United States
Environmental Protection
Agency

Effluent Guidelines Division
WH-552
Washington DC 20460

EPA 440/1-82/070-b
November 1982 Vol. 2

Water

EPA

Development Document for Effluent Limitations Guidelines and Standards for the

Proposed

Metal Molding and Casting (Foundries)

Point Source Category

Volume II

DEVELOPMENT DOCUMENT

FOR

EFFLUENT LIMITATIONS GUIDELINES
NEW SOURCE PERFORMANCE STANDARDS

AND

PRETREATMENT STANDARDS

FOR THE

METAL MOLDING AND CASTING
(FOUNDRIES)
POINT SOURCE CATEGORY
VOLUME II

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November 1982

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SECTION VIII

COST, ENERGY, AND NON-WATER QUALITY IMPACTS

INTRODUCTION

This section addresses the cost, energy, and non-water quality impacts of applying the different levels of wastewater pollution control to foundry operations. It includes a discussion of actual treatment costs incurred at sampled plants, alternative treatment technologies, and the cost, energy, and other non-water quality impacts associated with the application of the BPT, BAT, NSPS, PSES, and PSNS alternative treatment systems. In addition, the consumptive use of water is addressed.

SAMPLED PLANT TREATMENT COSTS

Tables VIII-1 through VIII-5 present the reported costs of treatment for the sampled foundry operations. The costs were derived from data supplied by the industry at the time of sampling. Standard cost of capital and depreciation percentages are applied because pertinent company supplied data were not provided. Supplement B to this document provides additional details on sampled plant costs of treatment. All costs have been adjusted to July 1978 dollars.

A comparison of capital cost data from the sampled plants with the Agency's estimated expenditures is shown below. Comparisons were made for those plants listed in Tables VIII-1 through VIII-5 which had sufficient data available to determine the in-place treatment components. The Agency's estimates were derived directly from the model cost tables. As can be seen in the following table, the agency's model costs compare favorably with the actual costs reported by industry. Only four of the 15 plants listed show a plant supplied cost which exceeds the EPA model cost. Overall, the Agency's total estimate is 36 percent higher than the total reported cost. The Agency therefore concludes that its cost models do not underestimate the costs of treatment (construction, retrofit, etc.) which the metal molding and casting industry may incur.

Plant Code	Reported Cost	EPA Model Cost
04704	$103,100	$207,000
04736	27,640	66,000
06809	9,170	43,000
06956	796,700	1,638,000
07170	12,380	167,000
07929	78,900	341,000
08146	9,300	26,000
09094	55,000	79,000
12040	491,100	439,000
15520	1,298,200	1,285,000
15654	10,540	256,000
17089	1,140,130	711,000
19872	7,550	47,000
20009	56,200	495,000
20147	280,450	152,000
TOTAL	$4,376,360	$5,952,000

DEVELOPMENT OF COST MODELS

Model treatment systems were prepared to assist in the development of the proposed limitations and standards and the estimation of treatment costs. The selection of the model treatment systems, upon which the proposed limitations and standards are based, is discussed in Sections IX through XIII. The model treatment components are described in Tables VIII-6 through VIII-23. In addition to listing the treatment technologies, these tables also describe for each component:

1. Status and reliability
2. Problems and limitations
3. Implementation time
4. Land requirement
5. Environmental impacts other than water
6. Solid waste generation

Note: Implementation time includes engineering, purchase, delivery, and construction activities.

Model Flow

After selecting the treatment technologies, models were developed to estimate the costs of treatment. The first step in the development of cost models for each process segment involved the determination of model flows. The Agency determined that gallons per ton of production was an appropriate unit for expressing flow.

The model flow values (in liters per kkg or gallons per ton) are based upon the "best" flow rates through the process (applied flow) of the plants in each process segment. The "best" model flows were determined to be the values of those plants which demonstrate conservative water use practices. Additional details on the development of applied and discharge model flows are presented in Section IX and X.

Model Size

The next step in the development of cost models for each process segment involved the determination of model size (tons/day). By relating size, flow (gal/ton), and the length of the operating day, treatment component sizes and, therefore, costs were determined. The production data in each process segment were separated by employee group and then averaged to determine the various model sizes in each process segment. In the few instances where there was insufficient production data for a particular segment, data from other related segments were used.

Co-Treatment Models

As a further refinement of the cost models, several models were developed to reflect co-treatment practices in the industry. These co-treatment models more accurately mirror industry operations and recognize the economies of scale in both investment and annual expenditures. Following is a list of the process combinations for which co-treatment models were developed.

- Aluminum Subcategory
  - Casting Quench and Die Casting
- Ferrous Subcategory
  - Dust Collection and Slag Quench
  - Dust Collection and Sand Washing
  - Melting Furnace Scrubber and Slag Quench

These process combinations reflect the predominant treatment combinations noted in the industry survey.

The co-treatment model sizes are based upon the average production value of the plants in the particular process combination and employee group. The co-treatment model flows are based upon the sum of the model flows for each contributing process. The co-treatment model systems are illustrated in Figures VIII-1 through VIII-4.

BASIS FOR MODEL COST ESTIMATES

Model investment (capital) costs are estimates of the equipment and installation costs of each treatment component and its ancillary facilities (pumps, piping, building, etc.). The annual costs include capital recovery costs, operation and maintenance costs, energy and power, chemical, and liquid and solid waste disposal costs. All costs presented in this section are in July 1978 dollars.

Capital recovery costs consist of the charges for depreciation and interest. Depreciation charges are based upon a ten year straight line depreciation. Interest charges are calculated on the basis of a seven percent interest rate. The capital recovery factor (CRF) is typically used to allocate investment costs and interest charges to the annual operating cost of a facility. The CRF is equal to i (the interest rate) times the nth power (n is equal to the depreciation period) of the quantity (1+i), the product of which is divided by the nth power of the quantity (1+i) less 1. The investment cost is multiplied by the CRF to obtain the capital recovery cost. The annual depreciation charge is determined by dividing the initial investment by the number of years in the depreciation period. The annual cost of capital is equal to the total annual capital recovery (ACR) minus the annual cost of depreciation (i.e. ACR-P/n = Annual cost of capital, where P is the principal or initial investment cost).

To maintain consistency, the following parameters were established as bases for the model cost estimates.

- The treatment facilities are contained within a "battery limit" and are erected on a "green field" site. Site clearance cost estimates are based upon average site conditions with no allowances for equipment relocation.

- Equipment costs are based upon specific flow rates.

- The treatment facilities are located in reasonable proximity to the process "source." Piping and utility costs for interconnecting runs between the treatment facility's battery limits and process equipment areas are based upon moderate linear distances.

- Land acquisition costs are not specifically included in the cost estimates.

- Limited instrumentation, for pH and ORP measurement and control, has been included. However, automatic samplers, temperature indicators, flow meters, recorders, etc., have not been included in the cost estimates.

- Control buildings are prefabricated structures.

In general, the model cost estimates reflect an on-site "battery limit" treatment plant with: electrical substation and equipment for supplying electrical power to the facilities; all necessary pumps; treatment facility interconnecting pipe lines; chemical treatment facilities; foundations; structural steel; a control house; access roadways; and a chain link fence. The cost estimates also include a 15 percent contingency, 10 percent contractor's overhead and profit, and engineering fees of 15 percent.

MODEL COST ESTIMATES

The cost estimates for the model treatment systems are presented in Tables VIII-24 through VIII-94. Model treatment system cost estimates were not developed for the melting furnace scrubber process segment of the lead casting subcategory because the proposed limitations and standards will not require additional expenditures. Of the five plants in the lead subcategory melting furnace scrubber process segment, four achieve "zero discharge" through the use of internal recycle systems. As a result, these four plants will not incur additional wastewater treatment costs. The remaining melting furnace scrubber achieves 99% recycle. The Agency believes that this plant will be able to achieve "zero discharge" through the tightening of its recycle system: Since tightening the recycle system is a treatment process adjustment, no additional investment or annual expenditures are expected.

The pollution control expenditures for new source operations in the lead subcategory melting furnace scrubber process segment would be related to the purchase and operation of air pollution control equipment packages as provided by equipment manufacturers. As manufactured, these scrubber packages contain wastewater reservoirs and recycle components. Therefore, the investment and annual expenditures for water pollution control at new source lead melting furnace scrubber operations are not addressed as part of this document.

COST, ENERGY, AND NON-WATER QUALITY IMPACTS

Following are the impacts, based upon the model treatment systems, of the proposed BPT, BAT, and PSES levels of treatment. Estimates of the cost, energy, and non-water quality impacts of NSPS and PSNS are based upon the treatment models. Since new plants have no existing treatment equipment in place, total treatment costs are not adjusted for existing treatment equipment as is the case for BPT, BAT, and PSES. NSPS and PSNS costs are estimated from model costs. The total energy and non-water quality impacts of the proposed BAT and PSES levels of treatment are based upon the selected treatment alternatives. For details on the selection of the BAT and PSES alternatives, refer to Sections X and XIII, respectively.

Estimated costs of Implementation of Pollution Control Technologies

Tables VIII-96 through VIII-118 present estimates of the investment and annual costs to the industry associated with the treatment levels considered. These costs were developed by the method outlined in Table VIII-95.

Tables VIII-119 through VIII-126 present summaries, (segmented by discharge mode, process group or combination, and employee group) of the number of foundries in each subcategory and segment. These data are based upon statistical projections. These summaries are current as of the industry update survey conducted in mid-1981. No data are available to determine the number of grid casting operations in the lead casting subcategory.

Energy Impacts

A summary, by subcategory, process segment, and employee group, pf the energy requirements due to water pollution control activities is presented in Table VIII-127. The data presented in this table were developed by multiplying the model treatment system energy consumption values by the number of plants represented by each model. It should be noted that the totals listed in Table VIII-127 do not include all operations. Those operations which currently achieve "zero discharge" through internal recycle or by holding quench tank wastes for contract disposal do not incur, nor will they require, expenditures for energy for wastewater treatment.

The total consumption of 107.5 million kwh represents 0.3% of the industry's 1978 electrical energy consumption of 31.3 billion kilowatt hours.

Non-water Quality Impacts

Air Pollution

None or the processes or treatment technologies proposed generate or contribute to the generation of any air pollutants.

Therefore, there will be no impacts on air quality as a result of water pollution control activities at the proposed levels of treatment.

Solid and Liquid Waste Disposal

A summary, by subcategory, process segment, and employee group, of solid and liquid waste disposal impacts due to water pollution control activities is presented in Table VIII-128. The data presented in this table were derived by multiplying model waste loads by the number of plants in each model. The solid wastes are comprised of dewatered wastewater treatment sludges (25% solids). The liquid wastes are comprised of the surface skimmings removed in wastewater treatment operations (specific gravity = 0.85 gm/cc).

Other solid and liquid wastes are generated by this industry. However, these other wastes (e.g., spent casting sand, furnace dusts, and spent quenching solutions) are generated by the process and not as a result of the proposed regulation and of wastewater treatment operations associated with the process.

The Agency considered the requirements of the Resource Conservation and Recovery Act (RCRA) in developing the proposed limitations and standards for this point source category. Since publication of the original RCRA listings for wastewater treatment sludges, the Agency has delisted those sludges resulting from the hydroxide precipitation of toxic metals. The solid wastes generated at the proposed levels of treatment by the copper and ferrous dust collection, the ferrous sand washing, and the electric furnace processes can contain toxic metals which have not been fixed or have been incompletely fixed as metal hydroxides. The Agency has, therefore, considered the impact on the above processes attaining compliance with RCRA requirements.

The EP toxicity test (refer to RCRA Procedures) is designed to provide an indication of the leachability of toxic materials from various solid wastes. In this test, measured amounts (up to a specific volume) of acetic acid are mixed with specific quantities of solid wastes. The resulting liquid extract is then analyzed for certain toxic metals. Concentrations found above certain values indicate RCRA nonconformance. The previously noted delistings were made because hydroxide fixation of the toxic metals inhibits the leaching ot toxic metals from these solid wastes. In the cases of the foundry processes noted above, conformance with RCRA requirements could be ensured by adding lime (a readily available hydroxide source) to the solid wastes generated by these processes. The model treatment systems for these foundry processes do not provide for the addition of a hydroxide source or provide for only a limited level of pH adjustment.

Sampled plant analytical data were reviewed to determine the excess alkalinity typically available in wastes from these processes. For this effort, the solid waste acidity and alkalinity were considered to be similar to that of the process wastewaters. The average excess alkalinity was found to be 230 gm per kkg of sludge. This amount represents approximately five (5) equivalents of excess alkalinity. Following EP toxicity test procedures, up to 2,000 equivalents of acid can be added per kkg of sludge. Therefore, 1,995 (2,000-5) equivalents of hydroxide would be needed to stabliize each kkg of sludge in these process segments. This ratio of represents 148 lb of lime per ton of sludge. On a current dollar basis of $42.50 per ton of lime (in bags), the resulting chemical cost is $3.14 per ton of sludge. This value represents only the cost of chemicals as plants would use their existing solid waste handling facilities to dispose of their sludges.

The Agency estimates that 2,880 tons/year of sludge will be generated in progressing from the current to the proposed levels of treatment in the processes noted above. The resulting cost of lime addition for the proposed regulation is $9,040 per year.

Consumptive Water Loss

In all but two of the process segments there will be no impacts related to the consumptive loss of water due to water pollution control activities. In the case of the two exceptions, the copper and the ferrous subcategory mold cooling and casting quench process segments, the use of evaporative cooling technologies as model treatment components will result in a net increase in the volume of water consumed in water pollution control activities.

1. In the copper subcategory mold cooling and casting quench process segment, the current level of water consumption is estimated to be 33.4 million gallons per year (126.6 million liters per year). Implementation of the proposed limitations and standards would result in the following net increases in annual water consumption:

Proposed BPT	0.22 Million gallons (0.83 Million liters)
Proposed PSES	0.09 Million gallons (0.34 Million liters)
Total	0.31 Million gallons (1.27 Million liters)

The preceding volumes are determined on the basis of a 2% loss due to evaporation, drift, etc., in evaporative cooling components, and a 0.9% loss due to evaporation from discharged wastewaters.

The following values show the net increases as percentages of the total volume of water applied in this process segment (1.66 billion gallons/year) and as percentages of the total volume applied in the category (110.9 billion gallons/year).

	Percent of Volume Applied	
	Process Segment	Foundry Industry
Proposed BPT	0.013	0.00020
Proposed PSES	0.005	0.00008
Total	0.018	0.00028

2. In the ferrous subcategory mold cooling and casting quench process segment, the current level of water consumption is estimated to be 86.2 million gallons (326.3 million liters) per year. Implementation of the proposed limitations and standards would result in the following net increases in annual water consumption.

Proposed BPT	6.58 Million Gallons	(24.9 Million Liters)
Proposed PESE	4.57 Million Gallons	(17.3 Million Liters)
	11.15 Million Gallons	(42.21 Million Liters)

The above volumes were determined on the same bases as described above for copper mold cooling and casting quench operations.

The following values show the net increases as percentages of the total volume of water applied in this process segment (4.87 billion gallons) and as percentages of the total volume applied in the category:

	Percent of Volume Applied	
	Process Segment	Foundry Industry
Proposed BPT	0.14	0.006
Proposed PSES	0.09	0.004

Total	0.23	0.010

The Agency concludes that the substantial reductions in process water requirements and discharge volumes achieved through recycle outweigh the comparatively minor net increases in the volume of water consumed in treatment operations. This favorable comparison would apply in all geographic regions. In fact, complete recycle is currently being practiced at operations in water scarce areas of the U.S.

SUMMARY

The Agency concludes that the pollutant load reduction benefits of the proposed limitations and standards outweigh any adverse impacts which may be attributed to the implementation of water pollution control facilities.

TABLE VIII-1

EFFLUENT TREATMENT COSTS
ALUMINUM CASTING SUBCATEGORY
(ALL COSTS ARE EXPRESSED IN JULY 1978 DOLLARS)

Plant Code:	04704	12040	17089	20147
Process Segment(s):	Investment Casting	Die Casting (Aluminum and Zinc)	Melting Furnace Scrubber, Die Casting, and Casting Quench	Die Lube
Initial Investment Cost	$103,100	$491,100	$1,140,130	$280,500
Annual Costs				
Cost of Capital	$ 4,430	$ 21,120	$ 49,150	$ 12,060
Depreciation	10,310	49,110	114,310	28,050
Operation and Maintenance	5,950	76,830	35,000	55,100
Energy and Power	375	3,300	9,060	800
Chemical Costs	1,500	48,620	108,210	-
Solid Waste Disposal	2,000	2,100	-	-
Other	26,450 (1)	1,290	-	-
Total Annual Cost	$ 51,015	$202,370	$ 315,730	$ 96,010
$/ton	118.64	6.29	3.08	2.39

(1) Contract removal of spent acid

TABLE VIII-2

EFFLUENT TREATMENT COSTS
COPPER CASTING SUBCATEGORY
(ALL COSTS ARE EXPRESSED IN JULY 1978 DOLLARS)

Plant Code:	04736	06809[1]	09094	19872
Process Segment(s):	Mold Cooling and Casting Quench	Mold Cooling and Casting Quench	Dust Collection	Dust Collection
Initial Investment Cost	$27,640	$9,170	$55,000	$7,550
Annual Costs				
Cost of Capital	$ 1,190	$ 390	$ 2,360	$ 320
Depreciation	2,760	920	5,500	760
Operation and Maintenance	6,290	930	22,000	625
Energy and Power	3,270	440	2,000	13,250
Chemical Costs	-	-	-	-
Solid Waste Disposal	10,900	380	5,000	250
Other	-	-	-	-
Total Annual Cost	$24,410	$3,060	$36,860	$15,205
$/ton	0.86	0.02	8.93	1.96

(1) Costs for this plant are apportioned from the total costs of a combined treatment system. The apportionment is made on the basis of contributing flow; this process contributes 5 percent of the total flow through the system. This estimate was provided by the company.

