed information could not be determined for many of the plants known to discharge wastewater. Therefore, to apportion costing group costs to subcategories in a consistent manner, costs were apportioned based on mass of finished product produced.

Subcategory Costs. Compliance costs for each subcategory were determined by summing the estimated costs for direct dischargers in a subcategory and the estimated costs for indirect dischargers in that subcategory. These estimates were made using the following procedure:

- First, for a single costing group, the number of pounds of metal formed in each subcategory by each plant in the group was determined. It was also determined if the wastewaters associated with this production were directly or indirectly discharged.

- Second, the total pounds of metal formed in the costing group were calculated.

- Third, for each subcategory present in the costing group, the pounds of metal associated with direct dischargers and the pounds of metal associated with indirect dischargers were calculated.

- Fourth, the total group cost was calculated by multiplying the estimated compliance cost of the representative plant by the number of plants in the costing group.

- Fifth, the total group cost was apportioned to the direct and indirect discharges in each subcategory present in the group by production weighting the total group cost.

For example:

$$\left[\frac{\text{pounds of Ni, wastewater directly discharged, group n}}{\text{total pounds metal, group n}}\right] \times$$

[total cost, group n] = cost from group n attributable to directly discharged nickel forming wastewater

These five steps were repeated for each of the 22 costing groups except group 7.

Costing group 7 consisted of two zinc forming plants. One plant is much larger than the other, has most of the equipment required by the treatment options in-place and discharges its wastewater directly into surface water. The plant with smaller production has no treatment in-place, discharges its wastewater to a POTW, and did not supply wastewater flow information in its dcp.

The compliance cost for the larger plant was estimated using the computer cost model. Required capital costs at each treatment option were determined by first calculating the total capital cost required by the option and then subtracting out the capital cost of equipment currently in-place at the plant. Required annual costs were determined by first calculating the total annual cost required by the treatment option and then subtracting out the annual costs currently incurred by the plant. Because of the large differences in production and treatment in-place between the costed plant and the other plant in the costing group, these estimates were not believed to represent the costs for both plants in the group. Therefore, a separate cost estimate was made for the smaller plant. This estimate was based on the total capital and annual costs estimated for the larger plant with the computer cost model (that is, making no allowance for treatment in-place). These costs were adjusted to more accurately represent the costs that would be incurred by the smaller plant by multiplying them by the ratio of the plant productions.

The estimates for the compliance costs for the two plants in costing group 7 were then used to estimate the total zinc forming subcategory compliance costs.

The compliance costs for direct discharges in one subcategory were determined by adding the production weighted costs from each costing group. The same procedure was used to determine compliance costs for indirect dischargers in the subcategory. Total compliance costs for the subcategory were simply the sum of the costs for direct and indirect dischargers.

The compliance costs for each of the 11 subcategories were determined in the same way.

Total Category Costs. The compliance costs of the nonferrous metals forming category were estimated by adding together the compliance costs for each of the 11 subcategories, estimated as described above.

Economic Impact Assessment. The Agency's assessment of the economic impact of these guidelines and standards is set forth in Economic Analysis of Proposed Effluent Limitations and Standards for the Nonferrous Metals Forming Industry (EPA 440/2-84-005). Part of this study involved assessing the impact of the various treatment options on each plant in the category. To perform this assessment the compliance costs estimated by the computer model for the 23 representative plants were extrapolated to the other plants in each costing group. Even though a specific plant might have operations in more than one subcategory, it was not necessary to apportion the costs to perform the plant-by-plant economic impact analysis. Therefore, the costs estimated for the 23 representative plants in the respective costing group were extrapolated to each of the remaining plants in the respective costing group based on the plant's total annual nonferrous metals forming wastewater flow. When this information was not available, costs were extrapolated based on plant annual production volume. The total category compliance costs calculated by this procedure are different from those calculated by apportioning costs to each subcategory based on mass of finished product produced.

Drawbacks of This Cost Estimation Methodology

The general approach outlined above was used to estimate costs because of the limited time between receipt of completed dcp's and the court-ordered date for proposal of these guidelines and standards. However, the Agency recognizes that this methodology has some drawbacks and will, therefore, evaluate the costs of the technology options on a plant-by-plant basis before promulgating these guidelines and standards. Some of the drawbacks of this method of cost estimation are discussed below.

Representative Plants. The average of the costs of the plants in a costing group was assumed to be equal to the compliance costs of the plant selected to represent that group. This will only be true to the extent that the costed plant represents the average of the factors which significantly affect compliance costs. The costed plant should have average wastewater characteristics, wastewater flow and treatment in-place. However, because of the small number of plants in each costing group and the heterogeneity of the category, it was not always possible to select such an average plant. When necessary, a plant believed to have slightly higher than average costs was chosen to represent the costing group.

Apportionment of Subcategory Costs. Treatment costs for each costing group were apportioned to subcategories based on mass of finished product produced. Since treatment costs depend on volume of water treated, apportioning costs by mass of finished product produced assumes that the total volume of wastewater generated by all of the operations at a plant per mass of final product will be constant from plant to plant. This is clearly not the case. As detailed in Section IX, the volume of wastewater generated by a particular plant depends upon the operations present and the mass of metal processed by those operations. Apportioning costs by production instead of wastewater flow will sometimes under- and sometimes overestimate the actual cost at a plant attributable to each subcategory. It is not clear if this will result in a net over- or underestimate of a subcategory compliance cost.

Treatment of Wastewater Other Than Nonferrous Metals Forming Process Wastewater. Plants which form nonferrous metals can generate three types of wastewater: (a) wastewater from nonferrous metals forming processes; (b) wastewater from manufacturing activities other than nonferrous metals forming; and (c) nonprocess wastewater (e.g., noncontact cooling water, plant site runoff, sanitary wastewater). Only treatment of nonferrous metals forming process wastewater was considered in the estimation of treatment technology costs in this category.

Approximately 56 percent of the discharging plants in the category and 12 of 23 plants for which costs were estimated discharge process water from manufacturing activities other than nonferrous metals forming. Most of these activities are covered by other effluent guidelines. However, the development of separate guidelines is not meant to imply that separate treatment systems are required, if the wastewater from one category is amenable to the same treatment as the wastewater from another category (that is, if the wastewaters are co-treatable). Since wastewater from the industrial categories most commonly associated with nonferrous metals forming (i.e., aluminum forming, copper forming, metal finishing, iron and steel manufacturing, and nonferrous metals manufacturing) is effectively treated by the same technology as that from nonferrous metals forming, in practice, separate treatment systems would usually not be required.

The questionnaires distributed to obtain information on the nonferrous metals forming operations did not specifically ask for information on wastewater flows from operations not in the category. However, some respondents volunteered this information.

For some of the plants which supplied such information, the nonferrous metals forming wastewater flow is a small part of

total wastewater flow. For these plants, compliance with the nonferrous metals forming guideline would require a small increase in the capacity of an existing treatment system or a treatment system required to comply with other newly promulgated regulations. The compliance cost for these plants is the cost of that increment of treatment capacity. Because of economies of scale, this cost is usually much smaller than the cost of two separate systems. Since treatment of nonscope wastewaters was not considered in the estimation of compliance costs for the nonferrous metals forming category, the compliance costs described in this section may overstate the actual costs for plants in which co-treatable nonscope wastewaters are present.

The wastewater generated from nonferrous metals forming operations at some plants may require significantly more treatment than the other wastewater generated at the plant. These wastewaters could be either from other manufacturing activities or nonprocess wastewater. If these waste streams are currently commingled with nonferrous metals forming process wastewater, the plants would incur the cost of segregating the nonferrous metals forming process wastewater from the commingled streams. No segregation costs were included in the estimation of treatment technology costs in this category. This omission might lead to an underestimate of costs in some cases.

Re-estimation of Costs for Promulgation of These Guidelines and Standards. Because of the issues described above, the Agency plans to re-evaluate the costs of the technology options considered for these guidelines on a plant-by-plant basis. To do this will require additional information on (a) the extent to which co-treatment is currently practiced in the industry, (b) the extent to which co-treatment is projected to be practiced in the future, (c) the costs of co-treatment currently experienced or projected, (d) method(s) of allocating costs for co-treatment to individual product lines, and (e) the effectiveness of co-treatment in reducing pollutant discharges.

Benefits. The total mass of pollutants removed by each treatment technology option (benefits) considered for this regulation was estimated as described in Section X. This estimate depends on the same assumptions as the cost estimates and so may have some of the same drawbacks. In addition to re-evaluating costs for these guidelines on a plant-by-plant basis, the Agency plans to re-evaluate benefits on a plant-by-plant basis prior to promulgation of these guidelines and standards.

COST ESTIMATION METHODOLOGY

Sources of Cost Data

Capital and annual cost data for the selected treatment processes were obtained from three sources: (1) equipment manufacturers, (2) literature data, and (3) cost data from existing plants. The major source of equipment costs was contacts with equipment vendors, while the majority of annual cost information was obtained from the literature. Additional cost and design data were obtained from data collection portfolios when possible.

Components of Costs

Capital Costs. Capital costs consist of two components: equipment capital costs and system capital costs. Equipment costs include: (1) the purchase price of the manufactured equipment and any accessories assumed to be necessary; (2) delivery charges, which account for the cost of shipping the purchased equipment a distance of 500 miles (considered an average delivery distance, given the geographical distribution of plants in this category); and (3) installation, which includes labor, excavation, site work, and materials. The correlating equations used to generate equipment costs are shown in Table VIII-3.

Capital system costs include contingency, engineering, and contractor's fees. These system costs, each expressed as a percentage of the total installed equipment cost, are combined into a factor which is multiplied by the total equipment cost to yield the total capital investment. The components of the total capital investment are listed in Table VIII-4.

Annual Costs. The total annualized costs also consist of a direct and a system component as in the case of total capital costs. The components of the total annualized costs are listed in Table VIII-5. Direct annual costs include the following:

- Raw materials - These costs are for chemicals used in the treatment processes, which include lime, ferrous sulfate, sulfuric acid, alum, polyelectrolyte, and sulfur dioxide.

- Operating labor and materials - These costs account for the labor and materials directly associated with operation of the process equipment. Labor requirements are estimated in terms of labor hours per year. A labor rate of 21 dollars per labor hour was used to convert the labor hour requirements into an annual cost. This composite labor rate included a base labor rate of nine dollars per hour for skilled labor, 15 percent of the

base labor rate for supervision and plant overhead at 100 percent of the total labor rate. Nine dollars per hour is the Bureau of Labor Statistics national wage rate for skilled labor during 1982 (National Bureau of Labor Statistics, Monthly Labor Review, March 1982).

- Maintenance Labor and Materials - These costs account for the labor and materials required for repair and routine maintenance of the equipment. The maintenance labor rate was also 21 dollars per labor hour, and maintenance materials were usually assumed as a percentage of capital costs.

- Energy - Energy, or power, costs are calculated based on total energy requirements in kw-hrs, an electricity charge of $.0483/kilowatt-hour and an operating schedule of 24 hours/day, 250 days/year unless otherwise specified. The cost of electricity (March 1982) is based on the industrial cost derived from the Department of Energy's Monthly Energy Review.

System annual costs include monitoring, taxes and insurance, and amortization. Monitoring refers to the periodic sampling and analysis of wastewater to ensure that discharge limitations are being met. The annual cost of monitoring was calculated using an analytical lab fee of $120 per wastewater sample and a sampling frequency based on the wastewater discharge rate, as shown in Table VIII-6.

Taxes and insurance cost is assumed to be one percent of the total depreciable capital investment (see Item 23 of Table VIII-5).

Amortization costs, which account for depreciation and the cost of financing, were calculated using a capital recovery factor (CRF). A CRF value of 0.177 was used, which is based on an interest rate of 12 percent, and a taxable lifetime of 10 years. The CRF is multiplied by the total depreciable investment to obtain the annual amortization costs (see Item 24 of Table VIII-5).

Cost Update Factors

All costs are standardized by adjusting to the first quarter of 1982. The cost indices used for particular components of costs are described below.

Capital Investment - Investment costs were adjusted using the EPA-Sewage Treatment Plant Construction Cost Index. The value of this index for March 1982 is 414.0.

Operation and Maintenance Labor - The Engineering News-Record Skilled Labor Wage Index is used to adjust the portion of Operation and Maintenance costs attributable to labor. The March 1982 value is 325.0.

Maintenance Materials - The producer price index published by the Department of Labor, Bureau of Statistics is used. The March 1982 value of this index is 276.5.

Chemicals - The Chemical Engineering Producer Price Index for industrial chemicals is used. This index is published biweekly in Chemical Engineering magazine. The March 1982 value of this index is 362.6.

Energy - Power costs are adjusted by using the price of electricity on the desired date and multiplying it by the energy requirements for the treatment module in kwhr equivalents.

Cost Estimation Model

Cost estimation was accomplished using a computer model which accepts inputs specifying the required treatment system, chemical characteristics of the raw waste streams, flow rates and treatment system entry points of these streams, and operating schedules. This model utilizes a computer-aided design of a wastewater treatment system containing modules that are configured to reflect the appropriate equipment at an individual plant. The model designs each treatment module and then executes a costing routine that contains the cost data for each module. The capital and annual costs from the costing routine are combined with capital and annual costs for the other modules to yield the total costs for that regulatory option. The process is repeated for each regulatory option.

Each module was developed by coupling theoretical design information from the technical literature with actual design data from operating plants. This permits the most representative design approach possible to be used, which is an important element in accurately estimating costs. The fundamental units for design and costing are not the modules themselves but the components within each module, e.g., the lime feed system within the chemical precipitation module. This is a significant aspect of this model for two reasons. First, it does not limit the model to certain fixed relationships between various components of each module. For instance, cost data for chemical precipitation systems are typically presented graphically as a family of curves with lime (or other alkali) dosage as a parametric function. The model, however, sizes the lime feed system as a funtion of the required mass addition rate (kg/hr) of lime. The model thus selects a feed system specifically designed for that plant.

Second, this approach more closely reflects the way a plant would actually design and purchase its equipment. The resulting costs are thus closer to the actual costs that would be incurred by the facility.

Overall Structure. The cost estimation model consists of two main parts: a design portion and a costing portion. The design portion uses input provided by the user to calculate design parameters for each module included in the treatment system. The design parameters are then used as input to the costing routine, which contains cost equations for each discrete component in the system. The structure of the program is such that the entire system is designed before any costs are estimated.

An overall logic diagram of the computer programs is depicted in Figure VIII-1. First, constants are initialized and certain variables such as the modules to be included, the system configuration, plant and wastewater flows, compositions, and entry points are specified by the user. Each module is designed utilizing the flow and composition data for influent streams. The design values are transmitted to the cost routine. The appropriate cost equations are applied, and the module costs and system costs are computed. Figures VIII-2 and VIII-3 depict the logic flow diagrams in more detail for the two major segments of the program.

Input Data Requirements. Several data inputs are required to run the computer model. First, the treatment modules to be included and their sequence must be specified. Next, information on hours of operation per day and number of days of operation per year for the particular plant under consideration is required. The flow values and characteristics must be specified for each wastewater stream entering the treatment system, as well as each stream's point of entry into the wastewater treatment system. These values will dictate the size and other parameters of equipment to be costed. The derivation of each of these inputs will be discussed in turn.

Choice of the appropriate end-of-pipe and preliminary treatment modules and their sequence for a plant are determined by applying the treatment technology for each option (see Figures X-1 and X-2). These option diagrams were adjusted to accurately reflect the treatment system that the plant would actually require. For example, if it were determined by examining a plant's dcp that emulsified oils are not used in the plant's forming operations, then a chemical emulsion breaking module would not be included in the treatment required for that plant. Flow reduction modules were not included for plants whose waste stream flow rates were already lower than the regulatory flows for flow reduced treatment options. The hours of operation per day and days of operation per year were estimated from information supplied in the data collection portfolio.

The flows used to size the treatment equipment were derived as follows: production (kkg/yr) and flow (l/yr) information was obtained from the plant's dcp, or from sampling data where possible, and a production normalized flow in liters per kkg was calculated for each waste stream. This flow was compared to the regulatory flow, also in liters per kkg, and the lower of the two flows was used to size the treatment equipment. Regulatory flow was also assigned to any stream for which production or flow data was not reported in the dcp.

The raw waste concentrations of each influent waste stream were derived from available sampling data. The actual values of the concentrations used as input into the cost model were based on two different assumptions; either a constant concentration or a constant mass assumption was used. Assuming constant concentration signifies that the same concentrations of pertinent pollutants were assumed for each waste stream regardless of plant, except where the actual flow was lower than the regulatory flow or where a waste stream is flow reduced. In these cases, the concentrations were adjusted to maintain the same mass of pollutant found at the regulatory or unreduced flow level. This was calculated by multiplying the concentrations by the ratio of the regulatory to the lower actual flow or unreduced to the reduced flow, whichever the case may be, to obtain concentrations at the lower flow. For example, a waste stream whose actual reported flow is half the value of the regulatory flow will have double the concentrations associated with the higher regulatory flow in order to maintain a constant pollutant mass loading for both flows. In other words, pollutant concentrations were assumed to be constant from plant to plant for a particular waste stream if the flow used for costing is at the regulatory level. From option to option (i.e., within a plant) however, pollutant mass loadings (mg/hr) were assumed to be constant.

Assuming constant mass signifies that the pollutant mass loadings (mg/hr) were constant for each waste stream. The mass loading is calculated as being directly proportional to the production rate (kkg/hr) associated with a particular waste stream and is independent of the flow (although the concentration derived from the mass loading will be a function of flow). The procedure used for determining the pollutant concentrations (mg/l) to be used as input to the cost model was as follows: for a given input waste stream to the model during actual costing, the average production normalized raw waste values (mg/kkg) are divided by the production normalized costing flow (l/kkg) (actual or regulatory based, whichever is lower) to obtain the pollutant concentration for costing. The underlying assumption is that the amount of pollutant generated by any process operation corresponds directly with the amount of product produced by that operation. A significant result of this assumption is that the total pollutant loading

(mg/hr) remains constant when in-process flow reduction techniques are used (e.g., for a stream that is reduced by a factor of two via a flow reduction measure, the pollutant concentrations will increase correspondingly by a factor of two).

Model Results. For a given plant, the model will generate comprehensive material balances for each parameter tracked at any point in the system. It will also summarize design values for key equipment in each treatment module, and provide a tabulation of costs for each piece of equipment in each module, module subtotals, total equipment costs, and system capital and annual costs.

Cost Estimates for Individual Treatment Technologies

Introduction. Treatment technologies have been selected from among the larger set of available alternatives discussed in Section VII after considering such factors as raw waste characteristics, typical plant characteristics (e.g., location, production schedules, product mix, and land availability), and present treatment practices. Specific rationale for selection is addressed in Sections IX, X, XI, and XII. Cost estimates for each technology addressed in this section include investment costs and annual costs for depreciation, capital recovery, operation and maintenance, and energy.

The specific assumptions for each wastewater treatment module are listed under the subheadings below. Costs are presented as a function of influent wastewater flow rate except where noted in the unit process assumptions.

Costs are presented for the following control and treatment technologies:

1. Flow Equalization,
2. Lime Precipitation and Gravity Settling,
3. Vacuum Filtration,
4. Multimedia Filtration,
5. Contract Hauling,
6. Chemical Emulsion Breaking,
7. Oil Skimming,
8. Ammonia Steam Stripping,
9. Chromium Reduction,
10. Recycling of Cooling Water, and
11. Countercurrent Cascade/Spray Rinsing.

Flow Equalization. Flow equalization is accomplished through steel equalization tanks which are sized based on a retention time of eight hours and an excess capacity factor of 1.2. Cost data were available for steel equalization tanks up to a capacity

of 500,000 gallons; multiple units were required for volumes greater than 500,000 gallons. The tanks are fitted with agitators with a horsepower requirement of 0.006 kw/1,000 liters (0.03 hp/1,000 gallons) of capacity to prevent sedimentation. An influent transfer pump is also included in the equalization system.

Lime Precipitation and Gravity Settling. Precipitation using lime followed by gravity settling is a fundamental technology for metals removal. In practice, either quicklime (CaO) or hydrated lime ($Ca(OH)_2$) can be used to precipitate toxic and other metals. Hydrated lime is more economical for low lime requirements since the use of slakers, which are necesary for quicklime usage, are practical only for large-volume application of lime.

Lime is used to adjust the pH of the influent waste stream to a value of approximately 9, at which optimum precipitation of the metals is assumed to occur, and to react with the metals to form metal hydroxides. The lime dosage is calculated as a theoretical stoichiometric requirement based on the influent metals concentrations and pH. The actual lime dosage requirement is obtained by assuming an excess of 10 percent of the theoretical lime dosage. The effluent concentrations are based on the Agency's combined metals data base lime precipitation treatment effectiveness concentrations.

The costs of lime precipitation and gravity settling were based on one of three operation modes, depending on the influent flowrate: continuous, normal batch, and "low flow" batch. The use of a particular mode for costing purposes was determined on a least (total annualized) cost basis for a given flowrate. The economic breakpoint between continuous and normal batch was estimated to be 11,800 liters/hour (3,117 gal/hour). Below 2,000 liters/hour (528 gal/hour), it was found that the "low flow" batch system was most economical.

For a continuous operation, the following equipment was included in the determination of capital and annual costs:

- Lime feed system (continuous)

  1. Storage units (sized for 30-day storage)
  2. Slurry mix tank (5-minute retention time)
  3. Feed pumps
  4. Instrumentation (pH control)

- Polymer feed system

  1. Storage hopper
  2. Chemical mix tank
  3. Agitator
  4. Chemical metering pump

- pH adjustment system

    1. Rapid mix tank, fiberglass (5-minute retention time)
    2. Agitator (velocity gradient is 300/second)
    3. Control system

- Gravity settling system

    1. Clarifier, circular, steel (overflow rate is 0.347 gpm/sq. ft. (0.849 m^3/m^2hr), underflow solids is 3 percent)
    2. Sludge pumps (1), (to transfer recycle sludge stream flow from clarifier to pH adjustment tank and to transfer sludge to dewatering)

Ten percent of the clarifier underflow stream is recycled to the pH adjustment tank to serve as seed material for the incoming equalized raw wastewater.

The direct capital costs of the lime and polymer feed systems were based on the respective chemical feed rates (dry lbs/hour), which are dependent on the influent waste stream characteristics. The flexibility of this feature (i.e., costs are independent of other module components) was previously noted in the description of the cost estimation model. The remaining equipment costs (e.g., for tanks, agitators, pumps) were developed as a function of the influent flowrate (either directly or indirectly, when coupled with the design assumptions).

Direct annual costs for the continuous system include operating and maintenance labor for the feed systems and the clarifier, the cost of lime and polymer, maintenance materials and energy costs required to run the agitators and pumps.

The normal batch treatment system (used for influent flows greater than 2,000 l/hr but less than 11,800 l/hr) consists of the following equipment:

- Lime feed system (batch)

    1. Slurry tank (5-minute retention time)
    2. Agitator
    3. Feed pump

- Polymer feed system

    1. Chemical mix tank
    2. Agitator
    3. Chemical metering pump

- pH adjustment system

    1. Reaction tanks (2), (8-hour retention time each)
    2. Agitators (2), (velocity gradient is 300/second)
    3. Sludge pump (1), (to transfer sludge to dewatering)
    4. pH control system

The reaction tanks used in pH adjustment are sized to hold the wastewater volume accumulated for one batch period (assumed to be 8 hours). The tanks are arranged in a parallel setup so that treatment occurs in one tank while wastewater is accumulating in the other tank. A separate gravity settler is not necessary since settling will occur in the reaction tank after precipitation has taken place. The settled sludge is then pumped to the dewatering stage.

If additional tank capacity is required in the pH adjustment system in excess of 25,000 gallons (largest single fiberglass tank capacity for which cost data were compiled), additional tanks are added in pairs. A sludge pump and agitator are costed for each tank.

The cost of operating labor is the major component of the direct annual costs for the normal batch system. For operation of the batch lime feed system, labor requirements range from 15 to 60 minutes per batch, depending on the lime feed rate (5 to 1,000 pounds/batch). This labor is associated with the manual addition of lime (stored in 50-pound bags). For pH adjustment, required labor is assumed to be one hour per batch (for pH control, sampling, valve operation, etc.). Both the pH adjustment tank and the lime feed system are assumed to require 52 hours per year (one hour/week) of maintenance labor. Labor requirements for the polymer feed system are approximately one hour/day, which accounts for manual addition of dry polymer and maintenance associated with the chemical feed pump and agitator.

Direct annual costs also include the cost of chemicals (lime, polymer) and energy required for the pumps and agitators. The costs of lime and polymer used in the model are $47.30/kkg of lime ($43/ton) and $4.96/kg of polymer ($2.25/pound), based on rates obtained from the Chemical Weekly Reporter (lime) and quotations from vendors (polymer).

For small influent flowrates (less than 2,000 liters/hour) it is more economical on a total annualized cost basis to select the "low flow" batch treatment system. The lower flowrates allow an assumption of five days for the batch duration, or holdup, as opposed to eight hours for the normal batch system. However, whenever the total batch volume (based on a five-day holdup) exceeds 25,000 gallons, the maximum single batch tank capacity,

the holdup is decreased accordingly to maintain the batch volume under this level. Capital and annual costs for the low flow system are based on the following equipment:

- pH adjustment system

  1. Rapid mix/holdup tank (5 days or less retention time)
  2. Agitator
  3. Transfer pump

Only one tank is required for both holdup and treatment because treatment is assumed to be accomplished during non-operating hours (since the holdup time is much greater than the time required for treatment). A lime feed system is not costed since lime addition at low application rates can be assumed to be done manually by the operator. A common pump is used for transfer of both the supernatant and sludge through an appropriate valving arrangement. Addition of polymer was assumed to be unnecessary due to the extended settling time available.

As in the normal batch case, annual costs consist mainly of labor costs for the low flow batch system. Labor requirements are constant at 1.0 hour per batch for operation (e.g., pH control, sampling, etc.) and 52 hours per year (one hour per week) for maintenance. Labor is also required for the manual addition of lime directly to the batch tank, ranging from 0.25 to 1.5 hours per batch depending on the lime requirement (1 to 500 pounds per batch). Annual costs also include energy costs associated with the pump and agitator.

Vacuum Filtration. The underflow from the clarifier is routed to a rotary precoat vacuum filter, which dewaters the hydroxide sludge (it may also include calcium sulfate and precipitated fluoride) to a cake of 20 percent dry solids. The dewatered sludge is disposed of by contract hauling and the filtrate is recycled to the rapid mix tank as seed material for sludge formation.

The capacity of the vacuum filter, expressed as square feet of filtration area, is based on a yield value of 14.6 kg of dry solids/hr per square meter of filter area (3 lbs/hr/ft^2), with a solids capture of 95 percent. It was assumed that the filter was operated 8 hours/day.

Cost data were compiled for vacuum filters ranging from 0.9 to 69.7 m^2 (9.4 to 750 ft^2) in filter surface area. Based on a total annualized cost comparison, it was assumed that it was more economical to directly contract haul clarifier underflow streams which were less than 42 l/hr (0.185 gpm), rather than dewater by vacuum filtration before hauling.

The capital costs for vacuum filtration include the following:

- Vacuum filter with precoat but no sludge conditioning,
- Housing, and
- Influent transfer pump.

Operating labor cost is the major component of annual costs, which also include maintenance and energy costs.

Multimedia Filtration. Multimedia filtration is used as a wastewater treatment polishing device to remove suspended solids not removed in previous treatment processes. The filter beds consist of graded layers of gravel, coarse anthracite coal, and fine sand. The equipment used to determine capital and annual costs are as follows:

- Influent storage tank sized for one backwash volume;
- Gravity flow, vertical steel cylindrical filters with media (anthracite, sand, and garnet);
- Backwash tank sized for one backwash volume;
- Backwash pump to provide necessary flow and head for backwash operations;
- Influent transfer pump; and
- Piping, valves, and a control system.

The hydraulic loading rate is 7,335 lph/m^2 (180 gph/ft^2) and the backwash loading rate is 29,340 lph/m^2 (720 gph/ft^2). The filter is backwashed once per 24 hours for 10 minutes. The backwash volume is provided from the stored filtrate.

Effluent pollutant concentrations are based on the Agency's combined metals data base for treatability of pollutants by filtration technology.

Cartridge-type filters are used to treat small flows (less than 800 liters/hour) since they are more economical compared to multimedia filters (based on a least total annualized cost comparison) at these flows. It was assumed that the effluent quality achieved by cartridge-type filters was at least the level attained by multimedia filters. The costs for cartridge-type filters are based on a two-stage filter unit, a holding tank (capacity is equal to the total batch volume of preceding batch chemical precipitation tank) and an influent transfer pump.

The majority of the annual cost is attributable to replacement of the spent cartridges which depends upon the amount of solids removed. The maximum loading for each cartridge is assumed to be 0.225 kg of suspended solids. The annual energy and maintenance costs associated with the pump are also included in the total annual costs.

Contract Hauling. Concentrated sludge and waste oils are removed on a contract basis for off-site disposal. The cost of contract hauling depends on the classification of the waste as being either hazardous or nonhazardous. For nonhazardous wastes, a rate of $0.106/liter ($0.40/gallon) was used in determining contract hauling costs. This value is based on reviewing information from several sources, including a paint industry survey, comments from the aluminum forming industry, and the literature. The contract hauling cost for nonhazardous waste was used in this cost estimation because the Agency believes that the wastes generated from nonferrous metals forming plants are not hazardous as defined under 40 CFR 261. The capital cost associated with contract hauling is assumed to be zero.

Chemical Emulsion Breaking. Chemical emulsion breaking involves the separation of relatively stable oil-water mixtures by chemical addition. Alum, polymer, and sulfuric acid are commonly used to destabilize oil-water mixtures. In the determination of capital and annual costs based on continuous operation, 400 mg/l of alum and 2 mg/l of polymer are added to waste streams containing emulsified oil. The equipment included in the capital and annual costs for continuous chemical emulsion breaking are as follows:

- Alum and polymer feed systems:

    1. Storage units
    2. Dilution tanks
    3. Conveyors and chemical feed lines
    4. Chemical feed pumps

- Rapid mix tank (retention time of 15 minutes; mixer velocity gradient is 300/sec)

- Flocculation tank (retention time of 45 minutes; mixer velocity gradient is 100/sec)

- Pump

Following the flocculation tank, the destabilized oil-water mixture enters the oil skimming module. In the determination of capital and annual costs based on batch operation, sulfuric acid is added to waste streams containing emulsified oil until a pH of 3 is reached. The following equipment is included in the determination of capital and annual costs based on batch operation:

- Sulfuric acid feed systems

    1. Storage tanks or drums
    2. Chemical feed lines
    3. Chemical feed pumps

- Two tanks equipped with agitators (retention time of 8 hrs., mixer velocity gradient is 300/sec)
- Two belt oil skimmers
- Two waste oil pumps
- Two effluent water pumps
- One waste oil storage tank (sized to retain the waste oil from ten batches)

The capital and annual costs for continuous and batch chemical emulsion breaking were determined by summing the costs from the above equipment. Alum, polymer and sulfuric acid costs were assumed to be $.257 per kg ($.118 per pound), $4.95 per kg ($2.25 per pound) and $0.08 per kg of 93 percent acid ($.037 per pound of 93 percent acid), respectively. (See Chemical Weekly Reporter, March, 1982).

Operation and maintenance and energy costs for the different types of equipment which comprise the batch and continuous systems were drawn from various literature sources and are included in the annual costs.

The cutoff flow for determining the operation mode (batch or continuous) is 5,000 liters per hour (1,321 gal/hr), above which the continuous system is costed; at lower flows, the batch system is costed.

For annual influent flows to the chemical emulsion breaking system of 91,200 liters/year (24,000 gallons/year) or less, it is more economical to directly contract haul rather than treat the waste stream. The breakpoint flow is based on a total annualized cost comparison and a contract hauling rate of $.40/gallon (no credit was given for oil resale).

Oil Skimming. Oil skimming costs apply to the separation of oil-water mixtures using a coalescent plate-type separator (which is essentially an enhanced API-type oil-water separator). Coalescent plate separators were not required following batch chemical emulsion breaking since the batch tank, in conjunction with a belt type oil skimmer, served as the oil-water separation tank. The cost of the belt skimmer in this case was included as part of the chemical emulsion breaking costs.

Although the required separator capacity is dependent on many factors, the sizing was based primarily on the influent wastewater flow rate, with the following design values assumed for the remaining parameters of importance:

Parameter	Nominal Design Value
Specific gravity of oil	0.85
Operating temperature (°F)	68
Influent oil concentration (mg/l)	30,000

Extreme operating conditions, such as influent oil concentrations greater than 30,000 mg/l, or temperatures lower than 68°F were accounted for in the sizing of the separator.

The capital and annual costs of oil skimming included the following equipment:

- Coalescent plate separator with automatic shutoff valve and level sensor
- Oily waste storage tanks (2-week retention time)
- Oily waste discharge pump
- Effluent discharge pump

Influent flow rates up to 159,100 l/hr (700 gpm) are costed for a single unit; flows greater than 700 gpm require multiple units.

The direct annual costs for oil skimming include the cost of operating and maintenance labor and replacement parts. Annual costs for the coalescent separators alone are minimal and involve only periodic clean out and replacement of the coalescent plates.

Ammonia Steam Stripping. This technology is used as a pretreatment step to remove free ammonia (NH_3) down to a treatability level of 32.2 mg/l by stripping with steam in a packed column. The treatability concentration is based on actual performance data at an iron and steel plant and verified by data from a zirconium/hafnium metal manufacturing plant. In the process, the ammonia-laden wastewater is adjusted to a pH of 11.5 using lime and contacted countercurrently in a packed column with steam.

The capital costs for ammonia steam stripping are based on the following equipment:

- Column (hydraulic loading based on 2 gpm/ft^2),
- pH adjustment system using lime
  1. Rapid mix tank with agitator (5-minute retention time)
  2. Lime feed system
  3. Transfer pump
- Steam generation system
  1. Reboiler (direct fired heat exchanger)

- Heat exchangers (influent preheat)

- Acid cleaning system

  1. Surge tank
  2. Agitator
  3. Transfer pump

The direct annual costs for ammonia steam stripping consist mainly of chemical costs (for lime and sulfuric acid), energy costs (for the reboiler, pumps, and agitators), and operating and maintenance labor costs.

Chromium Reduction. Chromium reduction refers to the reduction of hexavalent chromium to the trivalent form. Chromium in the hexavalent state will not precipitate as a hydroxide until it has been reduced to trivalent chromium. For large flows (greater than 2,000 l/hr) which undergo continuous treatment, the waste stream is treated by addition of acid (to lower pH to 2.5) and gaseous sulfur dioxide (SO_2) dissolved in water in an agitated reaction vessel. The SO_2 is oxidized to sulfate (SO_4) while it reduces the chromium. For smaller flows (less than 2,000 l/hr), for which batch treatment is more appropriate, the waste stream is treated by manual addition of sodium metabisulfite in the same reaction vessel used for chemical precipitation. The chemistry of this operation is similar to that for SO_2 addition.

The equipment required for the continuous stream includes a SO_2 feed system (sulfonator), a H_2SO_4 feed system, a reactor vessel and agitator, and a pump. The reaction pH is 2.5 and the SO_2 dosage is a function of the influent loading of hexavalent chromium. A conventional sulfonator is used to meter SO_2 to the reaction vessel. The mixer velocity gradient is 100/sec.

Annual costs are as follows:

- SO_2 feed system

  1. SO_2 cost at \$0.55/kg (\$0.25/lb),
  2. Operation and maintenance labor requirements vary from 437 hrs/yr at 4.5 kg SO_2/day (10 lbs SO_2/day) to 5,440 hrs/yr at 4,540 kg SO_2/day (10,000 lbs SO_2/day),
  3. Energy requirements vary from 570 kwh/yr at 4.5 kg SO_2/day (10 lbs SO_2/day) to 31,000 kwh/yr at 4,540 kg SO_2/day (10,000 lbs SO_2/day).

- H_2SO_4 feed system

    1. Operating and maintenance labor at 72 hrs/yr at 37.8 lpd (10 gpd) of 93 percent H_2SO_4 to 200 hrs/yr at 3,780 lpd (1,000 gpd), of 93 percent H_2SO_4,
    2. Maintenance materials at 3 percent of the equipment cost,
    3. Energy requirements for metering pump and storage heating and lighting.

- Reactor vessel and agitator

    1. Operation and maintenance labor at 120 hrs/yr,
    2. Electrical requirements for agitator.

For batch treatment of hexavalent chromium with sodium metabisulfite, no equipment in addition to that required for chemical precipitation is assumed to be necessary. Annual costs are based on 1/2 hour of labor per batch for chemical addition and testing.

Recycle of Cooling Water. Cooling towers are used to recycle casting and heat treatment contact cooling waters for recirculating flow rates above 3,400 l/hr (15 gpm). The minimum flowrate represents the smallest cooling tower commercially available from the vendors contacted. Conventional holding tanks are used to recycle flowrates less than 15 gpm.

The cooling tower capacity is sized based on the amount of heat removed, which takes into account both the flowrate and temperature range (or decrease in water temperature across the cooling tower). The amount of water recycled is equal to the difference between the recirculation flowrate and the regulatory reduced flow (discharge allowance). The recirculation flow is equal to the flow prior to recycling, i.e., the unreduced flow. For cases in which the actual flow is less than the regulatory reduced flow, a cooling tower is not costed since flow reduction is not required.

The range was based on a cold water temperature of 85°F and an average hot water temperature for each particular waste stream calculated from sampling data. When the hot water temperature was not available from sampling data, or found to be below 95°F, a value of 95°F was assumed, resulting in a range of 10°F (95-85°F). The remaining significant design parameters, the wet bulb temperature (ambient temperature at 100 percent relative humidity) and the approach (of cold water temperature to the wet bulb temp) are assumed to be constant at 75°F and 8°F, respectively.

The capital costs of cooling tower systems include the following equipment:

- Cooling tower (crossflow, mechanically-induced) and typical accessories
- Piping and valves (305 meters (1000 ft.) carbon steel)
- Cold water storage tank (1 hour retention time)
- Recirculation pump, centrifugal
- Chemical treatment system (for pH, slime and corrosion control)

For nominal recirculation flow rates greater than 159,100 l/hr (700 gpm), multiple cooling towers are assumed to be required.

A holding tank system would consist of a holding tank and a recirculation pump.

The direct capital costs include purchased equipment cost, installation and delivery. Installation costs for cooling towers were assumed to be 200 percent of the cooling tower cost based on information supplied by vendors.

Direct annual costs included raw chemicals for water treatment and fan energy requirements. Maintenance and operating labor was assumed to be constant at 60 hours per year. The water treatment chemical cost was based on a rate of $5/gpm of recirculated water.

Countercurrent Cascade/Spray Rinsing. This technology is used to reduce water use in rinsing operations. It involves multiple-stage rinsing, with product and rinse water moving in opposite directions (see Section VII for more details on theory). This allows for a significant reduction in flow over single stage rinsing, while achieving the same product cleanliness by using the most contaminated rinse water to rinse the incoming product.

The costs for countercurrent cascade/spray rinsing apply to a two-stage rinse system, each consisting of the following equipment:

- o Two fiberglass rectangular tanks (Existing source costs include only one tank since the other tank was assumed to be already in place).
- o One spray rinsing system (nozzles, piping, instrumentation, etc.) if not in place,
- o One centrifugal, transfer pump,
- o One sparger (air diffuser) for agitation, and

- o One blower (including motor) for supplying air to the sparger.

Information reported in dcp's was used to estimate the volume of countercurrent rinse tanks. If no information was available, tank volume was assumed to be 3,600 gallons, a typical value. When it was determined from a plant's dcp that two-stage countercurrent cascade rinsing could be achieved by converting two existing adjacent rinse tanks, only piping, pump, and spray rinsing costs were accounted for. A constant value of $1,000 was estimated for the piping costs.

NONWATER QUALITY ASPECTS

The elimination or reduction of one form of pollution may aggravate other environmental problems. Therefore, Sections 304(b) and 306 of the Act require EPA to consider the nonwater quality environmental impacts (including energy requirements) of certain regulations. In compliance with these provisions, EPA has considered the effect of this regulation on air pollution, solid waste generation, water scarcity, and energy consumption. This regulation was circulated to and reviewed by EPA personnel responsible for nonwater quality environmental programs. While it is difficult to balance pollution problems against each other and against energy utilization, the Administrator has determined that the impacts identified below are justified by the benefits associated with compliance with the limitations and standards in this guideline. The following are the nonwater quality environmental impacts (including energy requirements) associated with compliance with the nonferrous metals forming regulation.

Air Pollution

Imposition of BPT, BAT, BCT, NSPS, PSES, and PSNS will not create any substantial air pollution problems because the wastewater treatment technologies required to meet these limitations and standards do not cause air pollution.

Solid Waste

EPA estimates that nonferrous metals forming facilities generated 14,000 kkg (15,400 tons) of solid wastes (wet basis) in 1981 as a result of wastewater treatment-in-place. These wastes were composed of treatment system sludges containing toxic metals, including antimony, cadmium, chromium, copper, lead, nickel, and zinc.

EPA estimates that the proposed BPT will generate an additional 3,900 kkg (4,300 tons) per year of solid wastes. The proposed BAT will increase these wastes by approximately 5.9 kkg (6.5

tons) per year beyond BPT levels. PSES will increase these wastes by approximately 9,900 kkg (10,900 tons) per year beyond current levels. New nonferrous metals forming plants subject to PSNS/NSPS would also generate treatment system sludges. These sludges will necessarily contain additional quantities (and concentrations) of toxic metal pollutants.

Wastes generated by nonferrous metal formers are subject to regulation under Subtitle C of the Resource Conservation and Recovery Act (RCRA) if they are hazardous. However, the Agency examined solid wastes similar to those that would be generated at nonferrous metals forming plants by the suggested treatment technologies (that is, the sludges from lime and settle treatment) and believes they are not hazardous wastes under the Agency's regulations implementing Subtitle C of RCRA. None of these wastes are specifically listed as hazardous, nor are they likely to exhibit one of the four characteristics of hazardous waste (see 40 CFR Part 261) based on the recommended technology of chemical precipitation and sedimentation, preceded where necessary by hexavalent chromium reduction. By the addition of a small excess of lime during treatment, similar sludges, specifically toxic metal bearing sludges generated by other industries such as the iron and steel industry passed the Extraction Procedure (EP) toxicity test (see 40 CFR 261.24). Thus, the Agency believes that nonferrous metals forming wastewater treatment sludges will similarly not be EP toxic if the recommended technology is applied.

The Agency is not proposing an allowance for discharge of spent solvents from the solvent degreasing operations at nonferrous metals forming plants. Disposal of the spent solvent may be subject to regulation under RCRA. However, no plant in the nonferrous metals forming industry is known to currently discharge the spent solvents. Therefore, the cost of disposal of the spent solvents has not been included in estimating the cost of this proposed regulation because all plants which use solvent degreasing have already incurred those costs.

The Agency is proposing a no discharge requirement for tube-reducing spent lubricants because, based on analytical data for that waste stream at one plant sampled, the waste stream contains treatable levels of N-nitrosodiphenylamine. That waste stream would have to be disposed of as a solid waste. The Agency has not estimated the cost of that disposal but expects it to be quite small because the waste stream flow is quite small.

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 262.10). The Agency also may list these wastes as hazardous under 40 CFR 261.11.

If these wastes are hazardous, as defined by RCRA, 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 require generators of hazardous nonferrous metals forming wastes to meet containerization, labelling, recordkeeping, and reporting requirements; if plants dispose of hazardous wastes off-site, they 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). 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). Finally, RCRA regulations establish standards for hazardous waste treatment, storage, and disposal facilities allowed to receive such wastes (see 40 CFR Part 264).

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

Consumptive Water Loss

Treatment and control technologies that require extensive recycling and reuse of water may require cooling mechanisms. Evaporative cooling mechanisms can cause water loss and contribute to water scarcity problems--a primary concern in arid and semi-arid regions. While this regulation assumes water reuse, the overall amount of reuse through evaporative cooling mechanisms is low and the quantity of water involved is not significant. In addition, most nonferrous metals forming plants are located east of the Mississippi where water scarcity is not a problem. The Agency has concluded that consumptive water loss is insignificant and that the pollution reduction benefits of recycle technologies outweigh their impact on consumptive water loss.

Energy Requirements

EPA estimates that the achievement of BPT effluent limitations will result in a net increase in electrial energy consumption of approximately 3.9 million kilowatt-hours per year. The additional electricity would be used for extra pumps or agitators. The BAT effluent technology should not substantially increase the energy requirements of BPT because reducing the flow reduces the pumping requirements, the agitation requirement for mixing wastewater, and other volume-related energy requirements. Therefore,

the BAT limitations are assumed to require an equivalent energy consumption to that of the BPT limitations. To achieve the BPT and BAT effluent limitations, a typical direct discharger will increase total energy consumption by 110,000 kilowatt-hours per year.

The Agency estimates that PSES will result in a net increase in electrical energy consumption of approximately 6.0 million kilowatt-hours per year. To achieve PSES, a typical existing indirect discharger will increase energy consumption by 50,000 kilowatt-hours per year.