TABLE VIII-3

EFFLUENT TREATMENT COSTS
IRON AND STEEL CASTING SUBCATEGORY
(ALL COSTS ARE EXPRESSED IN JULY 1978 DOLLARS)

Plant Code:	00001	00002	06956	07170	07929
Process Segment(s):	Melting Furnace Scrubber	Melting Furnace Scrubber	Dust Collection, Melting Furnace Scrubbers, and Slag Quench	Melting Furnace Scrubber	Dust Collection
Initial Investment Cost	$106,700	$177,200	$796,700	$12,400	$78,900
Annual Costs					
Cost of Capital	N/A	N/A	$ 33,750 (1)	$ 530	$ 3,390
Depreciation			79,670	1,240	7,890
Operation and Maintenance			232,160	2,500	2,560
Energy and Power			5,000	20	4,110
Chemical Costs			35,300	1,000	-
Solid Waste Disposal			160,000	30	1,940
Other			-	-	-
Total Annual Costs			$545,880	$ 5,320	$19,890
$/ton			5.34	26.60	0.38

Plant Code:	15520			15654	20009
Process Segment(s):	Dust Collection	Melting Furnace Scrubber	Total	Mold Cooling and Casting Quench	Dust Collection and Sand Washing
Initial Investment Cost	$632,800	$665,400	$1,298,200	$10,500	$56,200
Annual Costs					
Cost of Capital	$ 27,210	$ 28,610	$ 55,820	$ 450	$ 2,420
Depreciation	63,280	66,540	129,820	1,050	5,620
Operation and Maintenance	127,890	451,260	579,150	100	49,980
Energy and Power	12,940	26,400	39,340	-	-
Chemical Costs	-	4,000	4,000	-	-
Solid Waste Disposal	-	3,310	3,310	-	-
Other	13,720 (2)	140,680 (2)	154,400 (2)	-	880 (3)
Total Annual Costs	$245,040	$720,800	$ 965,840	$ 1,600	$58,900
$/ton	-	-	5.80	0.01	0.81

(1) Reported value
(2) Sewer charges, assessed costs to main plant treatment, etc.
(3) Fuel

N/A: Not Available. No operating data provided.

TABLE VIII-4

EFFLUENT TREATMENT COSTS
MAGNESIUM CASTING SUBCATEGORY
(ALL COSTS ARE EXPRESSED IN JULY 1978 DOLLARS)

Plant Code:	08146
Process Segment(s):	Grinding Scrubbers and Dust Collection
Initial Investment Cost	$ 9,300
Annual Costs	
Cost of Capital	$ 400
Depreciation	930
Operation and Maintenance	4,900
Energy and Power	3,270
Chemical Costs	-
Solid Waste Disposal	650
Other	-
Total Annual Cost	$10,150
$/ton	52.86

TABLE VIII-5

EFFLUENT TREATMENT COSTS
ZINC CASTING SUBCATEGORY
(ALL COSTS ARE EXPRESSED IN JULY 1978 DOLLARS)

Plant Code:	04622	10308	18139
Process Segment(s):	Casting Quench	Casting Quench (Zinc and Aluminum)	Melting Furnace Scrubber and Casting Quench (Zinc and Aluminum)
Initial Investment Cost	N/A	$257,800	$1,709,340
Annual Costs			
Cost of Capital	-	$ 11,090	$ 73,500
Depreciation	-	25,780	170,930
Operation and Maintenance	-	26,570	419,500
Energy and Power	-	800	8,500
Chemical Costs	-	16,540	1,000
Solid Waste Disposal	-	-	10,000
Other	$ 17,040(1)	-	-
Total Annual Cost	$ 17,040	$ 80,780	$ 683,430
$/ton	1.60	9.02	16.26

(1) This value represents the cost of contractor disposal services.

N/A: Not Applicable

TABLE VIII-6

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
INVESTMENT CASTING OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Polymer addition - increases the settleability of the wastewater solids by enhancing floc formation. Used in conjunction with step B.

2. Status and Reliability

   Used in this process and other industrial wastewater treatment operations.

3. Problems and Limitations

   Proper feed rate must be maintained. Feed system must be periodically cleaned. Care must be used to assure proper solution makeup.

4. Implementation Time

   6 months

5. Land Requirements

   Included with step B.

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   See step C.

TABLE VIII-6

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
INVESTMENT CASTING OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Clarifier - provides solids sedimentation and removal capability.

2. Status and Reliability

   Used in this process and in a wide variety of other foundry and industrial wastewater treatment applications.

3. Problems and Limitations

   Hydraulic overload would result in process upset. Excess accumulation of settled solids would upset process and cause mechanical overload.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 25'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   See step C.

TABLE VIII-6

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
INVESTMENT CASTING OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Vacuum Filter-dewaters the sludge removed in step B.

2. Status and Reliability

   Used in a wide variety of foundry and industrial wastewater treatment sludge dewatering operations.

3. Problems and Limitations

   Routine maintenance must be provided. Periodic media replacement is necessary.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Based upon the model treatment system, 104.3 lbs of dewatered solids (25% by weight) are removed per ton of metal poured (280.6 lbs/day, 35.1 tons/year). These solids consist of investment materials and entrained oils and greases.

TABLE VIII-6

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
INVESTMENT CASTING OPERATIONS

Step D (Alternative No. 1)

1. Treatment and Control Methods Employed

   Recycle tank and pumps - recycle all process wastewaters to the process.

2. Status and Reliability

   Used in a variety of foundry and other industrial wastewater applications.

3. Problems and Limitations

   Periodic cleaning required, especially in case of treatment process upset.

4. Implementation Time

   12-14 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids removed in step C.

TABLE VIII-6

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
INVESTMENT CASTING OPERATIONS

Step E (Alternative No. 2)

1. Treatment and Control Methods Employed

   Filtration - provides a higher degree of suspended solids removal. The backwash is returned to the floc tank.

2. Status and Reliability

   Used in a variety of industrial wastewater treatment applications.

3. Problems and Limitations

   Surges must be controlled. Treatment process upset must be avoided to prevent fouling and plugging. Excessive backwash rate must be avoided.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided

7. Solid Waste Generation and Primary Constituents

   Backwash would result in the additional generation of 16.1 pounds of sludge (25% by weight) per ton of metal poured (32.3 lbs/day, 4.0 tons/year) which would be removed in step C. These solids are comprised of the same constituents described in step C.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling Tank - provides primary sedimentation capability.

2. Status and Reliability

   Widely used in this subcategory and in a variety of other wastewater treatment applications.

3. Problems and Limitations

   Periodic cleaning and solids removal required.

4. Implementation Time

   6-8 months

5. Land Requirements

   15' x 30'

6. Environmental Impact Other Than Water

   Proper solids disposal required.

7. Solid Waste Generation and Primary Constituents

   Infrequent (once or twice a year) solids removal required.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Oil Skimmer - removes oils which may be released from process wastewaters.

2. Status and Reliability

   Widely used in this process segment, subcategory, and category, and in other categories.

3. Problems and Limitations

   The skimming equipment and media must be carefully maintained.

4. Implementation Time

   3 months

5. Land Requirements

   No additional land required.

6. Environmental Impact Other Than Water

   Any oils which are collected must receive proper disposal.

7. Solid Waste Generation and Primary Constituents

   None.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Recycle - 95% of the settling tank effluent is recycled.

2. Status and Reliability

   Practiced by several plants in this process segment.

3. Problems and Limitations

   Routine maintenance practices are imperative.

4. Implementation Time

   12 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   None.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step D

1. Treatment and Control Methods Employed

   Lime Addition - insures adequate pH control: also used for its formation and sedimentation capabilities.

2. Status and Reliability

   Very widely used in industrial wastewater treatment applications.

3. Problems and Limitations

   Proper maintenance is required to keep the lime feed system functioning properly.

4. Implementation Time

   12 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Must amke provisions for dust collection while unloading the lime.

7. Solid Waste Generation and Primary Constituents

   Included with step G.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step E

1. Treatment and Control Methods Employed

   Coagulant Aid Addition - used to enhance floc formation and thus improve wastewater sedimentation characteristics.

2. Status and Reliability

   Widely demonstrated in foundry and other industrial wastewater treatment applications.

3. Problems and Limitations

   Care must be taken to insure rate of addition and proper solution makeup.

4. Implementation Time

   6 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Solid wastes removed in step G must receive proper disposal.

7. Solid Waste Generation and Primary Constituents

   Included with step G.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step F

1. Treatment and Control Methods Employed

   Clarifier - provides for the sedimentation of wastewater solids (precipitates, particulates, etc.).

2. Status and Reliability

   Used in a wide variety of foundry and other industrial wastewater treatment applications.

3. Problems and Limitations

   Routine, or continuous, sludge removal is required. Hydraulic overloads would result in poor solids removal. Excess sludge accumulation results in reduced treatment efficiency and mechanical overloads.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Refer to step G.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step G

1. Treatment and Control Methods Employed

   Vacuum Filter - used to dewater the sludges removed in step F. The filtrate is returned to the mix tank.

2. Status and Reliability

   Widely used in this and in a variety of other industrial wastewater treatment applications. Dewaters the sludge to 25% solids.

3. Problems and Limitations

   Regular maintenance is necessary. Filter media must be replaced periodically.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper solid waste disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Based upon a dewinering of the sludge removed at step F to 25% solids, about 0,38 lbs of filter cake per ton of metal poured (41 lbs per day. 5.1 ton/year) would be generated by this treatment component.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step H

1. Treatment and Control Methods Employed

   Filter - provides the capacity for the removal of additional suspended solids (and of the pollutants entrained in these solids).

2. Status and Reliability

   Used in a wide variety of similar industrial wastewater treatment applications.

3. Problems and Limitations

   Hydraulic surges must be controlled. Treatment process upsets must be curtailed in order to prevent the fouling or plugging of the filter.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   Proper disposal of backwash solids must be provided.

7. Solid Waste Generation and Primary Constituents

   This treatment component would generate an additional solid waste load (removed in step G) of 0.065 lbs of solid waste per ton of metal poured (7 lbs per day, 0.9 ton/year).

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step I

1. Treatment and Control Methods Employed

   Recycle - return the effluent from step H to the process.

2. Status and Reliability

   Demonstrated in various industrial wastewater treatment applications. Refer to Section X for additional details pertaining to this application.

3. Problems and Limitations

   It is imperative that preventive maintenance procedures be followed.

4. Implementation Time

   12-14 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   No additional solid waste load.

TABLE VIII-7

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step J

1. Treatment and Control Methods Employed

   Tighten the recycle rate of step C to 100%.

2. Status and Reliability

   Demonstrated at several melting furnace operations in this industry.

3. Problems and Limitations

   Preventive maintenance practices must be observed.

4. Implementation Time

   10-12 months

5. Land Requirements

   No additional land required.

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   No additional solid waste load.

TABLE VIII-8

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
CASTING QUENCH OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling Tank - provides primary solids removal.

2. Status and Reliability

   Widely practiced in plants using this process and in a wide variety of other wastewater treatment applications.

3. Problems and Limitations

   Tank must be cleaned periodically.

4. Implementation Time

   6-8 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Proper disposal of solids must be provided.

7. Solid Waste Generation and Primary Constituents

   The solids can be recovered for reuse.

TABLES VIII-8

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
CASTING QUENCH OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Oil Skimmer - removes oils and greases which may separate from the process waters.

2. Status and Reliability

   Widely used in a number of similar applications.

3. Problems and Limitations

   Surface turbulence renders the skimmer ineffective. The skimming medium must be properly maintained.

4. Implementation Time

   3 months

5. Land Requirements

   No additional land is required.

6. Environmental Impact Other Than Water

   Proper disposal of solids must be provided.

7. Solid Waste Generation and Primary Constituents

   Based on a skim with a density 85% that of water, 0.24 gal of skim per ton of metal poured must be removed. Following are the estimated volumes of oils removed from the model treatment systems.

   <50 employees - 1.42 gal/day, 302 gal/year
   ≥50 employees - 14.9 gal/day, 3725 gal/year

TABLE VIII-8

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
CASTING QUENCH OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Recycle Pumps - recycle all wastewaters back to the process.

2. Status and Reliability

   Widely practiced in this and other subcategories and industries.

3. Problems and Limitations

   Carelessness, resulting in the contamination of quench solutions with other wastes, would degrade quench solution quality and possibly negate 100% recycle.

4. Implementation Time

   10-12 months

5. Land Requirements

   10' x 15'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   None.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Alum Addition-used in conjunction with steps B and C for oil and grease removal.

2. Status and Reliability

   Used by several plants employing this process as well as in a variety of other waste treatment operations.

3. Problems and Limitations

   Adds significant amounts of suspended solids. Care must be used in handling alum powders and solutions.

4. Implementation Time

   8-10 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Proper disposal of the skim removed in step C must be provided.

7. Solid Waste Generation and Primary Constituents

   Included with step G.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Sulfuric Acid Addition-used in conjunction with steps A and C for oil and grease removal.

2. Status and Reliability

   Used by several plants employing this process and in a variety of other pH adjustment applications.

3. Problems and Limitations

   Extreme care must be used in the handling and storage of acids.

4. Implementation Time

   8-10 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Proper disposal of the skim removed in step C must be provided. Venting must be provided to avoid personnel contact with fumes.

7. Solid Waste Generation and Primary Constituents

   Included with step G.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Inclined plate separator - provides the capability oil and grease separation.

2. Status and Reliability

   Used in this and other processes in a variety of installations.

3. Problems and Limitations

   Periodic cleaning may be required. If an excessive amount of skim is allowed to collect, the effectiveness of the unit is degraded. Hydraulic overloads must be avoided to maintain effectiveness.

4. Implementation Time

   10-12 months

5. Land Requirements

   20' x 50'

6. Environmental Impact Other Than Water

   Proper disposal of the oily skim must be provided.

7. Solid Waste Generation and Primary Constituents

   Based on a skim with a density 85% that of water, 0.86 gal of skim per ton of metal poured must be removed (103 gal/day, 25,710 gal/year).

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step D

1. Treatment and Control Methods Employed

   Lime Addition-Used for pH control and in conjunction with steps E and F.

2. Status and Reliability

   Lime addition for pH adjustment is very common in numerous waste treatment operations.

3. Problems and Limitations

   Proper maintenance is required to keep the pH control and lime feed systems operating.

4. Implementation Time

   12 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Dust collection capability must be provided when unloading lime.

7. Solid Waste Generation and Primary Constituents

   Included with step G solids removals.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step E

1. Treatment and Control Methods Employed

   Coagulant Aid Addition-added to waste stream in clarifier center-well. coagulant aid addition enhances floc formation.

2. Status and Reliability

   Widely practiced in this and a wide variety of other waste treatment applications.

3. Problems and Limitations

   Proper feed rate must be maintained.

4. Implementation Time

   6 months

5. Land Requirements

   No additional land required.

6. Environmental Impact Other Than Water

   The solids removed in step G must receive proper disposal.

7. Solid Waste Generation and Primary Constituents

   Included with step G solids removal.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step F

1. Treatment and Control Methods Employed

   Clarification-provides solids removal via settling.

2. Status and Reliability

   Very widely used in this and other process waste treatment operations.

3. Problems and Limitations

   Sludge cannot be allowed to accumulate to an excess. Hydraulic overload results in poor solids removal.

4. Implementation Time

   15-18 months

5. Land Requirements

   30' x 60'

6. Environmental Impact Other Than Water

   Proper sludge disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Included with step G solids removal.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step G

1. Treatment and Control Methods Employed

   Vacuum Filter - ised to dewater the sludge removed in step F. The filtrate is returned to the neutralization tank.

2. Status and Reliability

   Widely used in this and in numerous other process wastewater treatment applications to dewater sludge to 25% solids.

3. Problems and Limitations

   Regular maintenance is necessary.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper disposal of filter cake is required.

7. Solid Waste Generation and Primary Constituents

   At a solids concentration of 25%, the vacuum filter would dewater the solids (which consist of debris, oils, chemical precipitates, etc.) to about 33.2 lbs filter cake per ton of metal poured (2.0 ton/day, 497 ton/year).

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step H

1. Treatment and Control Methods Employed

   Filter - provide additional suspended solids removal. Backwash is returned to the neutralization tank.

2. Status and Reliability

   Used in a variety of similar waste treatment applications.

3. Problems and Limitations

   Plant upsets result in fouling and plugging of the filter. Hydraulic surges must be avoided.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 30'

6. Environmental Impact Other Than Water

   Proper disposal of filter backwash solids is required.

7. Solid Waste Generation and Primary Constituents

   Included with step G.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step I

1. Treatment and Control Methods Employed

   Recycle tank and pumps - to return 85% of the treated effluent to the process.

2. Status and Reliability

   Practiced in this subcategory.

3. Problems and Limitations

   Pump maintenance required.

4. Implementation Time

   12-14 months

5. Land Requirements

   10' x 15'

6. Environmental Impact Other Than Water

   Minimal to none.

7. Solid Waste Generation and Primary Constituents

   Solids are removed in step G.

TABLE VIII-9

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step J

1. Treatment and Control Methods Employed

   Tighten Recycle of step I to 95%

2. Status and Reliability

   Practiced in several wastewater treatment applications.

3. Problems and Limitations

   Same as step I.

4. Implementation Time

   Same as step I.

5. Land Requirements

   Same as step I.

6. Environmental Impact Other Than Water

   Same as step I.