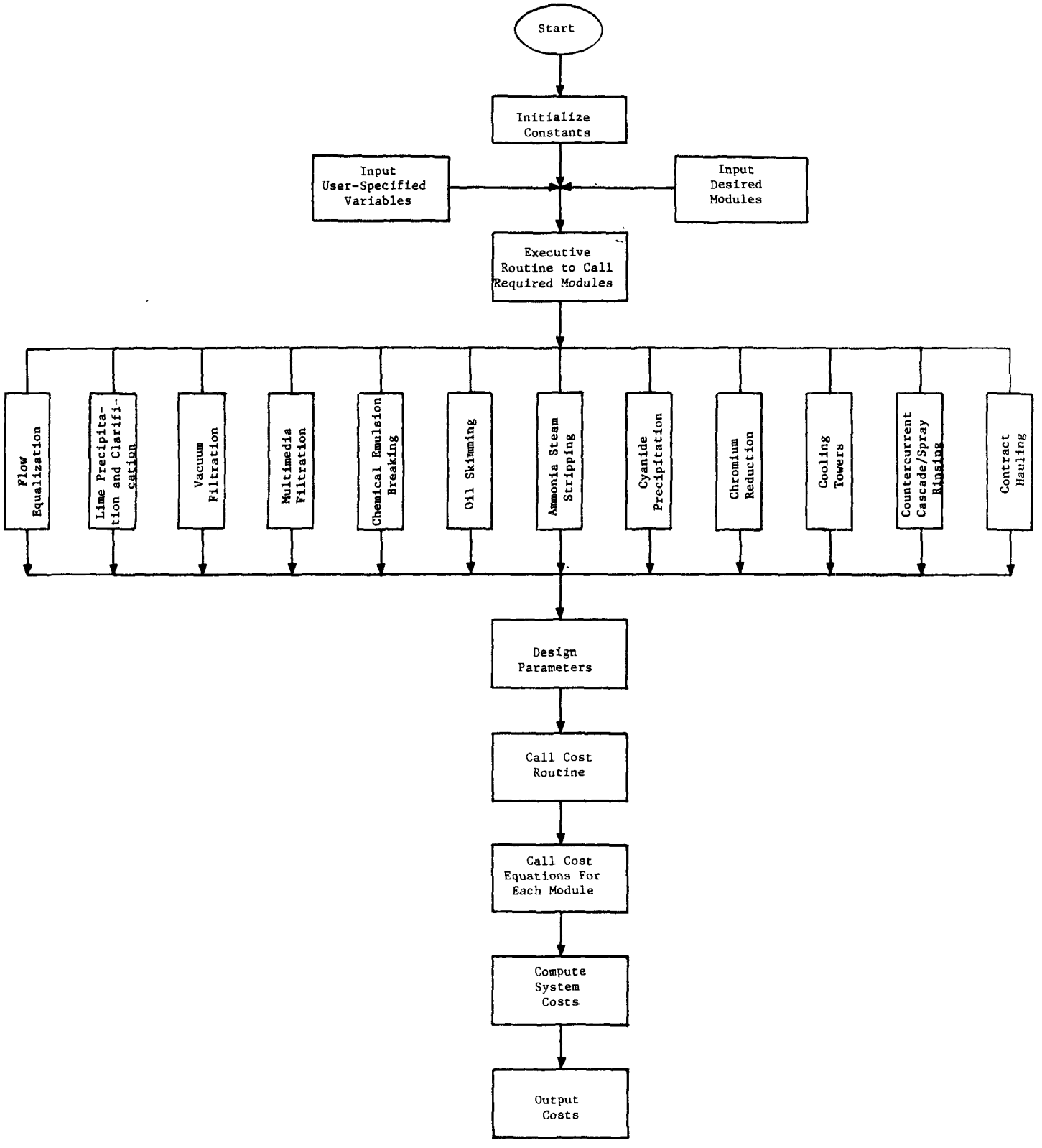


Figure VIII-1
GENERAL LOGIC DIAGRAM OF COMPUTER COST MODEL

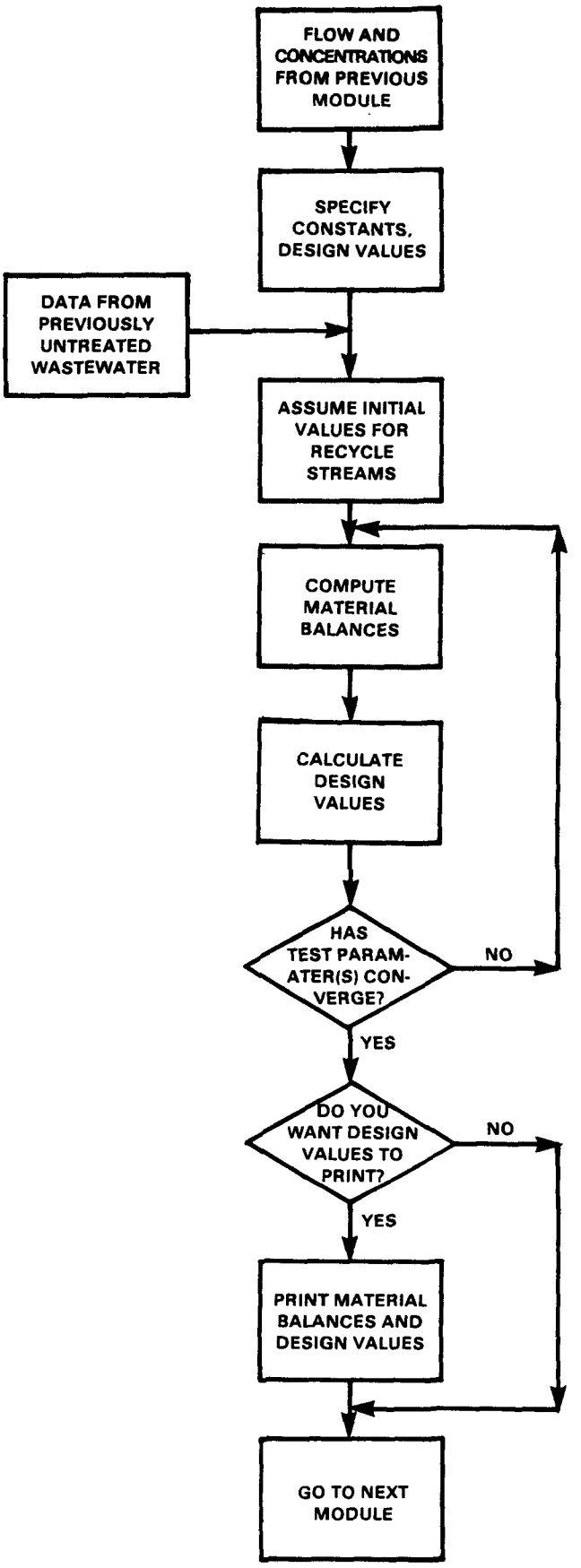


Figure VIII-2

LOGIC DIAGRAM OF MODULE DESIGN PROCEDURE

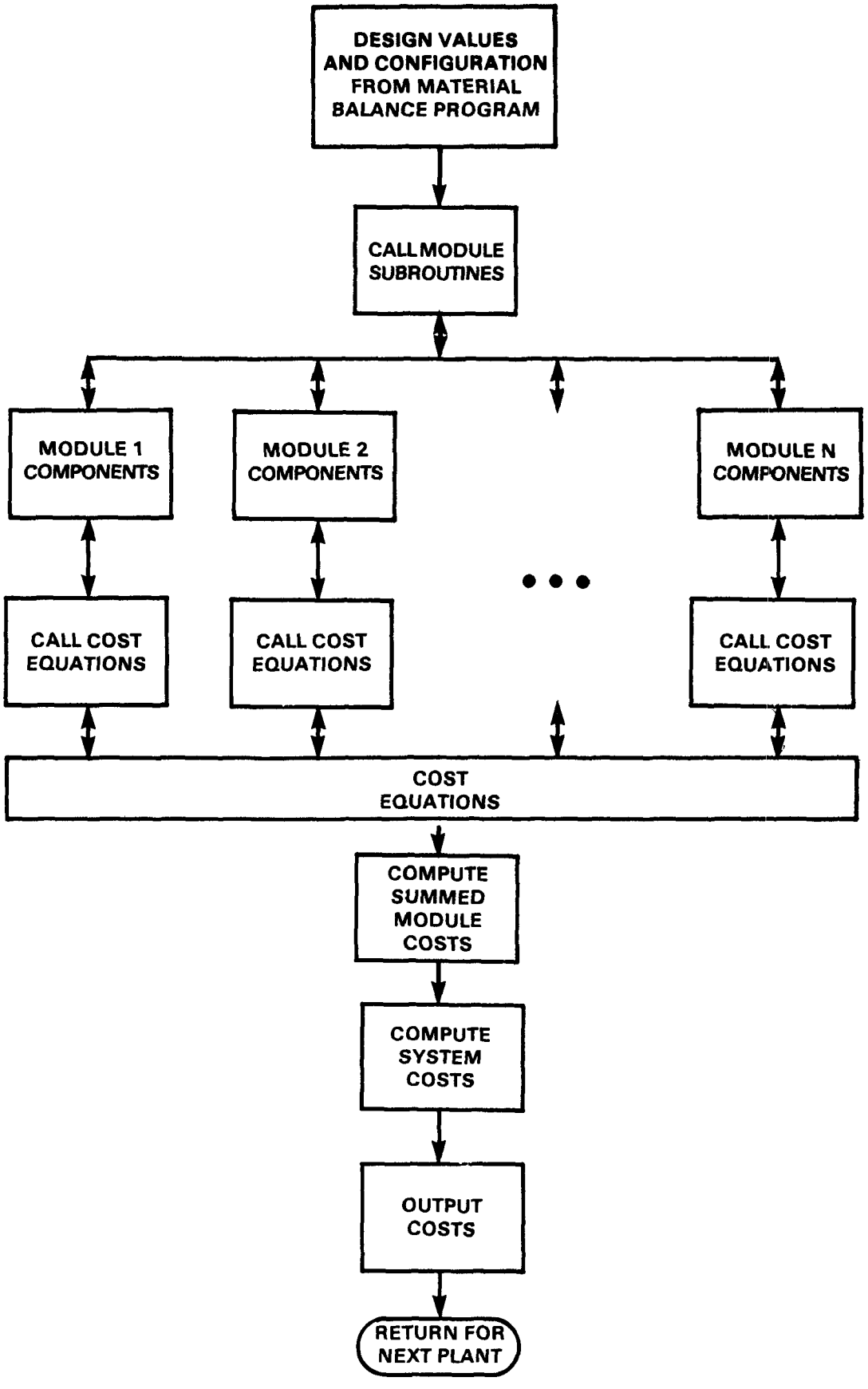


Figure VIII-3

LOGIC DIAGRAM OF THE COSTING ROUTINE

Table VIII-1

COSTING GROUPS

Costing Group		Number of Plants	Subcategory
1.	Bullet Manufacturers	4	Lead/Tin/Bismuth Forming
2.	Solder Manufacturers	5	Lead/Tin/Bismuth Forming
3.	Other Lead Products	5	Lead/Tin/Bismuth Forming
4.	Beryllium	1	Beryllium Forming
5.	Uranium	1	Uranium Forming
6.	Magnesium	1	Magnesium Forming
7.	Zinc	2*	Zinc Forming
8.	Metal Powder Production	6	Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy
9.	Production of Metal Parts from Powder	18	Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy
10.	Precious Metals Small	10	Precious Metals Forming
11.	Precious Metals Medium	8	Precious Metals Forming
12.	Precious Metals Large	6	Precious Metals Forming
14.	With Treatment Extra Small	14	Zirconium/Hafnium Forming, Nickel/Cobalt Forming Refractory Metals Forming, Titanium Forming
15.	With Treatment Small	7	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals Forming, Titanium Forming
16.	With Treatment Medium	8	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals Forming, Titanium Forming

Table VIII-1 (Continued)

COSTING GROUPS

Costing Group	Number of Plants	Subcategory
17. With Treatment Extra Large	1	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals, Titanium Forming
18. With Treatment Large	9	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals Forming, Titanium Forming
19. Without Treatment Extra Small	9	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals Forming, Titanium Forming
20. Without Treatment Small	4	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals Forming, Titanium Forming
21. Without Treatment Medium	12	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals Forming, Titanium Forming
22. Without Treatment Large	8	Zirconium/Hafnium Forming, Nickel Cobalt Forming, Refractory Metals Forming, Titanium Forming
23. Without Treatment Extra Large	1	Zirconium/Hafnium Forming, Nickel/Cobalt Forming, Refractory Metals Forming, Titanium Forming

Note: There is no costing group 13.

*See text for method of apportioning costs of these two plants.

Table VIII-2

COST PROGRAM POLLUTANT PARAMETERS

List A Pollutant Parameters	List B Pollutant Parameters	Units
Flowrate	Flowrate	liters/hour
pH	pH	pH units
Temperature	Temperature	°F
Total Suspended Solids	Total Suspended Solids	mg/l
Acidity (as $CaCO_3$)	Acidity (as $CaCO_3$)	mg/l
Aluminum	Aluminum	mg/l
Ammonia	Ammonia	mg/l
Antimony	Antimony	mg/l
Arsenic	Arsenic	mg/l
	Beryllium	mg/l
Cadmium	Cadmium	mg/l
Chromium (trivalent)	Chromium (trivalent)	mg/l
Chromium (hexavalent)	Chromium (hexavalent)	mg/l
Cobalt		mg/l
Copper	Copper	mg/l
Cyanide (free)	Cyanide (free)	mg/l
Cyanide (total)	Cyanide (total)	mg/l
Fluoride	Fluoride	mg/l
Iron	Iron	mg/l
Lead	Lead	mg/l
	Magnesium	mg/l
Manganese		mg/l
	Misc. Metals*	mg/l
Nickel	Nickel	mg/l
Oil and Grease	Oil and Grease	mg/l
Phosphorus		mg/l
Selenium	Selenium	mg/l
Silver	Silver	mg/l
	Sulfate	mg/l
Thallium	Thallium	mg/l
Zinc	Zinc	mg/l

Note: List A pollutant parameters used to cost plants in all groups except 6, 14, 17, 18, 22, and 23.

Note: List B pollutant parameters used to cost plants in groups 6, 14, 17, 18, 22, and 23.

* Includes bismuth, cobalt, columbium, hafnium, molybdenum, tantalum, tin, titanium, tungsten, uranium, and vanadium.

Table VIII-3

COST EQUATIONS FOR RECOMMENDED TREATMENT
AND CONTROL TECHNOLOGIES

Equipment	Equation	Range of Validity
Agitators, C-clamp	$C = 839.1 + 587.5\ (HP)$ $A = 2739.89 + 403.365\ (HP) + 0.7445\ (HP)^2$	$0.25 < HP < 0.33$
Agitators, Top Entry	$C = 1585.55 + 125.302\ (HP) - 3.27437\ (HP)^2$ $A = 2739.89 + 403.365\ (HP) + 0.7445\ (HP)^2$	$0.33 < HP < 5.0$
Clarifier, Concrete	$C = 78400 + 32.65\ (S) - 7.5357 \times 10^{-4}\ (S)^2$ $A = \exp[9.40025 - 0.539825\ (\ln S) + 0.551186\ (\ln S)^2]$	$500 < S < 12,000$
Clarifier, Steel	$C = 41197.1 + 72.0979(S) + 0.0106542(S)^2$ $A = \exp[9.40025 - 0.539825\ (\ln S) + 0.0551186\ (\ln S)^2]$	$50 < S < 2800$
Contract Hauling	$C = 0$ $A = 0.40\ (G)(HPY)$	Non Hazardous
Cooling Tower System	$C = \exp[8.76408 + 0.07048\ (\ln T) + 0.050949\ (\ln T)^2]$ $A = \exp[9.08702 - 0.75544\ (\ln T) + 0.140379\ (\ln T)^2]$	$1 < T < 700$
Equalization Tanks, Steel	$C = 14,759.8 + 0.170817\ (V) - 8.44271 \times 10^{-8}\ (V)^2$	$24,000 < V < 500,000$
	$C = 3,100.44 + 1.19041\ (V) - 1.7288 \times 10^{-5}\ (V)^2$	$1,000 < V < 24,000$
	$C = \exp[6.88763 - 0.643189\ (\ln V) + 0.11525\ (\ln V)^2]$	$V < 1,000$
	$A = 0.05\ (C)$	

Table VIII-3 (Continued)

COST EQUATIONS FOR RECOMMENDED TREATMENT
AND CONTROL TECHNOLOGIES

Equipment	Equation	Range of Validity
Feed System, Alum	$C = \exp[16.2911 - 0.206595\ (\ln F) + 0.06448\ (\ln F)^2]$ $A = [0.52661 + 0.11913\ (F) + 1.964 \times 10^{-8}(F)^2]$ HPY	$10 < F < 1000$
Feed System, Batch Lime	$C = 1697.79 + 19.489\ (B) - 0.036824\ (B)^2$ $C = 16149.2 + 10.2512\ (B) - 1.65864 \times 10^{-3}(B)^2$ $A = \exp[2.91006 - 0.44837\ (\ln B) + 0.0840605\ (\ln B)^2]$BPY + 1090	$5 < B < 1000$
Feed System, Lime	$C = \exp[8.64445 + 0.790902\ (\ln F) - 0.04556\ (\ln F)^2]$ $A = \exp[-1.90739 + 0.60058\ (\ln F) + 0.017236\ (\ln F)^2]$(HPY)	$10 < F < 10{,}000$
Feed System, Polymer	$C = 24190 + 1024.38\ (F) + 46.3977\ (F)^2$ $A = [0.479342 + 2.25578\ (F) + 8.49822 \times 10^{-4}(F)^2]$(HPY)	$0.04 < F < 10$
Feed System, Sulfuric Acid	$C = 10858.2 + 33.3414\ (F) - 3.3325 \times 10^{-3}(F)^2$ $A = \exp[-2.31035 + 0.707633\ (\ln F) + 0.0215896\ (\ln F)^2]$(HPY)	$6 < F < 3200$
Multimedia Filter	$C = 10.888 + 277.85\ (SA) - 0.154337\ (SA)^2$ $A = \exp[8.20771 + 0.275272\ (\ln SA) + 0.0323124\ (\ln SA)^2]$	$7 < SA < 500$
Oil/Water Separator	$C = 5{,}542.07 + 65.7158\ (Y) - 0.029627\ (Y)^2$ $A = 783.04 + 6.3616\ (Y) - 0.001736\ (Y)^2$	$0 < Y < 700$

Table VIII-3 (Continued)

COST EQUATIONS FOR RECOMMENDED TREATMENT AND CONTROL TECHNOLOGIES

Equipment	Equation	Range of Validity
Pumps, Centrifugal	$C = \exp[6.31076 + 0.228887(\ln Y) + 0.0206172\ (\ln Y)^2]$ $A = \exp[6.67588 + 0.01335\ (\ln Y) + 0.062016\ (\ln Y)^2$	$3 < Y < 3500$
Pumps, Sludge	$C = 2264.31 + 21.0097\ (Y) - 0.0037265\ (Y)^2$ $A = \exp[7.64414 + 0.192172\ (\ln Y) + 0.0202428\ (\ln Y)^2]$	$5 < Y < 500$
Spray Rinsing System	$C = 3212.72 - 0.009005\ (X) + 1.004 \times 10^{-6}\ (X)^2$ $A = N[1.05(HPY) + 64.246 - 1.801 \times 10^{-4}(X) + 2.008 \times 10^{-8}(X)^2]$	
Sulfonator	$C = 14336.3 + 38.1582\ (F) - 0.156326\ (F)^2$ $A = 6934.09 + 2704.2\ (F) - 1.08636\ (F)^2$	$4.0 < F < 350$
Tank, Batch Reactor	$C = 3100.44 + 1.19041\ (V) - 1.7288 \times 10^{-5}(V)^2$ $A = \exp[8.65018 - 0.0558684\ (\ln X) + 0.0145276\ (\ln X)^2]$	$500 < V < 24,000$ $100 < X < 100,000$
Tank, Concrete	$C = 5800 + 0.8V$ $A = 0$	$6000 < V < 24,000$
Tank, Fiberglass	$C = 3100.44 + 1.19041\ (V) - 1.7288 \times 10^{-5}(V)^2$ $A = 0$	$500 < V < 24,000$
Tank, Large Steel	$C = 3128.83 + 2.37281\ (V) - 7.10689 \times 10^{-5}(V)^2$ $A = 0$	$500 < V < 12,000$

Table VIII-3 (Continued)

COST EQUATIONS FOR RECOMMENDED TREATMENT
AND CONTROL TECHNOLOGIES

Equipment	Equation	Range of Validity
Tank, Small Steel	$C = 692.824 + 6.16706\ (V) - 3.95367 \times 10^{-3}(V)^2$ $A = 0$	$100 < V < 500$
Vacuum Filter	$C = 67595.1 + 504.701\ (SA) - 0.520067\ (SA)^2$ $A = 44096.8 + 138.057\ (SA) - 0.0485584\ (SA)^2$	$9.4 < SA < 750$
Vacuum Filter Housing	$C = 45[308.253 + 0.836592\ (SA)]$ $A = 4.96[308.253 + 0.836592\ (SA)]$	$9.4 < SA < 750$

C = Direct capital, or equipment costs (1982 dollars)
A = Direct annual costs (1982 dollars/year)
B = Batch chemical feed rate (pounds/hour)
BPY = Number of batches per year
F = Chemical feed rate (pounds/hour)
G = Sludge disposal rate (gallons/hour)
HP = Power requirement (horsepower)
HPY = Plant operating hours (hours/year)
S = Clarifier surface area (square feet)
SA = Filter surface area (square feet)
T = Cooling capcity in evaporative tons (°F gallons/minute)
V = Tank capacity (gallons)
X = Wastewater flowrate (liters/hour)
Y = Wastewater flowrate (gallons/minute)

Table VIII-4

COMPONENTS OF TOTAL CAPITAL INVESTMENT

Item Number	Item	Cost
1	Bare Module Capital Costs	Direct capital costs from model[a]
2	Electrical & instrumentation	0% of item 1
3	Yard piping	0% of item 2
4	Enclosure	Included in item 1
5	Pumping	Included in item 1
6	Retrofit allowance	Included in item 1
7	Total Module Cost	Item 1 + items 2 through 6
8	Engineering/admin. & legal	10.0% of item 7
9	Construction/yardwork	0% of item 7
10	Monitoring	0% of item 7
11	Total Plant Cost	Item 7 + items 8 through 10
12	Contingency	15% of item 11
13	Contractor's fee	10% of item 11
14	Total Construction Cost	Item 11 + items 12 through 13
15	Interest during construction	0% of item 14
16	Total Depreciable Investment	Item 14 + item 15
17	Land	0% of item 16
18	Working capital	0% of item 16
19	Total Capital Investment	Item 16 + items 17 through 18

[a]Direct capital costs include costs of equipment and required accessories, installation, and delivery.

Table VIII-5

COMPONENTS OF TOTAL ANNUALIZED COSTS

Item Number	Item	Cost
20	Bare Module Annual Costs	Direct annual costs from model[a]
21	Overhead	0% of item 16[b]
22	Monitoring	See footnote c
23	Taxes and Insurance	1% of item 16
24	Amortization	CRF x item 16[d]
25	Total Annualized Costs	Item 20 + items 21 through 24

[a]Direct annual costs include costs of raw materials, energy, operating labor, maintenance and repair.

[b]Item 16 is the total depreciable investment obtained from Table 1.

[c]See text for an explanation of the determination of monitoring costs.

[d]The capital recovery factor (CRF) was used to account for depreciation and the cost of financing.

Table VIII-6

WASTEWATER SAMPLING FREQUENCY

Wastewater Discharge (Liters Per Day)	Sampling Frequency
0 - 37,850	Once per month
37,851 - 189,250	Twice per month
189,251 - 378,500	Once per week
378,501 - 946,250	Twice per week
946,250+	Three times per week

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)(1)(A). BPT represents the average of the best existing performance by plants of various sizes, ages, and manufacturing processes within the nonferrous metals forming category. 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 best existing performances of plants of various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, BPT may be transferred from a different subcategory or category. Limitations based on transfer of technology are supported by a rationale concluding that the technology is, indeed, transferable, and a reasonable prediction that it will be capable of achieving the prescribed effluent limits. See Tanner's Council of America v. Train, 540 F.2d 1188 (4th Cir. 1976). BPT focuses on end-of-pipe treatment rather than process changes or internal controls, except where such practices are common industry practice.

TECHNICAL APPROACH TO BPT

The objective of BPT effluent limitations is to reduce the total quantity of pollutants discharged into surface waters. Because plants could meet a concentration-based standard by dilution rather than treatment, mass limitations have been developed for the nonferrous metals forming industry. In order for regulations to be equitable for plants with large productions and small productions, the mass limitations must be normalized by an appropriate unit of production called a production normalizing parameter (PNP). As discussed in Section IV, the PNP for the nonferrous metals forming category is off-metric ton (the metric tons of metal removed from a forming operation or associated operation at the end of a process cycle). Pollutant discharge limitations for this category are written as mass loadings, allowable mass of pollutant discharge per off-metric ton of production (mg/kkg).

Mass loadings were calculated for each operation within each subcategory. This calculation was made on an operation-by-operation basis because plants in this category may perform one or more operations in one or more subcategories.

The pollutant discharge limitation for each operation was calculated by multiplying the production normalized wastewater flow (l/kkg or gal/ton) for that operation by the effluent concentration achievable by the BPT treatment technology (mg/l).

Effluent Limitations

EPA conducted a screen sampling program to determine which pollutants are found in wastewaters generated by the nonferrous metals forming category. This program and its results are described in Section V of this document.

Oil and grease, suspended solids, toxic metals, and nonconventional pollutants are present in significant concentrations in wastewater produced by the major forming operations (rolling, drawing, extruding, and forging), minor forming operations (cladding, tube reducing, metal powder production and powder metallurgy) and by operations associated with metal forming (casting, heat treatment, surface treatment, alkaline cleaning, solvent degreasing, sawing, grinding, tumbling, burnishing, and product testing). Although the specific toxic metals present will vary from subcategory to subcategory, the Agency believes that one treatment technology with preliminary treatment, where necessary, is an appropriate basis for BPT effluent limitations for all subcategories.

Treatment Train

The Agency evaluated several end-of-pipe and in-process technologies to determine how suitable they are for controlling the pollutants detected in the sampling program (see Section VII). One of these treatment trains was selected as BPT: lime precipitation and sedimentation (L&S), with preliminary treatment, where necessary (see Figure IX-1). This treatment will remove toxic metals, cyanide, nonconventional pollutants, oil and grease, and TSS. Currently, this technology is in place at 24 of the 39 direct dischargers in the category.

Preliminary treatment is required when lime precipitation and sedimentation alone will not adequately remove regulated pollutants. The preliminary treatments required in this category (chemical emulsion breaking, oil skimming, chromium reduction, cyanide precipitation, and ammonia steam stripping) are described in Section VII. Preliminary treatments potentially required by each regulated waste stream are listed in Tables IX-1 through IX-11.

Whether preliminary treatment is required at a particular plant will be decided by each NPDES permitting authority on a case-by-case basis. Preliminary treatment of wastewater is only required when the pollutant controlled by the preliminary treatment is present above the treatment effectiveness concentration given in Section VII. Specifically:

- Oil skimming is required when oil and grease is present in a concentration greater than the treatment effectiveness (L&S technology) given in Table VII-9.

- Chemical emulsion breaking is always followed by oil skimming. It is required when oil and grease in an emulsified form is present in a concentration greater than the treatment effectiveness (L&S technology) given in Table VII-9.

- Ammonia steam stripping is required when ammonia-nitrogen is present in a concentration greater than the treatment effectiveness given in Table VII-9.

- Cyanide precipitation is required when cyanide is present in a concentration greater than the treatment effectiveness given in Table VII-9.

- Chromium reduction is required when hexavalent chromium is present in a concentration greater than the treatment effectiveness (L&S technology) given in Table VII-9. If chromium is already in the trivalent oxidation state, further chromium reduction is not required.

Effluent Concentrations

Table VII-9 presents the effluent concentrations achievable by the BPT treatment train for the pollutants regulated in each subcategory. These concentrations are based on the performance of chemical precipitation and sedimentation (lime and settle) when applied to a broad range of metal-bearing wastewaters. The derivation of these achievable effluent concentrations is discussed in substantial detail in Section VII.

Discharge Flows

EPA used the dcp data for each process within each subcategory to determine (1) whether or not the process generated wastewater, (2) the specific flow rate generated, and (3) the specific production normalized flows for the process.

The normalized flows were then analyzed to determine which flow was to be used as part of the basis for BPT mass limitations.

The selected flow (referred to as the BPT regulatory flow or BPT flow) reflects the water use controls which are common practices within the industry. 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. However, the controls or in-process technologies recommended under BPT include only those measures which are commonly practiced within the category or subcategory. Except for recycle of lubricating emulsions, most plants in this category do not have flow reduction in-place. Therefore, flow reduction is not generally included as part of the BPT technology.

The BPT normalized flow is based on the average of all applicable data. Plants with existing 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 generate any significant costs for the plants. In fact, these plants would save money by reducing water consumption.

Although BPT limitations apply only to plants which discharge wastewater directly, direct and indirect dischargers have been considered as a single group in making technical assessments of data, reviewing manufacturing processes, and evaluating wastewater treatment technology options. An examination of plants and processes did not indicate any process differences based on the type of discharge, whether it be direct or indirect. Consequently, the calculation of the BPT regulatory flow included normalized flows from both direct and indirect dischargers.

Regulated Pollutant Parameters

Pollutant parameters were selected for regulation in the nonferrous metals forming subcategories because of their frequent presence at treatable concentrations in raw wastewaters. Total suspended solids, oil and grease, and pH were selected for regulation in each subcategory. Toxic metals are also regulated in every subcategory, though the specific metals regulated vary. The pollutants selected for regulation under BPT in each subcategory and the reasons for their selection are described in Section VI.

Total suspended solids, in addition to being present at high concentrations in raw wastewater from nonferrous metals forming operations, is an important control parameter for metals removal in chemical precipitation and settling treatment systems. Metals are precipitated as insoluble metal hydroxides, and effective

solids removal is required in order to ensure reduced levels of regulated toxic metals in the treatment system effluent. Therefore, total suspended solids are regulated as a conventional pollutant to be removed from the wastewater prior to discharge.

Oil and grease is regulated under BPT since a number of nonferrous metals forming operations (i.e., rolling, sawing/grinding, drawing, and extrusion) generate emulsified wastewater streams which may be discharged.

The importance of pH control is documented in Section VII and its importance in metals removal technology cannot be overemphasized. Even small excursions from the optimum pH level can result in less than optimum functioning of the treatment system and inability to achieve specified results. The optimum operating level for removal of most metals is usually pH 8.8 to 9.3. However, nickel, cadmium, and silver require higher pH for optimal removal. To allow a reasonable operating margin and to preclude the need for final pH adjustment, the effluent pH is specified to be within the range of 7.5 to 10.

The remainder of this section describes the development of BPT mass loadings for each subcategory. The development of BPT regulatory flow for each operation in each subcategory is presented in detail. The pollutants regulated and the cost and benefit of their regulation at BPT are also listed.

LEAD/TIN/BISMUTH FORMING SUBCATEGORY

Production Operations and Discharge Flows

Rolling

The following information was reported on rolling operations in this subcategory:

Number of plants: 25
Number of operations: 25
Number of operations using emulsion lubricant: 7
Number of operations using soap solution lubricant-coolant: 1
Number of operations using no lubricant: 17.

Rolling Spent Emulsions. All of the operations using rolling emulsions completely recycle the emulsions and periodically batch dump them when they become spent. The spent emulsion from one operation is incinerated; the spent emulsion from one operation is applied to land; and the spent emulsion from five operations is contract hauled. Spent emulsions which are contract hauled off-site typically receive some type of emulsion breaking (chemical or thermal) and oil skimming treatment. After this treatment

the water fraction is discharged and the oil fraction is either sent to a reclaiming operation or landfilled directly. Since the spent emulsions could be treated on-site and the water discharged (with the oil fraction contract hauled), the BPT discharge allowance is 23.3 l/kkg (5.60 gal/ton), the average of the six reported values.

Rolling Spent Soap Solutions. The one operation using rolling soap solutions applies and discharges 43.0 l/kkg (10.3 gal/ton). Therefore, the BPT discharge allowance is 43.0 l/kkg (10.3 gal/ton).

Drawing

The following information was reported on drawing operations in this subcategory:

Number of plants: 18
Number of operations: 20
Number of operations using neat oil lubricant: 3
Number of operations using emulsion lubricant: 7
Number of operations using soap solution lubricant-coolant: 2
Number of operations using no lubricant: 8.

Drawing Spent Neat Oils. None of the three operations using neat oils discharge any of the lubricant. Two achieve zero discharge through recirculation with drag-out on the product and one contract hauls batches of the spent neat oils periodically. Since neat oils are pure oil streams, with no water fraction, it is better to remove the oil directly and not to discharge the stream than to commingle the oil with water streams and then remove it later. Therefore, the BPT discharge allowance is zero.

Drawing Spent Emulsions. Six of the seven operations using an emulsion as a lubricant achieve zero discharge. One operation discharges periodically to a POTW. Four of the six operations reporting zero discharge achieve 100 percent recycle of the emulsions with drag-out on the product surface being the only loss, while two operations report contract hauling the spent emulsions after periodic batch dumps. Spent emulsions which are contract hauled off-site typically receive some type of emulsion breaking (chemical or thermal) and oil skimming treatment. After this treatment, the water fraction is discharged and the oil fraction is either sent to a reclaiming operation or landfilled directly. Since the spent emulsions could be treated on-site and the water discharged (with the oil fraction contract hauled), the BPT discharge allowance is 16.7 l/kkg (4.00 gal/ton), the only reported non-zero discharge value.

Drawing Spent Soap Solutions. One of the two operations using soap solutions as a drawing lubricant periodically discharges the

solution. The other operation achieves zero discharge through recirculation with drag-out on the product. The BPT discharge allowance is 7.46 l/kkg (1.79 gal/ton), the one reported non-zero discharge value.

Extrusion

The following information was reported on extrusion operations in this subcategory:

Number of plants: 43
Number of operations: 50
Number of operations using contact cooling water: 18
Number of dry operations: 32.

Extrusion Press and Solution Heat Treatment Contact Cooling Water. As discussed in Section III, contact water is used in extrusion operations to accomplish a heat treatment effect, either by spraying water onto the metal as it emerges from the die or press, or by direct quenching in a contact water bath. Three operations achieve zero discharge by 100 percent recycle; one operation achieves zero discharge by evaporation; and one operation achieves zero discharge by contract hauling the contact cooling water. A discharge with no recycle is reported for 13 extrusion operations. No water use data were reported for one of the operations. The BPT discharge allowance is the average of the 12 reported non-zero discharge values, 1,750 l/kkg (419 gal/ton).

Extrusion Press Hydraulic Fluid Leakage. One of the 43 plants with extrusion operations discharges hydraulic fluid leakage from an extrusion press. However, the Agency believes that other plants in the lead/tin/bismuth forming subcategory use similar extrusion presses and have leakage. The BPT discharge allowance is based on the one reported value, 49.3 l/kkg (11.8 gal/ton).

Casting

The following information was reported on casting operations in this subcategory:

Total number of plants: 34
Total number of operations: 43

Number of plants and operations with continuous strip casting: 6
Number using contact cooling water: 5
Number dry: 1

Number of plants and operations with semi-continuous ingot casting: 2
Number using contact cooling water: 2

Number of plants and operations with shot casting: 3
Number using contact cooling water: 3

Number of plants and operations with continuous wheel casting: 1
Number dry: 1

Number of plants and operations with continuous sheet casting: 1
Number dry: 1

Number of plants and operations with stationary casting (also referred to as chill casting and mold casting): 26 plants, 28 operations
Number dry: 28

Number of plants and operations with shot pressing: 2
Number dry: 2.

Continuous Strip Casting Contact Cooling Water. In five of the six operations the cooling water is completely recycled and periodically batch dumped. One operation uses only noncontact cooling water. The BPT discharge allowance is the average of the five reported values, 1.00 l/kkg (0.240 gal/ton).

Semi-Continuous Ingot Casting Contact Cooling Water. Water use and discharge data were reported for only one operation. Based on the one reported value, the BPT discharge allowance is 29.4 l/kkg (7.04 gal/ton).

Shot Casting Contact Cooling Water. In all three operations, the wastewater is periodically dumped. The average of the two reported discharge values is the BPT discharge allowance, or 42.0 l/kkg (10.1 gal/ton).

Shot-Forming Wet Air Pollution Control Blowdown. One plant reported having a wet scrubber with no recycle to control air pollution from the lead polishing and drying unit operations of a shot-forming line. The BPT discharge allowance is the reported value by that one plant, 0.086 l/kkg (0.021 gal/ton).

Alkaline Cleaning

Four plants provided information on six alkaline cleaning operations. Five of the operations consist of a bath followed by a single stage rinse; one of the operations is a single stage bath/rinse which is periodically batch dumped.

Alkaline Cleaning Spent Baths. Spent baths are discharged from six alkaline cleaning operations. No water use data were reported for one of the operations. The BPT discharge allowance is 606 l/kkg (145 gal/ton), the average of the five reported values.

Alkaline Cleaning Rinsewater. Five alkaline cleaning operations discharge rinsewater with no recycle. The BPT discharge allowance is 6,460 l/kkg (1,550 gal/ton), the average of the five values.

Swaging

The following information was reported on swaging operations in this subcategory:

Number of plants: 5
Number of operations: 6
Number of operations using emulsion lubricant: 4
Number of operations using no lubricant: 2.

Swaging Spent Emulsions. Three of the four swaging operations which use lubricants achieve zero discharge by 100 percent recycle, with evaporation and drag-out on the product surface being the only losses. Spent emulsion is batch discharged from the other operation. Spent emulsions which are contract hauled offsite typically receive some type of emulsion breaking (chemical or thermal) and oil skimming treatment. After this treatment the water fraction is discharged and the oil fraction is either sent to a reclaiming operation or landfilled directly. Since the spent emulsions could be treated on-site and the water discharged (with the oil fraction contract hauled), the BPT discharge allowance is 1.77 l/kkg (0.424 gal/ton), the only reported non-zero discharge value.

Degreasing

A small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Miscellaneous Nondescript Wastewater

Several low volume sources of wastewater were reported in dcp's and observed during the site and sampling visits. Because these sources generally represent low volume periodic discharges applicable to most plants, the Agency has combined these individual

wastewater sources under the term "miscellaneous nondescript wastewater". The wastewater included in this allowance is from maintenance and cleanup, autoclave contact cooling water, and final product lubrication. The BPT discharge allowance for wastewater from these sources is the sum of the three reported values for these sources, 58.4 l/kkg (14.0 gal/ton).

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the lead/tin/bismuth forming subcategory are antimony, lead, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart B. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-12) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 5,222.3 kg/yr (11,513.2 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $21,100 and $30,300 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the lead/tin/bismuth forming subcategory.

NICKEL/COBALT FORMING SUBCATEGORY

Production Operations and Discharge Flows

Rolling

The following information was reported on rolling operations in this subcategory:

Number of plants: 26
Number of operations: 43
Number of operations using neat oil lubricant: 6
Number of operations using emulsion lubricant: 11
Number of operations using soap solution lubricant-coolant: 7
Number of operations using no lubricant: 19.

Rolling Spent Neat Oils. The neat oils in five of the operations are consumed during the rolling operation, while the neat oils in the other operation are contract hauled. Since neat oils are pure oil streams, with no water fraction, it is better to remove the oil directly and not to discharge the stream than to commingle the oil with water streams and then remove it later. Consequently, the BPT discharge allowance is zero.

Rolling Spent Emulsions. No discharge data are available for seven of the 11 operations. As discussed previously for rolling spent emulsions in the lead/tin/bismuth forming subcategory, the spent emulsions could be treated on-site and the water discharged (with the oil fraction contract hauled). Therefore, the average of the four reported discharge values is the BPT discharge allowance, 1,490 l/kkg (357 gal/ton).

Rolling Contact Lubricant-Coolant Water. Complete recirculation of this water was reported for five of the operations. The average of the two reported discharge values is the BPT discharge allowance, 13,400 l/kkg (3,210 gal/ton).

Rolling Solution Heat Treatment Contact Cooling Water. One plant reported using contact cooling water for heat treatment purposes in one rolling operation. The BPT discharge allowance, based on this one reported value, is 0.271 l/kkg (0.065 gal/ton).

Tube Reducing

Two plants reported information on two tube reducing (also referred to as pilgering) operations. Lubricants are used in both operations.

Tube Reducing Spent Lubricants. Tube reducing spent lubricants were sampled at one plant. Analysis of this stream showed treatable concentrations of N-nitrosodiphenylamine, a toxic organic pollutant. The most economical handling of this stream is to intercept it before mixing with other process wastewaters and transport it to off-site treatment or disposal. Because this is the only waste stream in the category with a significant concentration of an organic pollutant, treatment of this stream (with activated carbon) after mixing with other process wastewaters would be much more expensive. For this reason, and because the Agency believes the potentially carcinogenic properties of nitrosamines justify prohibiting its discharge, the BPT discharge allowance for tube reducing spent lubricants is zero.

Drawing

The following information was reported on drawing operations in this subcategory:

Number of plants: 23
Number of operations: 29
Number of operations using neat oil lubricant: 9
Number of operations using emulsion lubricant: 4
Number of operations using no lubricant: 16.

Drawing Spent Neat Oils. The neat oils in three of the operations are consumed during the drawing process while the neat oils in the remaining six operations are contract hauled or lost in drag-out. As discussed previously for drawing spent neat oils in the lead/tin/bismuth forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Drawing Spent Emulsions. No specific information was reported on recycle practices or batch dumping frequencies for drawing spent emulsions in this subcategory. As discussed previously for drawing spent emulsions in the lead/tin/bismuth forming subcategory, the spent emulsions could be treated on-site and the water discharged (with the oil fraction contract hauled). Therefore, the BPT discharge allowance is the average of the three reported discharge values, 95.4 l/kkg (22.9 gal/ton).

Extrusion

The following information was reported on extrusion operations in this subcategory:

Number of plants: 7
Number of operations: 7
Number of operations using a lubricant: 3*
Number of operations using contact cooling water: 2*
Number of dry operations: 3.

*One operation uses a lubricant and contact cooling water.

Extrusion Spent Lubricants. Lubricants are completely recycled in two operations, with the only loss occurring through drag-out; one operation discharges to a septic tank. The extrusion lubricants which are used are typically neat oils. Since neat oils are pure oil streams, with no water fraction, it is better to remove the oil directly and not to discharge the stream than to commingle the oil with water streams and then remove it later. Therefore, the BPT discharge allowance is zero.

Extrusion Press and Solution Heat Treatment Contact Cooling Water. As discussed in Section III, contact water is used in extrusion operations to accomplish a heat treatment effect, either by spraying water onto the metal as it emerges from the die or press, or by direct quenching in a contact water bath.

Contact cooling water in one of the operations is completely recycled and periodically batch dumped; the other operation discharges with no recycle. The average of the two reported values is the BPT discharge allowance, 83.2 l/kkg (20.0 gal/ton).

Forging, Extrusion, and Isostatic Press Hydraulic Fluid Leakage. Hydraulic presses in the nickel/cobalt forming subcategory are used in forging, extrusion, and isostatic pressing operations. Discharge of hydraulic fluid leakage was reported from presses for all three of these operations. The Agency has combined these discharges under the term "forging, extrusion, and isostatic press hydraulic fluid leakage". The average of the two reported values is the BPT discharge allowance, 124 l/kkg (29.7 gal/ton).

Forging

The following information was reported on forging operations in this subcategory:

Number of plants: 25
Number of operations: 31
Number of operations using neat oil lubricant: 3
Number of operations using die contact cooling water: 3
Number of dry operations: 25.

Forging and Swaging Spent Neat Oils. The neat oils from all three operations are contract hauled. Since neat oils are pure oil streams, with no water fraction, it is better to remove the oil directly and not to discharge the stream than to commingle the oil with water streams and then remove it later. Therefore, the BPT discharge allowance is zero.

Forging Die Contact Cooling Water. In all three operations, no water is recycled. The average of the three reported values is the BPT discharge allowance, 1,260 l/kkg (302 gal/ton).

Forging Equipment Cleaning Wastewater. One plant reported using water to clean the equipment in its forging operation. The BPT discharge allowance, based on the one reported value, is 1,630 l/kkg (390 gal/ton).

Casting

The following information was reported on casting operations in this subcategory:

Total number of plants: 11
Total number of operations: 16

Number of plants and operations with stationary and direct chill casting: 10 plants, 12 operations
Number using contact cooling water: 2
Number dry: 10

Number of plants and operations with vacuum melting and casting: 2
Number of plants with vacuum melting steam condensate: 1
Number dry: 1

Number of plants and operations with electroflux remelting: 2
Number dry: 2.

Stationary and Direct Chill Casting Contact Cooling Water. Complete recirculation occurs in both operations and the cooling water is periodically batch dumped. The BPT discharge allowance, based on the one reported value, is 17,800 l/kkg (4,280 gal/ton).

Vacuum Melting Steam Condensate. Information was reported on one vacuum melting operation which generates a waste stream from steam condensate. The water is completely recycled with a small periodic bleed. The BPT discharge allowance, based on the one reported value, is 168 l/kkg (40.4 gal/ton).

Metal Powder Production

The following information was reported on metal powder production in this subcategory:

Number of plants: 5
Number of operations: 6
Number of wet atomization operations: 3
Number of dry atomization operations: 3.

Metal Powder Production Atomization Wastewater. One operation has no available discharge data. The BPT discharge allowance is the average of the two reported values, 2,840 l/kkg (680 gal/ton).

Solution Heat Treatment

The following information was reported on solution heat treatment operations in this subcategory:

Number of plants: 29
Number of operations: 48
Number of operations using contact cooling water: 20
Number of dry operations: 28.

Solution Heat Treatment Contact Cooling Water. Five operations achieve zero discharge by complete recirculation; one operation achieves zero discharge by evaporation. No discharge data are available for eight of the operations. The BPT discharge allowance is the average of the six reported discharge values, 4,570 l/kkg (1,100 gal/ton).

Wet Air Pollution Control

Wet Air Pollution Control Blowdown. Seven plants provided information on seven operations that have an air pollution control scrubber. No water use data were provided for three of the operations. Three of the wet APC devices are operated at greater than 90 percent recycle. The BPT discharge allowance, based on 90 percent reduction of the four reported water use values, is 251 l/kkg (60.2 gal/ton).

Surface Treatment

Twenty-four plants provided information on surface treatment operations in the nickel/cobalt subcategory. Spent baths are discharged from 33 operations, rinsewater from 28.

Surface Treatment Spent Baths. Water discharge data are unavailable for 10 of these operations. The spent baths from one operation are contract hauled. The average of 22 reported non-zero discharge values is the BPT discharge allowance, 861 l/kkg (206 gal/ton).

Surface Treatment Rinsewater. No discharge data were provided for 11 of the rinses. The BPT discharge allowance is the average of the 17 reported discharge values, 10,600 l/kkg (2,535 gal/ton).

Alkaline Cleaning

Six plants provided information on alkaline cleaning operations in the nickel/cobalt subcategory. The reported operations include 16 baths and nine rinses.

Alkaline Cleaning Spent Baths. No discharge data were available for six baths. One bath is not discharged and loses water only by evaporation. The average of the nine available non-zero values is the BPT discharge allowance, 30.6 l/kkg (7.34 gal/ton).

Alkaline Cleaning Rinsewater. No discharge data were available for two rinses. The BPT discharge allowance is the average of the seven reported values, 4,970 l/kkg (1,190 gal/ton).

Molten Salt Treatment

The following information was reported on molten salt treatment in this subcategory:

Number of plants: 6
Number of operations: 7.

Molten Salt Rinsewater. No water discharge data were supplied for two operations. The BPT discharge allowance, based on the five reported values, is 1,280 l/kkg (307 gal/ton).

Ammonia Rinse Treatment

The following information was reported on ammonia rinse treatment in this subcategory:

Number of plants: 2
Number of operations: 3.

Ammonia Rinsewater. No discharge data were available for one operation. The average of the two reported values is the BPT discharge allowance, 15.7 l/kkg (3.77 gal/ton).

Sawing/Grinding

The following information was reported on sawing/grinding operations in this subcategory:

Number of plants: 17
Number of operations: 46
Number of operations using lubricants: 29
Number of dry operations: 17.

Sawing/Grinding Spent Lubricants. For 17 operations no water discharge data are available. Lubricants are completely recirculated in four operations. Sawing/grinding lubricants are typically emulsions which could be treated on-site and the water discharged (with the oil fraction contract hauled). The BPT discharge allowance is the average of the eight reported non-zero values, 1,000 l/kkg (240 gal/ton).

Steam Cleaning

Steam Cleaning Condensate. Two plants reported the discharge of contact steam condensate from product cleaning operations. Neither plant recycles any of this condensate. The BPT discharge allowance is the average of the two reported discharge values, 23.2 l/kkg (5.56 gal/ton).

Hydrostatic Tube Testing

Hydrostatic Tube Testing Wastewater. One plant provided water discharge information on a hydrostatic tube testing operation. The BPT discharge allowance is the one reported discharge value, 1,350 l/kkg (324 gal/ton).

Degreasing

Only a small number of surveyed plants with solvent degreasing operations indicated having process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Miscellaneous Nondescript Wastewater. Several low volume sources of wastewater were reported in dcp's and observed during the site and sampling visits. Because these sources generally represent low volume periodic discharges applicable to most plants, the Agency has combined these individual wastewater sources under the term "miscellaneous nondescript wastewater". Because limited information was available on the volume of these discharges in the nickel/cobalt subcategory, the BPT discharge allowance was transferred from the lead/tin/bismuth subcategory. This allowance is 58.4 l/kkg (14.0 gal/ton).

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the nickel/cobalt forming subcategory are chromium, nickel, fluoride, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart D. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-13) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Cost and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 19,579.2 kg/yr (43,165 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $141,200 and $119,700 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the nickel/cobalt forming subcategory.

ZINC FORMING SUBCATEGORY

Production Operations and Discharge Flows

Rolling

The following information was reported on rolling operations in this subcategory:

Number of plants: 5
Number of operations: 8
Number of operations using neat oil lubricant: 1
Number of operations using emulsion lubricant: 3
Number of operations using contact lubricant-coolant water: 2
Number of operations using no lubricant: 2.

Rolling Spent Neat Oils. The one rolling operation that uses a neat oil lubricant does not discharge any of the lubricant. Drag-out on the product surface accounts for the only losses. As discussed previously for rolling spent neat oils in the nickel/cobalt forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Rolling Spent Emulsions. The spent emulsion from one of the three operations is applied to land; the spent emulsion from one operation is contract hauled; and the spent emulsion from one operation is treated on-site and the water fraction is completely reused. As discussed previously for rolling spent emulsions in the lead/tin/bismuth forming subcategory, the spent emulsions could be treated on-site and the water discharged (with the oil fraction contract hauled). Therefore, the BPT discharge allowance is 1.39 l/kkg (0.334 gal/ton), the only reported value.

Rolling Contact Lubricant-Coolant Water. In both operations the lubricant-coolant water is not recycled. The BPT discharge allowance is the average of the two reported values, 347 l/kkg (83.2 l/kkg).

Drawing

The following information was reported on drawing operations in this subcategory:

Number of plants: 7
Number of operations: 7
Number of operations using emulsion lubricant: 4
Number of operations using no lubricant: 3.

Drawing Spent Emulsions. The spent emulsion from two of the four operations is contract hauled and the spent emulsion from two operations is treated on-site and the water fraction is discharged. As discussed previously for drawing spent emulsions in the lead/tin/bismuth forming subcategory, the spent emulsions can be treated on-site and the water discharged (with the oil fraction contract hauled). Therefore, the average of the three reported discharge values is used as the BPT discharge allowance, 8.01 l/kkg (1.92 gal/ton).

Casting

The following information was reported on casting in this subcategory:

Total number of plants: 7
Total number of operations: 7

Number of plants and operations with direct chill casting: 2
  Number using contact cooling water: 2

Number of plants and operations with stationary casting: 3
  Number using contact cooling water: 1
  Number dry: 2

Number of plants and operations with continuous casting: 2
  Number dry: 2.

Direct Chill Casting Contact Cooling Water. The contact cooling water from one operation is completely recycled with no discharge; the contact cooling water from the other operation is discharged with no recycle. The BPT discharge allowance is 503 l/kkg (121 gal/ton), which is the one reported non-zero value.

Stationary Casting Contact Cooling Water. The contact cooling water in the one operation is completely evaporated. Therefore, the BPT discharge allowance is zero.

Heat Treatment

The following information was reported on heat treatment operations in this subcategory:

Number of plants: 1
Number of operations: 1
Number of operations using contact cooling water: 1.

Solution Heat Treatment Contact Cooling Water. The contact cooling water in the one operation is batch dumped daily. The BPT discharge allowance is 761 l/kkg (183 gal/ton), the reported value.

Surface Treatment

Two plants provided information on five zinc surface treatment operations. Four of the surface treatment operations consist of a bath followed by a single-stage spray rinse and one operation consists of a coating bath not followed by a rinse.

Surface Treatment Spent Baths. Spent baths are discharged from all five surface treatment operations. The BPT discharge allowance is 9.50 l/kkg (2.28 gal/ton), the average of the four reported values.

Surface Treatment Rinsewater. Four surface treatment operations have a discharge from single-stage spray rinses with no recycle. The BPT discharge allowance is 4,860 l/kkg (1,170 gal/ton), the average of the two reported values.

Alkaline Cleaning

One plant supplied information on an alkaline cleaning operation. That operation consists of a bath followed by a two-stage countercurrent cascade rinse.

Alkaline Cleaning Spent Baths. The BPT discharge allowance is 0.715 l/kkg (0.171 gal/ton), the one reported value.

Alkaline Cleaning Rinsewater. The BPT discharge allowance is 5,720 l/kkg (1,370 gal/ton), the one reported value.

Sawing/Grinding

One plant provided information on grinding zinc. An emulsion is used as a lubricant in the operation.

Sawing/Grinding Spent Lubricants. The emulsion is completely recirculated and batch dumped periodically. The BPT discharge allowance is 54.9 l/kkg (13.2 gal/ton), the one reported value.

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the zinc forming subcategory are chromium, cyanide, zinc, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart I. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-14) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Cost and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to the one direct discharger will have no net benefits or costs because that plant currently meets or exceeds proposed BPT effluent mass limitations.

BERYLLIUM FORMING SUBCATEGORY

Production Operations and Discharge Flows

Because there is only one plant in the beryllium forming subcategory, the BPT discharge allowances are based on the discharge values reported from this plant.

Area Cleaning Wastewater. The plant reported four operation areas that require cleaning by hose spraying. The BPT discharge allowance is the average of the four values, or 21,300 l/kkg (5,110 gal/ton).

Billet Washing Wastewater. The plant reported two billet washing operations with no recirculation of wastewater. One washing operation follows vacuum casting and the other follows beryllium sintering. The average of the two discharge values is the BPT allowance, 38.2 l/kkg (9.17 gal/ton).

Surface Treatment

The plant has one surface treatment operation which consists of a bath followed by a single-stage overflow rinse.

Surface Treatment Spent Baths. The surface treatment operation has a discharge from a spent bath which is dumped once every week. The BPT discharge allowance is based on the reported discharge value which is 2,670 l/kkg (640 gal/ton).

Surface Treatment Rinsewater. The surface treatment rinsewater is not recycled. The BPT discharge allowance is the reported discharge value, 2,670 l/kkg (640 gal/ton).

Sawing/Grinding Spent Lubricants. Two sawing/grinding operations were reported. The plant did not report any use of lubricant in one of the operations. The lubricants from the other operation are discharged periodically. The BPT discharge allowance is 424 l/kkg (102 gal/ton), the only reported discharge value.

Inspection/Testing Wastewater. One inspection/testing operation was reported by the plant. The operation includes a stagnant bath which is not discharged. Therefore, the BPT discharge allowance is zero.

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the beryllium forming subcategory are beryllium, copper, cyanide, fluoride, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart A. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-15) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT will have no net costs or benefits because the one plant in this subcategory currently meets or exceeds the proposed BPT effluent mass limitations.

PRECIOUS METALS FORMING SUBCATEGORY

Production Operations and Discharge Flows

Rolling

The following information was reported on rolling operations in this subcategory:

Number of plants: 24
Number of operations: 29
Number of operations using emulsion lubricant: 8
Number of operations using no lubricant: 21.

Rolling Spent Emulsions. The spent emulsions from two operations are contract hauled and one operation has 60 percent recycle of spent emulsions. Five operations discharge spent emulsions with no recycle. The BPT discharge allowance, the average of the five non-recycled discharge values, is 360 l/kkg (86.0 gal/ton).

Rolling Solution Heat Treatment Contact Cooling Water. Contact cooling water with no recirculation is used in three rolling operations. The BPT discharge allowance is the average of the three reported discharge values, 7,000 l/kkg (1,680 gal/ton).

Drawing

The following information was reported on drawing operations in this subcategory:

Number of plants: 18
Number of operations: 22
Number of operations using neat oil lubricant: 2
Number of operations using emulsion lubricant: 7
Number of operations using soap solution lubricant-coolant: 2
Number of operations using an unspecified lubricant: 2
Number of operations using no lubricant: 9.

Drawing Spent Neat Oils. Neat oils are completely recycled in one operation and the neat oil in the other operation is entirely consumed in the drawing process. As discussed previously for drawing spent neat oils in the lead/tin/bismuth forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Drawing Spent Emulsions. One operation has complete recycle of spent emulsions and another operation has 99 percent recirculation with periodic contract hauling of spent emulsions. Spent emulsions from three operations are contract hauled. The average

of the two reported non-zero discharge values is the BPT discharge allowance, 213 l/kkg (51.0 gal/ton).

Drawing Spent Soap Solutions. No discharge data were provided on one operation and one operation was reported to discharge spent soap solution. The BPT discharge allowance is the one reported non-zero value, 6.93 l/kkg (1.66 gal/ton).

Extrusion

The following information was reported on extrusion operations in this subcategory:

Number of plants: 6
Number of operations: 7
Number of operations using contact cooling water: 2
Number of dry operations: 5.

Extrusion Solution Heat Treatment Contact Cooling Water. Contact cooling water is not recycled in either operation. The BPT discharge allowance is the average of the two reported values, 13,700 l/kkg (3,290 gal/ton).

Casting

The following information was reported on casting operations in this subcategory:

Total number of plants: 24
Total number of operations: 37

Number of dry operations (casting type unspecified): 21

Number of plants and operations with semi-continuous and continuous casting using contact cooing water: 6 plants, 11 operations

Number of plants and operations with shot casting using contact cooling water: 1

Number of plants and operations with stationary casting using contact cooling water: 2
Number dry: 1

Number of plants and operations with direct chill casting using contact cooling water: 1.

Semi-Continuous and Continuous Casting Contact Cooling Water. Zero discharge is achieved in five operations by complete recycle of the contact cooling water. One of the operations with a

discharge did not report water use information. The average of the five reported water discharge values is the BPT discharge allowance, 11,200 l/kkg (2,680 gal/ton).

Shot Casting Contact Cooling Water. The BPT discharge allowance is the value reported for the one shot casting operation, 892 l/kkg (214 gal/ton).

Stationary Casting Contact Cooling Water. A water discharge value was reported for only one of the two operations. That value is the BPT discharge allowance, 4.17 l/kkg (1 gal/ton).

Direct Chill Casting Contact Cooling Water. The one reported direct chill casting operation has greater than 99 percent recirculation of the contact cooling water. The reported water discharge value is the BPT discharge allowance, 818 l/kkg (196 gal/ton).

Casting Wet Air Pollution Control Blowdown. Two plants use wet scrubbers to control air pollution from their casting operations. One of the plants completely recirculates the scrubber water. The BPT discharge allowance is the non-zero discharge value, 58.6 l/kkg (14.0 gal/ton).

Metal Powder Production

The following information was reported on metal powder production in this subcategory:

Number of plants: 5
Number of operations: 10
Number of wet atomization operations: 1
Number of wet powder milling operations: 1
Number of dry atomization operations: 8.

Metal Powder Production Atomization Wastewater. The BPT discharge allowance, based on the one reported value, is 6,670 l/kkg (1,600 gal/ton).

Metal Powder Production Milling Wastewater. The BPT discharge allowance, based on the one reported value, is 21,700 l/kkg (5,200 gal/ton).

Pressure Bonding

Pressure Bonding Contact Cooling Water. One plant reported using contact cooling water after a pressure bonding operation. The reported value is the BPT discharge allowance, 83.5 l/kkg (20.0 gal/ton).

Heat Treatment

The following information was reported on heat treatment operations in this subcategory:

Number of plants: 23
Number of operations: 45
Number of operations using contact cooling water: 18
Number of dry operations: 27.

Annealing Heat Treatment Contact Cooling Water. Zero discharge is achieved in two operations by complete recycle of the contact cooling water. No discharge data were reported for six of the operations. The average of the 10 reported values is the BPT discharge allowance, 10,000 l/kkg (2,400 gal/ton).

Surface Treatment

Twenty-two plants supplied information on surface treatment operations. Some of these operations are associated with the cladding of precious metals to other metals. Wastewater is generated and discharged from these operations as follows:

Number of baths discharged: 17
Number of baths contract hauled: 3
Number of baths never discharged: 2
Number of rinses discharged: 14
Number of rinses treated and completely recycled: 1.

Surface Treatment Spent Baths. No water discharge data were reported for 13 of the operations. The BPT discharge allowance is the average of the four reported discharge values, 155 l/kkg (37.2 gal/ton).

Surface Treatment Rinsewater. Three of the 14 rinsing operations use two-stage countercurrent cascade rinsing. No water use data were reported for four of the operations. The BPT discharge allowance is the average of the 10 reported values, 2,840 l/kkg (681 gal/ton).

Alkaline Cleaning

Five plants supplied information on five precious metals alkaline cleaning operations, five discharge spent baths and two discharge rinsewater. Eight plants reported information on 11 prebonding cleaning operations.

Alkaline Cleaning Spent Baths. Bath discharge data were not reported for three of the operations. The BPT discharge allowance is the average of the two reported discharge values, 3.67 l/kkg (0.88 gal/ton).

Alkaline Cleaning Rinsewater. Discharge data were not reported for one of the operations. The BPT discharge allowance is the one reported discharge value, 6,920 l/kkg (1,660 gal/ton).

Prebonding Cleaning Wastewater. Discharge data were not reported for two of the operations. The BPT discharge allowance is the average of the nine reported discharge values, 3,400 l/kkg (817 gal/ton).

Tumbling/Burnishing

Tumbling Wastewater. One plant reported a tumbling operation using water. The BPT discharge allowance, based on the one reported value, is 1,150 l/kkg (277 gal/ton).

Burnishing Wastewater. Two plants reported information on two burnishing operations using water. The BPT discharge allowance, based on the average of the two reported values, is 25,700 l/kkg (6,170 gal/ton).

Sawing/Grinding

The following information was reported on sawing/grinding operations in this subcategory:

Number of plants: 9
Number of operations: 15
Number of operations using emulsion lubricant: 5
Number of operations using no lubricant: 10.

Sawing/Grinding Spent Emulsions. Zero discharge is achieved in one operation by complete recycle of the lubricant, the lubricant is completely consumed in another. Discharge information was not reported for one operation. The BPT discharge allowance is the average of the two reported discharge values, 6.05 l/kkg (1.45 gal/ton).

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the precious metals forming subcategory are cadmium, copper, cyanide, silver, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart E. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-16) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 2,194.7 kg/yr (4,838.5 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $173,400 and $114,000 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the precious metals forming subcategory.

IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

Production Operations and Discharge Flows

Metal Powder Production

The following information was reported on metal powder production in this subcategory:

Number of plants: 14
Number of operations: 19
Number of wet atomization operations: 6
Number of wet milling operations: 1
Number of dry atomization operations: 10
Number of dry milling operations: 2.

Metal Powder Production Atomization Wastewater. No recycle was reported for any of the six operations. From an examination of the available data, it is not apparent that there is any significant difference in water use and discharge among the different metals. Therefore, the BPT discharge allowance is the average of the six reported values, 5,040 l/kkg (1,210 gal/ton).

Metal Powder Production Milling Wastewater. No recycle was reported for the one wet powder milling operation. The BPT discharge allowance is based on the one reported value, 1,670 l/kkg (400 gal/ton).

Metal Powder Production Wet Air Pollution Control Blowdown. Two plants reported the use of wet scrubbers associated with metal powder production. One plant reported a discharge and 85 percent recycle; the other reported complete recycle. The BPT discharge allowance is based on 90 percent recycle of the scrubber water to achieve a discharge allowance of 2,640 l/kkg (632 gal/ton).

Sizing

Sizing Spent Lubricant. One plant reported information on two operations using lubricants in sizing operations associated with powder metallurgy parts production. However, because all of the lubricant is consumed during processing there is no resulting discharge. Therefore, the BPT flow allowance is zero.

Oil-Resin Impregnation

Oil-Resin Impregnation Wastewater. Three plants reported impregnation of powder metallurgy parts with oils and resins. Only one of the plants reported water use and discharge values. The BPT discharge allowance is based on the single reported value, 74.5 l/kkg (17.9 gal/ton).

Steam Treatment

Steam Treatment Scrubber Blowdown. One plant operates a wet scrubber to control air pollution from its steam treatment process. The BPT discharge allowance, based on the one reported discharge value, is 2,840 l/kkg (681 gal/ton).

Tumbling, Burnishing, and Cleaning

Tumbling, Burnishing, and Cleaning Wastewater. Eighteen plants reported information on 26 tumbling, burnishing, and other physical-chemical cleaning operations associated with powder metallurgy parts production. There appears to be no significant difference in the water use and discharge practices among these operations for iron, steel, copper, or aluminum parts. No water discharge information was reported for 12 of the 26 operations. The BPT discharge allowance is the average of the 14 reported values or 7,150 l/kkg (1,710 gal/ton).

Sawing/Grinding

Sawing/Grinding Spent Lubricants. Two plants reported information on four operations using lubricants for sawing and grinding of powder metallurgy parts. None of the plants reported lubricant use or discharge values. Because simlar operations are used in the nickel/cobalt forming subcategory, the BPT discharge allowance for these operations is the same as the allowance in the other subcategory, 1,000 l/kkg (240 gal/ton).

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory are copper, cyanide, lead, aluminum, iron, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart K. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-17) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 8,995.6 kg/yr (19,831.9 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $122,000 and $77,500 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory.

TITANIUM FORMING SUBCATEGORY

Production Operations and Discharge Flows

Rolling

The following information was reported on rolling operations in this subcategory:

Number of plants: 9
Number of cold rolling operations: 6
Number of hot rolling operations: 6
Number of cold rolling operations using lubricants: 4
Number of hot rolling operations using contact lubricant-coolant water: 3
Number of cold rolling operations using no lubricant: 2
Number of hot rolling operations using no lubricant: 3.

Cold Rolling Spent Lubricants. Two of the four operations have no water discharge because all water loss is through drag-out. The BPT discharge allowance is the average of the two reported discharge values, 3,340 l/kkg (800 gal/ton).

Hot Rolling Contact Lubricant-Coolant Water. No recycle was reported for any of the three operations. One operation has no available water usage or discharge data. The BPT discharge allowance is the average of the two reported discharge values, 4,300 l/kkg (1,030 gal/ton).

Extrusion

The following information was reported on extrusion operations in this subcategory:

Number of plants: 9
Number of operations: 10
Number of operations using lubricants: 3
Number of dry operations: 7.

Extrusion Spent Lubricants. The lubricant used in one of the operations is consumed during the extrusion. The BPT discharge allowance is the average of the two reported non-zero discharge values, 274 l/kkg (65.7 gal/ton).

Forging

The following information was reported on forging operations in this subcategory:

Number of plants: 26
Number of operations: 37

Number of operations using lubricants: 6
Number of operations using contact cooling water: 5
Number of dry operations: 26.

Forging Spent Lubricants. The lubricants in five of the six operations are consumed during forging and the lubricants from the other operation are contract hauled. The forging lubricants are typically neat oils. As discussed previously for forging and swaging spent neat oils in the nickel/cobalt forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Forging Contact Cooling Water. No discharge data were available for one of the five operations. Consequently, the BPT allowance is the average of the four reported non-zero values, 3,000 l/kkg (72.1 gal/ton).

Forging Wet Air Pollution Control Blowdown. Two plants use wet air pollution control scrubbers to control air pollution from forging operations. The BPT discharge allowance is the average of the two reported values, 2,020 l/kkg (485 gal/ton).

Heat Treatment

The following information was reported on heat treatment operations in this subcategory:

Number of plants: 17
Number of operations: 23
Number of operations using contact cooling water: 10
Number of dry operations: 13.

Heat Treatment Contact Cooling Water. Contact cooling water in two of the 10 operations is 100 percent recycled. No discharge data were supplied for four of the 10 operations. The BPT discharge allowance is the average of the four reported non-zero values or 4,510 l/kkg (1,080 gal/ton).

Surface Treatment

Seventeen plants reported information on 21 surface treatment operations.

Surface Treatment Spent Baths. No discharge data were supplied for 14 of the operations. The BPT discharge allowance is the average of six of the seven reported values. One value was omitted from the average because it was much higher than the values for spent surface treatment baths in other metal forming categories and subcategories and, therefore, not believed to be typical of current best practice. The BPT discharge allowance is 160 l/kkg (38.5 gal/ton).

Surface Treatment Rinsewater. No water is recycled in any of the operations. Water usage and discharge data were not supplied for eight of the operations. The BPT discharge allowance is the average of 10 reported non-zero values. Three of the reported values were omitted from the average because they were much higher than the average of the other 10 and therefore, not believed to be typical of current best practice. The BPT discharge allowance is 21,100 l/kkg (5,050 gal/ton).

Surface Treatment Wet Air Pollution Control Blowdown. Three plants reported using wet scrubbers to control air pollution from surface treatment operations. All of the plants supplied information for continuous discharges from the scrubbers. However, only two supplied enough information to determine the percent recycle of scrubber liquor. One of the plants, which recycles scrubber liquor, had a much greater production normalized discharge of air pollution control blowdown than plants in other metal forming categories and subcategories. Therefore, the PNF from that plant was not believed to be typical of current best practice. The other reported value, on a scrubber with 96 percent recycle, is the BPT discharge allowance, 170 l/kkg (40.8 gal/ton).

Alkaline Cleaning

Five plants supplied information on alkaline cleaning operations. All five plants discharge spent cleaning baths and four plants discharge rinsewater.

Alkaline Cleaning Spent Baths. Water usage and discharge data were not reported for two of the five operations. The BPT discharge allowance is the average of the three reported discharge values, 2,550 l/kkg (612 gal/ton).

Alkaline Cleaning Rinsewater. No water is recycled in any of the operations. No water discharge information was reported for one of the operations. One reported value is much higher than the other two reported values and much higher than the values for alkaline cleaning rinsewater in other metal forming categories and subcategories. This value was not included in the calculation of the BPT flow because it is not believed to be typical of current best practice. The BPT discharge allowance is the average of two of the three reported values, 2,760 l/kkg (663 gal/ton).

Sawing/Grinding

The following information was reported on sawing/grinding operations in this subcategory:

Number of plants: 12
Number of operations: 14
Number of operations using lubricants: 10
Number of operations using no lubricant: 4.

Sawing/Grinding Spent Lubricants. The lubricants used in two of the 10 operations are completely recycled; the lubricants in two other operations are completely consumed. No discharge information was reported for two of the operations. Two of the remaining four reported discharge values are much higher than the other two values, and much higher than the values for sawing/grinding spent lubricants in other metal forming categories and subcategories. These two values were not included in the calculation of the BPT discharge allowance because they are not believed to be typical of current best practice. The BPT discharge allowance is the average of the other two of the four reported values, 49.7 l/kkg (11.9 gal/ton).

Tumbling

Tumbling Wastewater. One plant reported information on a titanium tumbling operation. The BPT discharge allowance is based on the value for this operation, 790 l/kkg (189 gal/ton).

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the titanium forming subcategory are cyanide, lead, zinc, ammonia, fluoride, titanium, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart F. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-18) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 379,217.2 kg/yr

(836,030.8 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $1,164,700 and $858,300 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the titanium forming subcategory.

REFRACTORY METALS FORMING SUBCATEGORY

Production Operations and Discharge Flows

Rolling

The following information was reported on rolling operations in this subcategory:

Number of plants: 14
Number of operations: 20
Number of operations using neat oil lubricant: 1
Number of operations using emulsion lubricant: 1
Number of operations using no lubricant: 18.

Rolling Spent Neat Oils. No discharge information was reported for the one operation which uses a neat oil rolling lubricant. As discussed previously for rolling spent neat oils in the nickel/cobalt forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Rolling Spent Emulsions. Spent emulsions in the one rolling operation which uses emulsified lubricants are batch dumped annually and contract hauled. As discussed previously for rolling spent emulsions in the lead/tin/bismuth forming subcategory, the spent emulsions could be treated on-site and the water discharged (with the oil fraction contract hauled). Therefore, the reported value is the BPT discharge allowance, 1,200 l/kkg (288 gal/ton).

Drawing

The following information was reported on drawing operations in this subcategory:

Number of plants: 13
Number of operations: 16
Number of operations using lubricants: 5
Number of operations using no lubricant: 11.

Drawing Spent Lubricants. The lubricants in three operations are completely consumed. Lubricant loss in one operation occurs only

through drag-out. One operation has no available water discharge data. The drawing lubricants used are typically neat oils. As discussed previously for drawing spent neat oils in the lead/tin/bismuth forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Extrusion

The following information was reported on extrusion operations in this subcategory:

Number of plants: 3
Number of operations: 3
Number of operations using contact cooling water: 1
Number of dry operations: 2.

Extrusion Heat Treatment Contact Cooling Water. Contact cooling water is used with no recycle in a post-extrusion operation. The BPT discharge allowance is the one reported discharge value, 3,460 l/kkg (830 gal/ton).

Extrusion Press Leakage. Leakage of extrusion press hydraulic fluid was observed at one sampled plant. The BPT discharge allowance is based on the one value for this operation, 1,190 l/kkg (285 gal/ton).

Forging

The following information was reported on forging operations in this subcategory:

Number of plants: 13
Number of operations: 15
Number of operations using lubricants: 3*
Number of operations using contact cooling water: 2*
Number of operations that generate equipment cleaning wastewater: 3*
Number of dry operations: 11.

*Two operations use a lubricant, contact cooling water, and generate equipment cleaning wastewater.

Forging Spent Lubricants. The lubricants in two of the operations are consumed in the forging processes and lost through drag-out in the other operation. The forging lubricants used are typically neat oils. As discussed previously for forging spent neat oils in the nickel/cobalt forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Forging Solution Heat Treatment Contact Cooling Water. None of the contact cooling water in either of the two operations is recycled. The BPT discharge allowance is the average of the two reported values, 5,790 l/kkg (1,390 gal/ton).

Extrusion and Forging Equipment Cleaning Wastewater. Two plants use cleaning water that is not recycled to clean forging and extrusion equipment in three operations. The BPT discharge allowance is the average of the two reported values, 417 l/kkg (100 gal/ton).

Metal Powder Pressing

The following information was reported on metal powder pressing operations in this subcategory:

Number of plants: 22
Number of operations: 44
Number of operations using a lubricant: 1
Number of dry operations: 43.

Metal Powder Pressing Spent Lubricants. The lubricants used in one operation are neat oils which are completely recirculated. Since neat oils are pure oil streams, with no water fraction, it is better to remove the oil directly and not to discharge the stream than to commingle the oil with water streams and then remove it later. Therefore, the BPT discharge allowance is zero.

Casting

The following information was reported on casting operations in this subcategory:

Number of plants: 4
Number of operations: 4
Number of operations using contact cooling water: 1
Number of operations using post-casting washwater: 1
Number of dry operations: 3.

Casting Contact Cooling Water. One operation loses water only through evaporation. Therefore, the BPT discharge allowance is zero.

Post-Casting Washwater. One plant reported a water discharge from a post-casting wash operation. The BPT discharge allowance is the one reported value, 29.8 l/kkg (7.14 gal/ton).

Metal Powder Production

The following information was reported on metal powder production in this subcategory:

Number of plants: 11
Number of operations: 20
Number of wet operations: 4
Number of dry operations: 16.

Metal Powder Production Wastewater. No water discharge data were provided for one operation. The BPT discharge allowance, based on the average of the three reported values of metal powder production wastewater, is 1,640 l/kkg (393 gal/ton).

Metal Powder Production Wet Air Pollution Control Scrubber Blowdown. The one plant that reported using a wet scrubber to control air pollution from its metal powder production operation recirculates all of the scrubber liquor to achieve zero discharge. Because no water is discharged, the BPT allowance is zero.

Surface Treatment

Twelve plants supplied information on refractory metals surface treatment operations.

Surface Treatment Spent Baths. No discharge values were supplied for spent baths from 13 surface treatment operations. One of the two reported values was much higher than values reported in other metal forming categories and subcategories. This value was not used to calculate the BPT flow because it was not believed to be typical of current best practice. The BPT discharge allowance, based on the other reported value, is 12.7 l/kkg (3.04 gal/ton).

Surface Treatment Rinsewater. Rinsewater is discharged from 16 surface treatment operations. No discharge data were provided for five operations; no recycle of rinsewater was reported for any of the 16 operations. The BPT discharge allowance is the average of 10 of 11 reported values. One reported value was much higher than the average of the other 10 and, therefore, not believed to be typical of current best practice. The allowance is 121,000 l/kkg (29,100 gal/ton).

Surface Treatment Wet Air Pollution Control Scrubber Blowdown. Two plants reported using wet scrubbers to control air pollution from their surface treatment operations. Water discharge data were supplied for only one of the two operations. The BPT discharge allowance, based on the one reported value, is 11,800 l/kkg (2,480 gal/ton).

Coating Wet Air Pollution Control Scrubber Blowdown. One plant reported using a wet scrubber to control air pollution from its coating operation. The BPT discharge allowance, based on the one reported value, is 1,080 l/kkg (258 gal/ton).

Alkaline Cleaning

Thirteen plants supplied information on 14 alkaline cleaning operations.

Alkaline Cleaning Spent Baths. No discharge values were provided for any of the 14 operations. Consequently, the BPT discharge allowance for alkaline cleaning spent baths in the nickel/cobalt forming subcategory was transferred to this subcategory. The BPT discharge allowance is 30.6 l/kkg (7.34 gal/ton).

Alkaline Cleaning Rinsewater. Eight of the operations have no available water discharge data. No water is recirculated in any of the 14 operations. The average of the six reported values is the BPT discharge allowance, 140,000 l/kkg (33,500 gal/ton).

Molten Salt

Molten Salt Rinsewater. Rinsewater is discharged from five molten salt operations. Because no information on rinsewater discharge was provided for one operation, the BPT discharge allowance is the average of the four reported values, 90,200 l/kkg (21,600 gal/ton).

Tumbling/Milling/Burnishing

Tumbling/Milling/Burnishing Wastewater. Five plants provided information on 14 operations involving tumbling, milling, or burnishing. One operation is dry. One of the reported values is much higher than the other 12 and therefore, is not believed to be typical of current best practice. Consequently, the BPT discharge allowance is the average of 12 of the 13 reported values, 22,100 l/kkg (5,300 gal/ton).

Sawing/Grinding

The following information was reported on sawing/grinding operations in this subcategory:

Number of plants: 10
Number of operations: 31
Number of operations using neat oil lubricant: 1
Number of operations using emulsion lubricant: 17
Number of operations using lubricant-coolant water: 6
Number of operations using no lubricant: 7.

Sawing/Grinding Spent Neat Oils. No discharge information was reported for the one operation. Since neat oils are pure oil streams, with no water fraction, it is better to remove the oil directly and not to discharge the stream than to commingle the oil with water streams and then remove it later. Therefore, the BPT discharge allowance is zero.

Sawing/Grinding Spent Emulsions. The spent emulsions from six operations are contract hauled; emulsions are completely recycled in one operation; and, emulsions are lost only through drag-out in three operations. Water discharge data were not provided for five operations. The average of the two reported discharge values is the BPT discharge allowance, 217 l/kkg (52.1 gal/ton).

Sawing/Grinding Lubricant-Coolant Water. Discharge data were not provided for one operation. One hundred percent recycle of lubricant-coolant water was achieved in three operations. The two reported discharge values were much higher than values typical of similar operations in other metal forming subcategories and categories and were not believed to be typical of current best practice. For this reason, the BPT discharge allowance is 10 percent of the lower reported value, achievable through 90 percent recycle. The Agency believes this value reflects currently established use of sawing/grinding lubricant-coolant water in the nonferrous metals forming and other metal forming categories. The BPT discharge allowance is 812 l/kkg (195 gal/ton).

Sawing/Grinding Wet Air Pollution Control Scrubber Blowdown. One plant reported using a wet scrubber to control air pollution from a grinding operation. Since the quantity of wastewater discharged was not reported, the BPT discharge allowance for coating wet air pollution control blowdown was used as an allowance for this waste stream. Thus, the BPT discharge allowance is 1,080 l/kkg (258 gal/ton).

Post-Sawing/Grinding Rinsewater. One plant supplied information on a post-sawing/grinding operation. The BPT discharge allowance is the one reported value, 513 l/kkg (123 gal/ton).

Product Testing

Product Testing Wastewater. Wastewater from a product testing operation was observed at one sampled plant. The BPT discharge allowance is the value for this operation, 77.6 l/kkg (18.6 gal/ton).

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the

operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the refractory metals forming subcategory are copper, nickel, columbium, fluoride, molybdenum, tantalum, tungsten, vanadium, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart G. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-8) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 6,903.9 kg/yr (15,220.5 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $35,800 and $70,400 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the refractory metals forming subcategory.

ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

Production Operations and Discharge Flows

Drawing

The following information was reported on drawing operations in this subcategory:

Number of plants: 3
Number of operations: 3
Number of operations using lubricants: 3.

Drawing Spent Lubricants. The lubricant in two of the three operations is completely recycled; no discharge information was reported for the other operation. The drawing lubricants are

typically neat oils. As discussed previously for drawing spent neat oils in the lead/tin/bismuth forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Extrusion

The following information was reported on extrusion operations in this subcategory:

Number of plants: 5
Number of operations: 5
Number of operations using emulsion lubricant: 2*
Number of operations using contact cooling water: 1*
Number of dry operations: 3.

*One operation uses a lubricant and contact cooling water.

Extrusion Spent Emulsions. The emulsion in one of the operations is consumed; the spent emulsion in the other operation is discharged without recycle. The BPT discharge allowance, based on the one reported value, is 74.1 l/kkg (17.8 gal/ton).

Extrusion Heat Treatment Contact Cooling Water. The BPT discharge allowance is based on the single reported value, 285 l/kkg (68.4 gal/ton).

Extrusion Press Hydraulic Fluid Leakage. Two plants reported the discharge of leakage from extrusion presses. Hydraulic fluid leaks from moving part connection points in high pressure extrusion presses. Neither plant recirculates the leakage. Discharge information was not reported for one of the operations. The BPT discharge allowance is based on the one reported value, 370 l/kkg (88.8 gal/ton).

Forging

Forging Solution Heat Treatment Contact Cooling Water. Two plants reported using heat treatment quench baths following forging, but only one reported water use and discharge values. The BPT discharge allowance is based on the single reported value, 34.9 l/kkg (8.36 gal/ton).

Tube Reducing

Tube Reducing Spent Lubricants. Tube reducing spent lubricants were sampled at one plant in the nickel/cobalt forming subcategory. Analysis of this stream showed treatable concentrations of N-nitrosodiphenylamine, a toxic organic pollutant. The Agency believes that tube reducing operations are similar and use the

same lubricants in the two subcategories. The most economic handling of this stream is to intercept it before mixing with other process wastewaters and transport it to off-site treatment or disposal. Because this is the only waste stream in the category with a significant concentration of an organic pollutant, treatment of this stream (with activated carbon) after mixing with other process wastewaters would be much more expensive. For this reason, and because the Agency believes the potentially carcinogenic properties of nitrosamines justify prohibiting its discharge, the BPT discharge allowance for tube reducing spent lubricants is zero.

Surface Treatment

Seven plants supplied information on surface treatment operations in the zirconium/hafnium subcategory.

Surface Treatment Spent Baths. Spent surface treatment baths are discharged from 13 operations. Three of these baths are contract hauled. No data on water usage or water discharge was provided for seven operations. Even though the spent baths from three of the operations are contract hauled, the BPT discharge allowance is the average of the six reported values, 399 l/kkg (95.8 gal/ton).

Surface Treatment Rinsewater. Rinsewater is discharged from 10 surface treatment operations. No information on water usage or discharge was provided for four of the 10 operations. The reported water usage and discharge from one plant were omitted in determining the regulatory flow because they were far outside the range of values of the other plants and therefore not believed to be typical of best current practice. The BPT discharge allowance was based on the average of the five reported values, 15,300 l/kkg (3,680 gal/ton).

Alkaline Cleaning

Alkaline Cleaning Spent Baths. Six plants reported information on the discharge of alkaline cleaning baths from 11 operations. Even though the wastewater from two of these operations is contract hauled, the BPT discharge allowance is based on the average of all 11 reported values. The allowance is 2,130 l/kkg (511 gal/ton).

Alkaline Cleaning Rinsewater. Rinsewater is discharged from 10 operations. No data on water discharge were provided for two of the operations. The BPT discharge allowance is the average of the eight reported values, 55,300 l/kkg (13,300 gal/ton).

Sawing/Grinding

Sawing/Grinding Spent Lubricants. Four plants reported nine operations using lubricants in sawing and grinding. Plants generally recirculate the lubricants in these operations but periodically draw off a portion to prevent the excessive buildup of contaminants in the lubricant and to prevent it from becoming rancid. The amount discharged is generally very small relative to waste streams from other forming operations. A discharge value was reported for only one of the nine operations. The BPT discharge allowance, based on the one reported value, is 9.01 l/kkg (2.16 gal/ton).

Sawing/Grinding Wet Air Pollution Control Blowdown. Because the one plant reporting use of an air pollution control unit operates it with 100 percent recycle, the BPT discharge allowance is zero.

Degreasing

Degreasing Rinsewater. One plant reported the discharge of degreasing rinsewater from two operations. The BPT discharge allowance is the average of the two reported values, 2,030 l/kkg (486 gal/ton).

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the zirconium/hafnium forming subcategory are chromium, cyanide, nickel, ammonia, fluoride, hafnium, zirconium, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart J. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-20) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in the mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 1,061.8 kg/yr (2,340.9 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $172,200 and $88,500 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the zirconium/hafnium forming subcategory.

MAGNESIUM FORMING SUBCATEGORY

Production Operations and Discharge Flows

Rolling

The following information was reported on rolling operations in this subcategory:

Number of plants: 1
Number of operations: 2
Number of operations using emulsion lubricant: 2.

Rolling Spent Emulsions. The spent emulsions from both operations are batch dumped and contract hauled, therefore, the BPT discharge allowance is zero.

Forging

The following information was reported on forging operations in this subcategory:

Number of plants: 3
Number of operations: 4
Number of operations using lubricants: 3*
Number of operations using contact cooling water: 4*.

*Three of the operations use lubricants and contact cooling water.

Forging Spent Lubricants. The only loss of lubricant from any of the three operations is through drag-out on the product surface. Consequently, the BPT discharge allowance for forging spent lubricants is zero.

Forging Solution Heat Treatment Contact Cooling Water. One operation has no water discharge due to evaporation. The BPT discharge value is the average of the three reported non-zero discharge values, 6,330 l/kkg (1,520 gal/ton).

Forging Wet Air Pollution Control Blowdown. One plant reported discharging water from a wet scrubber used to control air pollution from a forging operation. Because the plant currently recycles 90 percent of the scrubber water, the BPT discharge allowance, based on the reported discharge value from this scrubber, is 266,000 l/kkg (63,800 gal/ton).

Forging Equipment Cleaning Wastewater. One plant reported using water to clean a forging press. The wastewater from this operation is not recycled. The BPT discharge allowance, based on the one reported value, is 1,620 l/kkg (388 gal/ton).

Casting

Direct Chill Casting Contact Cooling Water. One plant casts magnesium by the direct chill method. Since the cooling water used in this operation is completely recycled, the BPT discharge allowance is zero.

Surface Treatment

Three plants supplied information on eight magnesium surface treatment operations. Information was provided on the discharge of eight surface treatment baths and on eight rinsewater discharges.

Surface Treatment Spent Baths. Three of the operations only lose water by drag-out on the product surface and the wastewater from two of the operations is contract hauled. The BPT discharge allowance is the average of the three reported non-zero values, or 465 l/kkg (111 gal/ton).

Surface Treatment Rinsewater. Rinsewater is batch dumped from three operations on a yearly basis and from one operation on a daily basis. Rinsewater is continuously discharged from four operations. The average of the eight reported discharge values is the BPT flow, 17,700 l/kkg (4,250 gal/ton).

Sawing/Grinding

The following information was reported on sawing/grinding operations in this subcategory:

Number of plants: 4
Number of operations: 4
Number of operations using emulsion lubricant: 3
Number of operations using no lubricant: 1.

Sawing/Grinding Spent Lubricants. Two of the operations have no wastewater discharge because the spent lubricant is hauled with the saw chips and one operation loses lubricant only through drag-out. Consequently, the BPT discharge allowance is zero.

Sanding and Repairing Wet Air Pollution Control Blowdown. One plant reported using wet scrubbers to control air pollution from a sanding operation and a repairing operation. At least 90 percent of the scrubber liquor is recycled in both operations. The BPT discharge allowance is the average of the two reported discharge values, 428 l/kkg (103 gal/ton).

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the magnesium forming subcategory are chromium, zinc, ammonia, fluoride, magnesium, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart C. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-21) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

Costs and Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed (benefits). The application of BPT to direct dischargers will remove approximately 12,772.8 kg/yr (28,159.2 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $50,500 and $70,900 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the magnesium forming subcategory.

URANIUM FORMING SUBCATEGORY

Production Operations and Discharge Flows

Extrusion

The following information was reported on extrusion operations in this subcategory:

Number of plants: 2
Number of operations: 5
Number of operations using lubricants: 2*
Number of operations using contact cooling water: 4*.

*One operation uses lubricants and contact cooling water.

Extrusion Spent Lubricants. Spent lubricants are not discharged from either of the two operations. The extrusion lubricants used are typically neat oils. As discussed previously for extrusion spent lubricants in the nickel/cobalt forming subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance is zero.

Extrusion Solution Heat Treatment Contact Cooling Water. In none of the four operations is the water recycled. The BPT discharge allowance is the average of the four reported values, 2,720 l/kkg (653 gal/ton).

Extrusion Tool Contact Cooling Water. One plant reported using contact cooling water to quench the extrusion tools. The water was not recycled. The BPT discharge allowance is the reported value, 517 l/kkg (124 gal/ton).

Forging

The following information was reported on forging oprations in this subcategory:

Number of plants: 1
Number of operations: 1
Number of operations using lubricants: 1*
Number of operations using contact cooling water: 1*.

*The one operation uses a lubricant and contact cooling water.

Forging Spent Lubricant. No lubricant discharge information was provided for the one operation. The forging lubricants are typically neat oils. As discussed previously for forging and swaging spent neat oils in the nickel/cobalt subcategory, it is better to remove the neat oils directly and not to discharge the stream. Therefore, the BPT discharge allowance for spent lubricants is zero.

Forging Solution Heat Treatment Contact Cooling Water. The BPT discharge allowance is the one reported value, 2,840 l/kkg (682 gal/ton).

Surface Treatment

All three uranium forming plants provided information on surface treatment operations. Spent baths are discharged from four operations, rinsewater from five.

Surface Treatment Spent Baths. Spent baths from three of the four operations are neutralized and contract hauled. The BPT discharge allowance is based on the one reported non-zero value, 35.6 l/kkg (8.52 gal/ton).

Surface Treatment Rinsewater. Rinsewater from two of the operations is neutralized and contract hauled; rinsewater from one of the operations is sent to a holding pond which is not discharged. Rinsewater from the other two operations is discharged. The discharge value of one of these streams was not included in the calculation of the BPT allowance because it is much larger than the other one and is not believed to be typical of current best practice. The BPT discharge allowance, based on the other reported value, is 1,480 l/kkg (355 gal/ton).