7. Solid Waste Generation and Primary Constituents

   Same as step I.

TABLE VIII-9

FOUNDRY OPERATION
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE CASTING OPERATIONS

Step K

1. Treatment and Control Methods Employed

   Activated Carbon Filter-provides for the removal of toxic organic pollutants.

2. Status and Reliability

   Transferred technology from other industrial applications.

3. Problems and Limitations

   Maintenance required. Periodic removal and regeneration of carbon required.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 30'

6. Environmental Impact Other Than Water

   Energy consumed during carbon regeneration.

7. Solid Waste Generation and Primary Constituents

   Minimal to no effect. Solids are removed at step G.

TABLE VIII-10

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE LUBE OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Holding Tank - to provide waste holding capacity.

2. Status and Reliability

   Used in this and a number of other process waste treatment applications.

3. Problems and Limitations

   Periodic cleaning of tank may be required.

4. Implementation Time

   6-8 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Oily skim collected by step B requires proper disposal.

7. Solid Waste Generation and Primary Constituents

   Minimal; would be removed during infrequent cleaning.

TABLE VIII-10

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE LUBE OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Oil Skimmer-removes the oils and greases which separte out of process solutions.

2. Status and Reliability

   Used in a wide variety of applications involving the skimming of industrial wastewaters.

3. Problems and Limitations

   Surface turbulence renders skimming ineffective. The skimmer material must be properly maintained.

4. Implementation Time

   3 months

5. Land Requirements

   None.

6. Environmental Impact Other Than Water

   Proper disposal of the skimmed oils must be provided.

7. Solid Waste Generation and Primary Constituents

   Minimal - the skimmer is used to remove tramp oils which may accumulate.

TABLE VIII-10

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE LUBE OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Cyclonic Separator-provides removal, by intertial separation, of some suspended solids.

2. Status and Reliability

   Used in a plant with this process and in other industrial waste treatment applications.

3. Problems and Limitations

   Can remove only the larger suspended solids.

4. Implementation Time

   10-12 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Solids are removed in step D.

TABLE VIII-10

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE LUBE OPERATIONS

Step D

1. Treatment and Control Methods Employed

   Paper Filter-dewaters the concentrate (blow down) of the cyclonic separator.

2. Status and Reliability

   Used in this and a wide variety of other waste treatment applications.

3. Problems and Limitations

   Paper filter media must be continuously replaced. To permit solids removals, new filter media must always be exposed.

4. Implementation Time

   10-12 month

5. Land Requirements

   15' x 10'

6. Environmental Impact Other Than Water

   Solids must receive proper disposal.

7. Solid Waste Generation and Primary Constituents

   ColleThe cted material consists of debris, oils, and metal particulates. Based on dewatering to 25% solids, 0.46 lbs of solids would be removed for each ton of metal poured (61.2 lb/day, 7.6 ton/year).

TABLE VIII-10

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ALUMINUM FOUNDRIES
DIE LUBE OPERATIONS

Step E

1. Treatment and Control Methods Employed

   Recycle tank and pumps - recycle all process wastewaters.

2. Status and Reliability

   Used in this process and in a wide array of other waste treatment operations.

3. Problems and Limitations

   The recycle tank may require periodic cleaning. Pumps require maintenance. Proper maintenance, to prevent contamination with other wastes, is necessary to maintain recycle quality.

4. Implementation Time

   10-12 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids are aemoved in step D.

TABLE VIII-11

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
COPPER AND COPPER ALLOY FOUNDRIES
DUST COLLECTION OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling tank with a dragout mechanism - provides solids sedimentation and removal.

2. Status and Reliability

   Used in this process and in a wide variety of other foundry dust collection operations.

3. Problems and Limitations

   An excess of solids cannot be allowed to accumulate or else decreased settleability of wastewater results. The dragout flights require periodic maintenance and replacement.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 25'

6. Environmental Impact Other Than Water

   Proper disposal of solids is required.

7. Solid Waste Generation and Primary Constituents

   The solid wastes consist of waste sand from the scrubber. At a solids concentration of 25%, about 1.99 lbs of solid wastes is generated per ton of sand handled (731 lbs/day, 91.4 ton/year).

TABLE VIII-11

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
COPPER AND COPPER ALLOY FOUNDRIES
DUST COLLECTION OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Recycle pumps - provide for the recycle of all process wastewaters.

2. Status and Reliability

   Used in this and in a wide variety of other foundry dust collection operations.

3. Problems and Limitations

   Regular maintenance must be provided to keep recycle pumps operating properly.

4. Implementation Time

   12-14 months

5. Land Requirements

   10' x 15'

6. Environmental Impact Other Than Water

   Proper disposal of solids generated in step A must be provided.

7. Solid Waste Generation and Primary Constituents

   Solids are removed in Step A.

TABLE VIII-12

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
COPPER AND COPPER ALLOY FOUNDRIES
MOLD COOLING AND CASTING QUENCH OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling tank - provides primary solids removal

2. Status and Reliability

   Widely used in this and in numerous other foundry and industrial wastewater treatment applications.

3. Problems and Limitations

   Periodic cleaning required.

4. Implementation Time

   6-8 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper solids disposal must be required.

7. Solid Waste Generation and Primary Constituents

   Solids are comprised of product scale and chips. This material will be recoverd for reuse.

TABLE VIII-12

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
COPPER AND COPPER ALLOY FOUNDRIES
MOLD COOLING AND CASTING QUENCH OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Cooling Tower - provides for the cooling of process wastewaters.

2. Status and Reliability

   Widely used in this and in a wide variety of other foundry and industrial process applications.

3. Problems and Limitations

   Regular maintenance and periodic cleaning required.

4. Implementation Time

   18-20 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   The use of biocides may be necessary.

7. Solid Waste Generation and Primary Constituents

   Refer to Step A.

TABLE VIII-12

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
COPPER AND COPPER ALLOY FOUNDRIES
MOLD COOLING AND CASTING QUENCH OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Recycle Tank and Pumps - to recycle all process wastewater wastewaters.

2. Status and Reliability

   Widely used in this and other foundry and industrial process waste treatment applications.

3. Problems and Limitations

   Regular maintenance required as well as periodic cleaning, especially if a suspended solids overload occurs.

4. Implementation Time

   12-14 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Refer to Step A.

TABLE VIII-13

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
DUST COLLECTION OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling Tank with dragout - to provide primary solids removal.

2. Status and Reliability

   Widely used in this process and in a number of other foundry and industrial solids removal applications.

3. Problems and Limitations

   Periodic cleaning required. Dragout flights require periodic maintenance and/or replacement.

4. Implementation Time

   15-18 months

5. Land Requirements

   Up to 35' x 70'

6. Environmental Impact Other Than Water

   Proper disposal of solids required.

7. Solid Waste Generation and Primary Constituents

   Solids consist of casting sand and its byproducts. Assuming 25% solids in dragout, about 155 lbs of sludge is generated per ton of sand handled.

		Solid Waste	
Metal	Employee Group	Tons/Day	Tons/Year
Ductile Iron	<50	3.6	911
	50-249	52.9	13,230
	≥250	256	63,940

Gray Iron	<50	12.8	3,197
	50-249	59.1	14,760
	≥250	332	83,120
Malleable Iron	<250	48.0	12,010
	≥250	320	75,560
Steel	<250	28.3	7,072
	≥250	91.8	22,940

TABLE VIII-13

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
DUST COLLECTION OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Recycle Pumps - to recycle 100% of all process wastewaters.

2. Status and Reliability

   Used in a number of plants employing this process, as well as in a variety of other foundries and industries.

3. Problems and Limitations

   Regular maintenance is necessary to insure recycle operations.

4. Implementation Time

   12-14 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids removed in Step A.

TABLE VIII-14

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Caustic Addition - for pH adjustment and control. Used in conjunction with Step B.

2. Status and Reliability

   Used in a number of plants within this process segment as well as in a variety of other foundry melting furnace scrubber operations. Also used in a wide variety of other industrial waste treatment applications.

3. Problems and Limitations

   pH control and caustic feed systems must receive regular maintenance. Caustic is more expensive than lime, but it provides more alkalinity. Extreme caution must be used in handling. Heat must be provided, as 50% caustic "freezes" at about 55°F.

4. Implementation Time

   8-10 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   Proper disposal of the solids removed in Step D must be provided. Venting must be provided to avoid personnel exposure to any strong caustic fumes.

7. Solid Waste Generation and Primary Constituents

   Solids removed in Step D.

TABLE VIII-14

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Clarifer - to provide solids sedimentation and removal capability.

2. Status and Reliability

   Used in a number of plants with this process as well as in similar foundry operations which cast other metals. Very widely used in foundry and industrial waste treatment applications.

3. Problems and Limitations

   Regular maintenance must be provided. Solids cannot be allowed to accumulate to such an extent as to affect effluent quality or effect a mechanical overload. Periodic cleaning may be required. Hydraulic overload would result in poor solids removal.

4. Implementation Time

   15-18 months

5. Land Requirements

   Up to 80' x 80'

6. Environmental Impact Other Than Water

   Proper disposal of solids must be provided.

7. Solid Waste Generation and Primary Constituents

   See Step D.

TABLE VIII-14

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Polymer Addition - increases solids removal by enhancing floc formation.

2. Status and Reliability

   Widely used in this process and in other similar foundry operations. Also very widely used in other foundry and industrial waste treatment applications.

3. Problems and Limitations

   Periodic cleaning and regular maintenance of the feed system must be provided. Care must be taken in polymer solution makeup.

4. Implementation Time

   6 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   Proper disposal of solids must be provided.

7. Solid Waste Generation and Primary Constituents

   See Step D.

TABLE VIII-14

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step D

1. Treatment and Control Methods Employed

   Vacuum Filter - Dewaters the sludge removed in Step B. Filtrate is returned to neturalization tank.

2. Status and Reliability

   Widely used in this and similar operations of other foundries. Also, very widely used in foundry and industrial waste treatment applications.

3. Problems and Limitations

   Regular maintenance is necessary.

4. Implementation Time

   2 months

5. Land Requirements

   Up to 50' x 150'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   The vacuum filter is capable of dewatering the solids to 25% solids resulting in the generation of about 135 lbs of filter cake per ton of metal poured. This material consists of precipitates of treatment chemicals and process contaminants, and dusts.

TABLE VIII-14 (cont'd)

Metal	Employee Group	Filter Cake Tons/Day	Filter Cake Tons/Year
Ductile Iron			
Smaller Operations	<250	1.4	354
	≥250	2.3	572
Larger Operations	<250	12.3	3,064
	≥250	12.9	32,330
Gary Iron			
Smaller Operations	<50	0.75	189
	≥50	2.6	655
Larger Operations	<50	0.74	185
	50-249	7.4	1,852
	≥250	68.7	17,170
Malleable Iron	<250	8.2	2,054
	≥250	20.7	5,169

TABLE VIII-14

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step E

1. Treatment and Control Methods Employed

   Recycle Tank and Pumps - Recycles all wastewaters back to the process.

2. Status and Reliability

   Widely used in this process as well as other foundry melting operations.

3. Problems and Limitations

   Periodic cleaning may be required. Treatment process upset would result in excess discharge of solids which might accumulate in recycle tank. Regular pump maintenance is necessary to insure recycle operations.

4. Implementation Time

   12-14 months

5. Land Requirements

   Up to 20' x 30'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids are removed in Step D.

TABLE VIII-15

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SLAG QUENCHING OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling Tank and Dragout - provides primary solids removal.

2. Status and Reliability

   Used in a number of plants employing this process, and in a variety of other foundry and industrial waste treatment applications.

3. Problems and Limitations

   Periodic cleaning is required. Dragout flights require periodic repair and/or replacement.

4. Implementation Time

   15-18 months

5. Land Requirements

   Up to 40' x 70'

6. Environmental Impact Other Than Water

   Proper disposal of solids must be provided.

7. Solid Waste Generation and Primary Constituents

   The solid wastes consist of slag particulates. Based on a dragout sludge with 25% solids, about 0.72 lbs of sludge is generated for each ton of metal poured.

TABLE VIII-15 (cont'd)

Metal	Employee Group	Solid Waste Lbs/Day	Solid Waste Lbs/Year
Ductile Iron	<250	166	20.7
	≥250	1,411	176
Gray Iron	<250	74.2	9.3
	≥250	727	90.9
Malleable Iron	<250	59.0	7.4
	≥250	281	35.1

TABLE VIII-15

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SLAG QUENCHING OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Recycle Pumps - to provide for the recycle of 100% of process wastewaters.

2. Status and Reliability

   Widely used in plants with this process and in a wide variety of other foundry and industrial waste treatment applications.

3. Problems and Limitations

   Regular maintenance is necessary to insure proper recycle operation.

4. Implementation Time

   12-14 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids removed in Step A.

TABLE VIII-16

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
CASTING QUENCH AND MOLD COOLING OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Dragout Tank - provides primary solids removal.

2. Status and Reliability

   Widely used in this process and in a wide variety of other foundry and industrial waste treatment applications.

3. Problems and Limitations

   Periodic cleaning required. Dragout flights may require periodic repair or replacement.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 30'

6. Environmental Impact Other Than Water

   Proper solids disposal required.

7. Solid Waste Generation and Primary Constituents

   Solids consist of metal particulates (scale, etc.). Based on a dragout with 25% solids, about 13.5 lbs of dragout solids are removed for each ton of metal poured.

TABLE VIII-16 (Cont'd)

Metal	Employee Group	Solid Waste ton/day	Solid Waste ton/year
Ductile	<250	1.9	479
	≥250	5.4	1,354
Gray	<250	4.7	1,168
	≥250	5.3	1,335
Malleable	≥250	1.5	376
Steel	<250	0.91	228
	≥250	1.4	350

TABLE VIII-16

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
CASTING QUENCH AND MOLD COOLING OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Cooling Tower - to provide heat removal capability.

2. Status and Reliability

   Used in a number of applications in this process as well as a wide variety of other foundry and industrial applications.

3. Problems and Limitations

   Periodic cleaning and maintenance required.

4. Implementation Time

   18-20 months

5. Land Requirements

   20' x 30'

6. Environmental Impact Other Than Water

   Proper disposal of solids generated in step A must be provided. A biological growth control agent may be required.

7. Solid Waste Generation and Primary Constituents

   Negligible.

TABLE VIII-16

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
MOLD COOLING AND CASTING QUENCH OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Recycle Pumps - to recycle 100% of all wastewaters back to process.

2. Status and Reliability

   Used in a number of applications in this and other foundry and industrial processes.

3. Problems and Limitations

   Regular maintenance is necessary to assure proper recycle operations.

4. Implementation Time

   12-14 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids removed in step A.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Dragout Tank - provides primary solids removal for entire waste flow.

2. Status and Reliability

   Used in a wide variety of similar foundry and other industrial applications.

3. Problems and Limitations

   Periodic cleaning and maintenance is required. Dragout flights may require periodic repair or replacement.

4. Implementation Time

   15-18 months

5. Land Requirements

   Up to 60' x 80'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids can be returned to sand washing and reclamation operation. In this step, at least 95% of the solids load (i.e., the casting sand) is reclaimed.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Recycle Pumps - recycle 90% of the wastewater flow back to the process.

2. Status and Reliability

   Used in this and a number of other foundry processes.

3. Problems and Limitations

   Maintenance required on a regular basis to maintain recycle and to prevent treatment system overload.

4. Implementation Time

   12-14 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   The solids are removed in step A.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Lime Addition - to provide pH adjustment and control.

2. Status and Reliability

   Lime addition for pH control is a very common practice in foundry and other industrial waste treatment applications.

3. Problems and Limitations

   Maintenance is required to assure pH control and lime feed systems are functioning property. Control of pH is necessary to maintain the desired level of phenol destruction.

4. Implementation Time

   12 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Dust collection while unloading lime must be provided.

7. Solid Waste Generation and Primary Constituents

   Included in step G.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step D

1. Treatment and Control Methods Employed

   Potassium Permanganate Addition - provides phenol destruction capabilities.

2. Status and Reliability

   Capabilities have been demonstrated in other industrial waste treatment applications.

3. Problems and Limitations

   As this chemical is a strong oxidizing agent, caution must be exercized in storage and handling. The reaction is pH and time dependent. Feed system requires routine maintenance.

4. Implementation Time

   8-10 months

5. Land Requirements

   10' x 15'

6. Environmental Impact Other Than Water

   Any dust produced while unloading the chemical must be collected.

7. Solid Waste Generation and Primary Constituents

   Solids removed in step G.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step E

1. Treatment and Control Methods Employed

   Clarifer - provides sedimentation and solids removal capabilities.

2. Status and Reliability

   Widely used in this process and in a very wide variety of other foundry and industrial waste treatment applications.

3. Problems and Limitations

   Periodic cleaning required. Hydraulic overload would result in poor solids removal. Excess sludge accumulation results in a reduced degree of treatment and mechanical overload.

4. Implementation Time

   15-18 months

5. Land Requirements

   Up to 25' x 25'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Refer to step G.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step F

1. Treatment and Control Methods Employed

   Polymer Addition - to provide a greater degree of suspended solids removal by enhancing floc formation.

2. Status and Reliability

   Widely used in this and other foundry and industrial waste treatment applications.

3. Problems and Limitations

   Feed system requires regular cleaning and maintenance. Care must be used in making up solution. Proper feed rate must be maintained.

4. Implementation Time

   6 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper disposal of the solids removed in step G is required.

7. Solid Waste Generation and Primary Constituents

   Included with step G.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step G

1. Treatment and Control Methods Employed

   Vacuum Filter - to dewater the sludge removed in step E. The filtrate is returned to the reaction tank.

2. Status and Reliability

   Widely used in this and a number of other foundry and industrial waste treatment applications.

3. Problems and Limitations

   Regular maintenance and media replacement are necessary.

4. Implementation Time

   15-18 months

5. Land Requirements

   25' x 25'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Based on sludge dewatering to obtain a filter cake with 25% solids, about 1.97 lbs of filter cake are generated for each ton of sand handled. This would yield 0.4 tons of filter cake per day (293 ton/year) for the steel foundry model and 1.2 tons per day (103 ton/year) for the gray iron model.

TABLE VIII-17

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
FERROUS FOUNDRIES
SAND WASHING OPERATIONS

Step H

1. Treatment and Control Methods Employed

   Recycle - to recycle all wastewaters back to the process.

2. Status and Reliability

   Used in a variety of foundry and industrial wastewater applications. Also demonstrated within this process segment.

3. Problems and Limitations

   Treatment process upset might deposit solids in tank. Periodic cleaning and maintenance are required.

4. Implementation Time

   12-14 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   None.

TABLE VIII-18

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
LEAD FOUNDRIES
CONTINUOUS STRIP CASTING OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Lime Addition - used to remove toxic metal pollutants by forming hydroxide precipitates.

2. Status and Reliability

   Very widely used in industrial wastewater treatment applications for metals removal.

3. Problems and Limitations

   Proper maintenance is required to keep the lime feed system functioning properly.

4. Implementation Time

   12 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Provisions for dust collection must be made to control particulates while the lime is being unloaded.

7. Solid Waste Generation and Primary Constituents

   Negligible

TABLE VIII-18

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
LEAD FOUNDRIES
CONTINUOUS STRIP CASTING OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Clarification - provides for the removal, by sedimentation, of suspended particulate matter (particularly the metal hydroxide precipitates).

2. Status and Reliability

   Demonstrated widely in this process segment, subcategory, and category.

3. Problems and Limitations

   The mechanical equipment must receive routine maintenance to function properly.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   None

7. Solid Waste Generation and Primary Constituents

   Negligible

TABLE VIII-18

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
LEAD FOUNDRIES
CONTINUOUS STRIP CASTING OPERATIONS

Step C (Alternative No. 1)

1. Treatment and Control Method Employed

   Filter - provides the capacity for additional suspended particulate matter removal. This particulate matter would be comprised primarily of metal hydroxide precipitates.

2. Status and Reliability

   Demonstrated in this process segment, subcategory, and category.

3. Problems and Limitations

   Hydraulic and particulate matter overloads must be controlled.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   None

7. Solid Waste Generation and Primary Constituents

   Negligible

TABLE VIII-18

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
LEAD FOUNDRIES
CONTINUOUS STRIP CASTING OPERATIONS

Step D (Alternative No. 2)

1. Treatment and Control Methods Employed

   Recycle - recycle all process wastewaters.

2. Status and Reliability

   Demonstrated by one plant in this process segment.

3. Problems and Limitations

   Routine cleaning and maintenance are required.

4. Implementation Time

   12-14 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   None

7. Solid Waste Generation and Primary Constituents

   Negligible

TABLE VIII-19

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
LEAD FOUNDRIES
GRID CASTING OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Lime Addition - used to remove toxic metal pollutants by forming hydroxide precipitates.

2. Status and Reliability

   Very widely used in industrial wastewater treatment applications for metals removal.

3. Problems and Limitations

   Proper maintenance is required to keep the lime feed system functioning properly.

4. Implementation Time

   12 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Provisions for dust collection must be made to control particulates while the lime is being unloaded.

7. Solid Waste Generation and Primary Constituents

   Negligible

TABLE VIII-19

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
LEAD FOUNDRIES
CONTINUSTING OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Clarification - provides for the removal, by sedimentation, of suspended particulate matter (particularly the metal hydroxide precipitates).

2. Status and Reliability

   Demonstrated widely in this process segment, subcategory, and category.

3. Problems and Limitations

   The mechanical equipment must receive routine maintenance to function properly.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   None

7. Solid Waste Generation and Primary Constituents

   Negligible

TABLE VIII-19

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
LEAD FOUNDRIES
GRID CASTING OPERATIONS

Step C

1. Treatment and Control Method Employed

   Recycle-recycle all process wastewaters.

2. Status and Reliability

   Demonstrated in other lead subcategory process segments with similar waste streams.

3. Problems and Limitations

   Routine cleaning and maintenance required.

4. Implementation Time

   12-14 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   None

7. Solid Waste Generation and Primary Constituents

   Negligible

TABLE VIII-20

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
MAGNESIUM FOUNDRIES
GRINDING SCRUBBER OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling - to provide primary solids removal.

2. Status and Reliability

   Used in a wide variety of foundry and industrial wastewater treatment applications.

3. Problems and Limitations

   Periodic cleaning is required.

4. Implementation Time

   6-8 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Proper solids disposal is required.

7. Solid Waste Generation and Primary Constituents

   The solids which may accumulate, are periodically recovered and reused.

TABLE VIII-20

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
MAGNESIUM FOUNDRIES
GRINDING SCRUBBER OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Recycle pumps - to recycle all process wastewaters

2. Status and Reliability

   Used in other process segments in which wastewaters are generated by scrubbers.

3. Problems and Limitations

   Regular maintenance is necessary.

4. Implementation Time

   10-12 months

5. Land Requirements

   5' x 10'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids removed at step A.

TABLE VIII-21

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
MAGNESIUM FOUNDRIES
DUST COLLECTION OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Dragout Tank - to provide primary solids removal.

2. Status and Reliability

   Used in a wide variety of foundry dust collection systems.

3. Problems and Limitations

   Regular maintenance is required. Dragout flights require periodic repair and replacement. Periodic cleaning may be necessary.

4. Implementation Time

   15-18 months

5. Land Requirements

   10' x 15'

6. Environmental Impact Other Than Water

   Proper solids disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Minimal. Only infrequent removal is called for since the model treatment system would generate less than 0.01 lbs of sludge per ton of sand handled.

TABLE VIII-21

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
MAGNESIUM FOUNDRIES
DUST COLLECTION OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Recycle - to recycle all process wastewaters back to process.

2. Status and Reliability

   Demonstrated in other process segments with similar wastewaters.

3. Problems and Limitations

   Regular maintenance is required.

4. Implementation Time

   10-12 months

5. Land Requirements

   5' x 10'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   Solids are removed in step A.

TABLE VIII-22

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
CASTING QUENCH OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Settling Tank - provides for primary sedimentation.

2. Status and Reliability

   Widely used by casting quench operations, either as an independent step or integral with the quench tank.

3. Problems and Limitations

   Periodic removal of solid required.

4. Implementation Time

   6-8 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Solids disposal. However, if BMP is followed, solids may be only particles of zinc which could be reclaimed to be melted with manufacturing scrap.

7. Solid Waste Generation and Primary Constituents

   The solids, which consist primarily of particulate zinc, would be removed (as a sludge containing 25% solids) at the rate of 12.5 lb per ton of metal poured.

	Solid Waste	
Employee Group	lbs/day	ton/year
<50	150	18.8
50-249	915	114
≥250	464	58.0

TABLE VIII-22

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
CASTING QUENCH OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Surface Skimming - removes tramp oils and greases from surface of wastewater.

2. Status and Reliability

   Widely used in the foundry and other industries.

3. Problems and Limitations

   Surface turbulence renders the skimmer ineffective. Can take a long time to remove surface oils which may result from dumps or spills.

4. Implementation Time

   3 months

5. Land Requirements

   None - Unit is mounted over the settling tank.

6. Environmental Impact Other Than Water

   Proper disposal of oils and greases must be provided.

7. Solid Waste Generation and Primary Constituents

   Tramp oils would be collected at the rate of 0.005 gal per ton of metal poured.

	Waste Oils & Grease	
Employee Group	gal/day	gal/year
<50	0.06	15.0
50-249	0.36	91.2
≥250	0.18	46.2

TABLE VIII-22

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
CASTING QUENCH OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Recycle - recycle all waters back to the process.

2. Status and Reliability

   Practiced by several plants in this process segment.

3. Problems and Limitations

   Carelessness in cross-contamination of wastes or debris accumulation would degrade quality of quench waters.

4. Implementation Time

   10-12 months

5. Land Requirements

   5' x 10'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   None.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step A

1. Treatment and Control Methods Employed

   Alum addition - used in conjunction with steps B and C for oil and grease removal.

2. Status and Reliability

   Used by several of these operations in addition to a wide array of applications in other industries.

3. Problems and Limitations

   Adds a significant amount of dissolved solids. Care must be used in handling.

4. Implementation Time

   8-10 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Oil must be disposed of properly.

7. Solid Waste Generation and Primary Constituents

   See step C.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step B

1. Treatment and Control Methods Employed

   Sulfuric Acid Addition - used in conjunction with steps A and C for oil and grease removal.

2. Status and Reliability

   Used by several of these operations in addition to being widely practiced in similar oil removal applications.

3. Problems and Limitations

   Extreme care must be used in the storage and handling of the acid.

4. Implementation Time

   8-10 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper disposal must be provided for oils.

7. Solid Waste Generation and Primary Constituents

   See step C

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step C

1. Treatment and Control Methods Employed

   Emulsion Break Separator - provides quiescent period to allow oils and greases to separate and rise to surface where they are skimmed. Used in conjunction with steps A and B.

2. Status and Reliability

   Used by several of these operations in addition to being demonstrated in similar oil removal applications.

3. Problems and Limitations

   Hydraulic overload can adversely affect oils separation. If an excess of skim is allowed to accumulate, unit may require draining and cleaning.

4. Implementation Time

   10-12 months

5. Land Requirements

   15' x 20'

6. Environmental Impact Other Than Water

   Proper disposal of skimmed wastes must be provided.

7. Solid Waste Generation and Primary Constituents

   Based on a skim with a density 85% that of water, 0.58 gal of skim is collected per ton of metal poured (51.5 gal/day, 12,870 gal/year).

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step D

1. Treatment and Control Methods Employed

   Lime Addition - for pH adjustment.

2. Status and Reliability

   Lime addition for pH adjustment is a widely accepted practice in industrial wastewater treatment applications.

3. Problems and Limitations

   Proper maintenance is required to keep the pH control of lime feed functioning properly.

4. Implementation Time

   12 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Dust collection while unloading lime must be provided.

7. Solid Waste Generation and Primary Constituents

   Included with step H solids removal.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step E

1. Treatment and Control Methods Employed

   Potassium Permanganate Addition - for phenol destruction. Used in conjunction with step D.

2. Status and Reliability

   Industrial applications have demonstrated the capabilities of this treatment method.

3. Problems and Limitations

   Caution must be exercised in storage and handling as this chemical is a strong oxidizing agent. Reaction is pH dependent and the wastewater pH must be maintained between pH 8 and 9.

4. Implementation Time

   8-10 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Any dust while loading must be contained.

7. Solid Waste Generation and Primary Constituents

   Included with step H solids removal.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step F

1. Treatment and Control Methods Employed

   Polymer Addition - polymer is added to waste stream as it enters the clarifier center well. Polymer addition enhances floc formation.

2. Status and Reliability

   Widely used in this, as well as in many other industries.

3. Problems and Limitations

   Care must be taken to maintain proper feed rate.

4. Implementation Time

   6 months

5. Land Requirements

   10' x 10'

6. Environmental Impact Other Than Water

   Proper solid waste disposal practices must be observed.

7. Solid Waste Generation and Primary Constituents

   Included with sludge in step H.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step G

1. Treatment and Control Methods Employed

   Clarification - provides sedimentation capabilities.

2. Status and Reliability

   Widely practiced in this segment and in many other industrial applications.

3. Problems and Limitations

   Hydraulic overload results in poor solids removal. Sludge cannot be allowed to accumulate to an excessive amount.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   Proper sludge disposal must be provided.

7. Solid Waste Generation and Primary Constituents

   Included with step H.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step H

1. Treatment and Control Methods Employed

   Vacuum Filter-dewaters the sludge removed in step G. The filtrate is returned to the neutralization tank.

2. Status and Reliability

   Widely practiced in this and in a variety of other industries. Dewatering to achieve 25% dry solids in filter cake can reasonably be expected.

3. Problems and Limitations

   Requires regular maintenance to perform properly. Periodic media replacement is required.

4. Implementation Time

   15-18 months

5. Land Requirements

   15' x 15'

6. Environmental Impact Other Than Water

   Proper sludge disposal is required.

7. Solid Waste Generation and Primary Constituents

   At 25% solids concentrations, the vacuum filter would dewater the treatment process sludges to about 39.0 lbs of cake per ton of metal poured or 1.7 tons (429 ton/year) of filter cake per day.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step I

1. Treatment and Control Methods Employed

   Recycle - to return all of the treated effluent to the melting furnace scrubber system.

2. Status and Reliability

   Demonstrated by one plant in this process segment and by other melting furnace scrubber operations in this category.

3. Problems and Limitations

   Recycle tank would need to be cleaned periodically and more frequently in the event of process upsets.

4. Implementation Time

   12-14 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   None.

7. Solid Waste Generation and Primary Constituents

   None.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step J

1. Treatment and Control Methods Employed

   Sulfide Addition - added in conjunction with neutralization to enhance metals precipitation (esp. zinc).

2. Status and Reliability

   Practiced in similar industrial wastewater treatment applications for metals precipitation.

3. Problems and Limitations

   Caution must be exercized in the handing and the feeding of this product.

4. Implementation Time

   6 months

5. Land Requirements

   No additional land required.

6. Environmental Impact Other Than Water

   Proper sludge disposal is required. Proper pH control to eliminate odor problems is also required.

7. Solid Waste Generation and Primary Constituents

   Solids removed in step K.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step K

1. Treatment and Control Methods Employed

   Filter - provides additional suspended solids removal prior to activated carbon filtration. The backwash is returned to the neutralization tank.

2. Status and Reliability

   Used in a wide range of similar industrial applications.

3. Problems and Limitations

   Surges must be controlled and plant upsets must be avoided to prevent fouling and plugging.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   Proper disposal of filter backwash solids must be provided.

7. Solid Waste Generation and Primary Constituents

   Generates about 0.50 lbs of 25% sludge per ton of metal poured (44 lb/day, 5.5 ton/year). These solids would be removed from the system via Step H.

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step L

1. Treatment and Control Methods Employed

   Activated carbon filter - provides for toxic organic pollutant removal by adsorption on carbon.

2. Status and Reliability

   Transferred technology from other industrial applications.

3. Problems and Limitations

   Maintenance procedures must be carefully observed. Periodic removal and regeneration of carbon is needed.

4. Implementation Time

   15-18 months

5. Land Requirements

   20' x 20'

6. Environmental Impact Other Than Water

   Energy is consumed during carbon regeneration.

7. Solid Waste Generation and Primary Constituents

   None

TABLE VIII-23

FOUNDRY OPERATIONS
CONTROL AND TREATMENT TECHNOLOGY
ZINC FOUNDRIES
MELTING FURNACE SCRUBBER OPERATIONS

Step M

1. Treatment and Control Methods Employed

   Tighten scrubber system internal recycle rate to achieve complete recycle (zero discharge).

2. Status and Reliability

   Used in this process segment and in a number of other similar installations.

3. Problems and Limitations

   Rough pH control needed, however, this is currently practiced.

4. Implementation Time

   8-10 months

5. Land Requirements

   None - equipment in use.

6. Environmental Impact Other Than Water

   Minimal to none - if current practices are followed.

7. Solid Waste Generation and Primary Constituents

   Refer to current practices.

TABLE VIII-24

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Aluminum Foundry
: Investment Casting

Model: Size-TPD: 2
Oper. Days/Yr. : 250
Turns/Day : 1

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	42	81	40	163
Annual Cost $ x 10^{-3}				
Capital	1.79	3.48	1.70	6.97
Depreciation	4.15	8.10	3.95	16.20
Operation & Maintenance	1.45	2.84	1.38	5.67
Energy & Power (1)	0.06	0.08	0.05	0.19
Chemical Cost	0.10	-	-	0.10
Sludge Disposal	-	-	0.18	0.04
TOTAL	7.55	14.50	7.26	29.31

Wastewater Parameters		Raw Waste Level	BPT Effluent Level
Flow, gal/ton		6450	6450
Concentrations, mg/l			
085	Tetrachloroethylene	0.080	0.080
087	Trichloroethylene	0.400	0.400
120	Copper	0.36	0.36
128	Zinc	0.40	0.40
	Oil and Grease	20	10
	TSS	720	12
	pH (Units)	6-9	7.5-10

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Coagulant Aid Addition
B: Clarifier
C: Vacuum Filter

TABLE VIII-25

BAT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Aluminum Foundry
: Investment Casting

Model: Size-TPD: 2
Oper. Days/Yr. : 250
Turns/Day : 1

C&TT Step	No. 1 D	No. 1 Total	No. 2 E	No. 2 D	No. 2 Total
Investment $ x 10^{-3}	33	33	84	33	117
Annual Cost $ x 10^{-3}					
Capital	1.42	1.42	3.60	1.42	5.02
Depreciation	3.29	3.29	8.37	3.29	11.66
Operation & Maintenance	1.15	1.15	2.93	1.15	4.08
Energy & Power (1)	0.08	0.08	0.17	0.08	0.25
Sludge Disposal	-	-	0.02	-	0.02
TOTAL	5.94	5.94	15.09	5.94	21.03

Wastewater Parameters	BPT Effluent Level	Alt. No.1 Effluent Level	Alt. No.2 Effluent Level
Flow, gal/ton	6450	0	0
Concentrations, mg/l			
085 Tetrachloroethylene	0.080	-	-
087 Trichloroethylene	0.400	-	-
120 Copper	0.36	-	-
128 Zinc	0.40	-	-
Oil and Grease	10	-	-
TSS	12	-	-
pH (Units)	7.5-10	-	-

NOTE: EPA is not proposing BAT limitations in this process segment under provisions of paragraph 8 of the Revised Settlement Agreement.