Surface Treatment Wet Air Pollution Control. One plant reported using a wet scrubber to control air pollution from its surface treatment operations. The BPT discharge allowance, based on the one reported value, is 74.2 l/kkg (17.8 gal/ton).

Sawing/Grinding

Sawing/Grinding Spent Emulsions. One plant reported using lubricating emulsions in two sawing/grinding operations. However, water usage and discharge data were reported for only one of the operations. The BPT discharge allowance, based on the one reported value, is 3.10 l/kkg (0.744 gal/ton).

Post Sawing/Grinding Rinsewater. One plant reported using a stagnant bath to rinse uranium pieces after they are sawed or ground. The bath is batch dumped on a weekly basis. The BPT discharge allowance, based on the one reported value, is 38.1 l/kkg (9.12 gal/ton).

Degreasing

Only a small number of surveyed plants with solvent degreasing operations have process wastewater streams associated with the operation. These facilities may use a water rinse after solvent degreasing, or discharge solvent recovery sludge to the facility's oil treatment system. Because most plants practice solvent degreasing without wastewater discharge, the Agency believes zero discharge of wastewater is an appropriate discharge limitation.

Calculation of BPT Effluent Mass Limitations

The pollutants regulated in the uranium forming subcategory are cadmium, copper, nickel, fluoride, radium, uranium, oil and grease, TSS, and pH. The BPT mass limitations for these pollutants are listed in Section II, Part 2, Subpart H. These limitations were calculated by multiplying the BPT normalized flow (l/kkg, summarized in Table IX-22) by the one-day maximum and 10-day average effluent concentration (mg/l) for each pollutant achievable using the BPT treatment system (Table VII-9). The 10-day average is used to calculate the maximum monthly average

because, as discussed in Section VII, it provides a reasonable basis for a monthly avergage and is typical of the sampling frequency required by discharge permits.

Benefits

In establishing BPT, EPA must consider the cost of treatment and control in relation to the incremental increase in mass of pollutants removed from wastewater (benefits). The application of BPT to direct dischargers will remove approximately 1,655.0 kg/yr (3,648.7 lb/yr) of pollutants from estimated current discharge levels. The corresponding capital and annual costs (1982 dollars) for this removal are $287,900 and $148,400 per year, respectively. The Agency concludes that these pollutant removals justify the costs incurred by plants in the uranium forming subcategory.

APPLICATION OF REGULATIONS IN PERMITS

The purpose of these limitations (and standards) is to form a uniform basis for regulating wastewater effluent from the nonferrous metals forming category. For direct dischargers, this is accomplished through NPDES permits. Since the nonferrous metals forming category is regulated on an individual waste stream "building-block" approach, three examples of applying these limitations to determine the allowable discharge from nonferrous metals forming facilities are included.

Some process wastewater streams may not be covered by this regulation or other effluent guidelines but are generated in the nonferrous metals forming plant and must be dealt with either in the permit or pretreatment context. Whenever such wastewaters are encountered, the permit writer or control authority should take into account the minimum necessary water use for the process operation and the treatment effectiveness of the model technology using these factors to derive a mass discharge amount for the unregulated process wastewater.

Example 1

Plant X forms tantalum strip by a hot rolling operation which uses an emulsion as a lubricant. The plant produces 20 kkg (44,000 lbs) of final product strip per day. In the process, a stock billet is heated and put through the rolling mill for five passes, then annealed (dry annealing), brought back to the rolling mill for three more passes, annealed again, rolled for four more passes, and annealed for a final time to produce the product. Table IX-23 illustrates the calculation of the allowable BPT discharge for nickel, one of the pollutants regulated in this subcategory. The allowable discharge for the other regulated pollutants would be calculated in the same way.

This example illustrates the calculation of an allowable pollutant mass discharge using "off-kilograms". The term "off-kilogram" means the mass of metal or metal alloy removed from a forming operation at the end of a process cycle for transfer to a different machine or process. In this example, each of the passes through the rolling mill would not be counted as separate "off-kilograms" since the product is not transferred to a different machine or process after each pass. However, each of the three sets of passes would be counted as separate "off-kilograms" since the product is transferred to an annealing process after each set of passes and would require additional lubricant when brought back to the rolling mill. Therefore, for this plant, the off-kilograms to produce 20 kkg of final product is 60 kkg. This is the daily production used in the calculations presented in Table IX-23.

Example 2

Plant Y forms lead bullets by an extrusion and swaging process and casts lead shot. The plant operates 250 days per year with a total annual production of 250 kkg (551,000 lbs) of shot and 1,000 kkg (2,204,000 lbs) of bullets. Shot is produced by casting. Bullets are produced by casting lead into ingots (stationary casting), extrusion followed by a spray quench at the press, and swaging. The bullets are washed and rinsed before being assembled into cartridges. Table IX-24 illustrates the calculation of the allowable BPT discharge of TSS.

The daily shot casting production is 250 kkg/yr divided by 250 days/yr or 1 kkg/day. This production is multiplied by the shot casting limitation (mg/kkg) to get the daily discharge limit for shot casting at Plant Y. The daily bullet production is 1,000 kkg/yr divided by 250 days/yr or 4 kkg/day. This production is multiplied by the limitations (mg/kkg) for extrusion press heat treatment contact cooling water, extrusion press hydraulic fluid leakage, alkaline cleaning spent baths and rinsewater, and swaging spent emulsions to get the daily discharge limits for bullet making. The total plant production (5 kkg/day) is multiplied by the limitation for miscellaneous nondescript wastewater sources to get the daily limit for miscellaneous sources. The sum of the daily limits for the individual operations becomes the plant limit.

Example 3

Plant Z forges 125 kkg (275,000 lbs) of nickel and 25 kkg (55,000 lbs) of titanium per year (250 days). Eighty percent of the nickel and 10 percent of the titanium are pickled, then rinsed with a spray. The plant has one mechanical forge and uses contact cooling water on the dies. The one forge and one pickle bath are

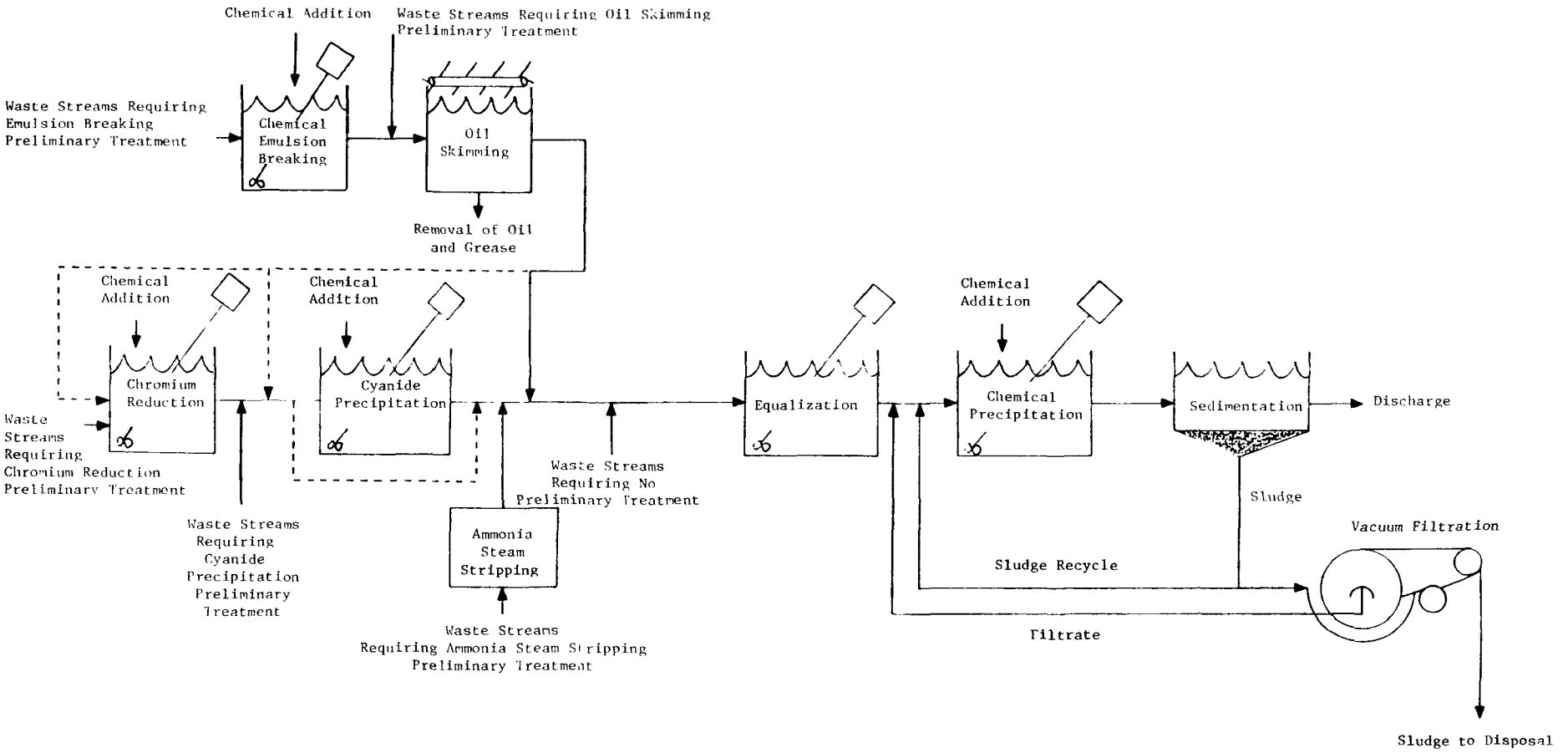
used for both nickel and titanium products. Air emissions from the pickling area are controlled by a wet scrubber. Table IX-25 illustrates the calculation of the allowable BPT discharge for nickel. Table IX-26 illustrates the calculation of the allowable BPT discharge for TSS.

The daily nickel forging production is 125 kkg/yr divided by 250 days/yr or 0.5 kkg/day. This production is multiplied by the nickel forging die contact cooling water limitation (mg/kkg) to get the daily nickel discharge limit for nickel forging at Plant Z. The plant does not generate any forging equipment cleaning wastewater so it receives no allowance for that waste stream. Eighty percent of forged nickel or 0.4 kkg/day are pickled and rinsed. This production is multiplied by the nickel surface treatment spent bath limitation, the nickel surface treatment rinsewater limitation, and the nickel wet air pollution control blowdown limitation to get the daily nickel discharge limit for nickel surface treatment at Plant Z. The total nickel production (0.5 kkg/day) is multiplied by the limitation for miscellaneous nondescript wastewater sources to get the daily nickel discharge limit for miscellaneous sources. There is no nickel limit for any of the waste streams generated by titanium forming and associated operations. Therefore, the daily nickel discharge limit for all titanium forming operations is zero.

The calculation of the allowable BPT discharge for TSS, shown in Table IX-26, is similar. However, there is a TSS limit for wastewater generated by titanium forming operations, so nickel and titanium operations contribute to the daily TSS discharge limit.

The same physical water may be used to process metal in more than one subcategory. For example, one bath can be used to pickle both nickel and titanium. Because the discharge limits are based on mass of production, the plant is allowed to discharge 35,000 mg of TSS for every kkg of nickel pickled in the bath and 6,600 mg of TSS for every kkg of titanium pickled in the bath.

Note, there is no allowance for miscellaneous nondescript wastewater sources in the titanium forming subcategory. For this reason, only the nickel production was used to calculate the daily TSS discharge limit for miscellaneous sources.



NOTE: Waste streams which may require specific preliminary treatment are listed in Table IX-1.

Figure IX-1

BPT TREATMENT TRAIN FOR THE NONFERROUS METALS FORMING CATEGORY

Table IX-1

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
LEAD/TIN/BISMUTH FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Rolling	Spent Emulsions	Chemical Emulsion Breaking
	Spent Soap Solutions	None
Drawing	Spent Emulsions	Chemical Emulsion Breaking
	Spent Soap Solutions	None
Extrusion	Press and Solution Heat Treatment Contact Cooling Water	None
	Press Hydraulic Fluid Leakage	Chemical Emulsion Breaking
Casting		
Continuous Strip Casting	Contact Cooling Water	None
Semi-Continuous Ingot Casting	Contact Cooling Water	None
Shot Casting	Contact Cooling Water	Oil Skimming
Shot Forming	Wet Air Pollution Control Blowdown	None
Alkaline Cleaning	Spent Bath	Oil Skimming
	Rinsewater	None
Swaging	Spent Emulsions	Chemical Emulsion Breaking
Miscellaneous Nondescript Wastewater Sources	Various	None

Table IX-2

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Rolling	Spent Emulsions	Chemical Emulsion Breaking
	Contact Lubricant-Coolant Water	Oil Skimming
	Solution Heat Treatment Contact Cooling Water	None
Drawing	Spent Emulsions	Chemical Emulsion Breaking
Extrusion	Press and Solution Heat Treatment Contact Cooling Water	None
Forging, Extrusion Isostatic Press	Hydraulic Fluid Leakage	Chemical Emulsion Breaking
Forging	Equipment Cleaning Wastewater	Oil Skimming
	Die Contact Cooling Water	None
Stationary Casting, Direct Chill Casting	Contact Cooling Water	Oil Skimming
Casting	Vacuum Melting Steam Condensate	None
Metal Powder Production	Atomization Wastewater	None
Annealing Solution Heat Treatment	Contact Cooling Water	None
Wet Air Pollution Control	Blowdown	Chromium Reduction

Table IX-2 (Continued)

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Surface Treatment	Spent Baths	Chromium Reduction
	Rinsewater	Oil Skimming, Chromium Reduction
Alkaline Cleaning	Spent Baths	Chromium Reduction, Oil Skimming
	Rinsewater	Oil Skimming
Molten Salt	Rinsewater	Chromium Reduction
Ammonia Rinse	Wastewater	None
Sawing, Grinding	Spent Lubricants	Chemical Emulsion Breaking, Chromium Reduction
Steam Cleaning	Condensate	Oil Skimming
Hydrostatic Tube Testing	Wastewater	Oil Skimming
Miscellaneous Non-descript Wastewater Sources	Various	None

Table IX-3

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
ZINC FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Rolling	Spent Emulsions	Chemical Emulsion Breaking
	Contact Lubricant-Coolant Water	Oil Skimming
Drawing	Spent Emulsions	Chemical Emulsion Breaking, Cyanide Precipitation
Casting		
Direct Chill Casting	Contact Cooling Water	Oil Skimming
Heat Treatment	Contact Cooling Water	None
Surface Treatment	Spent Baths	Chromium Reduction
	Rinsewater	Chromium Reduction
Alkaline Cleaning	Spent Baths	Oil Skimming, Cyanide Precipitation
	Rinsewater	Oil Skimming, Cyanide Precipitation
Sawing/Grinding	Spent Lubricants	Chemical Emulsion Breaking, Cyanide Precipitation

Table IX-4

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
BERYLLIUM FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Area Cleaning	Wastewater	Oil Skimming
Billet Washing	Wastewater	Cyanide Precipitation
Surface Treatment	Spent Baths	None
	Rinsewater	None
Sawing, Grinding	Spent Lubricants	Cyanide Precipitation

Table IX-5

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
PRECIOUS METALS FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Rolling	Spent Emulsions	Chemical Emulson Breaking
	Solution Heat Treatment Contact Cooling Water	None
Drawing	Spent Emulsions	Chemical Emulsion Breaking
	Spent Soap Solutions	None
Extrusion	Press and Solution Heat Treatment Contact Cooling Water	None
Casting		
Semi-Continuous, Continuous Casting	Contact Cooling Water	None
Stationary Casting	Contact Cooling Water	None
Direct Chill Casting	Contact Cooling Water	Oil Skimming
Shot Casting	Contact Cooling Water	Oil Skimming
Wet Air Pollution Control	Blowdown	None
Metal Powder Production	Atomization Wastewater	None
	Ball Milling Wastewater	None
Pressure Bonding	Contact Cooling Water	Oil Skimming

Table IX-5 (Continued)

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
PRECIOUS METALS FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Annealing Solution Heat Treatment	Contact Cooling Water	None
Surface Treatment	Spent Baths	Oil Skimming
	Rinsewater	Oil Skimming
Alkaline Cleaning	Spent Baths	Oil Skimming
	Rinsewater	Oil Skimming
	Prebonding Cleaning Wastewater	Oil Skimming
Tumbling	Wastewater	Cyanide Precipitation
Burnishing	Wastewater	Cyanide Precipitation
Sawing/Grinding	Spent Emulsions	Chemical Emulsion Breaking

Table IX-6

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND
POWDER METALLURGY SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Metal Powder Production	Atomization Wastewater	None
	Milling Wastewater	None
	Wet Air Pollution Control Blowdown	None
Oil-Resin Impregnation	Wastewater	Oil Skimming
Steam Treatment	Wet Air Pollution Control Blowdown	None
Tumbling, Burnishing, Cleaning	Wastewater	Cyanide Precipitation, Oil Skimming
Sawing, Grinding	Spent Lubricants	Chemical Emulsion Breaking

Table IX-7

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
TITANIUM FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Rolling		
Cold Rolling Hot Rolling	Spent Lubricants Contact Lubricant-Coolant Water	Chemical Emulsion Breaking Oil Skimming
Extrusion	Spent Lubricants	Chemical Emulsion Breaking
Forging	Die Contact Cooling Water Wet Air Pollution Control Blowdown	None None
Heat Treatment	Contact Cooling Water	None
Surface Treatment	Spent Baths	Ammonia Steam Stripping, Chromium Reduction
	Rinsewater	Ammonia Steam Stripping, Chromium Reduction
	Wet Air Pollution Control Blowdown	Ammonia Steam Stripping
Alkaline Cleaning	Spent Baths Rinsewater	Oil Skimming Oil Skimming
Tumbling	Wastewater	Cyanide Precipitation
Grinding, Sawing	Spent Lubricants	Cyanide Precipitation

Table IX-8

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Rolling	Spent Emulsions	Chemical Emulsion Breaking
Extrusion	Press and Solution Heat Treatment Contact Cooling Water	None
	Press Hydraulic Fluid Leakage	Chemical Emulsion Breaking
Forging	Solution Heat Treatment Contact Cooling Water	None
Extrusion, Forging	Equipment Cleaning Wastewater	Oil Skimming
Metal Powder Production	Wastewater	None
	Wet Air Pollution Control Blowdown	None
Casting	Post-Casting Billet Wastewater	Oil Skimming
Surface Treatment	Spent Baths	Chromium Reduction
	Rinsewater	Chromium Reduction
	Wet Air Pollution Control Blowdown	None
Surface Coating	Wet Air Pollution Control Blowdown	None
Alkaline Cleaning	Spent Baths	Oil Skimming
	Rinsewater	Oil Skimming

Table IX-8 (Continued)

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Molten Salt Cleaning	Rinsewater	Chromium Reduction
Tumbling, Burnishing	Wastewater	Chromium Reduction
Sawing, Grinding	Spent Emulsions	Chemical Emulsion Breaking
	Contact Lubricant-Coolant Water	Oil Skimming
	Wet Air Pollution Control Blowdown	None
	Post-Sawing, Grinding Rinsewater	Oil Skimming
Product Testing	Wastewater	Oil Skimming

Table IX-9

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Extrusion	Spent Emulsions	Chemical Emulsion Breaking
	Press Hydraulic Fluid Leakage	Chemical Emulsion Breaking, Oil Skimming
	Press and Solution Heat Treatment Contact Cooling Water	None
Forging	Solution Heat Treatment Contact Cooling Water	None
Sawing, Grinding	Spent Lubricants	Chemical Emulsion Breaking
Surface Treatment	Spent Baths	Ammonia Steam Stripping, Cyanide Precitation, Oil Skimming
	Rinsewater	Ammonia Steam Stripping, Cyanide Precipitation
Alkaline Cleaning	Spent Baths	Oil Skimming
	Rinsewater	Oil Skimming
Degreasing	Rinsewater	Oil Skimming

Table IX-10

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
MAGNESIUM FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Forging	Wet Air Pollution Control Blowdown	None
	Solution Heat Treatment Contact Cooling Water	None
	Equipment Cleaning Wastewater	Oil Skimming
Surface Treatment	Spent Baths	Chromium Reduction, Ammonia Steam Stripping
	Rinsewater	Chromium Reduction, Ammonia Steam Stripping
Sanding, Repairing	Wet Air Pollution Control Blowdown	None

Table IX-11

POTENTIAL PRELIMINARY TREATMENT REQUIREMENTS
URANIUM FORMING SUBCATEGORY

Operation	Waste Stream	Possible Required Preliminary Treatments
Extrusion	Tool Contact Cooling Water	Oil Skimming
	Press and Solution Heat Treatment Contact Cooling Water	None
Forging	Solution Heat Treatment Contact Cooling Water	None
Surface Treatment	Spent Baths	None
	Rinsewater	None
	Wet Air Pollution Control Blowdown	None
Sawing, Grinding	Spent Emulsions	Chemical Emulsion Breaking
	Post-Sawing, Grinding Rinsewater	Oil Skimming

Table IX-12

PRODUCTION OPERATIONS - LEAD/TIN/BISMUTH FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge l/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent emulsions	23.3	5.60	Mass of lead/tin/bismuth rolled with emulsions
	Spent soap solutions	43.0	10.3	Mass of lead/tin/bismuth rolled with soap solutions
Drawing	Spent neat oils	0	0	
	Spent emulsions	16.7	4.00	Mass of lead/tin/bismuth drawn with emulsions
	Spent soap solutions	7.46	1.79	Mass of lead/tin/bismuth drawn with soap solutions
Extrusion	Press and solution heat treatment contact cooling water	1,750	419	Mass of extruded lead/tin/bismuth heat treated
	Press hydraulic fluid leakage	49.3	11.8	Mass of lead/tin/bismuth extruded
Casting				
Continuous Strip Casting	Contact cooling water	1.00	0.240	Mass of lead/tin/bismuth cast by the continuous strip method
Semi-Continuous Ingot Casting	Contact cooling water	29.4	7.04	Mass of lead/tin/bismuth cast by the semi-continuous method
Shot Casting	Contact cooling water	42.0	10.1	Mass of lead/tin/bismuth shot cast
Shot Forming	Wet air pollution control blowdown	0.086	0.021	Mass of lead/tin/bismuth shot formed
Alkaline Cleaning	Spent baths	606	145	Mass of lead/tin/bismuth alkaline cleaned
	Rinsewater	6,460	1,550	Mass of lead/tin/bismuth alkaline cleaned
Swaging	Spent emulsions	1.77	0.424	Mass of lead/tin/bismuth swaged with emulsions

Table IX-12

PRODUCTION OPERATIONS - LEAD/TIN/BISMUTH FORMING SUBCATEGORY
(Continued)

Operation	Waste Stream	Normalized BPT Discharge		Production Normalizing Parameter
		l/kkg	gal/ton	
Degreasing	Spent solvent	0	0	
Miscellaneous Nondescript Wastewater Sources	Various	58.4	14.0	Mass of lead/tin/bismuth formed

Table IX-13

PRODUCTION OPERATIONS - NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge l/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent neat oils	0	0	
	Spent emulsions	1,490	357	Mass of nickel/cobalt rolled with emulsions
	Contact lubricant-coolant water	13,400	3,210	Mass nickel/cobalt of rolled with contact-lubricant water
	Solution heat treatment contact cooling water	0.271	0.065	Mass of rolled nickel/cobalt heat treated
Tube Reducing	Spent lubricants	0	0	
Drawing	Spent neat oils	0	0	
	Spent emulsions	95.4	22.9	Mass of nickel/cobalt drawn with emulsions
Extrusion	Spent lubricants	0	0	
	Press and solution heat treatment contact cooling water	83.2	20.0	Mass of extruded nickel/cobalt heat treated
Forging, Extrusion, and Isostatic Press	Hydraulic fluid leakage	124	29.7	Mass of nickel/cobalt forged, extruded, or pressed
Forging	Equipment cleaning wastewater	1,630	390	Mass of nickel/cobalt forged
	Die contact cooling water	1,260	302	Mass of nickel/cobalt forged
Forging, Swaging	Spent neat oils	0	0	
Stationary Casting, Direct Chill Casting	Contact cooling water	17,800	4,280	Mass of nickel/cobalt cast by the stationary or direct chill method

Table IX-13 (Continued)

PRODUCTION OPERATIONS - NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Casting	Vacuum melting steam condensate	168	40.4	Mass of nickel/cobalt vacuum melted
Metal Powder Production	Atomization wastewater	2,840	680	Mass of nickel/cobalt metal powder atomized
Annealing Solution Heat Treatment	Contact cooling water	4,570	1,100	Mass of nickel/cobalt annealed
Wet Air Pollution Control	Blowdown	251	60.2	Mass of nickel/cobalt formed
Surface Treatment	Spent baths	861	206	Mass of nickel/cobalt surface treated
	Rinsewater	10,600	2,534	Mass of nickel/cobalt surface treated
Alkaline Cleaning	Spent baths	30.6	7.34	Mass of nickel/cobalt alkaline cleaned
	Rinsewater	4,970	1,190	Mass of nickel/cobalt alkaline cleaned
Molten Salt	Rinsewater	1,280	307	Mass of nickel/cobalt treated with molten salt
Ammonia Rinse	Wastewater	15.7	3.77	Mass of nickel/cobalt treated with ammonia solution
Sawing, Grinding	Spent lubricants	1,000	240	Mass of nickel/cobalt sawed or ground

Table IX-13 (Continued)

PRODUCTION OPERATIONS - NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Steam Cleaning	Condensate	23.2	5.56	Mass of nickel/cobalt steam cleaned
Hydrostatic Tube Testing	Wastewater	1,350	324	Mass of nickel/cobalt tube tested by the hydrostatic method
Degreasing	Spent solvent	0	0	
Miscellaneous Nondescript Wastewater Sources	Various	58.4	14.0	Mass of nickel/cobalt formed

Table IX-14

PRODUCTION OPERATIONS - ZINC FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent neat oils	0	0	
	Spent emulsions	1.39	0.334	Mass of zinc rolled with emulsions
	Contact lubricant-coolant water	347	83.2	Mass of zinc rolled with contact lubricant-coolant water
Drawing	Spent emulsions	8.01	1.92	Mass of zinc drawn with emulsions
Casting				
Direct Chill Casting	Contact cooling water	503	121	Mass of zinc cast by the direct chill method
Stationary Casting	Contact cooling water	0	0	
Heat Treatment	Contact cooling water	761	183	Mass of zinc heat treated
Surface Treatment	Spent baths	9.50	2.28	Mass of zinc surface treated
	Rinsewater	4,860	1,170	Mass of zinc surface treated
Alkaline Cleaning	Spent baths	0.715	0.171	Mass of zinc alkaline cleaned
	Rinsewater	5,720	1,370	Mass of zinc alkaline cleaned
Sawing/Grinding	Spent lubricants	54.9	13.2	Mass of zinc sawed or ground
Degreasing	Spent solvent	0	0	

Table IX-15

PRODUCTION OPERATIONS - BERYLLIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Area Cleaning	Wastewater	21,300	5,110	Mass of beryllium formed
Billet Washing	Wastewater	38.2	9.17	Mass of beryllium billets washed
Surface Treatment	Spent baths	2,670	640	Mass of beryllium surface treated
	Rinsewater	7,670	1,840	Mass of beryllium surface treated
Sawing, Grinding	Spent lubricants	424	102	Mass of beryllium sawed or ground
Inspection, Testing	Wastewater	0	0	
Degreasing	Spent solvent	0	0	

Table IX-16

PRODUCTION OPERATIONS - PRECIOUS METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent emulsions	360	86.0	Mass of precious metals rolled with emulsions
	Solution heat treatment contact cooling water	7,000	1,680	Mass of rolled precious metals heat treated
Drawing	Spent neat oils	0	0	
	Spent emulsions	213	51.0	Mass of precious metals drawn with emulsions
	Spent soap solutions	6.93	1.66	Mass of precious metals drawn with soap solutions
Extrusion	Press and solution heat contreatment contact cooling water	13,700	3,290	Mass of extruded precious metals heat treated
Casting				
Semi-Continuous, Continuous Casting	Contact cooling water	11,200	2,680	Mass of precious metals cast by the semi-continuous or continuous method
Stationary Casting	Contact cooling water	4.17	1.00	Mass of precious metals cast by the stationary method
Direct Chill Casting	Contact cooling water	818	196	Mass of precious metals cast by the direct chill method
Shot Casting	Contact cooling water	892	214	Mass of precious metals shot cast
Wet Air Pollution Control	Blowdown	58.6	14.0	Mass of precious metals cast
Metal Powder Production	Atomization wastewater	6,670	1,600	Mass of precious metals powder wet atomized
	Ball Milling Wastewater	21,700	5,200	Mass of precious metals powder wet ball milled

Table IX-16 (Continued)

PRODUCTION OPERATIONS - PRECIOUS METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Pressure Bonding	Contact cooling water	83.5	20	Mass of precious metal and base metal pressure bonded
Annealing Solution Heat Treatment	Contact cooling water	10,000	2,400	Mass of precious metals annealed
Surface Treatment	Spent baths	155	37.2	Mass of precious metals surface treated
	Rinsewater	2,840	681	Mass of precious metals surface treated
Alkaline Cleaning	Spent baths	3.67	0.88	Mass of precious metals alkaline cleaned
	Rinsewater	6,920	1,660	Mass of precious metals alkaline cleaned
	Prebonding cleaning wastewater	3,400	817	Mass of precious metal and base metal cleaned prior to bonding
Tumbling	Wastewater	1,150	277	Mass of precious metals tumbled
Burnishing	Wastewater	25,700	6,170	Mass of precious metals burnished
Sawing/Grinding	Spent emulsions	6.05	1.45	Mass of precious metals sawed or ground
Degreasing	Spent solvent	0	0	

Table IX-17

PRODUCTION OPERATIONS - IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Metal Powder Production	Wet atomization wastewater	5,040	1,210	Mass of iron, copper, and aluminum powder wet atomized
	Milling wastewater	1,670	400	Mass of iron, copper, and aluminum powder milled
	Wet air pollution control blowdown	2,640	632	Mass of iron, copper, and aluminum powder produced
Sizing/Repressing	Spent lubricants	0	0	
Oil-Resin Impregnation	Wastewater	74.5	17.9	Mass of iron, copper, and aluminum powder metallurgy parts impregnated with oil-resin
Steam Treatment	Wet air pollution control blowdown	2,840	681	Mass of iron, copper, and aluminum powder metallurgy parts steam treated
Tumbling, Burnishing, Cleaning	Wastewater	7,150	1,710	Mass of iron, copper, and aluminum powder metallurgy parts tumbled, burnished, or cleaned
Sawing, Grinding	Spent lubricants	1,000	240	Mass of iron, copper, and aluminum powder metallurgy parts sawed or ground
Degreasing	Spent solvent	0	0	

Table IX-18

PRODUCTION OPERATIONS - TITANIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge l/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Rolling				
Cold Rolling	Spent lubricants	3,340	800	Mass of titanium cold rolled
Hot Rolling	Contact lubricant-coolant water	4,300	1,030	Mass of titanium hot rolled with contact lubricant-coolant water
Extrusion	Spent lubricants	274	65.7	Mass of titanium extruded
Forging	Spent lubricants	0	0	
	Die contact cooling water	3,000	721	Mass of titanium forged
	Wet air pollution control blowdown	2,020	485	Mass of titanium forged
Heat Treatment	Contact cooling water	4,510	1,080	Mass of titanium heat treated
Surface Treatment	Spent baths	160	38.5	Mass of titanium surface treated
	Rinsewater	21,100	5,050	Mass of titanium surface treated
	Wet air pollution control blowdown	170	40.8	Mass of titanium surface treated
Alkaline Cleaning	Spent baths	2,550	612	Mass of titanium alkaline cleaned
	Rinsewater	2,760	663	Mass of titanium alkaline cleaned
Tumbling	Wastewater	790	189	Mass of titanium tumbled
Grinding, Sawing	Spent lubricants	49.7	11.9	Mass of titanium sawed or ground
Degreasing	Spent solvent	0	0	

Table IX-19

PRODUCTION OPERATIONS - REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent neat oils	0	0	
	Spent emulsions	1,200	288	Mass of refractory metals rolled with emulsions
Drawing	Spent lubricants	0	0	
Extrusion	Press and solution heat treatment contact cooling water	3,460	830	Mass of extruded refractory metals heat treated
	Press hydraulic fluid leakage	1,190	285	Mass of refractory metals extruded
Forging	Spent lubricants	0	0	
	Solution heat treatment contact cooling water	5,790	1,390	Mass of forged refractory metals heat treated
Extrusion, Forging	Equipment cleaning wastewater	417	100	Mass of refractory metals extruded, forged
Metal Powder Production	Wastewater	1,640	393	Mass of refractory metals powder produced
	Wet air pollution control blowdown	0	0	
Metal Powder Pressing	Spent lubricants	0	0	
Casting	Contact cooling water	0	0	
	Post-casting billet washwater	29.8	7.14	Mass of cast refractory metals billets washed

Table IX-19 (Continued)

PRODUCTION OPERATIONS - REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge 1/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Surface Treatment	Spent baths	12.7	3.04	Mass of refractory metals surface treated
	Rinsewater	121,000	29,100	Mass of refractory metals surface treated
	Wet air pollution control blowdown	11,800	2,840	Mass of refractory metals surface treated
Surface Coating	Wet air pollution control blowdown	1,080	258	Mass of refractory metals surface coated
Alkaline Cleaning	Spent baths	30.6	7.34	Mass of refractory metals alkaline cleaned
	Rinsewater	140,000	33,500	Mass of refractory metals alkaline cleaned
Molten Salt Cleaning	Rinsewater	90,200	21,600	Mass of refractory metals cleaned with molten salt
Tumbling, Burnishing	Wastewater	22,100	5,300	Mass of refractory metals tumbled or burnished

Table IX-19 (Continued)

PRODUCTION OPERATIONS - REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge l/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Sawing, Grinding	Spent neat oils	0	0	
	Spent emulsions	217	52.1	Mass of refractory metals sawed, ground with emulsions
	Contact lubricant-coolant water	812	195	Mass of refractory metals sawed or ground with contact lubricant-coolant water
	Wet air pollution control blowdown	1,080	258	Mass of refractory metals sawed or ground
	Post-sawing, grinding rinsewater	513	123	Mass of sawed, ground refractory metals rinsed
Product Testing	Wastewater	77.6	18.6	Mass of refractory metals product tested
Degreasing	Spent solvent	0	0	

Table IX-20

PRODUCTION OPERATIONS - ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge l/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Drawing	Spent lubricants	0	0	
Extrusion	Spent emulsions	74.1	17.8	Mass of zirconium/hafnium extruded with emulsions
	Press hydraulic fluid leakage	370	88.8	Mass of zirconium/hafnium extruded
	Press and solution heat treatment contact cooling water	285	68.4	Mass of extruded zirconium/hafnium heat treated
Tube Reducing	Spent lubricants	0	0	
Forging	Solution heat treatment contact cooling water	34.9	8.36	Mass of forged zironcium/hafnium heat treated
Surface Treatment	Spent baths	399	95.8	Mass of zirconium/hafnium surface treated
	Rinsewater	15,300	3,680	Mass of zirconium/hafnium surface treated
Alkaline Cleaning	Spent baths	2,130	511	Mass of zirconium/hafnium alkaline cleaned
	Rinsewater	55,300	13,300	Mass of zirconium/hafnium alkaline cleaned
Sawing, Grinding	Spent lubricants	9.01	2.16	Mass of zirconium/hafnium sawed or ground
	Wet air pollution control blowdown	0	0	
Degreasing	Spent solvents	0	0	
	Rinsewater	2,030	486	Mass of zirconium/hafnium degreased

Table IX-21

PRODUCTION OPERATIONS - MAGNESIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge l/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent emulsions	0	0	
	Spent lubricants	0	0	
	Wet air pollution control blowdown	266,000	63,800	Mass of magnesium forged
	Solution heat treatment contact cooling water	6,330	1,520	Mass of forged magnesium heat treated
	Equipment cleaning wastewater	1,620	388	Mass of magnesium forged
Direct Chill Casting	Contact cooling water	0	0	
Surface Treatment	Spent baths	465	111	Mass of magnesium surface treated
	Rinsewater	17,700	4,250	Mass of magnesium surface treated
Sawing, Grinding	Spent lubricants	0	0	
Sanding, Repairing	Wet air pollution control blowdown	428	103	Mass of magnesium sanded, repaired
Degreasing	Spent solvent	0	0	

Table IX-22

PRODUCTION OPERATIONS - URANIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BPT Discharge l/kkg	Normalized BPT Discharge gal/ton	Production Normalizing Parameter
Extrusion	Spent lubricants	0	0	
	Tool contact cooling water	517	124	Mass of uranium extruded
	Press and solution heat treatment contact cooling water	2,720	653	Mass of extruded uranium heat treated
Forging	Spent lubricants	0	0	
	Solution heat treatment contact cooling water	2,840	682	Mass of forged uranium heat treated
Surface Treatment	Spent baths	35.6	8.52	Mass of uranium surface treated
	Rinsewater	1,480	355	Mass of uranium surface treated
	Wet air pollution control blowdown	74.2	17.8	Mass of uranium surface treated
Sawing, Grinding	Spent emulsions	3.10	0.744	Mass of uranium sawed or ground
	Post-sawing, grinding rinsewater	38.1	9.12	Mass of sawed or ground uranium rinsed
Degreasing	Spent solvent	0	0	

Table IX-23

ALLOWABLE DISCHARGE CALCULATIONS FOR REFRACTORY METALS
FORMING PLANT X IN EXAMPLE 1

Waste Stream	Average Daily Production (kkg/day)	BPT Regulatory One-Day Maximum Ni Discharge (mg/kkg)*	BPT Regulatory Monthly Average Ni Discharge (mg/kkg)*	BPT Allowable One-Day Maximum Ni Discharge (mg/day)	BPT Allowable Monthly Average Ni Discharge (mg/day)
Rolling Spent Emulsions	60	2,300	1,500	138,000	90,000
TOTAL				138,000** or 0.14 kg/day (0.31 lbs/day)	90,000** or 0.09 kg/day (0.20 lbs/day)

*These values are taken from Section II, Part 2, Subpart F (Refractory Metals Forming Subcategory).

**Allowable discharge concentrations (mg/l) can be calculated by dividing these values by the plant's daily process water discharge (liters).

Table IX-24

ALLOWABLE DISCHARGE CALCULATIONS FOR LEAD/TIN/BISMUTH FORMING PLANT Y IN EXAMPLE 2

Waste Stream	Average Daily Production (kkg/day)	BPT Regulatory One-Day Maximum TSS Discharge (mg/kkg)*	BPT Regulatory Monthly Average TSS Discharge (mg/kkg)*	BPT Allowable One-Day Maximum TSS Discharge (mg/day)	BPT Allowable Monthly Average TSS Discharge (mg/day)
Extrusion Press and Solution Heat Treatment Contact Cooling Water	4.0	72,000	34,000	288,000	136,000
Extrusion Press Hydraulic Fluid Leakage	4.0	2,000	960	8,000	3,840
Shot Casting Contact Cooling Water	1.0	1,700	820	1,700	820
Alkaline Cleaning Spent Bath	4.0	25,000	12,000	100,000	48,000
Alkaline Cleaning Rinsewater	4.0	260,000	130,000	1,040,000	520,000
Swaging Spent Emulsions	4.0	73	35	292	140
Miscellaneous Nondescript Wastewater Sources	5.0	2,400	1,100	12,000	5,500
TOTAL				1,449,992** or 1.45 kg/day (3.20 lbs/day)	714,300** or 0.71 kg/day (1.57 lbs/day)

*These values are taken from Section II, Part 2, Subpart B (Lead/Tin/Bismuth Forming Subcategory).

**Allowable discharge concentrations (mg/l) can be calculated by dividing these values by the plant's daily process water discharge (gal).

Table IX-25

ALLOWABLE DISCHARGE CALCULATIONS FOR NICKEL/COBALT AND TITANIUM FORMING PLANT Z IN EXAMPLE 3 (NICKEL)

Waste Stream	Average Daily Production (kkg/day)	BPT Regulatory One-Day Maximum Ni Discharge (mg/kkg)*	BPT Regulatory Monthly Average Ni Discharge (mg/kkg)*	BPT Allowable One-Day Maximum Ni Discharge (mg/day)	BPT Allowable Monthly Average Ni Discharge (mg/day)
Nickel Forging Die Contact Cooling Water	0.5	2,400	1,600	1,200	800
Nickel Surface Treatment Spent Bath	0.4	1,700	1,100	680	440
Nickel Surface Treatment Rinse-water	0.4	20,000	13,000	8,000	5,200
Nickel Wet Air Pollution Control Blowdown	0.4	480	320	192	128
Nickel Miscellaneous Nondescript Wastewater Sources	0.5	110	74	55	37
Titanium Forging Die Contact Cooling Water	0.1	0	0	0	0
Titanium Surface Treatment Spent Bath	0.01	0	0	0	0
Titanium Surface Treatment Rinsewater	0.01	0	0	0	0

Table IX-25 (Continued)

ALLOWABLE DISCHARGE CALCULATIONS FOR NICKEL/COBALT AND TITANIUM FORMING PLANT Z IN EXAMPLE 3 (NICKEL)

Waste Stream	Average Daily Production (kkg/day)	BPT Regulatory One-Day Maximum Ni Discharge (mg/kkg)*	BPT Regulatory Monthly Average Ni Discharge (mg/kkg)*	BPT Allowable One-Day Maximum Ni Discharge (mg/day)	BPT Allowable Monthly Average Ni Discharge (mg/day)
Titanium Surface Treatment Wet Air Pollution Control Blowdown	0.01	0	0	0	0
TOTAL				10,127** or 0.01 kg/day (0.02 lbs/day)	6,605** or 0.007 kg/day (0.015 lbs/day)

*These values are taken from Section II, Part 2, Subparts D and G (Nickel/Cobalt Forming and Titanium Forming Subcategories, respectively).

**Allowable discharge concentrations (mg/l) can be calculated by dividing these values by the plant's daily process water discharge (liters).

Table IX-26

ALLOWABLE DISCHARGE CALCULATIONS FOR NICKEL/COBALT AND TITANIUM FORMING PLANT Z IN EXAMPLE 3 (TSS)

Waste Stream	Average Daily Production (kkg/day)	BPT Regulatory One-Day Maximum TSS Discharge (mg/kkg)*	BPT Regulatory Monthly Average TSS Discharge (mg/kkg)*	BPT Allowable One-Day Maximum TSS Discharge (mg/day)	BPT Allowable Monthly Average TSS Discharge (mg/day)
Nickel Forging Die Contact Cooling Water	0.5	52,000	25,000	26,000	12,500
Nickel Surface Treatment Spent Bath	0.4	35,000	17,000	14,000	6,800
Nickel Surface Treatment Rinse-water	0.4	430,000	210,000	172,000	84,000
Nickel Surface Treatment Wet Air Pollution Control Blowdown	0.4	10,000	4,900	4,000	1,960
Nickel Miscellaneous Nondescript Wastewater Sources	0.5	15,000	7,000	7,500	3,500
Titanium Forging Die Contact Cooling Water	0.1	120,000	59,000	12,000	5,900
Titanium Surface Treatment Spent Bath	0.01	6,600	3,100	66	31
Titanium Surface Treatment Rinsewater	0.01	870,000	410,000	8,700	4,100

Table IX-26 (Continued)

ALLOWABLE DISCHARGE CALCULATIONS FOR NICKEL/COBALT AND TITANIUM FORMING PLANT Z IN EXAMPLE 3 (TSS)

Waste Stream	Average Daily Production (kkg/day)	BPT Regulatory One-Day Maximum TSS Discharge (mg/kkg)*	BPT Regulatory Monthly Average TSS Discharge (mg/kkg)*	BPT Allowable One-Day Maximum TSS Discharge (mg/day)	BPT Allowable Monthly Average TSS Discharge (mg/day)
Titanium Surface Treatment Wet Air Pollution Control Blowdown	0.01	7,000	3,300	70	33
TOTAL				244,336** or 0.24 kg/day (0.53 lbs/day)	115,324** or 0.12 kg/day (0.26 lbs/day)

*These values are taken from Section II, Part 2, Subparts D and G (Nickel/Cobalt Forming and Titanium Forming Subcategories, respectively).

**Allowable discharge concentrations (mg/l) can be calculated by dividing these values by the plant's daily process water discharge (liters).

SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

The effluent limitations in this section apply to existing direct dischargers. A direct discharger is a facility which discharges or may discharge pollutants into waters of the United States. These effluent limitations, which must be achieved by July 1, 1984, are based on the best control and treatment technology employed 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 employed for BPT, as well as improvements in reagent control, 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 employed, process changes, nonwater quality environmental impacts (including energy requirements), and the costs of application of such technology. BAT technology represents the best existing economically achievable performance of plants of various ages, sizes, processes, or other characteristics. Those categories whose existing performance is uniformly inadequate may require a transfer of BAT from a different subcategory or category. BAT may include process changes or internal controls, even when these are not common industry practice. This level of technology also considers those plant processes and control and treatment technologies which at pilot plants and other levels have demonstrated both technological performance and economic viability at a level sufficient to justify investigation.

TECHNICAL APPROACH TO BAT

The Agency reviewed and evaluated a wide range of technology options to ensure that the most effective technologies were used as the basis of BAT. To accomplish this, the Agency examined three technology alternatives which could be applied to nonferrous metals forming as BAT options and which would represent substantial progress toward prevention of pollution of the environment above and beyond progress achievable by BPT. 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 reasonableness of costs.

EPA evaluated three levels of BAT for the category at proposal. Option 1 is BPT treatment. Option 2 is BPT treatment plus flow reduction and in-plant controls. Option 3 provides additional levels of treatment. Options 1, 2, and 3 technologies are, in general, equally applicable to all the subcategories of the nonferrous metals forming category. Each treatment produces similar concentrations of pollutants in the the effluent from all subcategories. Mass limitations derived from these options will vary, however, because of the impact of different production normalized wastewater discharge flow allowances.

In summary form, the treatment technologies which were considered for the nonferrous metals forming category are:

Option 1 (Figure X-1):

Lime and settle (chemical precipitation of metals followed by sedimentation), and

pH adjustment; and, where required,

Chemical emulsion breaking,

Oil skimming,

Ammonia steam stripping,

Cyanide removal, and

Hexavalent chromium reduction.

(This option is the technology on which BPT is based).

Option 2 (Figure X-1):

Option 1, plus process wastewater flow reduction by the following methods:

- Heat treatment contact cooling water recycle through cooling towers.
- Air pollution control scrubber liquor recycle.
- Countercurrent cascade rinsing or other water efficient methods applied to alkaline cleaning or surface treatment and other rinses.

Option 3 (Figure X-2):

Option 2, plus multimedia filtration at the end of the Option 2 treatment train.

Option 1

Option 1 is the BPT end-of-pipe treatment technology. This treatment train depicted in Figure X-1 consists of preliminary treatment, when necessary, consisting of emulsion breaking, oil skimming, ammonia steam stripping, cyanide removal, and hexavalent chromium reduction. The effluent from preliminary treatment is combined with other wastewaters for combined treatment by lime and settle.

Option 2

Option 2 builds upon the BPT end-of-pipe treatment technologies by incorporating in-process flow reduction measures. The flow reduction measures eliminate some wastewater streams and concentrate the pollutants in others. Treatment of more concentrated streams allows a greater net removal of pollutants. Additionally, treating a reduced flow reduces costs. Methods for reducing process wastewater generation or discharge include:

Heat Treatment Contact Cooling Water Recycle Through Cooling Towers. The cooling and recycle of heat treatment contact cooling water is practiced by seven plants in this category. The function of heat treatment contact cooling water is to remove heat quickly from the nonferrous metals. Therefore, the principal requirements of the water are that it be cool and not contain dissolved solids at a level that would cause water marks or other surface imperfections. There is sufficient industry experience to assure the success of this technology using cooling towers or heat exchangers. Although five plants have reported that they do not discharge any quench water by reason of continued recycle, some blowdown or periodic cleaning is likely to be needed to prevent a build-up of dissolved and suspended solids.

Scrubber Liquor Recycle. The recycle of scrubber liquor from wet processes controlling air pollution from forming operations is practiced by 11 plants in this category. The scrubber water picks up particulates and fumes from the air. Scrubbers have relatively low water quality requirements for efficient operation, accordingly, recycle of scrubber liquor is appropriate for nonferrous metals forming operations. A blowdown or periodic cleaning is necessary to prevent the buildup of dissolved and suspended solids.

Countercurrent Cascade Rinsing Applied to Cleaning or Etching and Die Cleaning Rinses. Countercurrent cascade rinsing is a mechanism commonly encountered in nonferrous metals processing operations (see Section VII). The cleanest water is used for final rinsing of an item, preceded by rinse stages using water with progressively more contaminants to partially rinse the item.

Fresh make-up water is added to the final rinse, and contaminated rinse water is discharged from the initial rinse stage. The make-up water for all but the final rinse stage is from the following stage.

The countercurrent cascade rinsing process substantially improves efficiencies of water use for rinsing. For example, the use of a two-stage countercurrent cascade rinse can reduce water usage to approximately one-tenth of that needed for a single-stage rinse to achieve the same level of product cleanliness. Similarly, a three-stage countercurrent cascade rinse would reduce water usage to approximately one-thirtieth. Through information supplied by plants in dcps or obtained during sampling visits by the Agency, countercurrent cascade rinsing is known to be practiced at three nonferrous metals forming plants. However, the Agency believes that more than three plants use countercurrent cascade rinsing. Most plants did not provide sufficient information in the dcp to classify the type of rinsing performed in their operations. Nonetheless, there is sufficient industry experience in countercurrent cascade rinsing to assume that a larger number of plants use such rinsing operations. The installation of countercurrent cascade rinsing is applicable to existing nonferrous metals forming plants because surface treatment and alkaline cleaning operations are usually discrete operations and space is generally available for additional rinse tanks following these operations.

Option 3

Option 3, depicted in Figure X-2 builds upon the technical requirements of Option 2 by adding conventional mixed-media filtration after the Option 2 technology treatment train.

The Agency briefly considered a fourth option, filtration without flow reduction. This option would have been equivalent to Option 1 with the addition of conventional mixed-media filtration after the Option 1 technology treatment train. However, flow reduction greatly reduces the size of the wastewater treatment system required, and hence its costs. Simultaneously, the efficiency of the treatment system is increased. For these reasons, the Agency concluded that filtration without flow reduction did not make sense. Also, greater pollutant removals could be achieved by implementing in-process flow reduction prior to end-of-pipe treatments, including multimedia filtration. Furthermore, for waste streams which cannot be flow-reduced this option was equivalent to Option 3.

Estimation of BAT Options Costs and Benefits

The Agency estimated the costs and benefits of the implementation of each of the options described above in order to evaluate their economic achievability. The capital and annual costs of each

option were estimated for each subcategory, as described in detail in Section VIII. Costs were estimated for 140 dischargers by extrapolation of costs for 23 plants generated by the computer model described in Section VIII. The benefits of implementing each treatment option were also estimated for each subcategory, again, based on benefits calculated for 23 plants and extrapolated to the remaining dischargers in the category.

This approach was used because of the limited time between receipt of completed dcp's and the Court Ordered date for proposal of these guidelines and standards. However, the Agency recognizes that this methodology has some drawbacks and intends to evaluate the costs and benefits of the technology options on a plant-by-plant basis before promulgating these guidelines and standards.

The cost estimates for the direct dischargers are presented in Table X-1. All costs are based on March 1982 dollars.

The method of estimating costs has been described in detail in Section VIII. Briefly, cost estimation was accomplished using a computer model which accepts inputs specifying the required treatment system, chemical characteristics of the raw waste streams, flow rates and treatment system entry points of these streams, and operating schedules. The chemical characteristics of the raw waste streams input to the model were based on sampling data obtained during visits to 17 nonferrous forming plants. The model utilizes a computer-aided design of a wastewater treatment system containing modules that are configured to reflect the appropriate equipment at an individual plant. The model designs each treatment module and then executes a costing routine that contains the cost data for each module. The capital and annual costs from the costing routine are combined with capital and annual costs for the other modules to yield the total costs for that regulatory option. The process is repeated for each regulatory option.

Capital and annual cost data for the selected treatment processes were obtained from three sources: (1) equipment manufacturers, (2) literature data, and (3) cost data from existing plants. The major source of equipment costs was contacts with equipment vendors, while the majority of annual cost information was obtained from the literature. Additional cost and design data were obtained from data collection portfolios, when possible.

Each of the 23 costed plants was selected to represent a group of similar plants ("costing group") because the plants assigned to a given costing group were apportioned to the subcategories present in that group based on mass of finished product produced. This apportionment process is described in detail in Section VIII.

An estimate of the total mass of pollutants removed from wastewater (benefits) by each option was also made for each subcategory. The benefits that the treatment options are estimated to achieve for direct dischargers are presented in Tables X-2 through X-14.

The first step in the calculation of the benefit estimates was to estimate the concentration of pollutants in the raw wastewater from each subcategory. This was done with data from the computer model, which generates material balances for water and each pollutant at any point in the system. Concentrations of the pollutants removed by lime and settle (toxic and nonconventional metals, and fluoride) were assumed to be the concentrations generated by the computer model at the influent to the lime and settle module of a costed plant. Computer-generated data from a costed plant generating wastewater from operations in any one subcategory were used to estimate the pollutant concentration for all raw wastewater from that subcategory.

Concentrations of pollutants removed by preliminary treatment (oil and grease, cyanide, and ammonia) were estimated differently. First, the total mass of the pollutant generated by a costed plant was determined. This was done by multiplying the computer-generated pollutant concentration at the influent to the applicable preliminary treatment module by the flow into the module. The total mass of pollutant was then divided by the total volume of treated wastewater at the costed plant to yield the average concentration of the pollutant in the raw wastewater.

The raw waste concentrations (mg/l) for pollutants in each subcategory were multiplied by the raw waste flow (l/yr) for direct dischargers and indirect dischargers in each subcategory. This produced an estimate of the raw mass (kg/yr) of each pollutant generated in each subcategory by discharge status. Thus, to accurately estimate the raw mass (kg/yr) of each pollutant generated in each subcategory, the raw waste flow (l/yr) from each operation present in each subcategory at a given plant must be known. However, in the limited time available between the receipt of the dcp's and the Court Ordered deadline for proposal of these guidelines, it was not always possible to determine what portion of a plant's reported wastewater discharge was attributable to which nonferrous metals forming subcategory. Therefore, estimates of raw waste flow for direct dischargers and indirect dischargers in each subcategory were based on mass of finished product produced in each subcategory. These estimates were made using the same strategy as was used for cost estimation, described in detail in Section VIII, and reiterated below.

Raw waste flows for each subcategory were determined by summing the estimated flows for direct dischargers in a subcategory and the estimated flows for indirect dischargers in that subcategory. These estimates were made using the following procedure:

- First, for a single costing group, the number of pounds of metal formed in each subcategory in each plant in the group was determined. It was also determined if the wastewaters associated with this production were directly or indirectly discharged.

- Second, the total pounds of metal formed in the costing group were calculated.

- Third, for each subcategory present in the costing group, the pounds of metal associated with direct dischargers and the pounds of metal associated with indirect dischargers were calculated.

- Fourth, the total group wastewater flow was calculated by multiplying the wastewater flow of the representative plant by the number of plants in the costing group.

- Fifth, the total group raw waste flow was apportioned to the direct and indirect discharges in each subcategory present in the group by production weighting the total group raw waste flow.

For example:

$$\left[\frac{\text{pounds of Ni, wastewater directly discharged, group n}}{\text{total pounds metal, group n}}\right] \times$$

[total raw waste flow, group n] = raw waste flow from group n attributable to directly discharged nickel forming wastewater

These five steps were repeated for each of the 22 costing groups.

The raw waste flows for direct dischargers in one subcategory were determined by adding the production weighted flows from each costing group. The same procedure was used to determine raw waste flows for indirect dischargers in the subcategory. The raw waste flows for each of the 11 subcategories were determined in the same way. Discharge flows for each option for each subcategory were also calculated using the procedure described above.

The total mass of each pollutant (kg/yr) discharged at each option for each subcategory was calculated as follows: the total flow (l/yr) discharged at one option in a subcategory was multiplied by the long-term mean effluent concentration of each pollutant (mg/l) (Table VII-9) achievable using that option. This was done for all three options in all 11 subcategories. The total mass of each pollutant removed (kg/yr) at each option for each subcategory was calculated by subtracting the total mass discharged (kg/yr) from the total raw mass (kg/yr).

For some regulated pollutants (in particular, cyanide, ammonia, and fluoride), the benefits, calculated as described above, are very low or zero. This is due to the use of average subcategory concentrations in the calculation. These pollutants are not expected to be present in all waste streams in the subcategories in which they are regulated (see Section V). When they are present, they are present in concentrations significantly above treatable concentrations and substantial removals would be achieved by treatment at an individual plant.

No sampling data were available for several nonconventional pollutants regulated in some subcategories (columbium, hafnium, tantalum, tungsten, and zirconium). However, for all of these pollutants, raw wastewater concentrations were estimated using the criteria outlined in Section V and benefits were calculated. In addition, no estimates were made of vanadium benefits.

As discussed in Section VIII, the Agency intends to recalculate the costs and benefits of each technology option on a plant-by-plant basis prior to promulgation of these standards. This method of calculation will eliminate the use of average subcategory concentrations in calculating benefits and thus more accurately represent the true removals of cyanide, ammonia, and fluoride achievable by the technology options. The Agency also intends to include vanadium removals in the benefit recalculation.

The mass of pollutants currently discharged differs from the mass of pollutants in the raw waste because treatment is currently in place at some plants. The dcp summary sheets were used to tally the treatment systems which are currently in place at direct dischargers and indirect dischargers. It was not possible to tell from the dcp summary sheets if a plant is currently discharging wastewater at the reduced flows stipulated by Option 3. Therefore, it was assumed that flow reduction is not currently in place at any plant.

Treatment systems that used chemical precipitation (lime, caustic) and/or coagulant addition (lime, alum, polyelectrolyte) followed by settling, were considered to have treatment in place equivalent to Option 1. That is, the mass of toxic metals

(except chromium) and nonconventional pollutants (except ammonia) removed by these plants was considered to be equivalent to the mass removed by Option 1 treatment technology.

Treatment systems that consisted of chemical precipitation followed by settling and an additional solids removal step (filter, settling basin, polishing pond or lagoon) were considered to have treatment in place equivalent to Option 3 without in-process flow reduction. That is, the mass of toxic metals (except chromium) and nonconventional pollutants (except ammonia) removed by these plants was considered to be equivalent to the mass removed if Option 3 treatment technology was applied without flow reduction.

Treatment systems that had a preliminary chromium reduction step prior to chemical precipitation and settling were considered to remove the same mass of chromium as removed by Option 1 treatment technology. If the chromium reduction step preceded a treatment system consisting of chemical precipitation, settling and additional solids removal, the system was considered to remove the same mass of chromium as removed by Option 3 treatment technology, applied without flow reduction.

Treatment systems that included ammonia stripping were considered to remove the same mass of ammonia as removed by Option 1 treatment technology.

Treatment systems that included oil skimming and/or emulsion breaking were considered to remove the same mass of oil and grease as removed by Option 1 treatment technology.

Treatment systems that included a single settling, filtration or any other solids separation process were considered to remove the same mass of total suspended solids as removed by Option 1 treatment technology. Treatment systems that involved a second solids separation process after the primary step were considered to remove the same mass of total suspended solids as removed by Option 3 treatment technology, applied without flow reduction.

After the number of plants in each subcategory with various types of treatment in place was tallied, the fraction of plants with each treatment was calculated. Separate calculations were made for direct dischargers and indirect dischargers. No consideration was given to the volume of wastewater treated by the tallied plants. The mass of pollutant currently discharged was estimated for direct and indirect dischargers for each subcategory using an approach based upon the expression:

Current = (1-x) Raw + (x-y) Option 1 + (y) Option 3

Where x = fraction of plants currently removing the same mass of the pollutant as removed by Option 1

y = fraction of plants currently removing the same mass of the pollutant as removed by Option 3, without flow reduction

Raw = total mass of the pollutant in untreated wastewater (kg/yr)

Option 1 = total mass of the pollutant in discharged wastewater treated by Option 1 technology (kg/yr)

Option 3 = total mass of the pollutant in discharged wastewater treated by Option 3 technology, without flow reduction (kg/yr)

Current = total mass of pollutant currently discharged (kg/yr)

That is, the current mass discharged is the sum of the fraction of plants with no treatment multiplied by the raw mass discharge, plus the fraction of plants achieving Option 1 removals multiplied by the Option 1 mass discharge, plus the fraction of plants achieving Option 3 pollutant removals (without flow reduction) multiplied by the Option 3 without flow reduction mass discharge.

Inherent to this approach are the following assumptions:

- A facility with wastewater treatment equipment tallied as equivalent to that specified by Option 1 will discharge wastewater with the pollutant concentrations specified for lime and settle technology in Table VII-9.

- A facility with wastewater treatment equipment tallied as equivalent to that specified by Option 3 will discharge wastewater with the pollutant concentrations specified for lime, settle, and filter technology, in Table VII-9.

- A facility tallied as having no treatment in place discharges wastewater at the estimated raw waste pollutant concentrations.

However, an individual facility with treatment equipment in place equivalent to that specified by Option 1 or Option 3 may discharge wastewater at pollutant concentrations higher or lower than those specified in Table VII-9. Nevertheless, the Agency believes that even if a plant with wastewater treatment equipment

in place is not currently achieving the effluent limitations specified in Table VII-9, it could do so by operating its equipment properly. Because this could be accomplished without any additional costs, no additional benefits should be assumed.

Also, a facility with no tallied treatment in place may, in fact, discharge wastewater with pollutant concentrations lower than the estimated raw waste pollutant concentrations. However, this is the only possible assumption to make without preforming a plant-by-plant cost analysis.

The current mass removed of each pollutant (kg/yr) for each subcategory was calculated by subtracting the current mass discharged (kg/yr) from the total raw mass (kg/yr).

BAT OPTION SELECTION

EPA has selected Option 3 as the basis for BAT effluent limitations in 9 of the 11 subcategories. Option 2 was selected for the lead/tin/bismuth forming subcategory and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory. These options were selected because they provide protection of the environment consistent with proven operation of in-process controls and treatment effectiveness. The reduction of pollutants in the effluent, especially toxic metals, is substantial and economically achievable, thus resulting in a minimal impact on the industry.

Option 3 builds upon the technologies established for BPT. Flow reduction measures and multi-media filtration are the principal mechanisms for reducing pollutant discharges at this option. Flow reduction measures concentrate the pollutants in wastewater streams. Treatment of a more concentrated stream allows a greater net removal of pollutants. In addition, flow reduction lowers the cost of treatment by reducing the flow and hence pumping and chemical costs and the size of treatment equipment. In many cases, the costs for reducing a wastewater flow and treating the reduced flow with lime, settle, and multimedia filtration are less than the costs of treating a non-reduced wastewater flow by lime and settle alone. The application of technologies such as countercurrent cascade rinsing to surface treatment and alkaline cleaning lines is not expected to cause serious interruptions in production since these operations tend to be used intermittently, allowing process changes to be scheduled. In 9 of the 11 subcategories, sufficient amounts of pollutants remain in the waste streams after lime and settle treatment to justify the use of multi-media filtration. The Agency believes that the costs involved warrant selection of Option 3 as the model BAT technology for 9 of the 11 subcategories.

EPA has decided to select Option 2 technology for the lead/tin/bismuth subcategory and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory. Lime and settle treatment is particularly effective for these two subcategories. When it is applied after flow reduction, the amount of toxic metal pollutants remaining in the wastewater is not significant. That is, application of filters after lime and settle would remove an estimated 322 lbs/yr (146 kg/yr) of additional pollutants, but only an additional 22.5 lbs/yr (10.2 kg/yr) of toxic pollutants.

The Agency recognizes that many nonferrous metals forming plants not only perform operations that fall under more than one nonferrous metals forming subcategory, but also have discharges that are subject to regulation under other point source categories. Therefore, it was difficult to estimate the costs specifically associated with treating nonferrous metals forming wastewaters. As mentioned previously, the Agency intends to evaluate the costs and benefits of the proposed technology options on a plant-by-plant basis. As part of the effort, the Agency intends to conduct a plant-by-plant analysis of the degree of integration in nonferrous forming plants and the costs associated with each technology option. Based on this evaluation, and any data provided during the public comment period, EPA may choose to promulgate Option 2 as the BAT technology for one or more of these nine subcategories for which Option 3 is the proposed technology.

In particular, four subcategories, nickel/cobalt, refractory metals, titanium, and zirconium/hafnium, are highly integrated within themselves and with other industrial categories, some of which are not subject to effluent limitations based on the addition of filtration and typically combine process wastewaters from all operations for common treatment. If EPA determines that it has significantly underestimated the costs for these plants to either segregate their nonferrous metals forming flows subject to effluent limitations based on the addition of filtration or cotreating their combined wastewater flows and achieve the applicable effluent limitations, the Agency may choose to promulgate BAT based on Option 2 for those four subcategories and any other subcategories similarly situated.

The effluent limitations which would be imposed if Option 2 were selected for any of these nine subcategories are detailed in Section 2, Part 8, Subparts A and C through J.

The Agency is also considering promulgating Option 3 for both the lead/tin/bismuth and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategories, if the plant-by-plant analysis and additional data show that filtration does remove significant additional quantities of pollutants in

these two subcategories and that the filtration technology is economically achievable. The limitations that would be imposed if Option 3 were selected for either of these two subcategories are detailed in Section 2, Part 8, Subparts B and K.

REGULATED POLLUTANT PARAMETERS

The raw wastewater concentrations from individual operations and each subcategory as a whole were examined to select those pollutants found at frequencies and concentrations warranting regulation. The selection process and the pollutants selected for regulation are described in Section VI.

As discussed in Section VII, the correct pH must be maintained in the lime and settle treatment system to assure adequate removal of the metals regulated in each subcategory. Clarifier effluent pH should be maintained within the range of 7.5 to 10 at all times to ensure optimal metals removal.

The Agency recognizes that this effluent may be subsequently commingled with nonprocess wastewater not requiring treatment (i.e, noncontact cooling water) which might effectively lower the pH to below 7.0 prior to final discharge. This may be accounted for in individual NPDES permits.

APPLICATION OF FLOW REDUCTION TECHNOLOGY

Tables X-15 to X-25 list the BAT wastewater discharge flows for the production operations and associated waste streams that received an allowance under BPT. In some cases, the BAT discharge allowance is identical to the BPT allowance. The Agency could not identify applicable flow-reducing technologies for some of these streams. For other streams, flow-reduction technology is currently common industry practice, and further flow-reduction is not required at BAT. For many streams, the BAT discharge allowance is substantially less than the BPT allowance. In-process flow reduction measures considered as part of Option 3 technology were the bases for the BAT discharge allowances for these streams.

Production Operations and Discharge Flows for Which Applicable Flow Reduction Technology Could Not Be Identified

The Agency could not identify applicable flow reduction technology for the following waste streams. Therefore, the BAT discharge allowance equals the BPT discharge allowance for these waste streams.

Lead/Tin/Bismuth Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Rolling Spent Soap Solutions	43.0 l/kkg (10.3 gal/ton)
Extrusion Press Hydraulic Fluid Leakage	175 l/kkg (41.9 gal/ton)
Alkaline Cleaning Spent Bath	606 l/kkg (145 gal/ton)
Miscellaneous Nondescript Wastewater	58.4 l/kkg (14.0 gal/ton)

Nickel/Cobalt Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Forging, Extrusion, and Isostatic Press Hydraulic Fluid Leakage	124 l/kkg (29.7 gal/ton)
Vacuum Melting Steam Condensate	168 l/kkg (40.4 gal/ton)
Metal Powder Production Atomization Wastewater	2,840 l/kkg (680 gal/ton)
Alkaline Cleaning Spent Baths	30.6 l/kkg (7.34 gal/ton)
Surface Treatment Spent Baths	861 l/kkg (206 gal/ton)
Steam Cleaning Condensate	23.2 l/kkg (5.56 gal/ton)
Miscellaneous Nondescript Wastewater	58.4 l/kkg (14.0 gal/ton)

Zinc Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Surface Treatment Spent Baths	9.50 l/kkg (2.28 gal/ton)
Alkaline Cleaning Spent Baths	0.715 l/kkg (0.171 gal/ton)

Beryllium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Area Cleaning Wastewater	21,300 l/kkg (5,110 gal/ton)
Billet Washing Wastewater	38.2 l/kkg (9.17 gal/ton)

Precious Metals Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Metal Powder Production Atomization Wastewater	6,670 l/kkg
Surface Treatment Spent Baths	155 l/kkg (37.2 gal/ton)
Alkaline Cleaning Spent Baths	3.67 l/kkg (0.88 gal/ton)

Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Metal Powder Production Wet Atomization Wastewater	5,040 l/kkg (1,210 gal/ton)
Metal Powder Production Milling Wastewater	1,670 l/kkg (400 gal/ton)
Oil-Resin Impregnation Wastewater	74.5 l/kkg (17.9 gal/ton)

Titanium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Surface Treatment Spent Baths	160 l/kkg (38.5 gal/ton)

Refractory Metals Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Post-Casting Billet Washwater	29.8 l/kkg (7.14 gal/ton)
Surface Treatment Spent Baths	12.7 l/kkg (3.04 gal/ton)
Metal Powder Production Wastewater	1,640 l/kkg (393 gal/ton)
Alkaline Cleaning Spent Baths	30.6 l/kkg (7.34 gal/ton)

Zirconium/Hafnium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Extrusion Press Hydraulic Fluid Leakage	370 l/kkg (88.8 gal/ton)
Surface Treatment Spent Baths	399 l/kkg (95.8 gal/ton)
Alkaline Cleaning Spent Baths	2,130 l/kkg (511 gal/ton)

Magnesium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Surface Treatment Spent Baths	465 l/kkg (111 gal/ton)

Uranium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Surface Treatment Spent Baths	35.6 l/kkg (8.52 gal/ton)

Waste Streams Flow Reduced at BPT

Flow reduction is not required for the following streams because this technology is currently common industry practice. Therefore, the BAT and BPT discharge allowances are the same.

Lead/Tin/Bismuth Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Rolling Spent Emulsions	23.3 l/kkg (5.60 gal/ton)
Drawing Spent Neat Oils	0
Drawing Spent Emulsions	16.7 l/kkg (4.00 gal/ton)
Drawing Spent Soap Solutions	7.46 l/kkg (1.79 gal/ton)
Continuous Strip Casting Contact Cooling Water	1.00 l/kkg (0.240 gal/ton)
Swaging Spent Emulsions	1.77 l/kkg (0.424 gal/ton)
Degreasing Spent Solvents	0

Nickel/Cobalt Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Rolling Spent Neat Oils	0
Tube Reducing Spent Lubricants	0 l/kkg (0 gal/ton)
Drawing Spent Neat Oils	0
Drawing Spent Emulsions	95.4 l/kkg (22.9 gal/ton)
Extrusion Spent Lubricants	0
Extrusion Press and Solution Heat Treatment Contact Cooling Water	83.2 l/kkg (20.0 gal/ton)
Forging and Swaging Spent Neat Oils	0
Wet Air Pollution Control Blowdown	251 l/kkg (60.2 gal/ton)
Surface Treatment Spent Baths	861 l/kkg (206 gal/ton)
Molten Salt Rinsewater	1,280 l/kkg (307 gal/ton)
Ammonia Rinsewater	15.7 l/kkg (3.77 gal/ton)
Sawing/Grinding Spent Emulsions	1,000 l/kkg (240 gal/ton)
Degreasing Spent Solvents	0

Zinc Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Rolling Spent Neat Oils	0
Rolling Spent Emulsions	1.39 l/kkg (0.334 gal/ton)
Drawing Spent Emulsions	8.01 l/kkg (1.92 gal/ton)
Stationary Casting Contact Cooling Water	0
Alkaline Cleaning Rinse Water	5,720 l/kkg (1,370 gal/ton)
Sawing/Grinding Spent Lubricants	54.9 l/kkg (13.2 gal/ton)
Degreasing Spent Solvents	0

Beryllium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Sawing/Grinding Spent Lubricants	424 l/kkg (102 gal/ton)
Inspection Testing Wastewater	0
Degreasing Spent Solvents	0

Precious Metals Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Direct Chill Casting Contact Cooling Water	818 l/kkg (196 gal/ton)
Stationary Casting Contact Cooling Water	4.17 l/kkg (1.00 gal/ton)
Drawing Spent Neat Oils	0
Drawing Spent Soap Solutions	6.93 l/kkg (1.66 gal/ton)
Sawing/Grinding Spent Emulsions	6.05 l/kkg (1.45 gal/ton)
Surface Treatment Rinse Water	2,840 l/kkg (681 gal/ton)
Degreasing Spent Solvents	0

Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Metal Powder Production Wet Air Pollution Control Wastewater	2,640 l/kkg (632 gal/ton)
Sizing Spent Lubricants	0
Sawing/Grinding Spent Lubricants	1,000 l/kkg (240 gal/ton)
Degreasing Spent Solvents	0

Titanium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Extrusion Spent Lubricants	274 l/kkg (65.7 gal/ton)
Forging Spent Lubricants	0
Degreasing Spent Solvents	0
Grinding/Sawing Spent Lubricants	49.7 l/kkg (11.9 gal/ton)

Refractory Metals Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Rolling Spent Emulsions	1,200 l/kkg (288 gal/ton)
Rolling Spent Neat Oils	0
Drawing Spent Lubricants	0
Forging Spent Lubricants	0
Pressing Spent Lubricants	0
Casting Contact Cooling Water	0
Surface Treatment Spent Baths	12.7 l/kkg 93.04 gal/ton)
Surface Treatment Wet Air Pollution Control Blowdown	11,800 l/kkg (2,840 gal/ton)
Metal Powder Produciton Wet Air Pollution Control Blowdown	0
Molten Salt Spent Baths	0
Molten Salt Rinsewater	90,200 l/kkg (21,600 gal/ton)
Sawing/Grinding Spent Neat Oils	0
Sawing/Grinding Spent Emulsions	217 l/kkg (52.1 gal/ton)
Degreasing Spent Solvents	0
Coating Wet Air Pollution Control Blowdown	1,080 l/kkg (258 gal/ton)

Zirconium/Hafnium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Extrusion Spent Emulsions	74.1 l/kkg (17.8 gal/ton)
Drawing Spent Lubricants	0
Forging Solution Heat Treatment Contact Cooling Water	34.9 l/kkg (8.36 gal/ton)
Sawing/Grinding Spent Lubricants	9.01 l/kkg (2.16 gal/ton)
Sawing/Grinding Wet Air Pollution Control Scrubber Blowdown	0
Tube Reducing Spent Lubricants	0
Degreasing Spent Baths	0

Magnesium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Rolling Spent Emulsions	0
Forging Spent Lubricants	0
Forging Wet Air Pollution Control Scrubber Blowdown	266,000 l/kkg (63,800 gal/ton)
Direct Chill Casting Contact Cooling Water	0
Sawing/Grinding Spent Lubricants	0
Degreasing Spent Solvents	0
Sanding, Repairing Wet Air Pollution Control Blowdown	428 l/kkg (103 gal/ton)

Uranium Forming Subcategory

Waste Stream	Normalized BPT and BAT Discharge
Extrusion Spent Lubricants	0
Forging Spent Lubricants	0
Surface Treatment Wet Air Pollution Control Scrubber Blowdown	74.2 l/kkg (17.8 gal/ton)
Sawing/Grinding Spent Emulsions	3.10 l/kkg (0.744 gal/ton)
Post-Sawing/Grinding Rinsewater	38.1 l/kkg (9.12 gal/ton)
Degreasing Spent Solvents	0

Flow Reduced Contact Cooling Water - BAT Discharge Allowances

The Agency believes that recycle is a demonstrated flow-reducing technology and is basing the BAT discharge allowance for contact cooling water on recycle through a cooling tower. Holding tanks are used in place of cooling towers for streams with low flow rates. Because the Agency believes that some plants must discharge a portion of the coolant to control water quality, 90 percent recycle (i.e., 90 percent reduction of BPT flows) was selected as the basis for the BAT discharge allowance. The BAT discharge allowance is equivalent to 10 percent of the BPT discharge allowance for the streams listed below.

Lead/Tin/Bismuth Forming Subcategory

Waste Stream	Normalized BAT Discharge
Extrusion Press and Solution Heat Treatment Contact Cooling Water	175 l/kkg (41.9 gal/ton)
Semi-Continuous Ingot Casting Contact Cooling Water	2.94 l/kkg (0.704 gal/ton)
Shot Casting Contact Cooling Water	4.20 l/kkg (1.01 gal/ton)

Nickel/Cobalt Forming Subcategory

Waste Stream	Normalized BAT Discharge
Rolling Contact Lubricant-Coolant Water	1,340 l/kkg (321 gal/ton)
Rolling Solution Heat Treatment Contact Cooling Water	0.027 l/kkg (0.007 gal/ton)
Forging Die Contact Cooling Water	126 l/kkg (30.2 gal/ton)
Stationary and Direct Chill Casting Contact Cooling Water	1,780 l/kkg (428 gal/ton)
Solution Heat Treatment Contact Cooling Water	457 l/kkg (110 gal/ton)

Zinc Forming Subcategory

Waste Stream	Normalized BAT Discharge
Rolling Contact Lubricant-Coolant Water	34.7 l/kkg (8.32 gal/ton)
Direct Chill Casting Contact Cooling Water	50.3 l/kkg (12.1 gal/ton)
Solution Heat Treatment Contact Cooling Water	76.1 l/kkg (18.3 gal/ton)

Precious Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Semi-Continuous and Continuous Casting Contact Cooling Water	1,120 l/kkg (268 gal/ton)
Shot Casting Contact Cooling Water	89.2 l/kkg (21.4 gal/ton)
Rolling Solution Heat Treatment Contact Cooling Water	700 l/kkg (168 gal/ton)
Extrusion Solution Heat Treatment Contact Cooling Water	1,370 l/kkg (329 gal/ton)
Annealing Heat Treatment Contact Cooling Water	1,000 l/kkg (240 gal/ton)
Pressure Bonding Contact Cooling Water	83.5 l/kkg (20 gal/ton)

Titanium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Hot Rolling Contact Lubricant-Coolant Water	430 l/kkg (103 gal/ton)
Forging Contact Cooling Water	300 l/kkg (72.1 gal/ton)
Heat Treatment Contact Cooling Water	451 l/kkg (108 gal/ton)

Refractory Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Extrusion Heat Treatment Contact Cooling Water	346 l/kkg (83.0 gal/ton)
Forging Solution Heat Treatment Contact Cooling Water	579 l/kkg (139 gal/ton)
Sawing/Grinding Lubricant-Coolant Water	812 l/kkg (195 gal/ton)

Zirconium/Hafnium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Extrusion Heat Treatment Contact Cooling Water	28.5 l/kkg (6.84 gal/ton)

Magnesium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Forging Solution Heat Treatment Contact Cooling Water	633 l/kkg (152 gal/ton)

Uranium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Extrusion Solution Heat Treatment Contact Cooling Water	272 l/kkg (65.3 gal/ton)
Forging Solution Heat Treatment Contact Cooling Water	284 l/kkg (68.2 gal/ton)
Tool Contact Cooling Water	51.7 l/kkg (12.4 gal/ton)

Flow-Reduced Rinsewater - BAT Discharge Allowances

The BAT discharge allowance for rinsewater is based on installation of two-stage countercurrent cascade rinsing. The discharge is equivalent to 10 percent of the BPT discharge allowance for the rinsewater streams listed below.

Lead/Tin/Bismuth Forming Subcategory

Waste Stream	Normalized BAT Discharge
Alkaline Cleaning Rinsewater	646 l/kkg (155 gal/ton)

Nickel/Cobalt Forming Subcategory

Waste Stream	Normalized BAT Discharge
Alkaline Cleaning Rinsewater	497 l/kkg (119 gal/ton)
Surface Treatment Rinsewater	1,060 l/kkg (254 gal/ton)

Zinc Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Rinsewater	486 l/kkg (117 gal/ton)

Beryllium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Rinsewater	767 l/kkg (184 gal/ton)

Precious Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Alkaline Cleaning Rinsewater	692 l/kkg (166 gal/ton)
Prebonding Cleaning Wastewater	340 l/kkg (81.7 gal/ton)

Titanium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Rinsewater	2,110 l/kkg (505 gal/ton)
Alkaline Cleaning Rinsewater	276 l/kkg (66.3 gal/ton)

Refractory Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Rinsewater	12,100 l/kkg (2,910 gal/ton)
Alkaline Cleaning Rinsewater	1,400 l/kkg (335 gal/ton)*

Zirconium/Hafnium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Rinsewater	1,530 l/kkg (368 gal/ton)
Alkaline Cleaning Rinsewater	5,530 l/kkg (1,330 gal/ton)
Degreasing Rinsewater	203 l/kkg (48.6 gal/ton)

Magnesium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Rinsewater	1,770 l/kkg (425 gal/ton)

Uranium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Rinsewater	148 l/kkg (35.5 gal/ton)

*Based on three-stage countercurrent cascade rinsing

Flow-Reduced Emulsions - BAT Discharge Allowances

The Agency believes that recycle is a demonstrated, flow-reducing technology and is basing the BAT discharge allowance for emulsions on recycle through a holding tank equipped with in-line, paper or cloth filters. Because some plants must discharge a portion of the recirculating flow to prevent the excessive build-up of particulates, 90 percent recycle was selected as the basis for the BAT discharge allowance. The following emulsion waste streams can be flow-reduced:

Precious Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Rolling Spent Emulsions	36.0 l/kkg (8.60 gal/ton)
Drawing Spent Emulsions	21.3 l/kkg (5.10 gal/ton)

Titanium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Rolling Spent Lubricants	334 l/kkg (80.0 gal/ton)

Flow-Reduced Wet Air Pollution Control Blowdown - BAT Discharge Allowances

The Agency believes that recycle of scrubber liquor is a demonstrated technology. However, most plants will discharge a portion of the recirculating flow to prevent excessive build-up of dissolved solids. Based on data submitted in the dcp's, the Agency believes that recycling scrubber liquor with a 10 percent blowdown will control scale formation and equipment corrosion. Accordingly, the BAT discharge allowance is based on a 90 percent reycle of the normalized flow of scrubber liquor. The following scrubber waste streams can be flow-reduced:

Lead/Tin/Bismuth Forming Subcategory

Waste Stream	Normalized BAT Discharge
Shot-Forming Air Pollution Control Blowdown	0.009 l/kkg (0.002 gal/ton)

Precious Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Stationary Casting Wet Air Pollution Control Blowdown	5.86 l/kkg (1.40 gal/ton)

Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy Subcategory

Waste Stream	Normalized BAT Discharge
Steam Treatment Wet Air Pollution Control Scrubber Blowdown	284 l/kkg (68.1 gal/ton)

Titanium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Forging Wet Air Pollution Control Blowdown	202 l/kkg (48.5 gal/ton)
Surface Treatment Wet Air Pollution Control Blowdown	17.0 l/kkg (4.08 gal/ton)

Refractory Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Sawing/Grinding Wet Air Pollution Control Blowdown	108 l/kkg (25.8 gal/ton)

Uranium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Surface Treatment Wet Air Pollution Control Scrubber Blowdown	74.2 l/kkg (17.88 gal/ton)

Miscellaneous Flow-Reduced Waste Streams - BAT Discharge Flow Allowances

The Agency believes that recycle through a holding tank is a demonstrated flow-reduction technology for many wastewaters. The holding tank, equipped with in-line paper or cloth filters, provides removal of particulates through settling and filtration. This permits water recycle. However, to control water quality, a portion of the recirculating flow must be purged. Therefore, the BAT discharge allowance is based on a discharge of 10 percent of the normalized BPT flow allowances. The following waste streams are flow reduced by this method at BAT:

Nickel/Cobalt Forming Subcategory

Waste Stream	Normalized BAT Discharge
Forging Equipment Cleaning Wastewater	163 l/kkg (39.0 gal/ton)
Hydrostatic Tube Testing	135 l/kkg (32.4 gal/ton)

Precious Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Burnishing Wastewater	2,570 l/kkg (617 gal/ton)
Tumbling Wastewater	442 l/kkg (106 gal/ton)
Metal Powder Production Wastewater	2,170 l/kkg (520 gal/ton)

Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy Subcategory

Waste Stream	Normalized BAT Discharge
Tumbling Wastewater	715 l/kkg (171 gal/ton)

Titanium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Tumbling Wastewater	79.0 l/kkg (18.9 gal/ton)

Refractory Metals Forming Subcategory

Waste Stream	Normalized BAT Discharge
Forging Equipment Cleaning Wastewater	41.7 l/kkg (10.0 gal/ton)
Tumbling Wastewater	2,210 l/kkg (530 gal/ton)
Post-Sawing Grinding Wastewater	51.3 l/kkg (12.3 gal/ton)
Product Testing	7.76 l/kkg (1.86 gal/ton)

Magnesium Forming Subcategory

Waste Stream	Normalized BAT Discharge
Forging Equipment Cleaning Wastewater	162 l/kkg (38.8 gal/ton)

Spent Baths

Reducing the dumping frequency of spent baths will decrease the volume of these baths discharged. As with all flow reduction technology, this will increase the concentration of pollutants in the wastewater discharged, allowing a greater net removal during treatment. The following subcategories have spent baths which, based on bath-use information obtained during the screen sampling program, the Agency believes can be flow-reduced as follows:

Beryllium Forming Subcategory

Waste Stream	Present Discharge Rate	BAT Discharge Rate	BAT Normalized Flow
Surface Treatment Spent Bath	once/week	once/2 mos (6 times/yr)	308 l/kkg (73.8 gal/ton)

Titanium Forming Subcategory

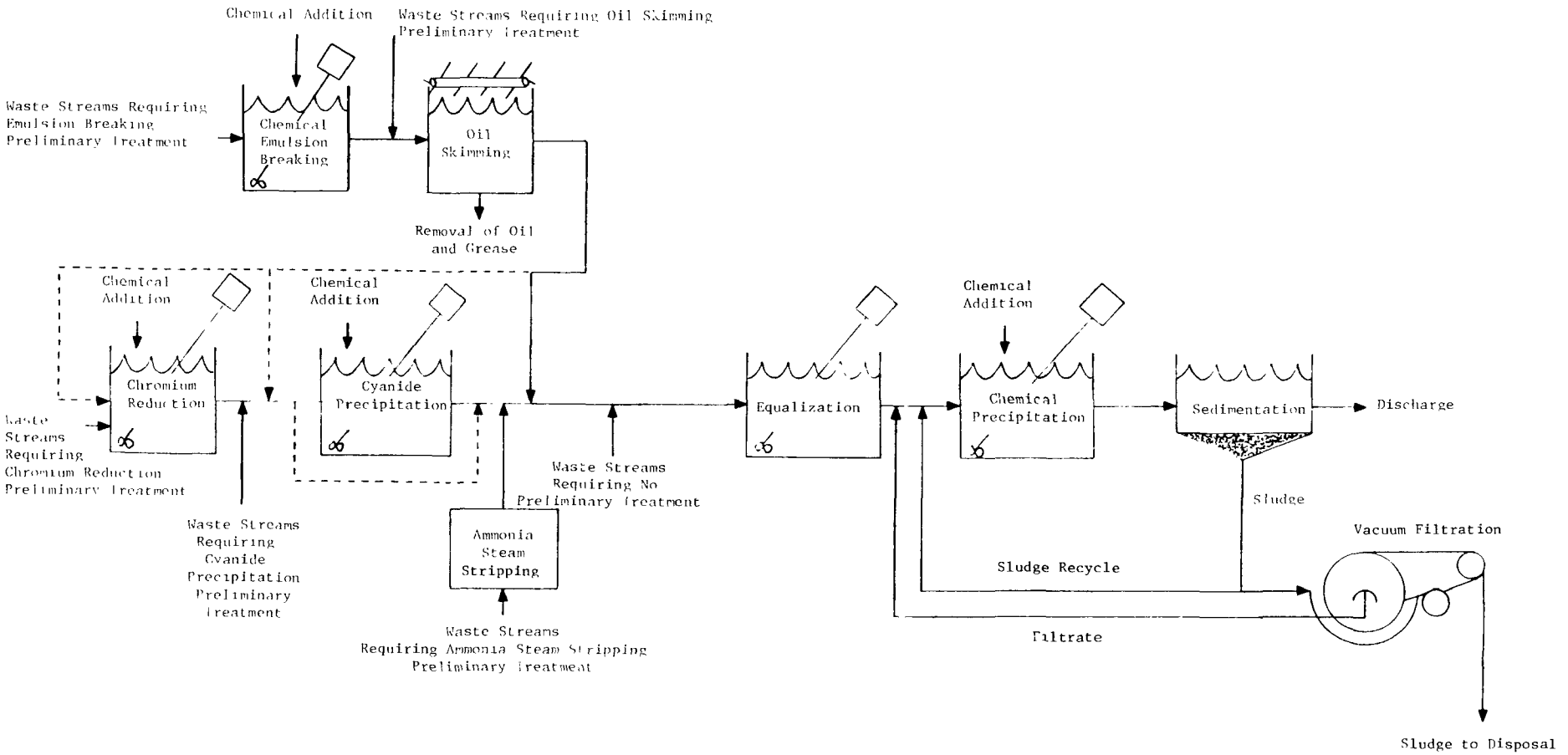
Waste Stream	Present Discharge Rate	BAT Discharge Rate	BAT Normalized Flow
Alkaline Cleaning Spent Bath	once/week	once/month	638 l/kkg (153 gal/ton)

CALCULATION OF BAT EFFLUENT MASS LIMITATIONS

BAT mass limitations (mass of pollutant allowed to be discharged per mass of product) are listed in Section II, Part 3, Subparts A through K. These limitations were calculated for each regulated pollutant in each subcategory as follows: the BAT normalized flow for each waste stream (summarized in Tables X-15 to X-25) was multiplied by the one-day average and 10-day maximum effluent concentrations achievable using the BAT treatment technology selected for the subcategory (Table VII-9). The 10-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits.