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

D: Recycle 100%
E: Filtration

KEY TO TREATMENT ALTERNATIVES

NSPS-1/PSES-1/PSNS-1 = BPT
NSPS-2/PSES-2/PSNS-2 = BPT + BAT-1
NSPS-3/PSES-3/PSNS-3 = BPT + BAT-2

TABLE VIII-26

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Aluminum Foundry : Melting Furnace Scrubbers

Model: Size-TPD: 108
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	G	Total
Investment $ x 10^{-3}	46	9	46	31	32	38	42	244
Annual Cost $ x 10^{-3}								
Capital	1.96	0.37	1.97	1.34	1.38	1.62	1.80	10.44
Depreciation	4.57	0.87	4.58	3.11	3.20	3.78	4.19	24.30
Operation & Maintenance	1.60	0.30	1.60	1.09	1.12	1.32	1.45	8.48
Energy & Power (1)	-	0.06	0.56	0.17	0.11	0.11	0.19	1.20
Chemical Cost	-	-	-	0.07	0.09	-	-	0.16
Sludge Disposal	-	-	-	-	-	-	0.03	0.03
TOTAL	8.13	1.60	8.71	5.78	5.90	6.83	7.66	44.61

Wastewater Parameters	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	1940	97
Concentrations, mg/l		
021 2,4,6-trichlorophenol	0.105	0.105
039 Fluoranthene	0.012	0.012
073 Benzo (a) pyrene	0.010	0.010
128 Zinc	3.50	0.30
Ammonia (N)	0.15	0.15
Sulfide	2.2	2.2
Phenols (4AAP)	0.62	0.62
Oil and Grease	10	10
TSS	40	12
pH (Units)	6-8	7.5-10

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Settling Tank
B: Skimmer
C: Recycle 95%
D: Lime Addition
E: Coagulant Aid Addition
F: Clarifier
G: Vacuum Filter

TABLE VIII-27

BAT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Aluminum Foundry : Melting Furnace Scrubbers

Model: Size-TPD: 108
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	Alternative No. 1 H	Alternative No. 1 I	Alternative No. 1 Total	Alternative No. 2 J
Investment $ x 10^{-3}	56	16	72	0
Annual Cost $ x 10^{-3}				
Capital	2.40	0.69	3.09	-
Depreciation	5.56	1.61	7.17	-
Operation & Maintenance	1.96	0.56	2.52	-
Energy & Power (1)	0.15	0.11	0.26	-
TOTAL	10.07	2.97	13.04	0

Wastewater Parameters		BPT Effluent Level	Alt. No. 1 Effluent Level	Alt. No. 2 Effluent Level
Flow, gal/ton		97	0	0
Concentrations, mg/l				
021	2,4,6-trichlorophenol	0.105	-	-
039	Fluoranthene	0.012	-	-
073	Benzo (a) pyrene	0.010	-	-
128	Zinc	0.30	-	-
	Ammonia (N)	0.15	-	-
	Sulfide	2.2	-	-
	Phenols (4AAP)	0.62	-	-
	Oil and Grease	10	-	-
	TSS	12	-	-
	pH (Units)	7.5-10	-	-

NOTE: EPA is not proposing BAT limitations in this process segment under provisions of paragraph 8 of the Revised Settlement Agreement.

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

H: Filter
I: Recycle 100%
J: Increase recycle rate of Step C to 100%.

KEY TO TREATMENT ALTERNATIVES

NSPS-1/PSES-1/PSNS-1 = BPT
NSPS-2/PSES-2/PSNS-2 = BPT + BAT-1
NSPS-3/PSES-3/PSNS-3 = BPT + BAT-2

TABLE VIII-28

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Aluminum Foundry	Model: Size-TPD:	6
:	Casting Quench	Oper. Days/Yr. :	250
	<50 employees	Turns/Day :	3

C&TT Step	A[2]	B	C	Total
Investment $ x 10^{-3}	8	4	14	26
Annual Cost $ x 10^{-3}				
Capital	0.35	0.19	0.59	1.13
Depreciation	0.81	0.44	1.38	2.63
Operation & Maintenance	0.28	0.15	0.48	0.91
Energy & Power[1]	-	0.06	0.06	0.12
Oil Disposal	-	0.02	-	0.02
TOTAL	1.44	0.86	2.51	4.81

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		292	0
Concentrations, mg/l			
021	2,4,6-trichlorophenol	1.025	-
031	2,4-dichlorophenol	0.100	-
039	Fluoranthene	0.040	-
067	Butyl benzyl phthalate	0.820	-
084	Pyrene	0.006	-
085	Tetrachloroethylene	0.950	-
120	Copper	0.14	-
128	Zinc	4.55	-
130	Xylene	0.003	-
	Sulfide	1.9	-
	Oil and Grease	730	-
	TSS	310	-
	pH (Units)	5.5-8.5	-

(1) Costs are all power unless otherwise noted.
(2) Solids are recovered for reuse, hence, no solids disposal costs are included.

KEY TO C&TT STEPS

A: Settling Tank
B: Skimmer
C: Recycle 100%

TABLE VIII-29

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Aluminum Foundry	Model: Size-TPD:	63
:	Casting Quench	Oper. Days/Yr. :	250
	≥50 employees	Turns/Day :	3

C&TT Step	A(2)	B	C	Total
Investment $ x 10^{-3}	21	5	19	45
Annual Cost $ x 10^{-3}				
Capital	0.89	0.19	0.82	1.90
Depreciation	2.08	0.45	1.91	4.44
Operation & Maintenance	0.73	0.16	0.67	1.56
Energy & Power(1)	-	0.06	0.11	0.17
Sludge Disposal	0.01	-	-	0.01
Oil Disposal	-	0.26	-	0.26
TOTAL	3.71	1.12	3.51	8.34

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		292	0
Concentrations, mg/l			
021	2,4,6-trichlorophenol	1.025	-
031	2,4-dichlorophenol	0.100	-
039	Fluoranthene	0.040	-
067	Butyl benzyl phthalate	0.820	-
084	Pyrene	0.006	-
085	Tetrachloroethylene	0.950	-
120	Copper	0.14	-
128	Zinc	4.55	-
130	Xylene	0.003	-
	Sulfide	1.9	-
	Oil and Grease	730	-
	TSS	310	-
	pH (Units)	5.5-8.5	-

(1) Costs are all power unless otherwise noted.
(2) Solids are recovered for reuse, hence, no solids disposal costs are included.

KEY TO C&TT STEPS

A: Settling Tank
B: Skimmer
C: Recycle 100%

TABLE VIII-30

BPT MODEL COST DATA: 7/1/78 DOLLARS

Subcategory: Aluminum Foundry
: Die Casting

Model: Size-TPD: 120
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	G	H	I	Total
Investment $ x 10^{-3}	45	49	52	47	31	113	102	105	46	590
Annual Cost $ x 10^{-3}										
Capital	1.92	2.09	2.22	2.04	1.32	4.86	4.37	4.52	1.98	25.32
Depreciation	4.47	4.86	5.16	4.74	3.07	11.30	10.17	10.50	4.60	58.87
Operation & Maintenance	1.56	1.70	1.81	1.66	1.08	3.96	3.56	3.68	1.61	20.62
Energy & Power (1)	0.17	0.11	0.06	0.28	0.11	0.22	1.04	0.22	0.22	2.43
Chemical Cost	4.06	0.77	-	1.02	1.04	-	-	-	-	6.89
Oil Disposal	-	-	1.80	-	-	-	-	-	-	1.80
Sludge Disposal	-	-	-	-	-	-	2.43	0.06	-	2.49
TOTAL	12.18	9.53	11.05	9.74	6.62	20.34	21.57	18.98	8.41	118.42

Wastewater Parameters		Raw Waste Level	BPT Effluent Level
Flow, gal/ton		1160	174
Concentrations, mg/l			
001	Acenaphthene	0.115	0.010
021	2,4,6-trichlorophenol	0.340	0.340
022	Parachlorometa cresol	0.080	0.080
023	Chloroform	0.155	0.155
039	Fluoranthene	0.250	0.010
063	N-nitrosodi-n-propyl-amine	0.00	0.00
065	Phenol	0.890	0.500
067	Butyl benzyl phthalate	0.390	0.010
072	Benzo (a) anthracene	3.30	0.010
076	Chrysene	3.76	0.010
084	Pyrene	0.053	0.010
085	Tetrachloroethylene	0.051	0.050
122	Lead	0.28	0.08
128	Zinc	2.60	0.23
130	Xylene	0.025	0.025
	Phenols (4AAP)	1.76	0.65
	Oil and Grease	670	5
	TSS	420	3
	pH (Units)	6.5-8.0	7.5-10.0

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Alum Addition
B: Sulfuric Acid Addition
C: Inclined Plate Separator
D: Lime Addition
E: Coagulant Aid Addition
F: Clarifier
G: Vacuum Filter
H: Filter
I: Recycle 85%

TABLE VIII-31

BAT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Aluminum Foundry
: Die Casting

Model: Size-TPD: 120
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	Alternative No.1 J	Alternative No.1 Total	Alternative No.2 K	Alternative No.2 Total	Alternative No. 3 K	Alternative No. 3 J	Alternative No. 3 Total
Investment $ x 10^{-3}	10	10	143	143	143	10	153
Annual Cost $ x 10^{-3}							
Capital	0.45	0.45	6.14	6.14	6.14	0.45	6.59
Depreciation	1.05	1.05	14.27	14.27	14.27	1.05	15.32
Operation & Maintenance	0.37	0.37	5.00	5.00	5.00	0.37	5.37
Energy & Power (1)	0.11	0.11	0.11	0.11	0.11	0.11	0.22
Carbon Regeneration	-	-	105.70	105.70	105.70	-	105.70
TOTAL	1.98	1.98	131.22	131.22	131.22	1.98	133.20

Wastewater Parameters		BPT Effluent Level	Alt. No.1 Effluent Level	Alt. No.2 Effluent Level	Alt. No.3 Effluent Level
Flow, gal/ton		174	58	174	58
Concentrations, mg/l					
001	Acenaphthene	0.010	0.010	0.010	0.010
021	2,4,6-trichlorophenol	0.340	0.340	0.025	0.025
022	Parachlorometacresol	0.080	0.080	0.050	0.050
023	Chlorofrom	0.155	0.155	0.150	0.150
039	Fluoranthene	0.010	0.010	0.010	0.010
063	N-nitrosodi-n-propylamine	0.00	0.00	0.00	0.00
065	Phenol	0.500	0.500	0.050	0.050
067	Butyl benzyl phthalate	0.010	0.010	0.010	0.010
072	Benzo (a) anthracene	0.010	0.010	0.010	0.010
076	Chrysene	0.010	0.010	0.010	0.010
084	Pyrene	0.010	0.010	0.010	0.010
085	Tetrachloroethylene	0.050	0.050	0.050	0.050
122	Lead	0.08	0.09	0.09	0.09
128	Zinc	0.23	0.42	0.42	0.42
130	Xylene	0.025	0.025	0.025	0.025
	Phenols (4AAP)	0.65	0.65	0.05	0.05
	Oil and Grease	5	5	5	5
	TSS	3	10	10	10
	pH (units)	7.5-10.0	7.5-10.0	7.5-10.0	7.5-10.0

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

J: Increase recycle rate of Step I to 95%
K: Activated Carbon Adsorption

KEY TO TREATMENT ALTERNATIVES

NSPS-1/PSES-1/PSNS-1 = BPT
NSPS-2/PSES-2/PSNS-2 = BPT + BAT-1
NSPS-3/PSES-3/PSNS-3 = BPT + BAT-2
NSPS-4/PSES-4/PSNS-4 = BPT + BAT-3

TABLE VIII-32

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcateogory: Aluminum Foundry : Die Lube

Model: Size-TPD: 133
Oper. Day/Yr. : 250
Turns/Day : 1

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	25	9	50	32	45	161
Annual Cost $ x 10^{-3}						
Capital	1.08	0.38	2.15	1.37	1.95	6.93
Depreciation	2.52	0.88	5.00	3.18	4.53	16.11
Operation & Maintenance	0.88	0.31	1.75	1.11	1.59	5.64
Energy & Power (1)	-	0.02	0.09	0.01	0.15	0.27
Sludge Disposal	-	-	-	0.04	-	0.04
TOTAL	4.48	1.59	8.99	5.71	8.22	28.99

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/t	23	0
Concentrations, mg/l		
005 Benzidine	1.39	-
006 Carbon Tetrachloride	0.31	-
007 Chlorobenzene	0.29	-
010 1,2-dichloroethane	0.16	-
011 1,1,1-trichloroethane	17.47	-
013 1,1-dichloroethane	0.05	-
021 2,4,6-trichlorophenol	0.23	-
023 Chloroform	0.53	-
039 Fluoranthene	2.92	-
044 Methylene Chloride	3.09	-
055 Naphthalene	1.44	-
058 4-nitrophenol	0.082	-
064 Pentachlorophenol	1.02	-
065 Phenol	21.86	-
066 bis-(2-ethylhexyl) phthalate	382	-
067 Butyl benzyl phthalate	0.27	-
072 Benzo (a) anthracene	11.30	-
077 Acenaphthylene	0.82	-
078 Anthracene	0.68	-
080 Fluorene	3.66	-
081 Phenanthrene	0.68	-
084 Pyrene	0.35	-
085 Tetrachloroethylene	0.13	-
087 Trichloroethylene	0.28	-
091 Chlordane	0.068	-
120 Copper	0.65	-
122 Lead	2.0	-
130 Xylene	33.12	-

TABLE VIII-32
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Concentrations, mg/l	Raw Waste Level	Effluent Level
Ammonia (N)	22	-
Sulfide	3.3	-
Phenols (4AAP)	66	-
Oil and Grease	8500	-
TSS	1700	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Holding Tank
B: Skimmer
C: Cyclone
D: Flat Bed Filter (Paper Media)
E: Recycle 100%

TABLE VIII-33

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Aluminum Foundry
: Casting Quench and Die Casting Co-Treatment
: <50 employees

Model: Size-TPD: 5.1
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	G	H	I	J	Total
Investment $ x 10^{-3}	2	13	39	48	38	25	104	33	32	16	350
Annual Cost $ x 10^{-3}											
Capital	0.1	0.6	1.7	2.1	1.6	1.1	4.5	1.4	1.4	0.7	15.2
Depreciation	0.2	1.3	3.9	4.8	3.8	2.5	10.4	3.3	3.2	1.6	35.0
Operation & Maintenance	0.1	0.5	1.4	1.7	1.3	0.9	3.6	1.1	1.1	0.6	12.3
Energy & Power (1)	0.1	-	0.1	0.1	0.1	0.1	1.2	0.1	0.1	-	1.9
Chemical Cost	-	-	0.04	0.2	0.05	0.04	-	-	-	-	0.33
Sludge Disposal	-	-	-	-	-	-	-	0.1	-	-	0.1
Oil Disposal	0.1	-	-	-	-	-	-	-	-	-	0.1
TOTAL	0.6	2.4	7.14	8.9	6.85	4.64	19.7	6.0	5.8	2.9	64.93

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1450	174
Concentrations, mg/l		
001 Acenaphthene	0.092	0.010
021 2,4,6-trichlorophenol	0.48	0.48
022 Parachlorometacresol	0.064	0.064
023 Chloroform	0.12	0.12
039 Fluoranthene	0.21	0.010
063 N-nitrosodi-n-propylamine	0.00	0.00
065 Phenol	0.71	0.500
067 Butyl benzyl phthalate	0.48	0.010
072 Benzo(a)anthracene	2.64	0.010
076 Chrysene	3.01	0.010
084 Pyrene	0.044	0.010
085 Tetrachloroethylene	0.23	0.050
120 Copper	0.028	0.03
122 Lead	0.22	0.08
128 Zinc	3.00	0.23
130 Xylene	0.021	0.021
Sulfide	0.38	0.35
Phenols (4AAP)	1.41	0.65
Oil and Grease	680	5
TSS	400	3
pH (Units)	6-9	7.5-10

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Skimmer
B: Recycle 20%
C: Sulfuric Acid Addition
D: Alum Addition
E: Lime Addition
F: Coagulant Aid Addition
G: Batch Treatment Tanks
H: Vacuum Filter
I: Filter
J: Recycle

TABLE VIII-34

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Aluminum Foundry
: Casting Quench and Die Casting Co-Treatment
: ≥50 employees

Model: Size-TPD: 128
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	G	H	I	J	Total
Investment $ x 10^{-3}	8	24	73	170	50	34	1060	104	136	35	169.4
Annual Cost $ x 10^{-3}											
Capital	0.3	1.0	3.1	7.3	2.2	1.5	45.6	4.5	5.8	1.5	72.8
Depreciation	0.8	2.4	7.3	17.0	5.0	3.4	106.0	10.4	13.6	3.5	169.4
Operation & Maintenance	0.3	0.8	2.6	6.0	1.7	1.2	37.2	3.6	4.8	1.2	59.4
Energy & Power (1)	0.1	-	0.2	0.6	0.6	0.1	22.4	2.4	0.6	-	27.0
Chemical Cost	-	-	0.9	4.3	1.2	1.1	-	-	-	-	7.5
Sludge Disposal	-	-	-	-	-	-	-	2.9	-	-	2.9
Oil Disposal	1.2	-	-	-	-	-	-	-	-	-	1.2
TOTAL	2.7	4.2	14.1	35.2	10.7	7.3	211.2	23.8	24.8	6.2	340.2