COSTS AND BENEFITS

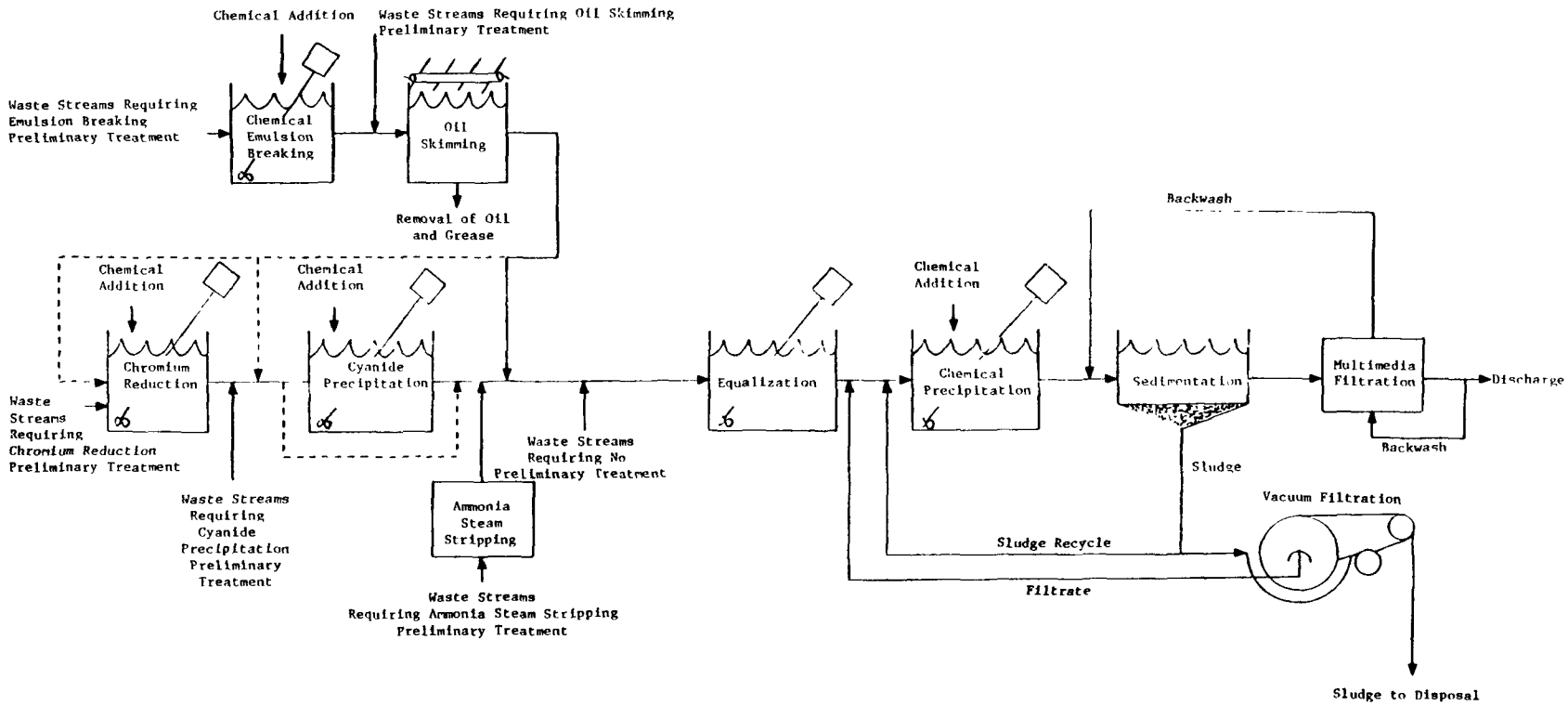
To evaluate the economic achievability of BAT, the Agency estimated the cost of treatment and control and also estimated the incremental increase in the mass of pollutants removed from wastewater by that treatment and control. Tables X-4 to X-14 list the Agency's estimate of the mass of pollutants removed, in each subcategory, through the application of BAT to direct dischargers. The capital and annual costs (1982 dollars) of this pollutant removal are listed in Table X-1.



NOTE: Waste streams which may require specific preliminary treatment are listed in Table IX-1.

Figure X-1

BAT OPTION 1 AND 2 TREATMENT TRAIN FOR THE NONFERROUS METALS FORMING CATEGORY



NOTE: Waste streams which may require specific preliminary treatment are listed in Table IX-1.

Figure X-2

BAT OPTION 3 TREATMENT TRAIN FOR THE NONFERROUS METALS FORMING CATEGORY

Table X-1

CAPITAL AND ANNUAL COST ESTIMATES FOR BAT OPTIONS
DIRECT DISCHARGERS ($1982)

Subcategory	Option 1	Option 2*	Option 3**
Lead/Tin/Bismuth Forming			
Capital	21,100	164,600	212,300
Annual	30,300	14,500	36,000
Nickel/Cobalt Forming			
Capital	141,200	213,700	244,600
Annual	119,700	71,800	94,400
Zinc Forming			
Capital	13,300	72,000	72,000
Annual	26,700	42,000	36,800
Beryllium Forming			
Capital	0	500	500
Annual	0	300†	300†
Precious Metals Forming			
Capital	173,400	292,300	345,500
Annual	114,000	158,200	184,900
Iron and Steel/Copper/ Aluminum MPP and PM			
Capital	122,000	122,000	142,900
Annual	77,500	77,500	101,600
Titanium Forming			
Capital	1,164,700	1,405,800	1,509,200
Annual	858,300	729,100	797,500
Refractory Metals Forming			
Capital	35,800	150,100	171,000
Annual	70,400	102,500	114,600

Table X-1 (Continued)

CAPITAL AND ANNUAL COST ESTIMATES FOR BAT OPTIONS
DIRECT DISCHARGERS ($1982)

Subcategory	Option 1	Option 2(a)	Option 3(b)
Zirconium/Hafnium Forming			
Capital	172,200	298,800	322,300
Annual	88,500	79,100	92,900
Magnesium Forming			
Capital	50,500	7 1,000	71,000
Annual	70,900	50,500	44,600
Depleted Uranium Forming			
Capital	287,900	237,500	237,500
Annual	148,400	136,600	126,600
Totals			
Capital	2,182,000	3,028,000	3,329,000
Annual	1,626,000	1,483,000	1,652,000

*Total cost to install Option 2 technology

**Total cost to install Option 3 technology

†The one beryllium forming plant currently incurs an annual cost for disposal of sludges generated from treating nonferrous metals forming wastewater. These costs were subtracted from the annual costs of Option 2 and Option 3 treatment technology.

Table X-2

SYMBOLS USED ON TABLES X-4 THROUGH X-14

Symbol	Meaning
TOT TOXICS	Total toxic pollutants
TOT NONCON	Total nonconventional pollutants
TSS	Total suspended solids
TOT CONV	Total conventional pollutants
TOT POLL	Total pollutants
e6	x 1,000,000
e7	x 10,000,000
e8	x 100,000,000

Table X-3

NONFERROUS METALS FORMING
POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
TOTAL CATEGORY DIRECT DISCHARGERS

	Current Raw Waste	Current Discharge	Current Removed	Option 1 Discharge	Option 2 Removed	Option 2 Discharge	Option 2 Removed	Option 3 Discharge	Option 3 Removed
Total Toxic Pollutants	38,446.3	20,370.1	18,076.2	1,127.2	37,319.0	412.0	38,034.3	255.3	38,191.0
Total Nonconventional Pollutants	654,838.4	392,610.2	262,228.2	36,635.7	618,202.7	8,729.0	646,109.4	8,460.4	646,378.0
Total Conventional Pollutants	286,951.4	79,595.8	207,355.6	17,331.6	269,619.8	5,683.9	281,267.5	3,288.6	283,662.8
Total Pollutants	980,236.1	492,576.1	487,660.0	55,094.5	925,142.5	14,824.9	965,411.2	12,004.3	968,231.8

Table X-4

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
LEAD/TIN/BISMUTH FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	50.1	25.9	24.2	16.1	34.0	3.4	46.7	2.3	47.8
Arsenic	.9	.9	.0	.9	.0	.9	.0	.9	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Copper	13.8	12.0	1.7	13.3	.5	2.8	11.0	1.9	11.9
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	1,185.9	404.7	781.2	2.8	1,183.1	.6	1,185.3	.4	1,185.5
Nickel	.0	.0	.0	.0	.0	.0	.0	.0	.0
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	4.8	4.8	.0	4.8	.0	1.6	3.2	1.1	3.7
TOT TOXICS	1,255.5	448.4	807.1	37.9	1,217.6	9.2	1,246.2	6.5	1,248.9
Aluminum	5.1	5.1	.0	5.1	.0	5.1	.0	5.1	.0
Ammonia	26.2	26.2	.0	26.2	.0	26.2	.0	26.2	.0
Bismuth	45.9	28.2	17.7	23.0	23.0	4.8	41.1	3.2	42.7
Fluoride	23.0	23.0	.0	23.0	.0	23.0	.0	23.0	.0
Iron	25.5	13.9	11.6	9.4	16.1	2.0	23.5	1.3	24.1
Tin	45.9	28.2	17.7	23.0	23.0	4.8	41.1	3.2	42.7
TOT NONCON	171.5	124.5	47.1	109.5	62.0	65.8	105.7	61.9	109.6
TSS	10,766.4	3,771.2	6,995.2	275.5	10,490.9	57.7	10,708.7	12.5	10,753.9
Oil & Grease	2,171.8	1,530.9	640.9	229.6	1,942.2	48.1	2,123.7	48.1	2,123.7
TOT CONV	12,938.2	5,302.1	7,636.1	505.1	12,433.1	105.8	12,832.4	60.6	12,877.6
TOT POLL	14,365.2	5,874.9	8,490.3	652.5	13,712.6	180.8	14,184.3	129.0	14,236.1
FLOW(l/yr)	2.296e7	2.296e7		2.296e7		4.81e6		4.81e6	

Table X-5

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
NICKEL/COBALT FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	1.3	1.3	.0	1.3	.0	1.3	.0	1.3	.0
Arsenic	.3	.3	.0	.3	.0	.3	.0	.3	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	1,720.0	1,359.6	360.4	4.2	1,715.8	.6	1,719.4	.5	1,719.5
Copper	1,448.3	936.2	512.1	29.3	1,419.1	4.4	1,444.0	2.9	1,445.4
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	3.1	3.1	.0	3.1	.0	.9	2.2	.6	2.5
Nickel	5,728.0	3,675.9	2,052.0	37.4	5,690.6	5.6	5,722.4	1.7	5,726.3
Selenium	.3	.3	.0	.3	.0	.3	.0	.3	.0
Silver	.1	.1	.0	.1	.0	.1	.0	.1	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	54.0	39.9	14.1	16.7	37.3	2.5	51.5	1.7	52.3
TOT TOXICS	8,955.3	6,016.7	2,938.6	92.6	8,862.8	15.8	8,939.5	9.4	8,946.0
Aluminum	153.5	134.1	19.5	113.1	40.4	16.8	136.7	11.2	142.3
Ammonia	308.1	308.1	.0	308.1	.0	240.3	67.7	240.3	67.7
Cobalt	62.6	40.9	21.7	2.5	60.1	.4	62.2	.3	62.4
Fluoride	3,122.9	2,262.3	860.6	732.3	2,390.7	100.9	3,014.0	100.9	3,014.0
Iron	1,424.6	918.3	506.3	20.7	1,403.9	3.1	1,421.5	2.1	1,422.5
TOT NONCON	5,071.7	3,663.6	1,408.1	1,176.7	3,895.1	369.5	4,702.2	362.8	4,709.0
TSS	36,334.2	10,905.5	25,428.8	606.0	35,728.2	90.1	36,244.1	19.5	36,314.7
Oil & Grease	2,242.2	1,373.6	868.6	505.0	1,737.2	75.1	2,167.1	75.1	2,167.1
TOT CONV	38,576.4	12,279.1	26,297.4	1,111.0	37,465.4	165.2	38,411.2	94.6	38,481.8
TOT POLL	52,603.5	21,959.4	30,644.1	2,380.2	50,223.3	550.6	52,052.9	466.7	52,136.7
FLOW(l/yr)	5.05e7	5.05e7		5.05e7		7.51e6		7.51e6	

Table X-6

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
ZINC FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	5.9	5.1	.7	5.9	.0	4.8	1.1	4.0	1.9
Copper	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	4.4	4.4	.0	4.4	.0	4.4	.0	4.4	.0
Nickel	.0	.0	.0	.0	.0	.0	.0	.0	.0
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	5,968.8	16.9	5,952.0	24.2	5,944.6	18.7	5,950.1	13.1	5,955.8
TOT TOXICS	5,979.1	26.4	5,952.7	34.5	5,944.6	27.9	5,951.2	21.4	5,957.6
Aluminum	4.4	4.4	.0	4.4	.0	4.4	.0	4.4	.0
Cobalt	34.5	2.5	32.0	3.7	30.8	2.8	31.6	1.9	32.5
TOT NONCON	38.8	6.9	32.0	8.1	30.8	7.2	31.6	6.3	32.5
TSS	5,578.9	190.6	5,388.3	879.6	4,699.3	681.6	4,897.3	147.7	5,431.2
Oil & Grease	1,876.0	993.0	883.0	646.0	1,230.0	646.0	1,230.0	646.0	1,230.0
TOT CONV	7,454.9	1,183.6	6,271.3	1,525.6	5,929.3	1,327.6	6,127.3	793.7	6,661.2
TOT POLL	13,472.8	1,216.9	12,255.9	1,568.1	11,904.7	1,362.8	12,110.0	821.4	12,651.3
FLOW(l/yr)	7.33e7	7.33e7		7.33e7		5.68e7		5.68e7	

Table X-7

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
BERYLLIUM FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.00	.00	.00	.00	.00	.00	.00	.00	.00
Arsenic	.00	.00	.00	.00	.00	.00	.00	.00	.00
Beryllium	415.58	1.33	414.25	2.00	413.59	1.98	413.61	1.32	414.27
Cadmium	.67	.33	.34	.53	.14	.52	.15	.32	.34
Chromium	.47	.47	.00	.47	.00	.47	.00	.46	.00
Copper	17.25	2.60	14.65	3.86	13.39	3.82	13.43	2.57	14.68
Cyanide	.00	.00	.00	.00	.00	.00	.00	.00	.00
Lead	.47	.47	.00	.47	.00	.47	.00	.47	.00
Nickel	4.40	1.47	2.93	4.40	.00	4.40	.00	1.45	2.95
Selenium	.00	.00	.00	.00	.00	.00	.00	.00	.00
Silver	.00	.00	.00	.00	.00	.00	.00	.00	.00
Thallium	.07	.07	.00	.07	.00	.07	.00	.07	.00
Zinc	6.46	1.53	4.93	2.20	4.26	2.17	4.29	1.52	4.94
TOT TOXICS	445.35	8.25	437.10	13.98	431.37	13.89	431.47	8.17	437.18
Aluminum	9.52	9.52	.00	9.52	.00	9.52	.00	9.52	.00
Ammonia	10.79	10.79	.00	10.79	.00	10.79	.00	10.79	.00
Cobalt	.40	.23	.17	.33	.07	.33	.07	.22	.18
Fluoride	21.84	21.84	.00	21.84	.00	21.84	.00	21.84	.00
Iron	37.16	1.86	35.30	2.73	34.43	2.70	34.46	1.85	35.32
TOT NONCON	79.72	44.25	35.47	45.22	34.50	45.19	34.53	44.23	35.49
TSS	29,970.00	17.32	29,952.68	79.92	29,890.08	79.08	29,890.92	17.13	29,952.87
Oil & Grease	366.30	366.30	.00	66.60	299.70	65.90	300.40	65.90	300.40
TOT CONV	30,336.30	383.62	29,952.68	146.52	30,189.78	144.98	30,191.32	83.03	30,253.27
TOT POLL	30,861.37	436.12	30,425.26	205.72	30,655.65	204.06	30,657.32	135.43	30,725.94
FLOW(l/yr)	6.66e6	6.66e6		6.66e6		6.59e6		6.59e6	

Table X-8

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
PRECIOUS METALS FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	193.6	72.3	121.4	1.1	192.6	.6	193.0	.4	193.2
Chromium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Copper	1,013.0	379.4	633.7	7.8	1,005.3	4.7	1,008.3	3.2	1,009.9
Cyanide	2.1	1.3	.8	.9	1.2	.6	1.6	.4	1.8
Lead	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nickel	470.6	179.4	291.2	9.9	460.7	6.0	464.6	1.8	468.8
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	188.8	70.6	118.2	1.3	187.5	.8	188.0	.6	188.2
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	5.0	4.4	.5	4.4	.5	2.7	2.3	1.9	3.1
TOT TOXICS	1,873.2	707.4	1,165.8	25.4	1,847.7	15.4	1,857.7	8.2	1,865.0
Aluminum	.4	.4	.0	.4	.0	.4	.0	.4	.0
Ammonia	2.1	2.1	.0	2.1	.0	2.1	.0	2.1	.0
Fluoride	17.8	17.8	.0	17.8	.0	17.8	.0	17.8	.0
Iron	3.1	3.1	.0	3.1	.0	3.1	.0	2.3	.8
TOT NONCON	23.5	23.5	.0	23.5	.0	23.5	.0	22.6	.8
TSS	6,089.8	1,625.4	4,464.4	160.8	5,929.0	97.6	5,992.2	21.1	6,068.6
Oil & Grease	198.2	182.1	16.0	134.0	64.2	81.3	116.9	81.3	116.9
TOT CONV	6,288.0	1,807.5	4,480.4	294.8	5,993.2	178.9	6,109.1	102.4	6,185.5
TOT POLL	8,184.6	2,538.4	5,646.2	343.7	7,840.9	217.7	7,966.8	133.3	8,051.3
FLOW(l/yr)	1.34e7	1.34e7		1.34e7		8.13e6		8.13e6	

Table X-9

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.2	.2	.0	.2	.0	.2	.0	.2	.0
Arsenic	.1	.1	.0	.1	.0	.1	.0	.1	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	.8	.8	.0	.7	.1	.7	.1	.6	.3
Copper	599.6	480.7	118.9	4.9	594.7	4.9	594.7	3.3	596.3
Cyanide	6.4	5.2	1.2	.6	5.8	.6	5.8	.4	6.0
Lead	120.0	96.2	23.8	1.0	118.9	1.0	118.9	.7	119.3
Nickel	12.2	11.0	1.2	6.2	6.0	6.2	6.0	1.9	10.4
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	12.1	10.3	1.9	2.8	9.4	2.8	9.4	1.9	10.2
TOT TOXICS	751.5	604.5	147.0	16.5	735.0	16.5	735.0	9.0	742.5
Aluminum	160.3	132.0	28.3	18.9	141.5	18.9	141.5	12.6	147.8
Ammonia	8.0	8.0	.0	8.0	.0	8.0	.0	8.0	.0
Fluoride	8.8	8.8	.0	8.8	.0	8.8	.0	8.8	.0
Iron	799.3	640.2	159.2	3.5	795.9	3.5	795.9	2.4	797.0
TOT NONCON	976.4	789.0	187.5	39.1	937.3	39.1	937.3	31.7	944.8
TSS	12,471.8	7,523.5	4,948.2	101.2	12,370.6	101.2	12,370.6	21.9	12,449.8
Oil & Grease	319.7	319.7	.0	84.3	235.4	84.3	235.4	84.3	235.4
TOT CONV	12,791.4	7,843.2	4,948.2	185.5	12,606.0	185.5	12,606.0	106.2	12,685.2
TOT POLL	14,519.3	9,236.6	5,282.7	241.0	14,278.3	241.0	14,278.3	146.9	14,372.4
FLOW(l/yr)	8.43e6	8.43e6		8.43e6		8.43e6		8.43e6	

Table X-10

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
TITANIUM FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	25.6	25.6	.0	25.6	.0	12.5	13.1	10.4	15.2
Copper	434.5	385.7	48.7	370.6	63.9	86.1	348.3	57.9	376.5
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	3,398.9	1,932.8	1,466.1	76.7	3,322.3	17.8	3,381.1	11.9	3,387.1
Nickel	76.7	76.7	.0	76.7	.0	76.7	.0	32.7	44.0
Selenium	44.7	44.7	.0	44.7	.0	44.6	.2	29.7	15.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	1,156.4	729.5	426.9	210.8	945.6	49.0	1,107.4	34.2	1,122.3
TOT TOXICS	5,136.8	3,194.9	1,941.8	805.0	4,331.7	286.6	4,850.1	176.7	4,960.0
Aluminum	22,042.1	12,891.8	9,150.3	1,431.1	20,610.9	332.6	21,709.4	221.3	21,820.8
Ammonia	41,937.4	41,937.4	.0	20,444.8	21,492.6	4,752.0	37,185.4	4,752.0	37,185.4
Cobalt	345.0	205.5	139.5	31.9	313.1	7.4	337.6	5.0	340.0
Fluoride	360,703.8	206,070.3	154,633.5	9,264.1	351,439.7	2,153.3	358,550.5	2,153.3	358,550.5
Iron	153,738.5	86,194.7	67,543.8	261.9	153,476.6	60.9	153,677.6	41.6	153,696.9
Titanium	44,723.0	25,289.1	19,433.9	638.9	44,084.1	148.5	44,574.5	98.0	44,625.0
Vanadium	12,778.0	7,399.9	5,378.1	638.9	12,139.1	148.5	12,629.5	98.0	12,680.0
TOT NONCON	636,267.7	379,988.6	256,279.1	32,711.7	603,556.1	7,603.2	628,664.5	7,369.2	628,898.6
TSS	146,627.6	37,217.2	109,410.3	7,666.8	138,960.8	1,782.0	144,845.6	386.1	146,241.5
Oil & Grease	4,363.7	4,363.7	.0	4,363.7	.0	1,485.0	2,878.7	1,485.0	2,878.7
TOT CONV	150,991.2	41,580.9	109,410.3	12,030.5	138,960.8	3,267.0	147,724.2	1,871.1	149,120.1
TOT POLL	792,395.7	424,764.5	367,631.3	45,547.2	746,848.5	11,156.8	781,238.9	9,417.0	782,978.7
FLOW(l/yr)	6.389e8	6.389e8		6.389e8		1.485e8		1.485e8	

Table X-11

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
REFRACTORY METALS FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	1.0	.7	.3	.6	.3	.1	.9	.1	.9
Chromium	4.0	4.0	.0	.7	3.3	.1	3.9	.1	3.9
Copper	32.0	13.5	18.4	4.6	27.3	.7	31.2	.5	31.5
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nickel	199.8	70.8	129.0	5.9	193.8	.9	198.8	.3	199.5
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	1.2	.9	.3	.8	.4	.1	1.1	.1	1.1
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	4.0	2.9	1.1	2.6	1.4	.4	3.6	.3	3.7
TOT TOXICS	241.9	92.7	149.1	15.3	226.6	2.4	239.5	1.3	240.6
Aluminum	159.8	64.6	95.2	17.9	141.9	2.8	157.0	1.8	158.0
Ammonia	4.0	4.0	.0	4.0	.0	4.0	.0	4.0	.0
Cobalt	.8	.5	.3	.4	.4	.1	.7	.0	.8
Columbium	79.9	31.8	48.1	8.0	71.9	1.2	78.7	.8	79.1
Fluoride	8.0	8.0	.0	8.0	.0	8.0	.0	8.0	.0
Iron	79.9	29.1	50.8	3.3	76.6	.5	79.4	.3	79.6
Molybdenum	40.0	18.2	21.8	8.0	32.0	1.2	38.7	.8	39.1
Tantalum	159.8	58.9	100.9	8.0	151.8	1.2	158.6	.8	159.0
Tungsten	599.3	208.3	390.9	8.0	591.3	1.2	598.0	.8	598.4
TOT NONCON	1,131.4	423.4	708.0	65.5	1,065.9	20.2	1,111.2	17.5	1,113.9
TSS	19,176.0	6,564.3	12,611.7	95.9	19,080.1	14.8	19,161.2	3.2	19,172.8
Oil & Grease	47.9	47.9	.0	47.9	.0	12.3	35.6	12.3	35.6
TOT CONV	19,223.9	6,612.3	12,611.7	143.8	19,080.1	27.1	19,196.9	15.5	19,208.4
TOT POLL	20,597.2	7,128.4	13,460.7	224.6	20,372.6	49.6	20,547.5	34.2	20,563.0
FLOW(l/yr)	7.99e6	7.99e6		7.99e6		1.23e6		1.23e6	

Table X-12

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	3.6	3.6	.0	3.6	.0	3.6	.0	2.6	1.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	68.5	52.1	16.4	3.0	65.4	.6	67.8	.5	67.9
Copper	2.9	2.9	.0	2.9	.0	2.9	.0	2.9	.0
Cyanide	34.2	2.5	31.7	2.5	31.7	.5	33.7	.4	33.9
Lead	2.5	2.5	.0	2.5	.0	.9	1.6	.6	1.9
Nickel	27.0	26.7	.4	26.7	.4	5.7	21.3	1.7	25.3
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	6.1	6.1	.0	6.1	.0	2.6	3.6	1.8	4.3
TOT TOXICS	144.9	96.4	48.4	47.4	97.5	16.9	128.0	10.5	134.4
Ammonia	2,166.0	2,166.0	.0	1,153.3	1,012.7	247.4	1,918.6	247.4	1,918.6
Fluoride	983.9	522.6	461.3	522.6	461.3	112.1	871.8	112.1	871.8
Hafnium	108.1	36.0	72.1	36.0	72.1	7.7	100.4	5.1	103.0
Zirconium	1,802.0	36.0	1,766.0	36.0	1,766.0	7.7	1,794.3	5.1	1,796.9
TOT NONCON	5,060.0	2,760.7	2,299.4	1,747.9	3,312.1	374.9	4,685.1	369.6	4,690.4
TSS	670.3	432.5	237.9	432.5	237.9	92.8	577.6	20.1	650.2
Oil & Grease	188.5	188.5	.0	188.5	.0	77.3	111.2	77.3	111.2
TOT CONV	858.8	621.0	237.9	621.0	237.9	170.1	688.8	97.4	761.4
TOT POLL	6,063.7	3,478.1	2,585.7	2,416.3	3,647.5	561.8	5,501.9	477.6	5,586.2
FLOW(l/yr)	3.604e7	3.604e7		3.604e7		7.73e6		7.73e6	

Table X-13

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
MAGNESIUM FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	13,561.6	9,086.6	4,475.0	1.2	13,560.4	.1	13,561.5	.1	13,561.5
Copper	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nickel	.0	.0	.0	.0	.0	.0	.0	.0	.0
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	43.8	30.4	13.4	4.8	39.1	.5	43.3	.4	43.4
TOT TOXICS	13,605.5	9,117.2	4,488.4	6.0	13,599.5	.8	13,604.8	.6	13,604.9
Aluminum	54.9	43.9	11.0	32.3	22.6	3.7	51.2	2.5	52.4
Iron	1.5	1.5	.0	1.5	.0	.7	.8	.5	1.1
Magnesium	3,709.4	2,488.5	1,221.0	14.4	3,695.0	1.7	3,707.8	1.1	3,708.4
TOT NONCON	3,765.8	2,533.8	1,232.0	48.2	3,717.7	6.0	3,759.8	4.0	3,761.8
TSS	2,479.5	912.4	1,567.1	172.8	2,306.7	19.8	2,459.7	4.3	2,475.2
Oil & Grease	795.3	580.4	214.9	144.0	651.3	16.5	778.8	16.5	778.8
TOT CONV	3,274.8	1,492.8	1,782.0	316.8	2,958.0	36.3	3,238.5	20.8	3,254.1
TOT POLL	20,646.2	13,143.8	7,502.4	371.0	20,275.2	43.1	20,603.1	25.4	20,620.8
FLOW(l/yr)	1.44e7	1.44e7		1.44e7		1.65e6		1.65e6	

Table X-14

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
URANIUM FORMING SUBCATEGORY
DIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	7.0	7.0	.0	1.6	5.4	.3	6.7	.2	6.8
Chromium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Copper	12.7	12.7	.0	11.9	.8	2.0	10.7	1.3	11.4
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	1.8	1.8	.0	1.8	.0	.4	1.4	.3	1.6
Nickel	33.6	33.6	.0	15.2	18.5	2.5	31.1	.8	32.9
Selenium	.2	.2	.0	.2	.0	.2	.0	.2	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	1.8	1.8	.0	1.8	.0	1.1	.7	.8	1.1
TOT TOXICS	57.2	57.2	.0	32.6	24.6	6.6	50.6	3.5	53.7
Aluminum	6.2	6.2	.0	6.2	.0	6.2	.0	5.1	1.0
Ammonia	307.5	307.5	.0	307.5	.0	110.1	197.4	110.1	197.4
Fluoride	410.0	410.0	.0	297.3	112.8	49.9	360.1	49.9	360.1
Iron	93.3	93.3	.0	8.4	84.9	1.4	91.9	1.0	92.3
Titanium	410.0	410.0	.0	20.5	389.5	3.4	406.6	2.3	407.7
Uranium	1,025.0	1,025.0	.0	20.5	1,004.5	3.4	1,021.6	2.3	1,022.7
TOT NONCON	2,251.9	2,251.9	.0	660.3	1,591.6	174.4	2,077.5	170.6	2,081.3
TSS	3,973.7	246.0	3,727.7	246.0	3,727.7	41.3	3,932.4	8.9	3,964.8
Oil & Grease	243.7	243.7	.0	205.0	38.7	34.4	209.3	34.4	209.3
TOT [illegible]	4,217.5	489.7	3,727.7	451.0	3,766.5	75.7	4,141.8	43.3	4,174.1
TOT POLL	6,526.6	2,798.9	3,727.7	1,143.9	5,382.7	256.6	6,269.9	217.5	6,309.1
FLOW(l/yr)	2.05e7	2.05e7		2.05e7		3.44e6		3.44e6	

Table X-15

PRODUCTION OPERATIONS - LEAD/TIN/BISMUTH FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge 1/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent emulsions	23.3	5.60	Mass of lead/tin/bismuth rolled with emulsions
	Spent soap solutions	43.0	10.3	Mass of lead/tin/bismuth rolled with soap solutions
Drawing	Spent neat oils	0	0	
	Spent emulsions	16.7	4.00	Mass of lead/tin/bismuth drawn with emulsions
	Spent soap solutions	7.46	1.79	Mass of lead/tin/bismuth drawn with soap solutions
Extrusion	Press and solution heat treatment contact cooling water	175	41.9	Mass of extruded lead/tin/bismuth heat treated
	Press hydraulic fluid leakage	49.3	11.8	Mass of lead/tin/bismuth extruded
Casting				
Continuous Strip Casting	Contact cooling water	1.00	0.240	Mass of lead/tin/bismuth cast by the continuous strip method
Semi-Continuous Ingot Casting	Contact cooling water	2.94	0.704	Mass of lead/tin/bismuth cast by the semi-continuous method
Shot Casting	Contact cooling water	4.20	1.01	Mass of lead/tin/bismuth shot cast
Shot Forming	Wet air pollution control blowdown	0.009	0.002	Mass of lead/tin/bismuth shot formed
Alkaline Cleaning	Spent baths	606	145	Mass of lead/tin/bismuth alkaline cleaned
	Rinsewater	646	155	Mass of lead/tin/bismuth alkaline cleaned
Swaging	Spent emulsions	1.77	0.424	Mass of lead/tin/bismuth swaged with emulsions

Table X-15 (Continued)

PRODUCTION OPERATIONS - LEAD/TIN/BISMUTH FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Degreasing	Spent solvent	0	0	
Miscellaneous Nondescript Wastewater Sources	Various	58.4	14.0	Mass of lead/tin/bismuth formed

Table X-16

PRODUCTION OPERATIONS - NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent neat oils	0	0	
	Spent emulsions	1,490	357	Mass of nickel/cobalt rolled with emulsions
	Contact lubricant-coolant water	1,340	321	Mass nickel/cobalt of rolled with contact-lubricant water
	Solution heat treatment contact cooling water	0.027	0.007	Mass of rolled nickel/cobalt heat treated
Tube Reducing	Spent lubricants	0	0	
Drawing	Spent neat oils	0	0	
	Spent emulsions	95.4	22.9	Mass of nickel/cobalt drawn with emulsions
Extrusion	Spent lubricants	0	0	
	Press and solution heat treatment contact cooling water	83.2	20.0	Mass of extruded nickel/cobalt heat treated
Forging, Extrusion, and Isostatic Press	Hydraulic fluid leakage	124	29.7	Mass of nickel/cobalt forged, extruded, or pressed
Forging	Equipment cleaning wastewater	163	39.0	Mass of nickel/cobalt forged
	Die contact cooling water	126	30.2	Mass of nickel/cobalt forged
Forging, Swaging	Spent neat oils	0	0	
Stationary Casting, Direct Chill Casting	Contact cooling water	1,780	428	Mass of nickel/cobalt cast by the stationary or direct chill method

Table X-16 (Continued)

PRODUCTION OPERATIONS - NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Casting	Vacuum melting steam condensate	168	40.4	Mass of nickel/cobalt vacuum melted
Metal Powder Production	Atomization wastewater	2,840	680	Mass of nickel/cobalt metal powder atomized
Annealing Solution Heat Treatment	Contact cooling water	457	110	Mass of nickel/cobalt annealed
Wet Air Pollution Control	Blowdown	251	60.2	Mass of nickel/cobalt formed
Surface Treatment	Spent baths	861	206	Mass of nickel/cobalt surface treated
	Rinsewater	1,060	253	Mass of nickel/cobalt surface treated
Alkaline Cleaning	Spent baths	30.6	7.34	Mass of nickel/cobalt alkaline cleaned
	Rinsewater	497	119	Mass of nickel/cobalt alkaline cleaned
Molten Salt	Rinsewater	1,280	307	Mass of nickel/cobalt treated with molten salt
Ammonia Rinse	Wastewater	15.7	3.77	Mass of nickel/cobalt treated with ammonia solution
Sawing, Grinding	Spent lubricants	1,000	240	Mass of nickel/cobalt sawed or ground

Table X-16 (Continued)

PRODUCTION OPERATIONS - NICKEL/COBALT FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge 1/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Steam Cleaning	Condensate	23.2	5.56	Mass of nickel/cobalt steam cleaned
Hydrostatic Tube Testing	Wastewater	135	32.4	Mass of nickel/cobalt tube tested by the hydrostatic method
Degreasing	Spent solvent	0	0	
Miscellaneous Nondescript Wastewater Sources	Various	58.4	14.0	Mass of nickel/cobalt formed

Table X-17

PRODUCTION OPERATIONS - ZINC FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge 1/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent neat oils	0	0	
	Spent emulsions	1.39	0.334	Mass of zinc rolled with emulsions
	Contact lubricant-coolant water	34.7	8.32	Mass of zinc rolled with contact lubricant-coolant water
Drawing	Spent emulsions	8.01	1.92	Mass of zinc drawn with emulsions
Casting				
Direct Chill Casting	Contact cooling water	50.3	12.1	Mass of zinc cast by the direct chill method
Stationary Casting	Contact cooling water	0	0	
Heat Treatment	Contact cooling water	76.1	18.3	Mass of zinc heat treated
Surface Treatment	Spent baths	9.50	2.28	Mass of zinc surface treated
	Rinsewater	486	117	Mass of zinc surface treated
Alkaline Cleaning	Spent baths	0.715	0.171	Mass of zinc alkaline cleaned
	Rinsewater	5,720	1,370	Mass of zinc alkaline cleaned
Sawing/Grinding	Spent lubricants	54.9	13.2	Mass of zinc sawed or ground
Degreasing	Spent solvent	0	0	

Table X-18

PRODUCTION OPERATIONS - BERYLLIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Area Cleaning	Wastewater	21,300	5,110	Mass of beryllium formed
Billet Washing	Wastewater	38.2	9.17	Mass of beryllium billets washed
Surface Treatment	Spent baths	308	73.8	Mass of beryllium surface treated
	Rinsewater	767	184	Mass of beryllium surface treated
Sawing, Grinding	Spent lubricants	424	102	Mass of beryllium sawed or ground
Inspection, Testing	Wastewater	0	0	
Degreasing	Spent solvent	0	0	

Table X-19

PRODUCTION OPERATIONS - PRECIOUS METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge 1/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent emulsions	36.0	8.60	Mass of precious metals rolled with emulsions
	Solution heat treatment contact cooling water	700	168	Mass of rolled precious metals heat treated
Drawing	Spent neat oils	0	0	
	Spent emulsions	21.3	5.10	Mass of precious metals drawn with emulsions
	Spent soap solutions	6.93	1.66	Mass of precious metals drawn with soap solutions
Extrusion	Press and solution heat contreatment contact cooling water	1,370	329	Mass of extruded precious metals heat treated
Casting				
Semi-Continuous, Continuous Casting	Contact cooling water	1,120	268	Mass of precious metals cast by the semi-continuous or continuous method
Stationary Casting	Contact cooling water	4.17	1.00	Mass of precious metals cast by the stationary method
Direct Chill Casting	Contact cooling water	818	196	Mass of precious metals cast by the direct chill method
Shot Casting	Contact cooling water	89.2	21.4	Mass of precious metals shot cast
Wet Air Pollution Control	Blowdown	5.86	1.40	Mass of precious metals cast
Metal Powder Production	Atomization wastewater	6,670	1,600	Mass of precious metals powder wet atomized
	Ball Milling Wastewater	2,170	520	Mass of precious metals powder wet ball milled

Table X-19 (Continued)

PRODUCTION OPERATIONS - PRECIOUS METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Pressure Bonding	Contact cooling water	83.5	20	Mass of precious metal and base metal pressure bonded
Annealing Solution Heat Treatment	Contact cooling water	1,000	240	Mass of precious metals annealed
Surface Treatment	Spent baths	155	37.2	Mass of precious metals surface treated
	Rinsewater	2,840	681	Mass of precious metals surface treated
Alkaline Cleaning	Spent baths	3.67	0.88	Mass of precious metals alkaline cleaned
	Rinsewater	692	166	Mass of precious metals alkaline cleaned
	Prebonding cleaning wastewater	340	81.7	Mass of precious metal and base metal cleaned prior to bonding
Tumbling	Wastewater	442	106	Mass of precious metals tumbled
Burnishing	Wastewater	2,570	617	Mass of precious metals burnished
Sawing/Grinding	Spent emulsions	6.05	1.45	Mass of precious metals sawed or ground
Degreasing	Spent solvent	0	0	

Table X-20

PRODUCTION OPERATIONS - IRON AND STEEL/COPPER/ALUMINUM
METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Metal Powder Production	Wet atomization wastewater	5,040	1,210	Mass of iron, copper, and aluminum powder wet atomized
	Milling wastewater	1,670	400	Mass of iron, copper, and aluminum powder milled
	Wet air pollution control blowdown	2,640	632	Mass of iron, copper, and aluminum powder produced
Sizing/Repressing	Spent lubricants	0	0	
Oil-Resin Impregnation	Wastewater	74.5	17.9	Mass of iron, copper, and aluminum powder metallurgy parts impregnated with oil-resin
Steam Treatment	Wet air pollution control blowdown	284	68.1	Mass of iron, copper, and aluminum powder metallurgy parts steam treated
Tumbling, Burnishing, Cleaning	Wastewater	715	171	Mass of iron, copper, and aluminum powder metallurgy parts tumbled, burnished, or cleaned
Sawing, Grinding	Spent lubricants	1,000	240	Mass of iron, copper, and aluminum powder metallurgy parts sawed or ground
Degreasing	Spent solvent	0	0	

Table X-21

PRODUCTION OPERATIONS - TITANIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge 1/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Rolling				
Cold Rolling	Spent lubricants	334	80.0	Mass of titanium cold rolled
Hot Rolling	Contact lubricant-coolant water	430	103	Mass of titanium hot rolled with contact lubricant-coolant water
Extrusion	Spent lubricants	274	65.7	Mass of titanium extruded
Forging	Spent lubricants	0	0	
	Die contact cooling water	300	72.1	Mass of titanium forged
	Wet air pollution control blowdown	202	48.5	Mass of titanium forged
Heat Treatment	Contact cooling water	451	108	Mass of titanium heat treated
Surface Treatment	Spent baths	160	38.5	Mass of titanium surface treated
	Rinsewater	2,110	505	Mass of titanium surface treated
	Wet air pollution control blowdown	17.0	4.08	Mass of titanium surface treated
Alkaline Cleaning	Spent baths	638	153	Mass of titanium alkaline cleaned
	Rinsewater	276	66.3	Mass of titanium alkaline cleaned
Tumbling	Wastewater	79.0	18.9	Mass of titanium tumbled
Grinding, Sawing	Spent lubricants	49.7	11.9	Mass of titanium sawed or ground
Degreasing	Spent solvent	0	0	

Table X-22

PRODUCTION OPERATIONS - REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge 1/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent neat oils	0	0	
	Spent emulsions	1,200	288	Mass of refractory metals rolled with emulsions
Drawing	Spent lubricants	0	0	
Extrusion	Press and solution heat treatment contact cooling water	346	83.0	Mass of extruded refractory metals heat treated
	Press hydraulic fluid leakage	1,190	285	Mass of refractory metals extruded
Forging	Spent lubricants	0	0	
	Solution heat treatment contact cooling water	579	139	Mass of forged refractory metals heat treated
Extrusion, Forging	Equipment cleaning wastewater	41.7	10.0	Mass of refractory metals extruded, forged
Metal Powder Production	Wastewater	1,640	393	Mass of refractory metals powder produced
	Wet air pollution control blowdown	0	0	
Metal Powder Pressing	Spent lubricants	0	0	
Casting	Contact cooling water	0	0	
	Post-casting billet washwater	29.8	7.14	Mass of cast refractory metals billets washed

Table X-22 (Continued)

PRODUCTION OPERATIONS - REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Surface Treatment	Spent baths	12.7	3.04	Mass of refractory metals surface treated
	Rinsewater	12,100	2,910	Mass of refractory metals surface treated
	Wet air pollution control blowdown	11,800	2,840	Mass of refractory metals surface treated
Surface Coating	Wet air pollution control blowdown	1,080	258	Mass of refractory metals surface coated
Alkaline Cleaning	Spent baths	30.6	7.34	Mass of refractory metals alkaline cleaned
	Rinsewater	1,400	335	Mass of refractory metals alkaline cleaned
Molten Salt Cleaning	Rinsewater	90,200	21,600	Mass of refractory metals cleaned with molten salt
Tumbling, Burnishing	Wastewater	2,210	530	Mass of refractory metals tumbled or burnished

Table X-22 (Continued)

PRODUCTION OPERATIONS - REFRACTORY METALS FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge 1/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Sawing, Grinding	Spent neat oils	0	0	
	Spent emulsions	217	52.1	Mass of refractory metals sawed, ground with emulsions
	Contact lubricant-coolant water	812	195	Mass of refractory metals sawed or ground with contact lubricant-coolant water
	Wet air pollution control blowdown	108	25.8	Mass of refractory metals sawed or ground
	Post-sawing, grinding rinsewater	51.3	12.3	Mass of sawed, ground refractory metals rinsed
Product Testing	Wastewater	7.76	1.86	Mass of refractory metals product tested
Degreasing	Spent solvent	0	0	

Table X-23

PRODUCTION OPERATIONS - ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Drawing	Spent lubricants	0	0	
Extrusion	Spent emulsions	74.1	17.8	Mass of zirconium/hafnium extruded with emulsions
	Press hydraulic fluid leakage	370	88.8	Mass of zirconium/hafnium extruded
	Press and solution heat treatment contact cooling water	28.5	6.84	Mass of extruded zirconium/hafnium heat treated
Tube Reducing	Spent lubricants	0	0	
Forging	Solution heat treatment contact cooling water	34.9	8.36	Mass of forged zironcium/hafnium heat treated
Surface Treatment	Spent baths	399	95.8	Mass of zirconium/hafnium surface treated
	Rinsewater	1,530	368	Mass of zirconium/hafnium surface treated
Alkaline Cleaning	Spent baths	2,130	511	Mass of zirconium/hafnium alkaline cleaned
	Rinsewater	5,530	1,330	Mass of zirconium/hafnium alkaline cleaned
Sawing, Grinding	Spent lubricants	9.01	2.16	Mass of zirconium/hafnium sawed or ground
	Wet air pollution control blowdown	0	0	
Degreasing	Spent solvents	0	0	
	Rinsewater	203	48.6	Mass of zirconium/hafnium degreased

Table X-24

PRODUCTION OPERATIONS - MAGNESIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Rolling	Spent emulsions	0	0	
	Spent lubricants	0	0	
	Wet air pollution control blowdown	266,000	63,800	Mass of magnesium forged
	Solution heat treatment contact cooling water	633	152	Mass of forged magnesium heat treated
	Equipment cleaning wastewater	162	38.8	Mass of magnesium forged
Direct Chill Casting	Contact cooling water	0	0	
Surface Treatment	Spent baths	465	111	Mass of magnesium surface treated
	Rinsewater	1,770	425	Mass of magnesium surface treated
Sawing, Grinding	Spent lubricants	0	0	
Sanding, Repairing	Wet air pollution control blowdown	428	103	Mass of magnesium sanded, repaired
Degreasing	Spent solvent	0	0	

Table X-25

PRODUCTION OPERATIONS - URANIUM FORMING SUBCATEGORY

Operation	Waste Stream	Normalized BAT Discharge l/kkg	Normalized BAT Discharge gal/ton	Production Normalizing Parameter
Extrusion	Spent lubricants	0	0	
	Tool contact cooling water	51.7	12.4	Mass of uranium extruded
	Press and solution heat treatment contact cooling water	272	65.3	Mass of extruded uranium heat treated
Forging	Spent lubricants	0	0	
	Solution heat treatment contact cooling water	284	68.2	Mass of forged uranium heat treated
Surface Treatment	Spent baths	35.6	8.52	Mass of uranium surface treated
	Rinsewater	148	35.5	Mass of uranium surface treated
	Wet air pollution control blowdown	74.2	17.8	Mass of uranium surface treated
Sawing, Grinding	Spent emulsions	3.10	0.744	Mass of uranium sawed or ground
	Post-sawing, grinding rinsewater	38.1	9.12	Mass of sawed or ground uranium rinsed
Degreasing	Spent solvent	0	0	

SECTION XI

NEW SOURCE PERFORMANCE STANDARDS

The basis for new source performance standards (NSPS) under Section 306 of the Clean Water 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. Therefore, NSPS includes process changes, in-plant controls (including elimination of wastewater streams), operating procedure changes, and end-of-pipe treatment technologies to reduce pollution to the maximum extent possible. This section describes the control technology for treatment of wastewater from new sources and presents mass discharge limitations of regulated pollutants for NSPS, based on the described control technology.

TECHNICAL APPROACH TO NSPS

The Agency considered three technology options which might be applied as the best available demonstrated technology. These options are identical to those considered for BAT and are described in detail in Section X. The options are summarized below:

NSPS Option 1:

Lime and settle (chemical precipitation of metals, followed by sedimentation), and
pH adjustment; and, where required,
Chemical emulsion breaking,
Oil skimming,
Ammonia steam stripping,
Cyanide removal, and
Hexavalent chromium reduction.

NSPS Option 2:

NSPS Option 1, plus process wastewater flow minimization by the following methods:

- Heat treatment contact cooling water recycle through cooling towers.
- Air pollution control scrubber liquor recycle.
- Countercurrent cascade rinsing or other water efficient methods applied to surface treatment rinses.

NSPS Option 3:

NSPS Option 2, plus multimedia filtration at the end of the NSPS Option 2 treatment train.

NSPS OPTION SELECTION

EPA is proposing that NSPS for all 11 subcategories be equal to BAT for those subcategories, since the Agency did not identify any additional technology which removes significant quantities of additional pollutants. Specifically, BDT technology is equivalent to NSPS Option 2 for the lead/tin/bismuth forming subcategory and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory. For the other nine subcategories, BDT technology is equivalent to NSPS Option 3. The technology basis for setting discharge limits for conventional pollutants for each subcategory would also be the BAT technology (even when BCT is less stringent than BAT for that subcategory).

The data relied upon for selection of NSPS were the data developed for the evaluation of treatment Options 1 through 3 as BAT for existing sources. The Agency believes that compliance costs could be lower for new sources than the cost estimates for equivalent existing sources, because production processes can be designed on the basis of lower flows and there will be no costs associated with retrofitting the in-process controls. Therefore, new sources, regardless of whether they are plants with major modifications (e.g., a nonferrous metals forming plant which installs a new rolling operation) or greenfield sites, will have costs that are not greater than the costs that existing sources would incur in achieving equivalent pollutant discharge reduction. Based on this the Agency believes that the selected NSPS (NSPS Options 2 and 3) are appropriate for both greenfield sites and existing sites undergoing major modifications.

As discussed in Section X, the Agency will consider promulgating Option 2 as the BAT model technology for subcategories for which Option 3 is proposed. Similarly, the Agency will consider promulgating Option 2 as the NSPS model technology for subcategories where the Agency is proposing NSPS based on Option 3 if the costs of NSPS based on the addition of filtration have been significantly underestimated. Once again, integration of plants is a particular concern, though it is generally easier and less expensive to install appropriate wastewater treatment technology in new plants than to retrofit existing plants.

The Agency is also considering promulgating Option 3 as the BAT model technology for both the lead/tin/bismuth and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategories. Similarly, Option 3 will be considered as the basis for PSNS if plant-by-plant analysis and additional data show that filtration does remove significant additional quantities of pollutants in these two subcategories and that the filtration technology is economically achievable.

Costs and Environmental Benefits of Treatment Options

Costs for an individual new source can be estimated using the methods described in Section VIII. The Agency has not estimated total costs or benefits for the category or subcategories since it is not known how many new nonferrous metals forming plants will be built.

REGULATED POLLUTANT PARAMETERS

The Agency has no reason to believe that the pollutants that will be found in significant quantities in processes within new sources will be any different than those found in existing sources. Consequently, the toxic and nonconventional pollutants selected for NSPS regulation are the same ones for each subcategory that were selected for BAT in accordance with the rationale of Section VI. The pollutants regulated at NSPS also include TSS, oil and grease, and pH.

CALCULATION OF NEW SOURCE PERFORMANCE STANDARDS

Because the pollutants regulated (with the addition of pH, oil and grease, and TSS for NSPS), the regulatory PNF's, and treatment trains at NSPS are identical to those at BAT, the NSPS (mass of pollutant allowed to be discharged per mass of product) are identical to BAT mass limitations and were calculated in the same manner. The one-day maximum and ten-day average effluent concentrations of each pollutant attainable by the selected treatment options (Table VII-9) were multiplied by the regulatory production normalized flows. The ten-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits. The resulting values are presented for each of the 11 subcategories in Section II, Part 4, Subparts A through K.

Alternate NSPS, based on Option 2 for those subcategories for which Option 3 is proposed and Option 3 for those subcategories for which Option 2 is proposed are found in Section II, Part 9, Subparts A through K.

SECTION XII

PRETREATMENT STANDARDS

Section 307(b) of the Clean Water Act requires EPA to promulgate pretreatment standards for existing sources (PSES). These standards 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 adds a new dimension by requiring pretreatment for pollutants, such as heavy metals, that limit POTW sludge management alternatives, including the beneficial use of sludges on agricultural lands. The legislative history of the 1977 Act indicates that pretreatment standards are to be technology based, analogous to the best available technology for removal of toxic pollutants.

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.

General Pretreatment Regulations for Existing and New Sources of Pollution appear in 40 CFR Parts 125 and 403. These regulations describe the Agency's overall policy for establishing and enforcing pretreatment standards for new and existing users of a POTW and delineate the responsibilities and deadlines applicable to each party in this effort. Prohibited discharges which apply to all users of a POTW appear in 40 CFR 403.5(b).

This section describes the treatment and control technology for pretreatment of process wastewaters from existing sources and new sources, and describes the calculation of mass discharge standards of regulated pollutants for existing and new sources, based on the described control technology.

DISCHARGE OF NONFERROUS METALS FORMING WASTEWATERS TO A POTW

There are 114 plants in the nonferrous metals forming industry which discharge to a POTW. The plants that may be affected by pretreatment standards represent about 78 percent of the nonferrous metals forming plants which discharge wastewater and approximately 39 percent of the entire category.

Pretreatment standards are established to ensure removal of pollutants which interfere with, pass through, or are otherwise incompatible with a POTW. A determination of which pollutants may pass through or be incompatible with POTW operations, and thus be subject to pretreatment standards, depends on the level of treatment employed by the POTW. In general, more pollutants will pass through or interfere with a POTW employing primary treatment (usually physical separation by settling) than one which has installed secondary treatment (settling plus biological treatment).

Many of the pollutants contained in nonferrous metals forming wastewaters are not biodegradable and are, therefore, ineffectively treated by biological treatment systems. Furthermore, some of these pollutants are known to pass through or interfere with the normal operations of these systems. Problems associated with the uncontrolled release of pollutant parameters identified in nonferrous metals forming process wastewaters to POTWs are discussed in the administrative record which accompanies this rulemaking. The discussion covers pass through, interference, and sludge usability.

The Agency based the selection of pretreatment standards for the nonferrous metals forming category on the minimization of pass through of toxic pollutants at a POTW. For each subcategory, the Agency compared the percentage of a pollutant removed by a well-operated POTW achieving secondary treatment with the percentage removed by direct dischargers. A pollutant was deemed to pass through the POTW when the average percentage removed nationwide by well-operated POTWs meeting secondary treatment requirements was 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, 1982).)

The Agency compared 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. The POTW removal rates were determined through a study conducted by the Agency at over 40 POTWs and a statistical analysis of the data. (See Fate of Priority Pollutants in Publicly Owned Treatment Works, Final Report, EPA 440/1-82/303, September 1982; and Determining National Removal Credits for Selected Pollutants for Publicly Owned Treatment Works, EPA 440/2-82-008, September, 1982.) The percent removals achieved for seven of the toxic metals and cyanide achieved by 25 percent of the POTWs in the "40 Cities Study" are presented in Table XII-1. The removals ranged from 19 to 66 percent. Limited information showing the removal

of other toxic and nonconventional pollutants is available. However, the Agency assumes that the removals are in the same range as the removals achieved for the studied pollutants. Therefore, in cases where the BAT technology achieves a greater percent removal of the seven toxic metals and cyanide than is achieved by a well-operated POTW with secondary treatment (i.e., these pollutants pass through the POTW), it is assumed that the other toxic metals and nonconventional pollutants would also pass through the POTW in the absence of pretreatment.

The Agency has concluded that the pollutants that would be regulated in the nonferrous metals forming category (primarily toxic metals) pass through a POTW. This conclusion is based on the fact that the percentage of these pollutants removed by a well-operated POTW (see Table XII-1) is less than the percentage removed by the treatment technology upon which BAT is based (Table XII-2). For example, a POTW will remove 48 percent of the lead in an influent wastewater; a lead forming plant with Option 2 treatment technology (flow reduction, lime and settle) will remove 99.9 percent of the lead from its wastewater. Therefore, lead is considered to pass through the POTW.

The percentage of each pollutant removed by BAT technology was calculated as follows. The total mass of the pollutant in discharged wastewater treated by the technology selected for BAT for the subcategory (BAT mass, kg/yr) was subtracted from the total mass of the pollutant in untreated wastewater (raw mass, kg/yr). This difference was divided by the raw mass and multiplied by 100 to yield the percent removed by BAT technology, or:

$$\frac{\text{Raw Mass - BAT Mass}}{\text{Raw Mass}} \times 100 = \text{Percent Removed by BAT Technology}$$

For some pollutants the percent removed was calculated for direct dischargers and in other cases it was calculated for indirect dischargers (see Table XII-2).

As described in Section X, the total mass of a pollutant in untreated wastewater was estimated by multiplying the average concentration of the pollutant in the total subcategory wastewater by the total wastewater flow in the subcategory. The total mass of the pollutant in discharged wastewater treated by each technology option was estimated by multiplying the average concentration of the pollutant achievable using that option (Table VII-9) by the total flow discharged at that option. Consequently, if the average subcategory concentration was less than the concentration achievable using the BAT treatment technology, the calculated percent removal was zero.

For some regulated pollutants (in particular, cyanide, ammonia, and fluoride) the percent removals, calculated as described above, are very low or zero. This is due to the use of average subcategory concentrations in the calculation. These pollutants are not expected to be present in all waste streams in a subcategory (see Section V). When they are present, they are present in concentrations significantly above treatable concentrations and substantial removals would be achieved by treatment at an individual plant.

No sampling data was available for several nonconventional pollutants regulated in some subcategories (columbium, hafnium, tantalum, tungsten and zirconium). However, for all of these pollutants, raw wastewater concentrations were estimated for the benefit calculations described in Section X and percent removals were calculated. However, no estimates were made for vanadium benefits or removal.

As discussed in Sections VIII and X, the Agency intends to recalculate the costs and benefits of each technology option on a plant-by-plant basis prior to promulgation of these standards. This method of calculation will eliminate the use of average subcategory concentrations in estimating benefits and thus more accurately represent the true removals of cyanide, ammonia and fluoride achievable by the technology options. After recalculating benefits, the Agency also intends to re-estimate percentages of pollutants removed by BAT technology and include estimates for vanadium.

However, based upon the estimate made for proposal of these guidelines and standards, the national average percentage of the toxic metals removed by a well-operated POTW meeting secondary treatment requirements is about 50 percent (varying from 19 to 66 percent; see Table XII-1), whereas the percentage that can be removed by BAT level treatment of nonferrous metals forming wastewater is approximately 99 percent (see Table XII-2). Hence, the Agency has concluded that, in general, toxic metals pass through a POTW and pretreatment standards for the indirect discharge of nonferrous metals forming wastewater are required.

TECHNICAL APPROACH TO PRETREATMENT

The pretreatment options for existing sources and new sources are identical to the options considered for BAT and are described in detail in Section X. The options are summarized below:

Pretreatment Option 1:

Lime and settle (chemical precipitation of metals followed by sedimentation) and pH adjustment; and, where required,

- Chemical emulsion breaking,
- Oil skimming,
- Ammonia steam stripping,
- Cyanide removal, and
- Hexavalent chromium reduction.

Pretreatment Option 2:

Pretreatment Option 1, plus process wastewater flow minimization by the following methods:

- Heat treatment contact cooling water recycle through cooling towers,
- Air pollution control scrubber liquor recycle, and
- Countercurrent cascade rinsing or other water efficient methods applied to surface treatment rinses.

Pretreatment Option 3:

Pretreatment Option 2, plus multimedia filtration at the end of the pretreatment Option 2 treatment train.

PSES AND PSNS OPTION SELECTION

EPA has selected PSES equal to BAT for all subcategories except the zinc and beryllium forming subcategories. The Agency proposes to exclude beryllium forming from PSES under the provisions of Paragraph 8(b) of the Settlement Agreement because there are no existing indirect dischargers in the beryllium forming subcategory.

The Agency proposes to exclude zinc forming from regulation because the economic impacts of pretreatment standards on this subcategory appear to be disproportionate. There are two indirect dischargers and one direct discharger in the subcategory. Costs of implementing the three technology options were estimated using the computer cost model for the direct discharger. The estimated costs were extrapolated to the indirect dischargers. Three methods of extrapolating the costs were used, each giving

substantially different results. However, for each method used, one plant is projected to close if required to comply with any of the three pretreatment options. This plant is by far the larger of the two indirect dischargers in the subcategory.

The Agency will reassess the costs of implementing the three technology options at the indirectly discharging zinc forming plants prior to promulgation. If this reassessment indicates that no plants will close, categorical pretreatment standards will be promulgated for this subcategory. These standards would be based on one of the three technology options described above.

It should be noted that even if the Agency does not promulgate categorical pretreatment standards for this subcategory, indirectly discharging zinc forming plants will still be subject to the general pretreatment standards.

PSES is equal to BAT for the remaining subcategories. That is, the technology basis for PSES is pretreatment Option 2 for the lead/tin/bismuth forming subcategory and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory and pretreatment Option 3 for the seven other subcategories regulated at PSES. The options selected for PSES achieve effective removal of toxic pollutants at a reasonable cost for each subcategory.

Three of the indirect dischargers in the category have filtration technology or provide additional sedimentation which is achieving effluent concentrations equivalent to those achieved by filtration. Implementation of the proposed PSES would remove annually an estimated 64,000 kg (141,200 pounds) of toxic pollutants over the current discharge. Capital costs for achieving the proposed PSES is $6.8 million, with an annualized cost of $3.72 million.

The technology options selected for PSES result in more stringent standards than if the technology option equivalent to BPT (Option 1) were selected. The Agency believes that Option 1 technology would not provide adequate removal of toxic pollutants. This conclusion is based on the fact that the selected PSES options would provide a substantial increase in percent removal over Option 1 technology (see Table XII-3).

The percentage of each pollutant removed by the PSES technology not removed by Option 1 technology was calculated in a manner similar to the calculation of percentage removal by BAT technology. That is:

$$\frac{\text{Option 1 Mass} - \text{PSES Mass}}{\text{PSES Mass}} \times 100 = \text{Percentage Removal Pretreatment Option 1 to Selected PSES Option}$$

This represents the percentage removal which would not be achieved unless pretreatment standards were enacted (assuming plants are presently using treatment technology equivalent to Option 1). For example, selecting PSES Option 2 would remove 66.8 percent more lead from lead forming wastewater than selecting PSES Option 1.

Just as with BAT, the Agency will give consideration to adopting Option 2 as the PSES technology for those subcategories where it is proposing Option 3 if it determines that the costs of this treatment level have been seriously underestimated. The costs of each technology option are listed in Table XII-4. The pollutant removals provided by each technology option are provided in Tables XII-6 through XII-13.

The Agency is also considering promulgating Option 3 for both the lead/tin/bismuth and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategories, if the plant-by-plant analysis and additional data show that filtration does remove significant additional quantities of pollutants in these two subcategories and that the filtration technology is economicaly achievable. The pollutant removals and costs of removal provided by each technology option are provided in Tables XII-4, XII-5, and XII-9.

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 dischargers will produce wastes having the same pass through problems as described for existing dischargers. In selecting the technology basis for PSNS, the Agency compared the toxic pollutant removals achieved by a well-operated POTW to that achieved by a direct discharger meeting NSPS. New indirect dischargers, like new direct dischargers, 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.

EPA is proposing mass-based PSNS for all subcategories to assure that the identified flow reduction technologies are considered in new plant designs. In addition, EPA is proposing PSNS for the zinc forming and beryllium forming subcategories for which BAT and NSPS, but not PSES, are proposed.

The technology basis for the proposed PSNS is identical to NSPS, that is, BAT. It is necessary to propose PSNS for all regulated toxic metals for the reasons given above under PSES. The Agency did not identify any economically feasible, demonstrated technology that removes significantly more pollutants than BAT technology. Because PSNS does not include any additional costs compared

to PSES, it is not believed that PSNS will prevent the entry of new plants.

Pretreatment Option 3 (flow reduction, lime and settle, multimedia filtration) is selected for nine of the 11 subcategories as the regulatory approach for PSNS and pretreatment Option 2 (flow reduction, lime and settle) is selected for the lead/tin/bismuth forming subcategory and the iron and steel/copper/aluminum metal powder production and powder metallurgy subcategory. These pretreatment technology options were selected because they achieve effective removal of toxic pollutants at a reasonable cost.

The data relied upon for selection of PSNS were the data developed for the evaluation of pretreatment Options 1 through 3 for existing sources. The Agency believes that compliance costs could be lower for new sources than the cost estimates for equivalent existing sources, because production processes can be designed on the basis of lower flows and there will be no costs associated with retrofitting the in-process controls. Therefore, new sources, regardless of whether they are plants with major modifications (e.g., a nonferrous metals forming plant which installs a new rolling operation) or greenfield sites, will have costs that are not greater than the costs that existing sources would incur in achieving equivalent pollutant discharge reduction. Based on this, the Agency believes that the selected PSNS (pretreatment Options 2 and 3) are appropriate for both greenfield sites and existing sites undergoing major modifications.

For the same reasons as discussed for BAT, NSPS, and PSES, EPA is considering promulgating Option 2 as the technology basis for PSNS for the subcategories where it is proposing Option 3 as PSNS. The Agency is also considering promulgating Option 3 as the technology basis for PSNS for the lead/tin/bismuth forming and the iron and steel/copper/aluminum subcategories where it is proposing Option 2 as PSNS.

Costs and Environmental Benefits of Treatment Options

As a means of evaluating the economic achievability of each of the PSES options, the Agency developed estimates of the compliance costs and benefits. Estimates of capital and annual costs for the pretreatment options were prepared for each subcategory as an aid in choosing the best pretreatment option. The cost estimates for indirect dischargers are presented in Table XII-4.

The method used to estimate costs has been described in detail in Section VIII. The method used to estimate benefits has been described in detail in Section X. The pollutant reduction benefit estimates for eight subcategories are presented in Tables XII-5 through XII-13. Insufficient data were available prior to

proposal to estimate costs or benefits for the indirect discharger in the uranium forming subcategory. These data will be added to the record as they become available.

REGULATED POLLUTANT PARAMETERS

The same pollutants selected for regulation at BAT have been selected for regulation under the pretreatment standards for each of the nine subcategories regulated under PSES and each of the 11 subcategories regulated under PSNS. The selection process and pollutants selected for regulation are given in detail in Section VI.

CALCULATION OF PRETREATMENT STANDARDS

PSES for this category are expressed in terms of mass per unit of production (mass-based) rather than concentration standards. Regulation on the basis of concentration is not appropriate for this category because flow reduction is a significant part of the model technology for pretreatment. Therefore, the Agency is not proposing concentration-based pretreatment standards (40 CFR Part 403.6) for this category.

The regulatory production normalized flows for PSES and PSNS are equivalent to BAT flows (see Tables X-15 to X-25).

Because the production normalized flows, regulated pollutants, and treatment trains at PSES and PSNS are also identical to those at BAT, the mass-based PSES and PSNS (mass of pollutant allowed to be discharged per mass of product) for the toxic and nonconventional pollutants are identical to BAT mass limitations and were calculated in the same manner. The one-day maximum and ten-day average effluent concentrations of each pollutant attainable by the selected treatment options (Table VII-9) were multiplied by the BAT production normalized flows. The ten-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits. The resulting PSES are found in Section II, Part 5, Subparts A through K. The resulting PSNS are found in Section II, Part 6, Subparts A through K.

Alternate PSES, based on Option 2 for those subcategories for which Option 3 is proposed and Option 3 for those subcategories for which Option 2 is proposed are found in Section II, Part 10, Subparts A through K. Alternate PSNS, based on Option 2 for those subcategories for which Option 3 is proposed and Option 3 for those subcategories for which Option 2 is proposed are found in Section II, Part 11, Subparts A through K.

Section 307(b)(1) of the Clean Water Act requires that the date for compliance with PSES be no more than three years from the regulation's final promulgation date. Few of the 114 indirect dischargers in this category have installed and are properly operating the treatment technology proposed as the basis for PSES. The readjustment of internal processing conditions to achieve reduced wastewater flows may require further time above installation of end-of-pipe treatment equipment. Many plants in this and other industries also will be installing the treatment equipment suggested as model technologies for this regulation which may result in delays in engineering, ordering, installing, and operating this equipment. Under these circumstances, the Agency believes that three years is the appropriate compliance deadline under Section 307(b)(1) of the Clean Water Act.

Table XII-1

POTW REMOVALS OF TOXIC POLLUTANTS IN THE "40 CITIES STUDY"

Toxic Pollutant	Number of POTW's	25th Percentile of the Removal Distribution
Cadmium	14	38%
Chromium	36	65%
Copper	39	58%
Cyanide	37	52%
Lead	11	48%
Nickel	30	19%
Silver	15	66%
Zinc	39	65%

Source: Determining National Removal Credits for Selected Pollutants for Publicly Owned Treatment Works, EPA 440/2-82-008, September, 1982.

Table XII-2

PERCENTAGE REMOVAL BY BAT TECHNOLOGY OPTIONS

		Forming Subcategory										
Toxic Pollutants	POTW Removal Percentage	Pb/Sn/Bi[a] Option 2	Ni/Co[a] Option 3	Zn[b] Option 3	Be[b] Option 3	Precious Metals[a] Option 3	MPP and P/M of Fe/Cu/Al[a] Option 2	Tl[a] Option 3	Refractory Metals[a] Option 3	Zr/Hf[a] Option 3	Mg[a] Option 3	U[b] Option 3
Antimony	N/A (c)	89.3 (f)	0.0	—	—	—	0.0	—	—	—	—	—
Arsenic	N/A	0.0 (d)	0.0	—	—	—	0.0	—	—	0.0	—	—
Beryllium	N/A	— (e)	—	—	99.7 (f)	—	—	—	—	—	0.0	—
Cadmium	38	—	—	—	51.5	99.8 (f)	—	—	87.7	—	—	97.6 (f)
Chromium	65	—	99.9 (f)	32.2 (f)	69.9	—	91.5	40.8	95.8	97.9 (f)	100.0 (f)	—
Copper	58	67.9	99.6	—	85.1 (f)	99.8 (f)	99.9 (f)	80.6	97.1 (f)	0.0	0.0	89.4 (f)
Cyanide	52	—	—	0.0 (f,g)	0.0 (f,g)	85.9 (f)	91.9 (f)	0.0 (f,g)	—	97.2 (f)	0.0	—
Lead	48	99.9 (f)	62.8	0.0	0.0	—	99.9 (f)	99.5 (f)	—	35.2	0.0	85.1
Nickel	19	—	99.9 (f)	—	67.0	99.7	94.9	38.0	99.7 (f)	83.4 (f)	—	97.7 (f)
Selenium	N/A	—	0.0	—	—	—	—	3.3	—	—	—	0.0
Silver	66	—	0.0	—	—	99.8 (f)	—	—	85.9	—	—	—
Thallium	N/A	—	—	—	0.0	—	—	—	—	—	—	—
Zinc	65	47.8	93.9	99.8 (f)	76.5	70.1	97.7	95.7 (f)	86.1	23.3	97.5 (f)	57.1
Total Toxics		98.9	99.8	99.6	98.2	99.7	99.7	95.0	99.0	86.4	100.0	93.8

Table XII-2 (Continued)

PERCENTAGE REMOVAL BY BAT TECHNOLOGY OPTIONS

		Forming Subcategory										
Toxic Pollutants	POTW Removal Percentage	Pb/Sn/Bi[a] Option 2	Ni/Co[a] Option 3	Zn[b] Option 3	Be[b] Option 3	Precious Metals[a] Option 3	MPP and P/M of Fe/Cu/Al[a] Option 2	Ti[a] Option 3	Refractory Metals[a] Option 3	Zr/Hf[a] Option 3	Mg[a] Option 3	U[b] Option 3
Aluminum	N/A (c)	0.0 (d)	86.1	0.0	0.0	0.0	98.8 (f)	98.5	97.7	—	87.3	16.7
Ammonia	N/A	0.0	0.0	—	0.0	0.0	0.0	83.5 (f)	0.0	69.8 (f)	0.0 (f,g)	64.2
Bismuth	N/A	83.4	—	—	—	—	—	—	—	—	—	—
Cobalt	N/A	— (e)	99.2	94.4	43.9	—	—	97.9	87.7	—	—	—
Columbium	N/A	—	—	—	—	—	—	—	98.0 (f)	—	—	—
Fluoride	N/A	0.0	93.3 (f)	—	0.0 (f,g)	0.0	0.0	99.1	0.0 (f,g)	69.9 (f)	0.0 (f,g)	87.8
Hafnium	N/A	—	—	—	—	—	—	—	—	87.5 (f)	—	—
Iron	N/A	87.7	99.7	—	95.0	41.5	100.0 (f)	100.0	99.2	—	13.5	99.0
Magnesium	N/A	—	—	—	—	—	—	—	—	—	99.9 (f)	—
Molybdenum	N/A	—	—	—	—	—	—	—	96.0 (f)	—	—	—
Tantalum	N/A	—	—	—	—	—	—	—	99.0 (f)	—	—	—
Tin	N/A	83.4	—	—	—	—	—	—	—	—	—	—
Titanium	N/A	—	—	—	—	—	—	99.7 (f)	—	—	—	99.4
Tungsten	N/A	—	—	—	—	—	—	—	98.7 (f)	—	—	—
Uranium	N/A	—	—	—	—	—	—	—	—	—	—	99.8
Vanadium	N/A	—	—	—	—	—	—	98.9	— (f,h)	—	—	—
Zirconium	N/A	—	—	—	—	—	—	—	—	99.3 (f)	—	—
Total Nonconventionals		57.7	89.3	83.7	44.5	5.5	98.1	98.3	98.0	80.7	99.7	92.4

Table XII-2 (Continued)

PERCENTAGE REMOVAL BY BAT TECHNOLOGY OPTIONS

[a] Data based on indirect dischargers

[b] Data based on direct dischargers

(c) N/A - Not available

(d) 0.0 percent removal means the pollutant is present in wastewater from this subcategory at less than treatable concentrations

(e) Means this pollutant was never detected in wastewater from this subcategory

(f) This pollutant is regulated in this subcategory

(g) This pollutant was present in some waste streams above treatable concentrations; average subcategory concentration is less than treatable

(h) This pollutant is believed to be present in some waste streams in significant concentrations, no estimate of these concentrations was made

Table XII-3

PERCENTAGE REMOVAL - PRETREATMENT OPTION 1 TO SELECTED PSES OPTIONS

		Forming Subcategory								
Toxic Pollutants	POTW Removal Percentage	Pb/Sn/Bi(a) Option 2	Ni/Co(a) Option 3	Precious Metals(a) Option 3	MPP and P/M of Fe/Cu/Al(a) Option 2	Ti(a) Option 3	Refractory Metals(a) Option 3	Zr/Hf(a) Option 3	Mg(a) Option 3	U(b) Option 3
Antimony	N/A (c)	66.8 (f)	0.0	—	0.0	—	—	—	—	—
Arsenic	N/A	0.0 (d)	0.0	—	0.0	—	—	0.0	—	—
Beryllium	N/A	— (e)	—	—	—	—	—	—	0.0	—
Cadmium	38	—	—	70.2 (f)	—	—	81.2	—	—	89.6 (f)
Chromium	65	—	76.4 (f)	—	89.9	40.8	74.8	52.7 (f)	73.0 (f)	—
Copper	58	66.8	80.9	67.7 (f)	89.9 (f)	77.3	79.7 (f)	0.0	0.0	88.7 (f)
Cyanide	52	—	—	67.7 (f)	89.9 (f)	0.0 (f,g)	—	61.9 (f)	0.0	—
Lead	48	66.8 (f)	62.8	—	89.9 (f)	0.0 (f)	—	35.2	0.0	85.1
Nickel	19	—	91.6 (f)	85.7	89.9	38.0	91.0 (f)	83.1 (f)	—	95.0 (f)
Selenium	N/A	—	0.0	—	—	3.3	—	—	—	0.0
Silver	66	—	0.0	66.4 (f)	—	—	78.8	—	—	—
Thallium	N/A	—	—	—	—	—	—	—	—	—
Zinc	65	47.8	80.2	66.5	89.9	76.4	78.9	23.3	77.4	57.1
Total Toxics		62.7	82.6	74.5	88.5	68.0	83.7	58.4	75.3	89.1

Table XII-3 (Continued)

PERCENTAGE REMOVAL - PRETREATMENT OPTION 1 TO SELECTED PSES OPTIONS

Toxic Pollutants	POTW Removal Percentage	Forming Subcategory								
		Pb/Sn/Bi(a) Option 2	Ni/Co(a) Option 3	Precious Metals(a) Option 3	MPP and P/M of Fe/Cu/Al(a) Option 2	Ti(a) Option 3	Refractory Metals(a) Option 3	Zr/Hf(a) Option 3	Mg(a) Option 3	U(b) Option 3
Aluminum	N/A (c)	0.0 (d)	81.1	0.0	89.9	77.5	79.9	—	78.4	16.7
Ammonia	N/A	0.0	0.0	0.0	0.0	66.2	0.0	43.3	—	64.2
Bismuth	N/A	66.8	—	—	—	—	—	—	—	—
Cobalt	N/A	— (e)	80.7	—	—	77.0	79.4	—	—	—
Columbium	N/A	—	—	—	—	—	80.0	—	—	—
Fluoride	N/A	0.0	71.6 (f)	0.0	0.0	66.2	0.0 (f,g)	43.3 (f)	0.0 (f,g)	83.2
Hafnium	N/A	—	—	—	—	—	—	62.6 (f)	—	—
Iron	N/A	66.8	80.6	41.5	89.9 (f)	76.9	79.3	—	13.5	88.5
Magnesium	N/A	—	—	—	—	—	—	—	78.6 (f)	—
Molybdenum	N/A	—	—	—	—	—	80.0 (f)	—	—	—
Tantalum	N/A	—	—	—	—	—	80.0 (f)	—	—	—
Tin	N/A	66.8	—	—	—	—	—	—	—	—
Titanium	N/A	—	—	—	—	77.7	—	—	—	88.9
Tungsten	N/A	—	—	—	—	—	80.0 (f)	—	—	—
Uranium	N/A	—	—	—	—	—	—	—	—	88.9
Vanadium	N/A	—	—	—	—	77.7	— (f,h)	—	—	—
Zirconium	N/A	—	—	—	—	—	—	62.6 (f)	—	—
Total Nonconventionals		33.7	54.0	5.5	51.4	67.2	65.3	44.1	76.4	74.2

Table XII-3 (Continued)

PERCENTAGE REMOVAL - PRETREATMENT OPTION 1 TO SELECTED PSES OPTIONS

(a) Data based on indirect dischargers.

(b) Data based on direct dischargers.

(c) N/A - Not available.

(d) 0.0 percent removal means the pollutant is present in wastewater from this subcategory at concentrations lower than that treatable by BAT technology.

(e) Means the pollutant was never detected in wastewater from this subcategory.

(f) This pollutant is regulated in this subcategory.

(g) This pollutant was present in some waste streams above treatable concentrations; average subcategory concentration is less than treatable.

(h) This pollutant is believed to be present in some waste streams in significant concentrations; no estimate of these concentrations was made.

Table XII-4

CAPITAL AND ANNUAL COST ESTIMATES FOR PSES OPTIONS
INDIRECT DISCHARGERS ($1982)

Subcategory	Option 1	Option 2	Option 3
Lead/Tin/Bismuth Forming			
Capital	177,700	325,600	401,800
Annual	125,000	114,000	154,000
Nickel/Cobalt Forming			
Capital	1,539,000	2,425,500	2,639,700
Annual	886,500	826,600	949,500
Zinc Forming			
Capital	30,186	30,874	36,575
Annual	9,909	10,931	13,233
Precious Metals Forming			
Capital	382,400	622,900	733,600
Annual	241,800	313,500	369,700
Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy			
Capital	1,770,000	1,479,000	1,527,200
Annual	716,600	654,100	696,400
Titanium Forming			
Capital	310,300	527,700	567,200
Annual	165,500	203,000	223,200
Refractory Metals Forming			
Capital	374,500	727,800	815,400
Annual	244,500	310,100	355,900
Zirconium/Hafnium Forming			
Capital	1,900	3,300	3,500
Annual	900	1,300	1,400

Table XII-4 (Continued)

CAPITAL AND ANNUAL COST ESTIMATES FOR PSES OPTIONS
INDIRECT DISCHARGERS ($1982)

Subcategory	Option 1	Option 2	Option 3
Magnesium Forming			
Capital	210	220	280
Annual	340	360	400
Totals			
Capital	4,556,000	6,112,000	6,688,700
Annual	2,381,100	2,423,000	2,750,500

Table XII-5

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
LEAD/TIN/BISMUTH FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	61.0	53.6	7.5	19.6	41.4	6.5	54.5	4.4	56.6
Arsenic	1.1	1.1	.0	1.1	.0	1.1	.0	1.1	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Copper	16.8	16.7	.1	16.2	.6	5.4	11.4	3.6	13.2
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	1,445.7	1,186.1	259.6	3.4	1,442.3	1.1	1,444.6	.7	1,444.9
Nickel	.0	.0	.0	.0	.0	.0	.0	.0	.0
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	5.9	5.9	.0	5.9	.0	3.1	2.8	2.1	3.7
TOT TOXICS	1,530.5	1,263.3	267.2	46.2	1,484.3	17.2	1,513.3	12.0	1,518.5
Aluminum	6.2	6.2	.0	6.2	.0	6.2	.0	6.2	.0
Ammonia	31.9	31.9	.0	31.9	.0	31.9	.0	31.9	.0
Bismuth	56.0	50.9	5.0	28.0	28.0	9.3	46.7	6.1	49.8
Fluoride	28.0	28.0	.0	28.0	.0	28.0	.0	28.0	.0
Iron	31.1	27.5	3.5	11.5	19.6	3.8	27.3	2.6	28.5
Tin	56.0	50.9	5.0	28.0	28.0	9.3	46.7	6.1	49.8
TOT NONCON	209.1	195.5	13.6	133.5	75.6	88.5	120.6	80.9	128.1
TSS	13,125.1	10,823.0	2,302.1	335.9	12,789.2	111.6	13,013.5	24.2	13,100.9
Oil & Grease	2,647.6	2,505.5	142.1	279.9	2,367.7	93.0	2,554.6	93.0	2,554.6
TOT CONV	15,772.6	13,328.5	2,444.1	615.8	15,156.9	204.6	15,568.0	117.2	15,655.5
TOT POLL	17,512.2	14,787.3	2,724.9	795.5	16,716.7	310.3	17,201.9	210.1	17,302.1
FLOW(l/yr)	2.799e7	2.799e7		2.799e7		9.3e6		9.3e6	

Table XII-6

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
NICKEL/COBALT FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	11.1	11.1	.0	11.1	.0	11.1	.0	11.1	.0
Arsenic	2.7	2.7	.0	2.7	.0	2.7	.0	2.7	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	15,057.9	12,804.6	2,253.4	37.1	15,020.8	10.5	15,047.4	8.8	15,049.1
Copper	12,679.4	7,955.3	4,724.1	256.4	12,423.0	72.7	12,606.7	48.9	12,630.5
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	27.0	27.0	.0	27.0	.0	15.0	11.9	10.0	16.9
Nickel	50,145.2	31,205.1	18,940.1	327.2	49,818.0	92.8	50,052.4	27.6	50,117.6
Selenium	2.7	2.7	.0	2.7	.0	2.7	.0	2.7	.0
Silver	.4	.4	.0	.4	.0	.4	.0	.4	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	472.6	346.7	125.9	145.9	326.7	41.4	431.2	28.8	443.8
TOT TOXICS	78,398.9	52,355.5	26,043.4	810.4	77,588.6	249.3	78,149.6	140.9	78,258.0
Aluminum	1,344.0	1,196.3	147.7	990.3	353.7	280.9	1,063.1	186.8	1,157.1
Ammonia	2,696.8	2,696.8	.0	2,696.8	.0	2,696.8	.0	2,696.8	.0
Cobalt	548.2	348.0	200.2	22.1	526.1	6.3	541.9	4.3	543.9
Fluoride	27,339.5	19,386.4	7,953.0	6,410.5	20,929.0	1,818.3	25,521.2	1,818.3	25,521.2
Iron	12,471.6	7,799.0	4,672.6	181.3	12,290.4	51.4	12,420.2	35.1	12,436.5
TOT NONCON	44,400.1	31,426.6	12,973.5	10,300.9	34,099.2	4,853.7	39,546.4	4,741.3	39,658.8
TSS	318,086.5	174,040.9	144,045.6	5,385.2	312,701.3	1,504.8	316,581.7	326.0	317,760.5
Oil & Grease	19,629.2	16,739.7	2,889.6	4,421.0	15,208.2	1,254.0	18,375.2	1,254.0	18,375.2
TOT CONV	337,715.8	190,780.6	146,935.2	9,726.2	327,989.6	2,758.8	334,957.0	1,580.0	336,135.7
TOT POLL	460,514.8	274,562.6	185,952.2	20,837.5	439,677.3	7,861.8	452,653.0	6,462.3	454,052.5
FLOW(l/yr)	4.421e8	4.421e8		4.421e8		1.254e8		1.254e8	

Table XII-7

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
ZINC FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	.4	.4	.0	.4	.0	.3	.1	.3	.1
Copper	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	.3	.3	.0	.3	.0	.3	.0	.3	.0
Nickel	.0	.0	.0	.0	.0	.0	.0	.0	.0
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	421.8	211.8	210.0	1.7	420.1	1.3	420.5	.9	420.9
TOT TOXICS	422.5	212.5	210.0	2.4	420.1	2.0	420.6	1.5	421.0
Aluminum	.3	.3	.0	.3	.0	.3	.0	.3	.0
Cobalt	2.4	1.3	1.1	.3	2.2	.2	2.2	.1	2.3
TOT NONCON	2.7	1.7	1.1	.6	2.2	.5	2.2	.4	2.3
TSS	394.2	228.2	166.0	62.2	332.1	48.2	346.0	10.5	383.8
Oil & Grease	62.4	62.4	.0	51.8	10.6	40.2	22.2	40.2	22.2
TOT CONV	456.7	290.6	166.0	114.0	342.7	88.4	368.2	50.7	406.0
TOT POLL	881.9	504.8	377.2	117.0	765.0	90.9	791.0	52.6	829.3
FLOW(l/yr)	5.18e6	5.18e6		5.18e6		4.02e6		4.02e6	

Table XII-8

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
PRECIOUS METALS FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	546.2	421.1	125.0	3.0	543.2	1.4	544.8	.9	545.3
Chromium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Copper	2,857.7	2,205.2	652.5	21.9	2,835.8	10.5	2,847.1	7.1	2,850.6
Cyanide	6.0	5.2	.8	2.6	3.4	1.3	4.8	.9	5.2
Lead	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nickel	1,327.5	1,027.9	299.7	28.0	1,299.6	13.4	1,314.1	4.0	1,323.5
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	532.6	410.9	121.7	3.8	528.8	1.8	530.8	1.3	531.3
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	14.0	13.5	.5	12.5	1.5	6.0	8.0	4.2	9.8
TOT TOXICS	5,284.1	4,083.9	1,200.2	71.8	5,212.3	34.5	5,249.6	18.3	5,265.8
Aluminum	1.1	1.1	.0	1.1	.0	1.1	.0	1.1	.0
Ammonia	6.0	6.0	.0	6.0	.0	6.0	.0	6.0	.0
Fluoride	50.3	50.3	.0	50.3	.0	50.3	.0	50.3	.0
Iron	8.7	8.7	.0	8.7	.0	7.4	1.2	5.1	3.6
TOT NONCON	66.2	66.2	.0	66.2	.0	64.9	1.2	62.5	3.6
TSS	17,178.6	11,979.6	5,199.0	453.6	16,725.0	217.9	16,960.7	47.2	17,131.4
Oil & Grease	559.1	544.6	14.5	378.0	181.1	181.6	377.5	181.6	377.5
TOT CONV	17,737.7	12,524.2	5,213.4	831.6	16,906.1	399.5	17,338.1	228.8	17,508.8
TOT POLL	23,087.9	16,674.2	6,413.6	969.5	22,118.3	498.9	22,589.0	309.6	22,778.2
FLOW(l/yr)	3.78e7	3.78e7		3.78e7		1.816e7		1.816e7	

Table XII-9

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
IRON AND STEEL/COPPER/ALUMINUM METAL POWDER PRODUCTION AND POWDER METALLURGY SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	1.2	1.2	.0	1.2	.0	1.2	.0	1.2	.0
Arsenic	.6	.6	.0	.6	.0	.6	.0	.6	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	6.2	6.2	.0	5.2	1.0	.5	5.6	.4	5.7
Copper	4,388.7	4,388.7	.0	35.8	4,352.9	3.6	4,385.1	2.4	4,386.3
Cyanide	46.9	46.9	.0	4.3	42.6	.4	46.5	.3	46.6
Lead	878.0	878.0	.0	7.4	870.6	.7	877.2	.5	877.5
Nickel	89.5	89.5	.0	45.7	43.8	4.6	84.9	1.4	88.1
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	88.8	88.8	.0	20.4	68.5	2.1	86.8	1.4	87.4
TOT TOXICS	5,499.9	5,499.9	.0	120.6	5,379.4	13.8	5,486.1	8.3	5,491.6
Aluminum	1,173.5	1,173.5	.0	138.2	1,035.3	13.9	1,159.6	9.3	1,164.3
Ammonia	58.6	58.6	.0	58.6	.0	58.6	.0	58.6	.0
Fluoride	64.2	64.2	.0	64.2	.0	64.2	.0	64.2	.0
Iron	5,850.4	5,850.4	.0	25.3	5,825.1	2.6	5,847.8	1.7	5,848.7
TOT NONCON	7,146.7	7,146.7	.0	286.3	6,860.4	139.3	7,007.4	133.8	7,012.9
TSS	91,282.1	74,984.6	16,297.5	740.4	90,541.7	74.6	91,207.4	16.2	91,265.9
Oil & Grease	2,339.7	2,236.3	103.4	617.0	1,722.7	62.2	2,277.5	62.2	2,277.5
TOT CONV	93,621.7	77,220.9	16,400.9	1,357.4	92,264.3	136.8	93,484.9	78.4	93,543.4
TOT POLL	106,268.4	89,867.5	16,400.9	1,764.2	104,504.1	289.9	105,978.5	220.5	106,047.9
FLOW(l/yr)	6.17e7	6.17e7		6.17e7		6.22e6		6.22e6	

Table XII-10

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
TITANIUM FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	1.2	1.2	.0	1.2	.0	.8	.3	.7	.5
Copper	20.0	18.8	1.2	17.0	2.9	5.8	14.2	3.9	16.1
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	156.3	111.9	44.4	3.5	152.8	1.2	155.1	.8	155.5
Nickel	3.5	3.5	.0	3.5	.0	3.5	.0	2.2	1.3
Selenium	2.1	2.1	.0	2.1	.0	2.1	.0	2.0	.1
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	53.2	40.4	12.8	9.7	43.5	3.3	49.9	2.3	50.9
TOT TOXICS	236.2	177.9	58.3	37.0	199.2	16.7	219.6	11.8	224.4
Aluminum	1,013.6	737.4	276.2	65.8	947.8	22.3	991.3	14.8	998.8
Ammonia	1,928.5	1,928.5	.0	940.2	988.3	318.1	1,610.4	318.1	1,610.4
Cobalt	15.9	11.7	4.2	1.5	14.4	.5	15.4	.3	15.5
Fluoride	16,587.1	11,900.4	4,686.7	426.0	16,161.1	144.1	16,442.9	144.1	16,442.9
Iron	7,069.7	5,022.8	2,047.0	12.0	7,057.7	4.1	7,065.6	2.8	7,066.9
Titanium	2,056.6	1,468.1	588.5	29.4	2,027.2	9.9	2,046.7	6.6	2,050.0
Vanadium	587.6	425.1	162.5	29.4	558.2	9.9	577.7	6.6	581.0
TOT NONCON	29,259.0	21,493.9	7,765.0	1,504.3	27,754.7	508.9	28,750.0	493.3	28,765.7
TSS	6,742.7	4,873.0	1,869.7	352.6	6,390.2	119.3	6,623.4	25.8	6,716.9
Oil & Grease	200.7	200.7	.0	200.7	.0	99.4	101.3	99.4	101.3
TOT CONV	6,943.4	5,073.7	1,869.7	553.2	6,390.2	218.7	6,724.7	125.2	6,818.1
TOT POLL	36,438.5	26,745.5	9,693.1	2,094.5	34,344.0	744.3	35,694.3	630.3	35,808.2

Table XII-11

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
REFRACTORY METALS FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	4.5	4.2	.4	3.0	1.5	.9	3.6	.6	4.0
Chromium	18.9	18.8	.0	3.2	15.7	1.0	17.9	.8	18.1
Copper	150.8	122.2	28.6	21.9	128.9	6.6	144.2	4.4	146.4
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nickel	942.5	740.7	201.8	27.9	914.6	8.4	934.1	2.5	940.0
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	5.7	5.2	.4	3.8	1.9	1.1	4.5	.8	4.9
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	18.9	17.3	1.5	12.4	6.4	3.8	15.1	2.6	16.2
TOT TOXICS	1,141.2	908.4	232.7	72.1	1,069.1	21.8	1,119.4	11.7	1,129.4
Aluminum	754.0	685.9	148.1	84.4	669.6	25.5	728.5	17.0	737.0
Ammonia	18.9	18.9	.0	18.9	.0	18.9	.0	18.9	.0
Cobalt	3.8	3.3	.4	1.9	1.9	.6	3.2	.4	3.4
Columbium	377.0	302.0	75.0	37.7	339.3	11.4	365.6	7.5	369.5
Fluoride	37.7	37.7	.0	37.7	.0	37.7	.0	37.7	.0
Iron	377.0	297.3	79.7	15.5	361.5	4.7	372.3	3.2	373.8
Molybdenum	188.5	154.9	33.6	37.7	150.8	11.4	177.1	7.5	181.0
Tantalum	754.0	596.0	158.0	37.7	716.3	11.4	742.6	7.5	746.5
Tungsten	2,827.5	2,213.4	614.1	37.7	2,789.8	11.4	2,816.1	7.5	2,820.0
TOT NONCON	5,338.3	4,229.3	1,109.0	309.1	5,029.2	132.9	5,205.4	107.2	5,231.1
TSS	90,480.0	60,760.3	29,719.7	452.4	90,027.6	136.8	90,343.2	29.6	90,450.4
Oil & Grease	226.2	226.2	.0	226.2	.0	114.0	112.2	114.0	112.2
TOT CONV	90,706.2	60,986.5	29,719.7	678.6	90,027.6	250.8	90,455.4	143.6	90,562.6
TOT POLL	97,185.7	66,124.2	31,061.5	1,059.9	96,125.8	485.5	96,780.2	262.6	96,923.1
FLOW(l/yr)	3.77e7	3.77e7		3.77e7		1.14e7		1.14e7	

Table XII-12

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
ZIRCONIUM/HAFNIUM FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	.2	.2	.0	.0	.2	.0	.2	.0	.2
Copper	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cyanide	.1	.0	.1	.0	.1	.0	.1	.0	.1
Lead	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nickel	.1	.1	.0	.1	.0	.0	.0	.0	.1
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOT TOXICS	.4	.3	.1	.1	.3	.1	.3	.1	.3
Ammonia	5.8	5.8	.0	3.1	2.7	1.8	4.1	1.8	4.1
Fluoride	2.6	1.8	.8	1.4	1.2	.8	1.9	.8	1.9
Hafnium	.3	.2	.1	.1	.2	.1	.2	.0	.3
Zirconium	4.9	1.7	3.2	.1	4.8	.1	4.8	.0	4.8
TOT NONCON	13.6	9.5	4.1	4.7	8.9	2.7	11.0	2.6	11.0
TSS	1.8	1.4	.4	1.2	.6	.7	1.1	.1	1.7
Oil & Grease	.5	.5	.0	.5	.0	.5	.0	.5	.0
TOT CONV	2.3	1.9	.4	1.7	.6	1.2	1.1	.7	1.7
TOT POLL	16.3	11.7	4.6	6.5	9.8	3.9	12.4	3.3	13.0
FLOW(l/yr)	9.7e4	9.7e4		9.7e4		5.5e4		5.5e4	

Table XII-13

NONFERROUS METALS FORMING POLLUTANT BENEFIT REDUCTION ESTIMATES (kg/yr)
MAGNESIUM FORMING SUBCATEGORY
INDIRECT DISCHARGERS

POLLUTANT	RAW WASTE	CURRENT DISCHARGE	CURRENT REMOVED	OPTION 1 DISCHARGED	OPTION 1 REMOVED	OPTION 2 DISCHARGED	OPTION 2 REMOVED	OPTION 3 DISCHARGED	OPTION 3 REMOVED
Antimony	.0	.0	.0	.0	.0	.0	.0	.0	.0
Arsenic	.0	.0	.0	.0	.0	.0	.0	.0	.0
Beryllium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cadmium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Chromium	3.5	3.5	.0	.0	3.5	.0	3.5	.0	3.5
Copper	.0	.0	.0	.0	.0	.0	.0	.0	.0
Cyanide	.0	.0	.0	.0	.0	.0	.0	.0	.0
Lead	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nickel	.0	.0	.0	.0	.0	.0	.0	.0	.0
Selenium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Silver	.0	.0	.0	.0	.0	.0	.0	.0	.0
Thallium	.0	.0	.0	.0	.0	.0	.0	.0	.0
Zinc	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOT TOXICS	3.5	3.5	.0	.0	3.5	.0	3.5	.0	3.5
Aluminum	.0	.0	.0	.0	.0	.0	.0	.0	.0
Iron	.0	.0	.0	.0	.0	.0	.0	.0	.0
Magnesium	1.0	1.0	.0	.0	.9	.0	1.0	.0	1.0
TOT NONCON	1.0	1.0	.0	.0	1.0	.0	1.0	.0	1.0
TSS	.6	.6	.0	.0	.6	.0	.6	.0	.6
Oil & Grease	.2	.2	.0	.0	.2	.0	.2	.0	.2
TOT CONV	.8	.8	.0	.1	.8	.0	.8	.0	.8
TOT POLL	5.3	5.3	.0	.1	5.2	.0	5.3	.0	5.3
FLOW(l/yr)	3.7e3	3.7e3		3.7e3		1.2e3		1.2e3	

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. Conventional pollutants are those defined in Section 304(a)(4) (biological oxygen demanding pollutants (BOD_5), total suspended solids (TSS), fecal coliform, and pH), and any additional pollutants defined by the Administrator as "conventional" (oil and grease, 44 FR 44501, July 30, 1979).