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1450	174
Concentrations, mg/l		
001 Acenaphthene	0.092	0.010
021 2,4,6-trichlorophenol	0.48	0.48
022 Parachlorometacresol	0.064	0.064
023 Chloroform	0.12	0.12
039 Fluoranthene	0.21	0.010
063 N-nitrosodi-n-propylamine	0.00	0.00
065 Phenol	0.71	0.500
067 Butyl benzyl phthalate	0.48	0.010
072 Benzo(a)anthracene	2.64	0.010
076 Chrysene	3.01	0.010
084 Pyrene	0.044	0.010
085 Tetrachloroethylene	0.23	0.050
120 Copper	0.028	0.03
122 Lead	0.22	0.08
128 Zinc	3.00	0.23
130 Xylene	0.021	0.021
Sulfide	0.38	0.35
Phenols (4AAP)	1.41	0.65
Oil and Grease	680	5
TSS	400	3
pH (Units)	6-9	7.5-10

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Skimmer
B: Recycle 20%
C: Sulfuric Acid Addition
D: Alum Addition
E: Lime Addition
F: Coagulant Aid Addition
G: Batch Treatment Tanks
H: Vacuum Filter
I: Filter
J: Recycle

TABLE VIII-35

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Copper & Copper Alloy Foundry : Dust Collection

Model: Size-TPD: 367
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	Total
Investment \$ x 10^{-3}	47	32	79
Annual Cost \$ x 10^{-3}			
Capital	2.03	1.36	3.39
Depreciation	4.72	3.17	7.89
Operation & Maintenance	1.65	1.11	2.76
Energy & Power (1)	0.56	0.22	0.78
Sludge Disposal	0.46	-	0.46
TOTAL	9.42	5.86	15.28

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		206	0
Concentrations, mg/l			
067	Butyl benzyl phthalate	1.22	-
074	3,4-benzofluoranthene	0.007	-
075	Benzo (k) fluoranthene	0.007	-
084	Pyrene	0.015	-
120	Copper	69	-
122	Lead	17	-
124	Nickel	4.8	-
128	Zinc	83	-
	Manganese	0.60	-
	Phenols (4AAP)	1.34	-
	Oil and Grease	10	-
	TSS	390	-
	pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tanks
B: Recycle 100%

TABLE VIII-36

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Copper & Copper Alloy Foundry	Model: Size-TPD:	29
:	Mold Cooling and Casting Quench Operations	Oper.Days/Yr. :	250
		Turns/Day :	3

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	43	23	23	89
Annual Cost $ x 10^{-3}				
Capital	1.86	0.97	1.00	3.83
Depreciation	4.34	2.25	2.33	8.92
Operation & Maintenance	1.52	0.79	0.82	3.13
Energy & Power(1)	-	0.67	0.11	0.78
TOTAL	7.72	4.68	4.26	16.66

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1130	0
Concentrations, mg/l		
120 Copper	0.15	-
128 Zinc	0.90	-
Oil and Grease	10	-
TSS	25	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Settling Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-37

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	47
:	Ductile Iron	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	1
:	<50 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	24	19	43
Annual Cost $ x 10^{-3}			
Capital	1.02	0.81	1.83
Depreciation	2.36	1.88	4.24
Operation & Maintenance	0.83	0.66	1.49
Energy & Power[(1)]	0.11	0.04	0.15
Sludge Disposal	4.55	-	4.55
TOTAL	8.87	3.39	12.26

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-37
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
120 Copper	2.7	-
122 Lead	3.3	-
124 Nickel	1.5	-
128 Zinc	9.6	-
Ammonia (N)	75	-
Sulfide	18	-
Manganese	170	-
Iron	1280	-
Phenols (4AAP)	27	-
Oil and Grease	130	-
TSS	33600	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-38

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry : Ductile Iron : Dust Collection 50-249 employees

Model: Size-TPD: 683
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	Total
Investment $ x 10^{-3}	57	29	86
Annual Cost $ x 10^{-3}			
Capital	2.44	1.26	3.70
Depreciation	5.67	2.94	8.61
Operation & Maintenance	1.99	1.03	3.02
Energy & Power (1)	0.56	0.22	0.78
Sludge Disposal	66.17	-	66.17
TOTAL	76.83	5.45	82.28

	Wastewater Parameters	Raw Waste Level	Effluent Level
	Flow, gal/ton	140	0
	Concentrations, mg/l		
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-
120	Copper	2.7	-
122	Lead	3.3	-
124	Nickel	1.5	-
128	Zinc	9.6	-
	Ammonia (N)	75	-
	Sulfide	18	-
	Manganese	170	-
	Iron	1280	-
	Phenols (4AAP)	27	-
	Oil and Grease	130	-
	TSS	33600	-
	pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-39

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	3300
:	Ductile Iron	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	3
:	$\geq$250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	220	55	275
Annual Cost $ x 10^{-3}			
Capital	9.44	2.38	11.82
Depreciation	21.96	5.54	27.50
Operation & Maintenance	7.68	1.94	9.62
Energy & Power (1)	3.36	1.12	4.48
Sludge Disposal	319.69	-	319.69
TOTAL	362.13	10.98	373.11

	Wastewater Parameters	Raw Waste Level	Effluent Level
	Flow, gal/ton	140	0
	Concentrations, mg/l		
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-
120	Copper	2.7	-
122	Lead	3.3	-
124	Nickel	1.5	-
128	Zinc	9.6	-
	Ammonia (N)	75	-
	Sulfide	18	-
	Manganese	170	-
	Iron	1280	-
	Phenols (4AAP)	27	-
	Oil and Grease	130	-
	TSS	33600	-
	pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-40

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	165
:	Gray Iron	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	2
:	10 to 49 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	31	22	53
Annual Cost $ x 10^{-3}			
Capital	1.35	0.95	2.30
Depreciation	3.14	2.20	5.34
Operation & Maintenance	1.10	0.77	1.87
Energy & Power[(1)]	0.22	0.08	0.30
Sludge Disposal	15.98	-	15.98
TOTAL	21.79	4.00	25.79

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-40
BPT/NSPS/PSES/PSNS MODEL COST DATA
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Wastewater Parameters	Raw Waste Level	Effluent Level
120 Copper	2.7	-
122 Lead	3.3	-
124 Nickel	1.5	-
128 Zinc	9.6	-
Ammonia (N)	75	-
Sulfide	18	-
Manganese	170	-
Iron	1280	-
Phenols (4AAP)	27	-
Oil and Grease	130	-
TSS	33600	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-41

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	762
:	Gray Iron	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	2
:	50 to 249 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	83	36	119
Annual Cost $ x 10^{-3}			
Capital	3.55	1.54	5.09
Depreciation	8.26	3.57	11.83
Operation & Maintenance	2.89	1.25	4.14
Energy & Power (1)	0.75	0.37	1.12
Sludge Disposal	73.82	-	73.82
TOTAL	89.27	6.73	96.00

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-41
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters		Raw Waste Level	Effluent Level
120	Copper	2.7	-
122	Lead	3.3	-
124	Nickel	1.5	-
128	Zinc	9.6	-
	Ammonia (N)	75	-
	Sulfide	18	-
	Manganese	170	-
	Iron	1280	-
	Phenols (4AAP)	27	-
	Oil and Grease	130	-
	TSS	33600	-
	pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-42

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	4290
:	Gray Iron	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	3
:	≥250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	270	71	341
Annual Cost $ x 10^{-3}			
Capital	11.60	3.07	14.67
Depreciation	26.98	7.13	34.11
Operation & Maintenance	9.44	2.50	11.94
Energy & Power(1)	5.03	1.68	6.71
Sludge Disposal	415.59	-	415.59
TOTAL	468.64	14.38	483.02

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-42
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
120 Copper	2.7	-
122 Lead	3.3	-
124 Nickel	1.5	-
128 Zinc	9.6	-
Ammonia (N)	75	-
Sulfide	18	-
Manganese	170	-
Iron	1280	-
Phenols (4AAP)	27	-
Oil and Grease	130	-
TSS	33600	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-43

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	620
:	Malleable Iron	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	2
:	<250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	76	35	111
Annual Cost $ x 10^{-3}			
Capital	3.27	1.51	4.78
Depreciation	7.60	3.52	11.12
Operation & Maintenance	2.66	1.23	3.89
Energy & Power (1)	0.75	0.22	0.97
Sludge Disposal	60.06	-	60.06
TOTAL	74.34	6.48	80.82

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-43
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
120 Copper	2.7	-
122 Lead	3.3	-
124 Nickel	1.5	-
128 Zinc	9.6	-
Ammonia (N)	75	-
Sulfide	18	-
Manganese	170	-
Iron	1280	-
Phenols (4AAP)	27	-
Oil and Grease	130	-
TSS	33600	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-44

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	3900
:	Malleable Iron	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	3
:	≥250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	257	71	328
Annual Cost $ x 10^{-3}			
Capital	11.06	3.04	14.10
Depreciation	25.73	7.07	32.80
Operation & Maintenance	9.01	2.48	11.49
Energy & Power[1]	5.03	1.68	6.71
Sludge Disposal	377.81	-	377.81
TOTAL	428.64	14.27	442.91

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-44
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters		Raw Waste Level	Effluent Level
120	Copper	2.7	-
122	Lead	3.3	-
124	Nickel	1.5	-
128	Zinc	9.6	-
	Ammonia (N)	75	-
	Sulfide	18	-
	Manganese	170	-
	Iron	1280	-
	Phenols (4AAP)	27	-
	Oil and Grease	130	-
	TSS	33600	-
	pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-45

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	365
:	Steel	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	3
:	<250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	40	23	63
Annual Cost $ x 10^{-3}			
Capital	1.70	1.00	2.70
Depreciation	3.95	2.32	6.27
Operation & Maintenance	1.38	0.81	2.19
Energy & Power (1)	0.56	0.22	0.78
Sludge Disposal	35.36	-	35.36
TOTAL	42.95	4.35	47.30

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-45
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
120 Copper	2.7	-
122 Lead	3.3	-
124 Nickel	1.5	-
128 Zinc	9.6	-
Ammonia (N)	75	-
Sulfide	18	-
Manganese	170	-
Iron	1280	-
Phenols (4AAP)	27	-
Oil and Grease	130	-
TSS	33600	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-46

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	1184
:	Steel	Oper. Days/Yr. :	250
:	Dust Collection	Turns/Day :	3
:	≥250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	86	36	122
Annual Cost $ x 10^{-3}			
Capital	3.68	1.54	5.22
Depreciation	8.55	3.57	12.12
Operation & Maintenance	2.99	1.25	4.24
Energy & Power (1)	1.12	0.56	1.68
Sludge Disposal	114.70	-	114.70
TOTAL	131.04	6.92	137.96

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		140	0
Concentrations, mg/l			
001	Acenaphthene	0.125	-
031	2,4-dichlorophenol	0.410	-
034	2,4-dimethylphenol	4.710	-
039	Fluoranthene	0.100	-
062	N-nitrosodiphenylamine	0.070	-
064	Pentachlorophenol	0.045	-
065	Phenol	22.3	-
067	Butyl benzyl phthalate	0.140	-
072	Benzo (a) anthracene	0.007	-
076	Chrysene	0.065	-
077	Acenaphthylene	0.055	-
080	Fluorene	0.160	-
081	Phenanthrene	0.580	-
084	Pyrene	0.105	-
085	Tetrachloroethylene	0.250	-

TABLE VIII-46
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
120 Copper	2.7	-
122 Lead	3.3	-
124 Nickel	1.5	-
128 Zinc	9.6	-
Ammonia (N)	75	-
Sulfide	18	-
Manganese	170	-
Iron	1280	-
Phenols (4AAP)	27	-
Oil and Grease	130	-
TSS	33600	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-47

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	182
:	Ductile Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber	Turns/Day :	1
:	<250 employees		

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	101	290	42	212	84	729
Annual Cost $ x 10^{-3}						
Capital	4.33	12.46	1.81	9.17	3.60	31.37
Depreciation	10.07	28.98	4.21	21.20	8.36	72.82
Operation & Maintenance	3.52	10.14	1.47	7.42	2.93	25.48
Energy & Power (1)	0.13	0.56	0.08	1.44	0.56	2.77
Sludge Disposal	-	-	-	15.32	-	15.32
Chemical Cost	2.19	-	1.80	-	-	3.99
TOTAL	20.24	52.14	9.37	54.55	15.45	151.75

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.050	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.035	-
064 Pentachlorophenol	0.100	-
065 Phenol	1.00	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo (a) anthracene	0.018	-
076 Chrysene	0.017	-
077 Acenaphthylene	0.045	-
080 Fluorene	0.130	-
081 Phenanthrene	0.075	-

TABLE VIII-47
BPT/NSPS/PSES/PSNS MODEL COST DATA
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Wastewater Parameters	Raw Waste Level	Effluent Level
084 Pyrene	0.240	-
085 Tetrachloroethylene	0.039	-
114 Antimony	0.99	-
115 Arsenic	0.11	-
118 Cadmium	0.77	-
119 Chromium	0.25	-
120 Copper	4.3	-
122 Lead	111	-
124 Nickel	1.6	-
128 Zinc	2200	-
Ammonia (N)	11	-
Fluoride	59	-
Iron	230	-
Manganese	113	-
Phenols (4AAP)	1.8	-
Sulfide	3.9	-
Oil and Grease	19	-
TSS	3100	-
pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Caustic Addition
B: Clarifier
C: Coagulant Aid Addition
D: Vacuum Filter
E: Recycle 100%

TABLE VIII-48

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	1920
:	Ductile Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber	Turns/Day :	3
:	≥250 employees		

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	188	498	54	373	185	1298
Annual Cost $ x 10^{-3}						
Capital	8.09	21.43	2.31	16.04	7.93	55.80
Depreciation	18.82	49.84	5.38	37.31	18.45	129.80
Operation & Maintenance	6.59	17.44	1.88	13.06	6.46	45.43
Energy & Power (1)	1.17	2.24	0.28	8.03	5.59	17.31
Sludge Disposal	-	-	-	161.64	-	161.64
Chemical Cost	22.75	-	18.90	-	-	41.65
TOTAL	57.42	90.95	28.75	236.08	38.43	451.63

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	-
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-

TABLE VIII-48
BPT/NSPS/PSES/PSNS MODEL COST DATA
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Wastewater Parameters		Raw Waste Level	Effluent Level
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Caustic Addition
B: Clarifier
C: Coagulant Aid Addition
D: Vacuum Filter
E: Recycle 100%

TABLE VIII-49

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	11
:	Gray Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber	Turns/Day :	1
:	10 to 49 employees		

C&TT Step	A	B	C	D	E	Total
Investment \$ x 10^{-3}	43	75	25	90	24	257
Annual Cost \$ x 10^{-3}						
Capital	1.86	3.24	1.09	3.83	1.03	11.10
Depreciation	4.33	7.54	2.53	9.02	2.39	25.81
Operation & Maintenance	1.52	2.64	0.89	3.16	0.84	9.05
Energy & Power (1)	0.04	0.19	0.04	0.54	0.04	0.85
Sludge Disposal	-	-	-	0.93	-	0.93
Chemical Cost	0.13	-	0.11	-	-	0.24
TOTAL	7.88	13.61	4.66	17.53	4.30	47.98

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	-

TABLE VIII-49
BPT/NSPS/PSES/PSNS MODEL COST DATA
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Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Caustic Addition
B: Clarifier
C: Coagulant Aid Addition
D: Vacuum Filter
E: Recycle 100%

TABLE VIII-50

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	110
:	Gray Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber	Turns/Day :	2
:	50 to 249 employees		

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	66	162	30	146	54	458
Annual Cost $ x 10^{-3}						
Capital	3.04	6.95	1.29	6.27	2.33	19.88
Depreciation	6.64	16.15	3.01	14.58	5.41	45.79
Operation & Maintenance	2.32	5.65	1.05	5.10	1.89	16.01
Energy & Power (1)	0.11	0.75	0.11	1.83	0.37	3.17
Sludge Disposal	-	-	-	9.26	-	9.26
Chemical Cost	1.31	-	1.08	-	-	2.39
TOTAL	13.42	29.50	6.54	37.04	10.00	96.50

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	-

TABLE VIII-50
BPT/NSPS/PSES/PSNS MODEL COST DATA
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Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Caustic Addition
B: Clarifier
C: Coagulant Aid Addition
D: Vacuum Filter
E: Recycle 100%

TABLE VIII-51

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	1020
:	Gray Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber	Turns/Day :	3
:	≥ 250 employees		

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	135	424	41	333	146	1079
Annual Cost $ x 10^{-3}						
Capital	5.81	18.24	1.77	14.32	6.26	46.40
Depreciation	13.50	42.42	4.12	33.31	14.55	107.90
Operation & Maintenance	4.73	14.85	1.44	11.66	5.09	37.77
Energy & Power[1]	0.62	2.24	0.22	6.75	3.36	13.19
Sludge Disposal	-	-	-	85.87	-	85.87
Chemical Cost	12.03	-	9.90	-	-	21.93
TOTAL	36.69	77.75	17.45	151.86	29.26	313.06

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	-

TABLE VIII-51
BPT/NSPS/PSES/PSNS MODEL COST DATA
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Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Caustic Addition
B: Clarifier
C: Coagulant Aid Addition
D: Vacuum Filter
E: Recycle 100%

TABLE VIII-52

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	122
:	Malleable Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber	Turns/Day :	2
:	<250 employees		

C&TT Step	A	B	C	D	E	Total
Investment \$ x 10^{-3}	69	169	30	146	62	476
Annual Cost \$ x 10^{-3}						
Capital	2.96	7.25	1.29	6.28	2.68	20.46
Depreciation	6.89	16.86	3.00	14.60	6.24	47.59
Operation & Maintenance	2.41	5.90	1.05	5.11	2.18	16.65
Energy & Power[(1)]	0.11	0.75	0.11	1.83	0.37	3.17
Sludge Disposal	-	-	-	10.27	-	10.27
Chemical Cost	3.63	-	1.17	-	-	4.80
TOTAL	16.00	30.76	6.62	38.09	11.47	102.94

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	-

TABLE VIII-52
BPT/NSPS/PSES/PSNS MODEL COST DATA
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Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Caustic Addition
B: Clarifier
C: Coagulant Aid Addition
D: Vacuum Filter
E: Recycle 100%

TABLE VIII-53

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	307
:	Malleable Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber	Turns/Day :	2
:	≥250 employees		

C&TT Step	A	B	C	D	E	Total
Investment $ x 10^{-3}	100	268	42	212	82	704
Annual Cost $ x 10^{-3}						
Capital	4.29	11.54	1.81	9.12	3.51	30.27
Depreciation	9.97	26.84	4.21	21.20	8.15	70.37
Operation & Maintenance	3.49	9.39	1.47	7.42	2.85	24.62
Energy & Power(1)	0.22	1.12	0.15	2.87	1.12	5.48
Sludge Disposal	-	-	-	25.85	-	25.85
Chemical Cost	3.63	-	3.02	-	-	6.65
TOTAL	21.60	48.89	10.66	66.46	15.63	163.24

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	-

TABLE VIII-53
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Caustic Addition
B: Clarifier
C: Coagulant Aid Addition
D: Vacuum Filter
E: Recycle 100%

TABLE VIII-54

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	21
:	Ductile Iron	Oper. Days/Yr. :	250
:	Smaller Melting Furnace Scrubber Operations	Turns/Day :	0.4
:	<250 employees		

C&TT Step	A	B	C	D	Total
Investment $ x 10^{-3}	76	34	39	57	206
Annual Cost $ x 10^{-3}					
Capital	3.25	1.44	1.68	2.43	8.80
Depreciation	7.56	3.35	3.90	5.66	20.47
Operation & Maintenance	2.65	1.17	1.36	1.98	7.16
Energy & Power(1)	0.14	0.01	0.01	0.07	0.23
Chemical Cost	-	0.22	0.50	-	0.72
TOTAL	13.60	6.19	7.45	10.14	37.38

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	

TABLE VIII-54
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Decant and Recirculation Tank
B: Coagulant Aid Addition
C: Caustic Addition
D: Recycle 100%

TABLE VIII-55

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Ductile Iron
: Smaller Melting Furnace Scrubber Operations
: >250 employees

Model: Size-TPD: 34
Oper. Days/Yr. : 250
Turns/Day : 0.4

C&TT Step	A	B	C	D	Total
Investment $ x 10^{-3}	95	34	40	59	228
Annual Cost $ x 10^{-3}					
Capital	4.08	1.47	1.73	2.53	9.81
Depreciation	9.49	3.42	4.03	5.88	22.82
Operation & Maintenance	3.32	1.20	1.41	2.06	7.99
Energy & Power(1)	0.21	0.01	0.01	0.10	0.33
Chemical Cost	-	0.32	0.81	-	1.13
TOTAL	17.10	6.42	7.99	10.57	42.09

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.050	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.035	-
064 Pentachlorophenol	0.100	-
065 Phenol	1.00	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo (a) anthracene	0.018	-
076 Chrysene	0.017	-

TABLE VIII-55
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Decant and Recirculation Tank
B: Coagulant Aid Addition
C: Caustic Addition
D: Recycle 100%

TABLE VIII-56

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	11.2
:	Gray Iron	Oper. Days/Yr. :	250
:	Smaller Melting Furnace Scrubber Operations	Turns/Day :	0.4
:	<50 employees		

C&TT Step	A	B	C	D	Total
Investment $ x 10^{-3}	46	31	36	47	160
Annual Cost $ x 10^{-3}					
Capital	2.00	1.35	1.57	2.00	6.92
Depreciation	4.64	3.13	3.65	4.66	16.08
Operation & Maintenance	1.62	1.10	1.28	1.63	5.63
Energy & Power(1)	0.07	0.01	0.01	0.04	0.13
Chemical Cost	-	0.11	0.26	-	0.37
TOTAL	8.33	5.70	6.77	8.33	29.13

Wastewater Parameters		Raw Waste Level	Effluent Level
Flow, gal/ton		1300	0
Concentrations, mg/l			
024	2-chlorophenol	0.018	-
031	2,4-dichlorophenol	0.020	-
034	2,4-dimethylphenol	0.050	-
039	Fluoranthene	0.025	-
059	2,4-dinitrophenol	0.017	-
060	4,6-dinitro-o-cresol	0.025	-
062	N-nitrosodiphenylamine	0.035	-
064	Pentachlorophenol	0.100	-
065	Phenol	1.00	-
067	Butyl benzyl phthalate	0.035	-
072	Benzo (a) anthracene	0.018	-
076	Chrysene	0.017	

TABLE VIII-56
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Decant and Recirculation Tank
B: Coagulant Aid Addition
C: Caustic Addition
D: Recycle 100%

TABLE VIII-57

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	38.9
:	Gray Iron	Oper. Days/Yr. :	250
:	Smaller Melting Furnace Scrubber Operations	Turns/Day :	0.4
:	≥50 employees		

C&TT Step	A	B	C	D	Total
Investment $ x 10^{-3}	75	34	40	59	208
Annual Cost $ x 10^{-3}					
Capital	3.23	1.47	1.73	2.55	8.98
Depreciation	7.51	3.42	4.03	5.94	20.90
Operation & Maintenance	2.63	1.20	1.41	2.08	7.32
Energy & Power (1)	0.28	0.01	0.01	0.14	0.44
Chemical Cost	-	0.36	0.92	-	1.28
TOTAL	13.65	6.46	8.10	10.71	38.92

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.050	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.035	-
064 Pentachlorophenol	0.100	-
065 Phenol	1.00	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo (a) anthracene	0.018	-
076 Chrysene	0.017	

TABLE VIII-57
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters		Raw Waste Level	Effluent Level
077	Acenaphthylene	0.045	-
080	Fluorene	0.130	-
081	Phenanthrene	0.075	-
084	Pyrene	0.240	-
085	Tetrachloroethylene	0.039	-
114	Antimony	0.99	-
115	Arsenic	0.11	-
118	Cadmium	0.77	-
119	Chromium	0.25	-
120	Copper	4.3	-
122	Lead	111	-
124	Nickel	1.6	-
128	Zinc	2200	-
	Ammonia (N)	11	-
	Fluoride	59	-
	Iron	230	-
	Manganese	113	-
	Phenols (4AAP)	1.8	-
	Sulfide	3.9	-
	Oil and Grease	19	-
	TSS	3100	-
	pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Decant and Recirculation Tank
B: Coagulant Aid Addition
C: Caustic Addition
D: Recycle 100%

TABLE VIII-58

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	230
:	Ductile Iron	Oper. Days/Yr. :	250
:	Slag Quench	Turns/Day :	1
:	<250 Employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	130	41	171
Annual Cost $ x 10^{-3}			
Capital	5.58	1.74	7.32
Depreciation	12.98	4.05	17.03
Operation & Maintenance	4.54	1.42	5.96
Energy & Power (1)	0.75	0.28	1.03
Sludge Disposal	0.10	-	0.10
TOTAL	23.95	7.49	31.44

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	360	0
Concentrations, mg/l		
034 2,4-dimethylphenol	0.050	-
062 N-nitrosodiphenylamine	0.275	-
065 Phenol	0.030	-
085 Tetrachloroethylene	0.080	-
118 Cadmium	0.02	-
119 Chromium	0.16	-
120 Copper	0.08	-
122 Lead	1.3	-
124 Nickel	0.08	-
128 Zinc	3.4	-
Ammonia (N)	6.4	-
Fluoride	54	-
Iron	5.0	-
Manganese	196	-
Phenols (4AAP)	0.39	-
Sulfide	5.1	-
Oil & Grease	15	-
TSS	80	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-59

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	1960
:	Ductile Iron	Oper. Days/Yr. :	250
:	Slag Quench	Turns/Day :	3
:	≥250 Employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	300	77	377
Annual Cost $ x 10^{-3}			
Capital	12.88	3.29	16.17
Depreciation	29.95	7.65	37.60
Operation & Maintenance	10.48	2.68	13.16
Energy & Power(1)	6.71	1.68	8.39
Sludge Disposal	0.88	-	0.88
TOTAL	60.90	15.30	76.20

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	360	0
Concentrations, mg/l		
034 2,4-dimethylphenol	0.050	-
062 N-nitrosodiphenylamine	0.275	-
065 Phenol	0.030	-
085 Tetrachloroethylene	0.080	-
118 Cadmium	0.02	-
119 Chromium	0.16	-
120 Copper	0.08	-
122 Lead	1.3	-
124 Nickel	0.08	-
128 Zinc	3.4	-
Ammonia (N)	6.4	-
Fluoride	54	-
Iron	5.0	-
Manganese	196	-
Phenols (4AAP)	0.39	-
Sulfide	5.1	-
Oil & Grease	15	-
TSS	80	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-60

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	103
:	Gray Iron	Oper. Days/Yr. :	250
:	Slag Quench	Turns/Day :	2
:	<250 Employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	42	23	65
Annual Cost $ x 10^{-3}			
Capital	1.82	1.00	2.82
Depreciation	4.24	2.32	6.56
Operation & Maintenance	1.48	0.81	2.29
Energy & Power (1)	0.37	0.15	0.52
Sludge Disposal	0.05	-	0.05
TOTAL	7.96	4.28	12.24

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	360	0
Concentrations, mg/l		
034 2,4-dimethylphenol	0.050	-
062 N-nitrosodiphenylamine	0.275	-
065 Phenol	0.030	-
085 Tetrachloroethylene	0.080	-
118 Cadmium	0.02	-
119 Chromium	0.16	-
120 Copper	0.08	-
122 Lead	1.3	-
124 Nickel	0.08	-
128 Zinc	3.4	-
Ammonia (N)	6.4	-
Fluoride	54	-
Iron	5.0	-
Manganese	196	-
Phenols (4AAP)	0.39	-
Sulfide	5.1	-
Oil & Grease	15	-
TSS	80	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-61

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	1010
:	Gray Iron	Oper. Days/Yr. :	250
:	Slag Quench	Turns/Day :	3
:	≥250 Employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	170	48	218
Annual Cost $ x 10^{-3}			
Capital	7.31	2.05	9.36
Depreciation	17.01	4.77	21.78
Operation & Maintenance	5.95	1.67	7.62
Energy & Power (1)	3.36	1.12	4.48
Sludge Disposal	0.45	-	0.45
TOTAL	34.08	9.61	43.69

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	360	0
Concentrations, mg/l		
034 2,4-dimethylphenol	0.050	-
062 N-nitrosodiphenylamine	0.275	-
065 Phenol	0.030	-
085 Tetrachloroethylene	0.080	-
118 Cadmium	0.02	-
119 Chromium	0.16	-
120 Copper	0.08	-
122 Lead	1.3	-
124 Nickel	0.08	-
128 Zinc	3.4	-
Ammonia (N)	6.4	-
Fluoride	54	-
Iron	5.0	-
Manganese	196	-
Phenols (4AAP)	0.39	-
Sulfide	5.1	-
Oil & Grease	15	-
TSS	80	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-62

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	82
:	Malleable Iron	Oper. Days/Yr. :	250
:	Slag Quench	Turns/Day :	2
:	<250 Employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	24	16	40
Annual Cost $ x 10^{-3}			
Capital	1.04	0.68	1.72
Depreciation	2.41	1.57	3.98
Operation & Maintenance	0.84	0.55	1.39
Energy & Power (1)	0.37	0.08	0.45
Sludge Disposal	0.04	-	0.04
TOTAL	4.70	2.88	7.58

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	360	0
Concentrations, mg/l		
034 2,4-dimethylphenol	0.050	-
062 N-nitrosodiphenylamine	0.275	-
065 Phenol	0.030	-
085 Tetrachloroethylene	0.080	-
118 Cadmium	0.02	-
119 Chromium	0.16	-
120 Copper	0.08	-
122 Lead	1.3	-
124 Nickel	0.08	-
128 Zinc	3.4	-
Ammonia (N)	6.4	-
Fluoride	54	-
Iron	5.0	-
Manganese	196	-
Phenols (4AAP)	0.39	-
Sulfide	5.1	-
Oil & Grease	15	-
TSS	80	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-63

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS - 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	390
:	Malleable Iron	Oper. Days/Yr. :	250
:	Slag Quench	Turns/Day :	2
:	≥250 Employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	97	37	134
Annual Cost $ x 10^{-3}			
Capital	4.15	1.59	5.74
Depreciation	9.65	3.70	13.35
Operation & Maintenance	3.38	1.30	4.68
Energy & Power (1)	1.12	0.37	1.49
Sludge Disposal	0.18	-	0.18
TOTAL	18.48	6.96	25.44

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	360	0
Concentrations, mg/l		
034 2,4-dimethylphenol	0.050	-
062 N-nitrosodiphenylamine	0.275	-
065 Phenol	0.030	-
085 Tetrachloroethylene	0.080	-
118 Cadmium	0.02	-
119 Chromium	0.16	-
120 Copper	0.08	-
122 Lead	1.3	-
124 Nickel	0.08	-
128 Zinc	3.4	-
Ammonia (N)	6.4	-
Fluoride	54	-
Iron	5.0	-
Manganese	196	-
Phenols (4AAP)	0.39	-
Sulfide	5.1	-
Oil & Grease	15	-
TSS	80	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-64

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Ductile Iron
: Casting Quench and Mold Cooling
: <250 employees

Model: Size-TPD: 283
Oper. Days/Yr. : 250
Turns/Day : 1

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	89	51	43	183
Annual Cost $ x 10^{-3}				
Capital	3.81	2.20	1.87	7.88
Depreciation	8.86	5.11	4.34	18.31
Operation & Maintenance	3.10	1.79	1.52	6.41
Energy & Power (1)	0.56	0.49	0.19	1.24
Sludge Disposal	2.39	-	-	2.39
TOTAL	18.72	9.59	7.92	36.23

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	220	0
Concentrations, mg/l		
Iron	8.4	-
Oil and Grease	115	-
TSS	1800	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-65

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Ductile Iron
: Casting Quench and Mold Cooling
: ≥250 employees

Model: Size-TPD: 800
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	87	50	43	180
Annual Cost $ x 10^{-3}				
Capital	3.75	2.14	1.87	7.76
Depreciation	8.71	4.98	4.34	18.03
Operation & Maintenance	3.05	1.74	1.52	6.31
Energy & Power(1)	1.68	1.45	0.56	3.69
Sludge Disposal	6.77	-	-	6.77
TOTAL	23.96	10.31	8.29	42.56

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	220	0
Concentrations, mg/l		
Iron	8.4	-
Oil and Grease	115	-
TSS	1800	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-66

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	690
:	Gray Iron	Oper. Days/Yr. :	250
:	Casting Quench and Mold Cooling	Turns/Day :	3
:	<250 employees		

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	83	48	41	172
Annual Cost $ x 10^{-3}				
Capital	3.55	2.06	1.78	7.39
Depreciation	8.25	4.78	4.13	17.16
Operation & Maintenance	2.89	1.67	1.45	6.01
Energy & Power (1)	1.12	1.45	0.56	3.13
Sludge Disposal	5.84	-	-	5.84
TOTAL	21.65	9.96	7.92	39.53

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	220	0
Concentrations, mg/l		
Iron	8.4	-
Oil and Grease	115	-
TSS	1800	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-67

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Gray Iron
: Casting Quench and Mold Cooling
: $\geq$250 employees

Model: Size-TPD: 789
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	86	50	43	179
Annual Cost $ x 10^{-3}				
Capital	3.71	2.15	1.85	7.71
Depreciation	8.62	5.01	4.30	17.93
Operation & Maintenance	3.02	1.75	1.51	6.28
Energy & Power (1)	1.68	1.45	0.56	3.69
Sludge Disposal	6.68	-	-	6.68
TOTAL	23.71	10.36	8.22	42.29

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	220	0
Concentrations, mg/l		
Iron	8.4	-
Oil and Grease	115	-
TSS	1800	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-68

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Malleable Iron
: Casting Quench and Mold Cooling
: ≥250 employees

Model: Size-TPD: 222
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	52	37	32	121
Annual Cost $ x 10^{-3}				
Capital	2.25	1.58	1.39	5.22
Depreciation	5.22	3.67	3.23	12.12
Operation & Maintenance	1.83	1.29	1.13	4.25
Energy & Power (1)	0.37	0.63	0.15	1.15
Sludge Disposal	1.88	-	-	1.88
TOTAL	11.55	7.17	5.90	24.62

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	220	0
Concentrations, mg/l		
Iron	8.4	-
Oil and Grease	115	-
TSS	1800	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-69

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	135
:	Steel	Oper. Days/Yr. :	250
:	Casting Quench and Mold Cooling	Turns/Day :	3
:	<250 employees		

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	26	30	28	84
Annual Cost $ x 10^{-3}				
Capital	1.13	1.27	1.19	3.59
Depreciation	2.63	2.95	2.76	8.34
Operation & Maintenance	0.92	1.03	0.97	2.92
Energy & Power (1)	0.34	0.67	0.11	1.12
Sludge Disposal	1.14	-	-	1.14
TOTAL	6.16	5.92	5.03	17.11

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	220	0
Concentrations, mg/l		
Iron	8.4	-
Oil and Grease	115	-
TSS	1800	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-70