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 and respond to a judicial remand of the BCT methodology originally established in 1977. A more specific explanation of the BCT methodology than this document provides appears in the October 29, 1982 Federal Register notice.

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 POTWs. 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 $0.27 per pound in 1976 dollars. (The benchmark cost is $0.48 per pound in 1982 dollars). If the conventional pollutant removal cost per pound for the candidate BCT is less than the POTW benchmark, Part 1 of the cost-reasonableness test is passed. Part 2 of the cost-reasonableness test is then performed.

Part 2 of the BCT test is an industry cost-effectiveness test which requires the evaluation of the incremental costs of removing conventional pollutants by the BCT technology in relation to the cost of removing conventional pollutants by BPT technology in the same industry. As a benchmark to assess the reasonableness of the ratio between the cost per pound of removal to achieve BPT

and to achieve BCT, EPA has developed a ratio for POTW costs which compares the dollars per pound of conventional pollutant removed in going from primary to secondary treatment levels with that of going from secondary to a more advanced treatment level. The proposed benchmark is 1.43. If the cost ratio as defined for a given subcategory is lower than 1.43, the subcategory passes the BCT ratio test. Both cost-tests must be passed to establish BCT limitations more stringent than BPT limits. If all candidate BCT technologies fail the cost-reasonableness test, the BCT requirements for conventional pollutants are equal to BPT.

The Agency considers two conventional pollutants in the cost test: TSS and an oxygen-demanding pollutant. Although both oil and grease and BOD_5 are considered to be oxygen-demanding pollutants by EPA (see 44 FR 50733, August 29, 1979), only oil and grease, the pollutant accounting for the greatest removal was included in the cost analysis (See 47 FR 49181, October 29, 1982). Oil and grease is used rather than BOD_5 in the cost analysis performed for nonferrous metals forming waste streams (in addition to TSS), due to the common use of oils in this industry.

TECHNICAL APPROACH TO BCT

The Agency has applied the proposed BCT cost test to assess candidate BCT technologies by comparing the annualized cost for the candidate technologies to the annualized cost for the selected BPT technology. The incremental cost of each candidate BCT technology was then divided by the incremental amounts of conventional pollutants (TSS and oil and grease) removed by the additional technology. The annualized costs for each option considered as a candidate technology for each subcategory are presented in Table XIII-1. Option 1, lime and settle without flow reduction, was selected as the BPT technology in all subcategories. Option 2 is lime and settle with flow reduction, and Option 3 is lime and settle plus filtration plus flow reduction.

Table XIII-1 shows that in many cases the higher level options are less expensive than Option 1. In those cases, the incremental cost is negative (there is a savings in annualized costs) and the higher level option automatically passes both BCT cost tests. Those higher level options with the same annualized costs as the annualized BPT cost also pass both BCT cost tests, since there are no incremental costs in those cases. Therefore, the incremental costs and incremental pollutant removals only have to be assessed for those cases where the higher level options have greater annualized costs than the BPT option. An example of the calculation is as follows:

BCT cost for Lead/Tin/Bismuth Forming Subcategory direct dischargers:

Annualized Cost of Option 1 = $30,301 per year (from Table XIII-1)

Annualized Cost of Option 3 = $35,981 per year (from Table XIII-1)

Incremental Cost = $ 5,680 per year.

Conventional Pollutants Discharged at Option 1 = 1,114 pounds per year (505.1 kg/yr) (from Table X-4)

Conventional Pollutants Discharged at Option 3 = 134 pounds per year (60.6 kg/yr) (from Table X-4)

Incremental Removal = 980 pounds per year (444.5 kg/yr)

Dollars Per Pound = $5,680 - 980 pounds = $5.80 per pound ($12.78/kg)

The calculated cost in dollars per pound of conventional pollutants removed exceeds the benchmark cost for the first BCT cost test, $0.48, and the candidate technology fails the proposed BCT cost test. Therefore, there is no need to consider the second BCT cost test, and the candidate technology would not be selected for BCT.

Results of part 1 of the BCT cost test for all 11 subcategories are presented in Table XIII-2. Results of part 2 of the BCT cost test for all 11 subcategories are presented in Table XIII-3.

BCT OPTION SELECTION

The Agency selected BCT based on Option 3 for the following four subcategories because the Option 3 technology passed the proposed BCT cost test:

- Nickel/Cobalt Forming
- Titanium Forming
- Magnesium Forming
- Uranium Forming

As shown in Table XIII-1, in all four subcategories, the reduced operating costs which result from flow reduction more than offset the increased costs for the additional technology so that the annualized cost for the selected BCT technology is less than the annualized cost for the BPT technology.

The Agency selected BCT based on Option 2 for the following three subcategories:

- Lead/Tin/Bismuth Forming
- Zirconium/Hafnium Forming
- Iron and Steel/Copper/Aluminum Metal Powder Production and Powder Metallurgy

These subcategories failed the proposed BCT cost test with costs ranging from $3.78 to $137.95 per pound of conventional pollutants removed. However, the annualized cost of Option 2 is less than or equal to the annualized cost of the BPT technology (Option 1) for these three subcategories. Therefore, Option 2 is appropriate for BCT.

The Agency selected BCT based on Option 1 for the following four subcategories because both higher level options failed the proposed BCT cost test:

- Zinc Forming
- Beryllium Forming
- Precious Metals Forming
- Refractory Metals Forming

The costs ranged from $2.20 to $173.25 per pound of conventional pollutants removed when BCT is based on Option 2 technology. The costs ranged from $2.20 to $167.18 per pound of conventional pollutants removed when BCT is based on Option 3 technology.

COSTS AND ENVIRONMENTAL BENEFITS OF TREATMENT OPTIONS

No separate cost or benefit estimates were prepared for BCT. As a matter of convenience, the costs and benefits for removal of conventional pollutants are included in the estimates for BAT, described in detail in Section X and presented in Tables X-4 through X-14.

REGULATED POLLUTANT PARAMETERS

The pollutants regulated under BCT are oil and grease, TSS, and pH. These pollutants are regulated in all 11 subcategories.

BEST CONVENTIONAL TECHNOLOGY MASS LIMITATIONS

The regulatory production normalized flows and the selected treatment options for each subcategory are presented in Table XIII-4. The ten-day average is used to calculate the maximum monthly average because, as discussed in Section VII, it provides a reasonable basis for a monthly average and is typical of the sampling frequency required by discharge permits. The one-day

maximum and ten-day average effluent concentrations of each pollutant achievable by the selected treatment options (Table VII-9) were multiplied by the regulatory production normalized flows. The resulting values are presented for each of the 11 subcategories in Section II, Part 7, Subparts A through K.

ALTERNATIVE BCT COST TEST CALCULATIONS

It should be noted that the costs used in the BCT test for the nonferrous metals forming category are somewhat different from those used in the economic impact analysis and in estimating the total cost of compliance with this regulation. For the BCT test, the costs used for Option 1 are the engineering estimates of costs to implement the technology used as the basis for BPT. However, for the economic impact analysis and the estimate of total compliance cost, if a plant could meet the BPT limitation at a lower cost by installing flow reduction in conjunction with its lime and settle system, i.e., Option 2, EPA assumed the plant would do so. In this case, the cost of BPT would then be the lower cost estimated for Option 2, even though flow reduction would be unnecessary to meet the pollutant removals achievable by the BPT technology.

The Agency's decision to use the actual engineering cost estimates for Option 1 when using the proposed BCT cost test, rather than assume that a company would install the cost-minimizing flow reduction is consistent with the Agency's previous BCT proposals.

Under an alternative calculation of costs for each option, the cost of the lowest cost option for each model plant is assigned to BPT as long as it is not negative. When the cost of Option 2 is negative, the cost is set equal to zero for that model plant. The annualized costs for each option for each subcategory which are estimated using this method are presented in Table XIII-5.

Significantly different technology options would be selected in several subcategories as BCT technology using the costs presented in Table XIII-5, because in no case, using those cost estimates, is the annualized cost of a higher level option less than the annualized cost of BPT. Those cases where the annualized costs are the same would still pass the BCT cost test since the incremental cost is zero. However, where the annualized cost of the higher level option exceeds that of BPT, the higher level option fails the proposed BCT cost test. An example calculation is as follows:

BCT cost test for Lead/Tin/Bismuth Forming Subcategory direct dischargers:

Annualized Cost of Option 1 = $12,822 per year
(from Table XIII-3)

Annualized Cost of Option 2 = $14,482 per year
(from Table XIII-3)

Incremental Cost = $ 1,660 per year

Conventional Pollutants Discharged at Option 1 = 1,114 pounds per year (505.1 kg/yr) (from Table X-4)

Conventional Pollutants Discharged at Option 2 = 234 pounds per year (105.8 kg/yr) (from Table X-4)

Incremental Removals = 880 pounds per year (399.3 kg/yr)

Dollars Per Pound = $1,660 ÷ 880 pounds = $1.88 per pound ($4.16/kg)

The candidate BCT technology failed the BCT cost test. Therefore, Option 1 would have been selected as BCT for this subcategory if the alternative costs had been used.

Alternate results of part 1 of the BCT cost test for all 11 subcategories are presented in Table XIII-6. Alternate results of part 2 of the BCT cost test for all 11 subcategories are presented in Table XIII-7.

Table XIII-1

ANNUALIZED BCT COST ESTIMATES FOR THE NONFERROUS METALS FORMING CATEGORY

Subcategory	Option 1 Annualized Cost ($)	Option 2 Annualized Cost ($)	Option 3 Annualized Cost ($)
Lead/Tin Bismuth Forming	30,301	14,482	35,981
Nickel/Cobalt Forming	119,721	71,844	94,392
Zinc Forming	26,708	36,841	36,841*
Beryllium Forming	0	310	310*
Precious Metals Forming	113,936	158,200	184,855
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	77,523	77,523	101,641
Titanium Forming	858,341	729,081	797,492
Refractory Metals Forming	70,374	102,479	114,577
Zirconium/Hafnium Forming	88,523	79,063	92,881
Magnesium Forming	70,850	44,564	44,570
Uranium Forming	148,395	126,619	126,619*

*There is only one direct discharger in this subcategory. This plant already has a filter or provides additional treatment which achieves equivalent results in the nonferrous metals forming industry, and no additional costs would be incurred for the additional treatment.

Table XIII-2

BCT COST TEST (Part 1) RESULTS FOR THE NONFERROUS METALS FORMING CATEGORY

Subcategory	Incremental Dollars Per Pound Option 1 to Option 2	Cost Test Result (a)	Incremental Dollars Per Pound Option 1 to Option 3	Cost Test Result (a)	BCT Status
Lead/Tin Bismuth Forming	-17.97	Pass	5.80	Fail	1
Nickel/Cobalt Forming	-22.96	Pass	-11.30	Pass	2
Zinc Forming*	6.28	Fail	6.28	Fail	3
Beryllium Forming*	2.20	Fail	2.20	Fail	3
Precious Metals Forming	173.25	Fail	167.18	Fail	3
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	0.00	Pass	137.95	Fail	1
Titanium Forming	-6.69	Pass	-2.72	Pass	2
Refractory Metals Forming	124.79	Fail	156.28	Fail	3
Zirconium/Hafnium Forming	-9.52	Pass	3.78	Fail	1
Magnesium Forming	-42.51	Pass	-40.27	Pass	2
Uranium Forming*	-24.23	Pass	-24.23	Pass	2

(a) The benchmark value is 0.48

BCT Status:

1: For these subcategories part 2 of the BCT cost test must be performed for Option 2 only.

2: For these subcategories part 2 of the BCT cost test must be performed for Option 2 and Option 3.

3: For these subcategories part 2 of the BCT cost test does not have to be performed and BCT will equal BPT.

*For direct dischargers in these subcategories, no incremental cost is incurred or benefit achieved from Option 2 to Option 3, therefore, the incremental dollars per pound from Option 1 to Option 2 and Option 3 are the same.

Table XIII-3

BCT COST TEST (Part 2) RESULTS FOR THE NONFERROUS METALS FORMING CATEGORY

Subcategory	Ratio of Incremental Dollars Per Pound Option 1 to Option 2 to Incremental Dollars Per Pound Current to Option 1	Cost Test Result (a)	Ratio of Incremental Dollars Per Pound Option 1 to Option 3 to Incremental Dollars Per Pound Current to Option 1	Cost Test Result (a)	BCT Status
Lead/Tin Bismuth Forming	-6.27	Pass	NR	--	1
Nickel/Cobalt Forming	-4.72	Pass	-2.32	Pass	2
Zinc Forming	NR	--	NR	--	--
Beryllium Forming	NR	--	NR	--	--
Precious Metals Forming	NR	--	NR	--	--
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	0.00	Pass	NR	--	1
Titanium Forming	-0.51	Pass	-0.21	Pass	2
Refractory Metals Forming	NR	--	NR	--	--
Zirconium/Hafnium Forming	*	Pass	NR	--	1
Magnesium Forming	-1.56	Pass	-1.47	Pass	2
Uranium Forming	-0.01	Pass	-0.01	Pass	2

(a) The benchmark value is 1.43

NR - Part 2 of the BCT cost test is not required

BCT Status:

1: These subcategories passed both parts of the BCT cost test for Option 2 and BCT will equal Option 2.

2: These subcategories passed both parts of the BCT cost test for Option 3 and BCT will equal Option 3.

*For direct dischargers in this subcategory, there is no incremental removal of conventional pollutants from current to Option 1 (there is incremental removal of toxic and nonconventional pollutants), therefore, part 2 of the BCT cost test is mathematically indeterminate. However, this subcategory will pass the second test since the annualized cost at Option 2 is lower than the annualized cost at Option 1.

Table XIII-4

BCT PRODUCTION NORMALIZED FLOWS AND SELECTED TREATMENT OPTIONS

Subcategory	Production Normalized Flow (a)	Selected Treatment Option (b)
Lead/Tin/Bismuth Forming	BAT	L + S
Nickel/Cobalt Forming	BAT	L, S + F
Zinc Forming	BPT	L + S
Beryllium Forming	BPT	L + S
Precious Metals Forming	BPT	L + S
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	BAT	L + S
Titanium Forming	BAT	L, S + F
Refractory Metals Forming	BPT	L + S
Zirconium/Hafnium Forming	BAT	L + S
Magnesium Forming	BAT	L, S + F
Uranium Forming	BAT	L, S + F

(a) BPT production normalized flows are presented in Tables IX-12 through IX-22; BAT production normalized flows are presented in Tables X-15 through X-25.

(b) L + S = lime and settle technology
L, S + F = lime, settle, filter technology

Table XIII-5

ALTERNATIVE ANNUALIZED BCT COST ESTIMATES FOR THE NONFERROUS METALS FORMING CATEGORY

Subcategory	Option 1 Annualized Cost ($)	Option 2 Annualized Cost ($)	Option 3 Annualized Cost ($)
Lead/Tin Bismuth Forming	12,822	14,482	35,981
Nickel/Cobalt Forming	74,504	80,897	94,392
Zinc Forming	26,708	36,841	36,841
Beryllium Forming	0	310	310
Precious Metals Forming	113,936	158,200	184,855
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	77,523	77,523	101,641
Titanium Forming	719,325	755,546	797,492
Refractory Metals Forming	67,811	102,935	114,577
Zirconium/Hafnium Forming	61,020	84,569	92,881
Magnesium Forming	44,561	44,564	44,570
Uranium Forming	126,619	126,619	126,619

Table XIII-6

ALTERNATE BCT COST TEST (Part 1) RESULTS FOR THE NONFERROUS METALS FORMING CATEGORY

Subcategory	Incremental Dollars Per Pound Option 1 to Option 2	Cost Test Result (a)	Incremental Dollars Per Pound Option 1 to Option 3	Cost Test Result (a)	BCT Status
Lead/Tin Bismuth Forming	1.89	Fail	23.63	Fail	1
Nickel/Cobalt Forming	3.07	Fail	8.88	Fail	1
Zinc Forming*	6.28	Fail	6.28	Fail	1
Beryllium Forming*	2.20	Fail	2.20	Fail	1
Precious Metals Forming	173.23	Fail	167.18	Fail	1
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	0.00	Pass	137.95	Fail	2
Titanium Forming	1.87	Fail	3.49	Fail	1
Refractory Metals Forming	136.52	Fail	165.34	Fail	1
Zirconium/Hafnium Forming	23.69	Fail	27.60	Fail	1
Magnesium Forming	0.01	Pass	0.01	Pass	3
Uranium Forming*	0.00	Pass	0.00	Pass	3

(a) The benchmark value is 0.48

BCT Status:

1: For these subcategories part 2 of the BCT cost test would not have to be performed and BCT would equal BPT.

2: For this subcategory part 2 of the BCT cost test would be performed for Option 2 only.

3: For these subcategories part 2 of the BCT cost test would be performed for Option 2 and Option 3.

*For direct dischargers in these subcategories, no incremental cost is incurred or benefit achieved from Option 2 to Option 3, therefore, the incremental dollars per pound from Option 1 to Option 2 and Option 3 would be the same.

Table XIII-7

ALTERNATE BCT COST TEST (Part 1) RESULTS FOR THE NONFERROUS METALS FORMING CATEGORY

Subcategory	Ratio of Incremental Dollars Per Pound Option 1 to Option 2 to Incremental Dollars Per Pound Current to Option 1	Cost Test Result (a)	Ratio of Incremental Dollars Per Pound Option 1 to Option 3 to Incremental Dollars Per Pound Current to Option 1	Cost Test Result (a)	BCT Status
Lead/Tin Bismuth Forming	NR	--	NR	--	--
Nickel/Cobalt Forming	NR	--	NR	--	--
Zinc Forming	NR	--	NR	--	--
Beryllium Forming	NR	--	NR	--	--
Precious Metals Forming	NR	--	NR	--	--
Iron and Steel, Copper, and Aluminum Metal Powder Production and Powder Metallurgy	0.00	Pass	NR	--	1
Titanium Forming	NR	--	NR	--	--
Refractory Metals Forming	NR	--	NR	--	--
Zirconium/Hafnium Forming	NR	--	NR	--	--
Magnesium Forming	0.00	Pass	0.00	Pass	2
Uranium Forming	0.00	Pass	0.00	Pass	2

(a) The benchmark value is 1.43

NR - Part 2 of the BCT cost test is not required

BCT Status:

1: This subcategory would pass both parts of the BCT cost test for Option 2 and BCT would equal Option 2.
2: This subcategory would pass both parts of the BCT cost test for Option 2 and Option 3 and BCT would equal Option 3.

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SECTION XV

GLOSSARY

This section is an alphabetical listing of technical terms (with definitions) used in this document which may not be familiar to the reader.

4-AAP Colorimetric Method

An analytical method for total phenols and total phenolic compounds that involves reaction with the color developing agent 4-aminoantipyrine.

Acidity

The quantitative capacity of aqueous solutions to react with hydroxyl ions. Measured by titration with a standard solution of a base to a specified end point. Usually expressed as milligrams per liter of calcium carbonate.

The Act

The Federal Water Pollution Control Act Amendments of 1972 as amended by the Clean Water Act of 1977 (PL 92-500).

Aging

A change in the properties of certain metals and alloys that occurs at ambient or moderately elevated temperatures after hot working or heat treatment (quench aging in ferrous alloys, natural or artificial aging in ferrous and nonferrous alloys) or after a cold working operation (strain aging). The change in properties is often due to a phase change (precipitation), but never involves a change in chemical composition of the metal or alloy.

Alkaline Cleaning

A process in which a solution, usually detergent, is used to remove lard, oil, and other such compounds from a metal surface.

Alkalinity

The capacity of water to neutralize acids, a property imparted by the water's content of carbonates, bicarbonates, hydroxides, and occasionally borates, silicates, and phosphates. It is measured by titration with a standardized acid to a specified end point, and is usually reported in milligrams per liter of calcium carbonate.

Alloy

A substance having metallic properties and being composed of two or more chemical elements of which at least one is an elemental metal.

Amortization

The allocation of a cost or account according to a specified schedule, based on the principal, interest and period of cost allocation.

Analytical Quantification Level

The minimum concentration at which quantification of a specified pollutant can be reliably measured.

Annealing

A generic term describing a metal's treatment process that is used primarily to soften metallic materials, but also to simultaneously produce desired changes in other properties or in microstructure. The purpose of such changes may be, but is not confined to, improvement of machinability, facilitation of cold work, improvement of mechanical or electrical properties, and/or increase in stability of dimensions. Annealing consists of heating and cooling the metal at varying rates to achieve the desired properties.

Anvil

In drop forging, the base of the hammer into which the sow block and lower die part are set. Also, a block of steel upon which metal is forged.

Atomization

The process in which a stream of water or gas impinges upon a molten metal stream, breaking it into droplets which solidify as powder particles.

Backwashing

The operation of cleaning a filter or column by reversing the flow of liquid through it and washing out matter previously trapped.

Ball Mill

A mill in which materials are finely ground on a rotating cylinder containing balls (usually steel).

Batch Treatment

A waste treatment method where wastewater is collected over a period of time and then treated prior to discharge. Treatment is not continuous, but collection may be continuous.

Bench Scale Pilot Studies

Experiments providing data concerning the treatability of a wastewater stream or the efficiency of a treatment process conducted using laboratory-size equipment.

Best Available Demonstrated Technology (BADT)

Treatment technology upon which new source performance standards are based as defined by Section 306 of the Act.

Best Available Technology Economically Achievable (BAT)

Level of technology applicable to toxic and nonconventional pollutants on which effluent limitations are established. These limitations are to be achieved by July 1, 1984 by industrial discharges to surface waters as defined by Section 301(b)(2)(C) of the Act.

Best Conventional Pollutant Control Technology (BCT)

Level of technology applicable to conventional pollutant effluent limitations to be achieved by July 1, 1984 for industrial discharges to surface waters as defined in Section 301(b)(2)(E) of the Act.

Best Management Practices (BMP)

Regulations intended to control the release of toxic and hazardous pollutants from plant runoff, spillage, leaks, solid waste disposal, and drainage from raw material storage.

Best Practicable Control Technology Currently Available (BPT)

Level of technology applicable to effluent limitations to have been achieved by July 1, 1977 (originally) for industrial discharges to surface waters as defined by Section 301(b)(1)(A) of the Act.

Billet

A long slender cast product used as raw material in subsequent forming operations.

Biochemical Oxygen Demand (BOD)

The quantity of oxygen used in the biochemical oxidation of organic matter under specified conditions for a specified time.

Blowdown

The minimum discharge of circulating water for the purpose of discharging dissolved solids or other contaminants contained in the water, the further buildup of which would cause concentration in amounts exceeding limits established by best engineering practice.

Boring

A machining method using single-point tools on internal surfaces of revolution.

Brazing

A process that bonds two metal pieces by heating them to a suitable temperature and by using a filler material which melts above 425°C (800°F) but below the melting point of the metal being joined. The filler material is distributed between the surfaces of the joint by capillary action.

Bright Annealing

Annealing in a protective medium to prevent discoloration of the bright surface.

Brittleness

The quality of a metal that leads to crack propagation without appreciable plastic deformation.

Burnishing

A surface finishing process in which minute surface irregularities are displaced rather than removed.

Burr

A turned-over edge on a metal piece resulting from cutting, pressing, or grinding.

Catalyst

An agent that (1) reduces the energy required for activating a chemical reaction and (2) is not consumed by that reaction.

Chelation

The formation of coordinate covalent bonds between a central metal ion and a liquid that contains two or more sites for combination with the metal ion.

Chemical Finishing

Producing a desired finish on the surface of a metallic product by immersing the workpiece in a chemical bath.

Chemical Oxygen Demand (COD)

A measure of the oxygen-consuming capacity of the organic and inorganic matter present in the water or wastewater.

Chromating

Treating a metal in a solution of hexavalent chromium compound to produce a conversion coating consisting of trivalent and hexavalent chromium compound.

Clad Metal

A composite metal containing two or more layers that have been metallurgically bonded together by roll bonding (co-rolling), solder application (or brazing) and explosion bonding.

Coining

A closed-die squeezing operation, usually performed cold, in which all surfaces of the work are confined or restrained, resulting in a well-defined imprint of the die upon the work.

Cold Working

Deforming metal plastically at a temperature lower than the recrystallization temperature of the metal, generally at room temperature.

Colloid

Suspended solids whose diameter may vary between less than one micron and 15 microns.

Compact (Briquet)

An object produced by the compression of metal powder.

Composite Samples

A series of samples collected over a period of time but combined into a single sample for analysis. The individual samples can be taken after a specified amount of time has passed (time composited), or after a specified volume of water has passed the sampling point (flow composited). The sample can be automatically collected and composited by a sampler or can be manually collected and combined.

Consent Decree (Settlement Agreement)

Agreement between EPA and various environmental groups, as instituted by the United States District Court for the district of Columbia, directing EPA to study and promulgate regulations for the toxic pollutants (NRDC, Inc. v Train, 8 ERC 2120 (D.D.C. 1976), modified March 9, 1979, 12 ERC 1833, 1841).

Contact Water

Any water or oil that comes into direct contact with nonferrous metal during forming operations, whether the metal is raw material, intermediate product, waste product, or finished product.

Continuous Casting

A casting process that produces sheet, rod, or other long shapes by solidifying the metal while it is being poured through an open-ended mold using little or no contact cooling water. Thus, no restrictions are placed on the length of the product and it is not necessary to stop the process to remove the cast product.

Continuous Treatment

Treatment of waste streams operating without interruption as opposed to batch treatment. Sometimes referred to as flow-through treatment.

Contractor Removal (Contract Hauling)

Disposal of oils, spent solutions, or sludge by a commercial firm.

Conventional Pollutants

Constituents of wastewater as determined by Section 304(a)(4) of the Act, including but not limited to pollutants classified as biological-oxygen-demanding, oil and grease, suspended solids, fecal coliforms, and pH.

Conversion Coating

A coating consisting of a compound of the surface metal, produced by chemical or electrochemical treatments of the metal. Examples are chromate coatings on zinc and magnesium, oxides or phosphate coatings on steel. Also, the process of producing such a coating.

Cooling Tower

A hollow, vertical structure with internal baffles designed to break up falling water so that it is cooled by upward-flowing air and the evaporation of water.

Corrosion

The deterioration of a metal by chemical or electrochemical reaction with its environment.

Countercurrent Cascade Rinsing

A staged process that employs recycled, often untreated water as a rinsing medium to clean metal products. Water flow is opposite to product flow such that the most contaminated water encounters incoming product first.

Crucible

A vessel or pot made of a material with a high melting point used for melting metals.

Data Collection Portfolio (dcp)

The questionnaire used in the survey of the nonferrous metals forming industry.

Deoxidizing

The removal of any oxide film from a metal.

Desmutting

A process that removes smut by immersing the product in an acid solution, usually nitric acid.

Die

Various tools used to impart shape to metal primarily because of the shape of the die itself. Examples are forging dies, drawing dies, and extrusion dies.

Direct Chill Casting

A method of casting where the molten metal is poured into a water-cooled mold. The base of this mold is the top of a hydraulic cylinder that lowers the metal first through the mold and then through a water spray and bath to cause solidification. The vertical distance of the drop limits the length of the ingot. This process is also known as semi-continuous casting.

Direct Discharger

Any point source that discharges to a surface water.

Drag-out

The solution that adheres to the objects removed from a bath or rinse, more precisely defined as that solution which is carried past the edge of the tank.

Drawing

Pulling the metal through a die or succession of dies to reduce the metal's diameter or alter its shape.

Drying Beds

Areas for dewatering of sludge by evaporation and seepage.

Ductility

The ability of a metal to deform plastically without fracturing.

Dummy Block

In extrusion, a thick unattached disk placed between the ram and billet to prevent overheating of the ram.

Effluent

Discharge from a point source.

Effluent Limitation

Any standard (including schedules of compliance) established by a state or EPA on quantities, rates, and concentrations of chemical, physical, biological, and other constituents that are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean.

Electrochemical Finishing

Producing a desired finish on the surface of a metallic product by immersing the workpiece in an electrolyte bath through which direct current is passed.

Electroplating

The production of a thin coating of one metal on another by electrodeposition.

Electrostatic Precipitator (ESP)

A gas cleaning device that induces an electrical charge on a solid particle which is then attracted to an oppositely charged collector plate. The collector plates are intermittently vibrated to discharge the collector dust to a hopper.

Emulsifying Agent

A material that increases the stability of a dispersion of one liquid in another.

Emulsions

Stable dispersions of two immiscible liquids. In the nonferrous metals forming category this is usually an oil and water mixture.

End-of-Pipe Treatment

The reduction of pollutants by wastewater treatment prior to discharge or reuse.

Etching

The removal of surface imperfections, oxides, and scratches by chemical action. Etching can also provide surface roughness.

Eutectic Temperature

The lowest temperature at which a solution (in this case, the solution is molten metal and various alloying materials) remains completely liquid.

Extrusion

A process in which high pressures are applied to a metal billet, forcing the metal to flow through a die orifice.

Finishing

The coating or polishing of a metal surface.

Fluxes

Substances added to molten metal to help remove impurities and prevent excessive oxidation, or promote the fusing of the metals.

Forging

Deforming metal, usually hot, with compressive force into desired shapes, with or without dies. Where dies are used, the metal is forced to take the shape of the die.

Gas Chromatography/Mass Spectroscopy (GC/MS)

Chemical analytical instrumentation used for quantitative organic analysis.

Grab Sample

A single sample of wastewater taken without regard to time or flow.

Grain

An individual crystal in a polycrystalline metal or alloy.

Green Compact

An unsintered compact.

Grinding

The process of removing stock from a workpiece by the use of a tool consisting of abrasive grains held by a rigid or semi-rigid binder. Grinding includes surface finishing, sanding, and slicing.

Hammer Forging

Forging in which the workpiece is deformed by repeated blows.

Hardness

Resistance of metal to plastic deformation by indentation, scratching, abrasion or cutting.

Heat Treatment

A process that changes the physical properties of the metal, such as strength, ductility, and malleability by controlling the rate of cooling.

Homogenizing

Holding solidified metal at high temperature to eliminate or decrease chemical segregation by diffusion.

Hot Working

Deforming metal plastically at such a temperature and rate that strain hardening does not occur. The low limit of temperature is the recrystallization temperature of the metal.

Hydraulic Press

A press in which fluid pressure is used to actuate and control the ram.

Impacting

Forming, usually cold, a part from a metal slug confined in a die, by rapid single-stroke application of force through a punch, causing the metal to flow around the punch.

Indirect Discharger

Any point source that discharges to a publicly owned treatment works.

Inductively-Coupled Argon Plasma Spectrophotometer (ICAP)

A laboratory device used for the analysis of metals.

Ingot

A large, block-shaped casting produced by various methods. Ingots are intermediate products from which other products are made.

In-Process Control Technology

Any procedure or equipment used to conserve chemicals and water throughout the production operations, resulting in a reduction of the wastewater volume.

Jet

A stream of fluid (gas or liquid) discharged from a narrow opening or nozzle.

Mandrel

A rod used to retain the cavity in hollow metal products during working.

Metal Powder Production

Any process operations which convert metal to a finely divided form without an increase in metal purity.

Neat Oil

A pure oil with no or few impurities added. In nonferrous metals forming its use is mostly as a lubricant.

New Source Performance Standards (NSPS)

Effluent limitations for new industrial point sources as defined by Section 306 of the Act.

Nonconventional Pollutant

Parameters selected for use in performance standards that have not been previously designated as either conventional or toxic pollutants.

Nonferrous Metal

Any pure metal other than iron, copper or aluminum; or metal alloy for which a metal other than iron, copper, and aluminum is its major constituent in percent by weight.

Nonferrous Metals Forming

A set of manufacturing operations in which nonferrous metals and nonferrous alloys are made into semifinished products by hot or cold working. It also includes metal powder production and powder metallurgy of all metals, including iron, copper, and aluminum.

Non-Water Quality Environmental Impact

The ecological impact as a result of solid, air, or thermal pollution due to the application of various wastewater technologies to achieve the effluent guidelines limitations. Also associated with the non-water quality aspect is the energy impact of wastewater treatment.

NPDES Permits

Permits used by EPA or an approved state program under the National Pollutant Discharge Elimination System.

Off-Gases

Gases, vapors, and fumes produced as a result of a nonferrous metals forming operation.

Off-Kilogram (Off-Pound)

The mass of nonferrous metal or metal alloy removed from a forming operation or associated surface or heat treatment operation at the end of a process cycle for transfer to a different process or machine. For example, one kilogram for all pounds of metal that is cold rolled twice in succession on the same or tandem rolling mill and then annealed represents one off-kilogram for all pounds for cold rolling and one off-kilogram for all pounds for annealing; one off-kilogram for all pounds of metal that is cold rolled once then annealed and cold rolled again represents two off-kilograms for all pounds for cold rolling and one off-kilogram for all pounds for annealing. Product storage is also a factor in calculating off-kilograms for all pounds: one off-kilogram for all pounds of metal that is cold rolled, taken off the line and stored, then cold rolled at a later date represents two off-kilograms for all pounds for cold rolling.

Oil and Grease (O&G)

Any material that is extracted by freon from an acidified sample and that is not volatilized during the analysis, such as hydrocarbons, fatty acids, soaps, fats, waxes, and oils.

Oxidation

A reaction in which there is an increase in valence resulting from a loss of electrons.

pH

The pH is the negative logarithm of the hydrogen ion activity of a solution.

Phosphating

Forming an adherent phosphate coating on a metal immersed in a suitable aqueous phosphate solution.

Pickle Liquor

A spent acid-pickling bath.

Pickling

Removing oxides from metals by chemical or electrochemical reactions.

Pig

A metal casting used in remelting.

Plate

A flat, extended, rigid metal body having a thickness greater than or equal to 6.3 mm (0.25 inches).

Pointing

Reducing the diameter of wire, rod, or tubing over a short length by swaging, hammer forging or squeezing to facilitate entry into a drawing die and gripping in the drawhead.

Pollutant Parameters

Those constituents of wastewater determined to be detrimental and, therefore, requiring control.

Powder

Particles of matter characterized by small size, i.e., 0.1 to 1,000 um.

Powder Metallurgy

The art of producing metal powders and using metal powders for the production of massive materials (ingots, billets) and shaped objects (parts).

Press Forging

Forging metal, usually hot, between dies in a press.

Pressing

In powder metallurgy, forming a powder-metal part with compressive force.

Priority Pollutants

Those pollutants included in Table 2 of Committee Print number 95-30 of the "Committee on Public Works and Transportation of the House of Representatives," subject to the Act.

Process Water

Water used in a production process that contacts the product, raw materials, or reagents.

Production Normalized Water Discharge

The volume of water discharged from a given process per mass of nonferrous metal processed. The water may be discharged to further treatment, discharged without treatment, or removed by a contractor. Differences between the water use and wastewater flows associated with a given stream result from recycle, evaporation, and carryover on the product.

Production Normalized Water Use

The volume of water or other fluid (e.g., emulsions, lubricants) required per mass of metal processed through the operation. Water use is based on the sum of recycle and make-up flows to a given process.

Production Normalizing Parameter (PNP)

The unit of production specified in the regulations used to determine the mass of pollutants that a production facility may discharge.

PSES

Pretreatment standards (effluent regulations) for existing sources, under Section 307(b) of the Act.

PSNS

Pretreatment standards (effluent regulations) for new sources, under Section 307(c) of the Act.

Publicly Owned Treatment Works (POTW)

A waste treatment facility that is owned by a state or municipality.

Quenching

Rapid cooling, in air, vapor or water.

Ram

The moving part of a hammer or press to which a tool is fastened.

Recrystallization Temperature

The minimum temperature at which a new, stain-free grain structure is formed from that existing in a cold worked metal.

Recycle

Returning treated or untreated wastewater to the production process from which it originated for use as process water.

Reduction

A reaction in which there is a decrease in valence resulting from a gain in electrons.

Repressing

The application of pressure to a previously pressed and sintered compact, usually to improve some physical property.

Reuse

The use of treated or untreated process wastewater in a different production process.

Ring Rolling

A forging process used to shape weldless rings from pierced disks or thick-walled, ring-shaped blanks. The rings are forged between rolls or a mandrel and hammer.

Rinsing

A process in which water is used to wash surface treatment and cleaning chemicals from the surface of metal.

Rod

An intermediate metal product having a solid, round cross section 9.5 mm (3/8 inches) or more in diameter.

Roll Bonding

The process by which a permanent bond is created between two metals by rolling under high pressure in a bonding mill (co-rolling).

Rolling

A forming process that reduces the thickness of a workpiece by passing it between a pair of lubricated steel rollers.

Sand Blasting

Abrasive blasting with sand.

Sawing

Cutting a workpiece with a band, blade, or circular disk having teeth.

Scale

A thick layer of oxidation products formed on metals at high temperatures. Also deposits of water-insoluble constituents formed on surfaces in cooling towers and wet air pollution control equipment.

Scrubber Liquor

The untreated wastewater stream produced by wet scrubbers cleaning gases produced by nonferrous metals forming operations.

Seal Water

A water curtain used as a barrier between the furnace atmosphere and the outside atmosphere.

Semi-Fabricated Products

Intermediate products that are the final product of one process and the raw material for a second process.

Sheet

A flat-rolled metal product thinner than plate.

Shot

Small spherical particles of metal, larger in diameter than powder.

Shot Casting or Shotting

The production of shot by pouring metal in finely divided streams. Solidified spherical particles formed during the descent are cooled in a tank of water.

Shot Peening

Cold working the surface of a metal by metal-shot impingement.

Sintering

The bonding of adjacent surfaces of particles in a mass of metal powders or a compact, by heating to a temperature less than the melting point of the metal.

Sizing

Final pressing of a sintered compact to produce specified dimensions and tolerances.

Skiving

Removal of a material in thin layers with a high degree of shear or slippage or both. This process is used to form a trough in a strip of base metal in preparation for producing clad inlay strip.

Soldering

A process that bonds two metal pieces by heating them to a suitable temperature and by using a filler material which melts below 425°C (800°F). The filler material is distributed between the surfaces of the joint by capillary action.

Solid Solution

A single solid homogeneous crystalline phase containing two or more chemical species.

Solution Heat Treatment

Heating an alloy to a suitable temperature, holding it at that temperature long enough to cause one or more constituents to enter into solid solution, and then cooling rapidly enough to hold these constituents in solution.

Stainless Steel

An iron-base alloy, containing chromium and sometimes nickel or manganese, which is extremely resistant to corrosion. Some alloys called stainless steel are greater than 50 percent nickel.

Stationary Casting

A process in which the molten metal is poured into molds and alloyed to cool. It is often used to recycle in-house scrap.

Steam Oxidation (Bluing)

Subjecting the surface of a ferrous alloy to the action of steam at a suitable temperature, thus forming a thin blue film or oxide and improving the appearance and resistance to corrosion. This process is often used for iron and steel parts pressed from metal powders.

Steel

An iron-base alloy, containing manganese, usually carbon, and often other alloying elements.

Strain Hardening

An increase in hardness and strength caused by plastic deformation at temperatures lower than the recrystallization temperature.

Strip

A sheet of metal in which the length is many times the breadth.

Subcategorization

The process of segmentation of an industry into groups of plants for which uniform effluent limitations can be established.

Surface Treatments

Operations such as pickling, etching, phosphating, and chromating which chemically alter the metal surface.

Surface Water

Any visible stream or body of water, natural or man-made. This does not include bodies of water whose sole purpose is wastewater retention or the removal of pollutants, such as holding ponds or lagoons.

Surfactants

Surface active chemicals that tend to lower the surface tension between liquids.

Swaging

A process in which a solid point is formed at the end of a tube, rod, or bar by the repeated blows of one or more pairs of opposing dies. It is often the initial step in the drawing process.

Swarf

Metallic particles and abrasive fragments removed by a cutting or grinding tool.

Tensile Strength

The ratio of maximum load to original cross-sectional area.

Total Dissolved Solids (TDS)

Organic and inorganic molecules and ions that are in solution in the water or wastewater.

Total Organic Carbon (TOC)

A measure of the organic contaminants in a wastewater. The TOC analysis does not measure as much of the organics as the COD or BOD tests, but is much quicker than these tests.

Total Recycle

The complete reuse of a stream, with makeup water added for evaporation losses. There is no blowdown stream from a totally recycled flow and the process water is not periodically or continuously discharged.

Total Suspended Solids (TSS)

Solids in suspension in water, wastewater, or treated effluent. Also known as suspended solids.

Trepanning

A type of boring where an annular cut is made into a solid material with the coincidental formation of a plug or solid cylinder. Used to prepare billets for extrusion into tubing.

Tube Reducing

Reducing both the diameter and wall thickness of tubing with a mandrel and a pair of rolls with tapered grooves.

Tubing Blank

A sample taken by passing one gallon of distilled water through a composite sampling device before initiation of actual wastewater sampling.

Tumbling (Barrel Finishing)

An operation in which castings, forgings, or parts pressed from metal powder are rotated in a barrel with ceramic or metal slugs or abrasives to remove scale, fins, or burrs. It may be done dry or with an aqueous solution.

Turning

Removing stock from a rotating workpiece with a tool.

Ultrasonic Cleaning

Immersion cleaning aided by sound waves with frequency greater than 15 kHz that cause microagitation.

Volatile Substances

Materials that are readily vaporized at relatively low temperatures.

Wet Scrubbers

Air pollution control devices used to remove particulates and fumes from air by entraining the pollutants in a water spray.

Wire

A slender strand of metal with a diameter less than 9.5 mm (3/8 inches).

Work-Hardening

An increase in hardness and strength and a loss of ductility that occurs in the workpiece as a result of passing through cold forming or cold working operations. Also known as strain-hardening.

Zero Discharger

Any industrial or municipal facility that does not discharge wastewater.

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