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	207
:	Steel	Oper. Days/Yr. :	250
:	Casting Quench and Mold Cooling	Turns/Day :	3
:	≥250 employees		

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	36	34	30	100
Annual Cost $ x 10^{-3}				
Capital	1.54	1.43	1.29	4.26
Depreciation	3.57	3.32	2.99	9.88
Operation & Maintenance	1.25	1.16	1.05	3.46
Energy & Power (1)	0.56	0.67	0.11	1.34
Sludge Disposal	1.75	-	-	1.75
TOTAL	8.67	6.58	5.44	20.69

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	220	0
Concentrations, mg/l		
Iron	8.4	-
Oil and Grease	115	-
TSS	1800	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Cooling Tower
C: Recycle 100%

TABLE VIII-71

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Gray Iron
: Sand Washing
: >250 employees

Model: Size-TPD: 1190
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A(2)	B	C	D	E	F	G	H	Total
Investment $ x 10^{-3}	651	103	98	92	136	39	111	41	1271
Annual Cost $ x 10^{-3}									
Capital	28.00	4.44	4.22	3.94	5.86	1.67	4.79	1.74	54.66
Depreciation	65.12	10.32	9.82	9.17	13.63	3.89	11.13	4.05	127.13
Operation & Maintenance	22.79	3.61	3.44	3.21	4.77	1.36	3.90	1.42	44.50
Energy & Power(1)	11.19	2.98	0.86	0.82	0.75	0.08	1.76	0.37	18.81
Sludge Disposal	-	-	-	-	-	-	1.47	-	1.47
Chemical Cost	-	-	0.25	9.63	-	0.99	-	-	10.87
TOTAL	127.10	21.35	18.59	26.77	25.01	7.99	23.05	7.58	257.44

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1120	0
Concentrations, mg/l		
001 Acenaphthene	0.050	-
065 Phenol	0.660	-
077 Acenaphthylene	0.013	-
084 Pyrene	0.014	-
119 Chromium	0.16	-
120 Copper	0.39	-
122 Lead	0.78	-
124 Nickel	0.19	-
128 Zinc	0.20	-
Ammonia (N)	4.3	-
Iron	155	-
Manganese	3.3	-
Phenols (4AAP)	27.0	-
Sulfide	0.68	-
Oil and Grease	20	-
TSS	8700	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.
(2) Casting sand reclaimed in this step is returned to the mold making process.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 90%
C: Lime Addition
D: Potassium Permanganate Addition
E: Clarifier
F: Coagulant Aid Addition
G: Vacuum Filter
H: Recycle 100% of Treated Effluent

TABLE VIII-72

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Steel
: Sand Washing
: >250 employees

Model: Size-TPD: 418
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A(2)	B	C	D	E	F	G	H	Total
Investment $ x 10^{-3}	251	56	60	53	70	31	80	25	626
Annual Cost $ x 10^{-3}									
Capital	10.78	2.41	2.58	2.27	3.00	1.35	3.45	1.05	26.89
Depreciation	25.07	5.60	6.00	5.28	6.98	3.13	8.03	2.45	62.54
Operation & Maintenance	8.78	1.96	2.10	1.85	2.44	1.10	2.81	0.86	21.90
Energy & Power(1)	3.36	1.12	0.34	0.39	0.56	0.11	1.62	0.11	7.61
Sludge Disposal	-	-	-	-	-	-	0.52	-	0.52
Chemical Cost	-	-	0.08	3.15	-	0.36	-	-	3.59
TOTAL	47.99	11.09	11.10	12.94	12.98	6.05	16.43	4.47	123.05

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1120	0
Concentrations, mg/l		
001 Acenaphthene	0.050	-
065 Phenol	0.660	-
077 Acenaphthylene	0.013	-
084 Pyrene	0.014	-
119 Chromium	0.16	-
120 Copper	0.39	-
122 Lead	0.78	-
124 Nickel	0.19	-
128 Zinc	0.20	-
Ammonia (N)	4.3	-
Iron	155	-
Manganese	3.3	-
Phenols (4AAP)	27.0	-
Sulfide	0.68	-
Oil and Grease	20	-
TSS	8700	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.
(2) Casting sand reclaimed in this step is returned to the mold making process.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 90%
C: Lime Addition
D: Potassium Permanganate Addition
E: Clarifier
F: Coagulant Aid Addition
G: Vacuum Filter
H: Recycle 100% of Treated Effluent

TABLE VIII-73

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	(Sand) 205
:	Ductile Iron	Model: Size-TPD:	(Metal) 150
:	Dust Collection and Slag Quench Co-Treatment	Oper. Days/Yr. :	250
		Turns/Day :	1
:	<250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	130	40	170
Annual Cost $ x 10^{-3}			
Capital	5.58	1.74	7.32
Depreciation	12.98	4.05	17.03
Operation & Maintenance	4.54	1.42	5.96
Energy & Power[1]	0.75	0.28	1.03
Sludge Disposal	3.83	-	3.83
TOTAL	27.68	7.49	35.17

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/day	82,700	0
Concentrations, mg/l		
001 Acenaphthene	0.043	-
031 2,4-dichlorophenol	0.14	-
034 2,4-dimethylphenol	1.63	-
039 Fluoranthene	0.035	-
062 N-nitrosodiphenylamine	0.20	-
064 Pentachlorophenol	0.016	-
065 Phenol	7.76	-
067 Butyl benzyl phthalate	0.049	-
072 Benzo(a)anthracene	0.002	-

TABLE VIII-73
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
076 Chrysene	0.022	-
077 Acenaphthylene	0.019	-
080 Fluorene	0.056	-
081 Phenanthrene	0.20	-
084 Pyrene	0.036	-
085 Tetrachloroethylene	0.14	-
118 Cadmium	0.013	-
119 Chromium	0.10	-
120 Copper	0.99	-
122 Lead	1.99	-
124 Nickel	0.57	-
128 Zinc	5.55	-
Ammonia (N)	30	-
Fluoride	35	-
Iron	450	-
Manganese	190	-
Phenols (4AAP)	9.62	-
Sulfide	9.58	-
Oil and Grease	55	-
TSS	11,700	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-74

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	(Sand) 3306
:	Ductile Iron	Model: Size-TPD:	(Metal) 2560
:	Dust Collection and Slag Quench Co-Treatment	Oper. Days/Yr. :	250
		Turns/Day :	3
:	≥250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	529	100	629
Annual Cost $ x 10^{-3}			
Capital	22.76	4.29	27.05
Depreciation	52.92	9.97	62.89
Operation & Maintenance	18.52	3.49	22.01
Energy & Power (1)	11.19	3.36	14.55
Sludge Disposal	64.09	-	64.09
TOTAL	169.48	21.11	190.59

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/day	1,383,600	0
Concentrations, mg/l		
001 Acenaphthene	0.042	-
031 2,4-dichlorophenol	0.14	-
034 2,4-dimethylphenol	1.61	-
039 Fluoranthene	0.033	-
064 Pentachlorophenol	0.015	-
065 Phenol	7.47	-
067 Butyl benzyl phthalate	0.047	-
072 Benzo(a)anthracene	0.0023	-
076 Chrysene	0.022	-

TABLE VIII-74
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
077 Acenaphthylene	0.018	-
080 Fluorene	0.054	-
081 Phenanthrene	0.19	-
084 Pyrene	0.035	-
085 Tetrachloroethylene	0.14	-
118 Cadmium	0.013	-
119 Chromium	0.11	-
120 Copper	0.96	-
122 Lead	1.97	-
124 Nickel	0.55	-
128 Zinc	5.47	-
Ammonia (N)	29	-
Fluoride	36	-
Iron	430	-
Manganese	190	-
Phenols (4AAP)	9.28	-
Sulfide	9.41	-
Oil and Grease	53	-
TSS	11,300	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-75

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	(Sand) 720
:	Gray Iron	Model: Size-TPD:	(Metal) 93
:	Dust Collection and Slag Quench Co-Treatment	Oper. Days/Yr. :	250
		Turns/Day :	2
:	<250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	118	39	157
Annual Cost $ x 10^{-3}			
Capital	5.08	1.69	6.77
Depreciation	11.81	3.93	15.74
Operation & Maintenance	4.13	1.38	5.51
Energy & Power (1)	1.12	0.37	1.49
Sludge Disposal	12.70	-	12.70
TOTAL	34.84	7.37	42.21

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/day	134,280	0
Concentrations, mg/l		
001 Acenaphthene	0.094	-
031 2,4-dichlorophenol	0.31	-
034 2,4-dimethylphenol	3.55	-
039 Fluoranthene	0.075	-
062 N-nitrosodiphenylamine	0.12	-
064 Pentachlorophenol	0.034	-
065 Phenol	17	-
067 Butyl benzyl phthalate	0.10	-
072 Benzo(a)anthracene	0.0053	-

TABLE VIII-75
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
076 Chrysene	0.049	-
077 Acenaphthylene	0.041	-
080 Fluorene	0.12	-
081 Phenanthrene	0.44	-
084 Pyrene	0.079	-
085 Tetrachloroethylene	0.21	-
118 Cadmium	0.0050	-
119 Chromium	0.040	-
120 Copper	2.05	-
122 Lead	2.80	-
124 Nickel	1.15	-
128 Zinc	8.06	-
Ammonia (N)	58	-
Fluoride	13	-
Iron	960	-
Manganese	180	-
Phenols (4AAP)	20	-
Sulfide	15	-
Oil and Grease	100	-
TSS	25,300	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-76

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	(Sand) 2420
:	Gray Iron	Model: Size-TPD:	(Metal) 540
:	Dust Collection and Slag Quench Co-Treatment	Oper. Days/Yr. :	250
		Turns/Day :	3
:	≥250 employees		

C&TT Step	A	B	Total
Investment $ x 10^{-3}	258	76	334
Annual Cost $ x 10^{-3}			
Capital	11.08	3.27	14.35
Depreciation	25.76	7.61	33.37
Operation & Maintenance	9.02	2.66	11.68
Energy & Power[1]	3.36	1.68	5.04
Sludge Disposal	50.45	-	50.45
TOTAL	99.67	15.22	114.89

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/day	533,200	0
Concentrations, mg/l		
001 Acenaphthene	0.079	-
031 2,4-dichlorophenol	0.26	-
034 2,4-dimethylphenol	3.01	-
039 Fluoranthene	0.064	-
062 N-nitrosodiphenylamine	0.15	-
064 Pentachlorophenol	0.029	-
065 Phenol	14	-
067 Butyl benzyl phthalate	0.089	-
072 Benzo(a)anthracene	0.0044	-

TABLE VIII-76
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
076 Chrysene	0.041	-
077 Acenaphthylene	0.035	-
080 Fluorene	0.10	-
081 Phenanthrene	0.37	-
084 Pyrene	0.067	-
085 Tetrachloroethylene	0.19	-
118 Cadmium	0.0073	-
119 Chromium	0.058	-
120 Copper	1.74	-
122 Lead	2.57	-
124 Nickel	0.98	-
128 Zinc	7.34	-
Ammonia (N)	50	-
Fluoride	20	-
Iron	820	-
Manganese	180	-
Phenols (4AAP)	17	-
Sulfide	13	-
Oil and Grease	83	-
TSS	21,400	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-77

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Malleable Iron
: Dust Collection and Slag Quench Co-Treatment
: <250 employees

Model: Size-TPD: (Sand) 960
Model: Size-TPD: (Metal) 115
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A	B	Total
Investment $ x 10^{-3}	133	47	180
Annual Cost $ x 10^{-3}			
Capital	5.71	2.04	7.75
Depreciation	13.27	4.74	18.01
Operation & Maintenance	4.64	1.66	6.30
Energy & Power[(1)]	1.49	0.56	2.05
Sludge Disposal	17.38	-	17.38
TOTAL	42.49	9.00	51.49

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/day	175,800	0
Concentrations, mg/l		
001 Acenaphthene	0.096	-
031 2,4-dichlorophenol	0.31	-
034 2,4-dimethylphenol	3.61	-
039 Fluoranthene	0.076	-
062 N-nitrosodiphenylamine	0.12	-
064 Pentachlorophenol	0.034	-
065 Phenol	17	-
067 Butyl benzyl phthalate	0.11	-
072 Benzo(a)anthracene	0.0054	-

TABLE VIII-77
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
076 Chrysene	0.050	-
077 Acenaphthylene	0.042	-
080 Fluorene	0.12	-
081 Phenanthrene	0.44	-
084 Pyrene	0.080	-
085 Tetrachloroethylene	0.21	-
118 Cadmium	0.0047	-
119 Chromium	0.038	-
120 Copper	2.08	-
122 Lead	2.83	-
124 Nickel	1.17	-
128 Zinc	8.14	-
Ammonia (N)	59	-
Fluoride	13	-
Iron	980	-
Manganese	180	-
Phenols (4AAP)	21	-
Sulfide	15	-
Oil and Grease	100	-
TSS	25,700	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-78

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Gray Iron and Steel
: Dust Collection and Sand Washing Co-Treatment
: >250 employees

Model: Size-TPD: 1800
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A	B	C	D	E	F	Total
Investment $ x 10^{-3}	1050	157	171	30	104	55	1567
Annual Cost $ x 10^{-3}							
Capital	45.17	6.75	7.34	1.28	4.46	2.35	67.35
Depreciation	105.05	15.70	17.08	2.98	10.37	5.46	156.64
Operation & Maintenance	36.77	5.50	5.98	1.04	3.63	1.91	54.83
Energy & Power (1)	17.90	5.59	1.12	0.08	0.84	0.56	26.09
Chemical Cost	-	-	-	1.53	-	-	1.53
Sludge Disposal	103.86	-	-	-	1.51	-	105.37
TOTAL	308.75	33.54	31.52	6.91	20.81	10.28	411.81

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1260	0
Concentrations, mg/l		
001 Acenaphthene	0.058	-
031 2,4-dichlorophenol	0.046	-
034 2,4-dimethylphenol	0.52	-
039 Fluoranthene	0.011	-
062 N-nitrosodiphenylamine	0.0078	-
064 Pentachlorophenol	0.0050	-
065 Phenol	3.06	-
067 Butyl benzyl phthalate	0.089	-
072 Benzo(a)anthracene	0.00078	-
076 Chrysene	0.0072	-
077 Acenaphthylene	0.018	-
080 Fluorene	0.018	-
081 Phenanthrene	0.064	-
084 Pyrene	0.024	-
085 Tetrachloroethylene	0.028	-
119 Chromium	0.14	-
120 Copper	0.65	-
122 Lead	1.06	-
124 Nickel	0.34	-
128 Zinc	1.24	-
Ammonia (N)	12	-
Iron	280	-
Manganese	22	-
Phenols (4AAP)	27	-
Sulfide	2.6	-
Oil and Grease	32	-
TSS	11,500	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 91%
C: Clarifier
D: Coagulant Aid Addition
E: Vacuum Filter
F: Recycle 100%

TABLE VIII-79

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	312
:	Ductile Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber and Slag Quench Co-Treatment	Turns/Day :	1
:	<250 employees		

C&TT Step	A	B	C	D	E	F	Total
Investment $ x 10^{-3}	436	95	370	33	189	92	1215
Annual Cost $ x 10^{-3}							
Capital	18.76	4.10	15.89	1.42	8.14	3.94	52.25
Depreciation	43.63	9.54	36.95	3.30	18.94	9.17	121.53
Operation & Maintenance	15.27	3.34	12.93	1.16	6.63	3.21	42.54
Energy & Power[1]	3.36	0.41	0.56	0.06	1.25	0.93	6.57
Chemical Cost	-	7.39	-	3.06	-	-	10.45
Sludge Disposal	5.92	-	-	-	2.82	-	8.74
TOTAL	86.94	24.78	66.33	9.00	37.78	17.25	242.08

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.064	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.11	-
064 Pentachlorophenol	0.10	-
065 Phenol	1.01	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo(a)anthracene	0.018	-
076 Chrysene	0.017	-
077 Acenaphthylene	0.045	-
080 Fluorene	0.13	-
081 Phenanthrene	0.075	-
084 Pyrene	0.24	-
085 Tetrachloroethylene	0.061	-
114 Antimony	0.99	-

TABLE VIII-79
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Wastewater Parameters	Raw Waste Level	Effluent Level
Concentrations, mg/l		
115 Arsenic	0.11	-
118 Cadmium	0.78	-
119 Chromium	0.29	-
120 Copper	4.32	-
122 Lead	110	-
124 Nickel	1.62	-
128 Zinc	2200	-
Ammonia (N)	13	-
Fluoride	74	-
Iron	230	-
Manganese	170	-
Phenols (4AAP)	1.91	-
Sulfide	5.31	-
Oil and Grease	23	-
TSS	3120	-
pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Caustic Addition
C: Clarifier
D: Coagulant Aid Addition
E: Vacuum Filter
F: Recycle 100%

TABLE VIII-80

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Ductile Iron
: Melting Furnace Scrubber and Slag Quench Co-Treatment
: ≥250 employees

Model: Size-TPD: 2610
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	Total
Investment $ x 10^{-3}	1103	173	682	52	217	152	2379
Annual Cost $ x 10^{-3}							
Capital	47.44	7.44	29.33	2.25	9.31	6.55	102.32
Depreciation	110.33	17.31	68.20	5.24	21.66	15.23	237.97
Operation & Maintenance	38.62	6.06	23.87	1.83	7.58	5.33	83.29
Energy & Power (1)	26.84	2.91	2.24	0.45	3.58	8.39	44.41
Chemical Cost	-	61.93	-	25.20	-	-	87.13
Sludge Disposal	49.55	-	-	-	23.60	-	73.15
TOTAL	272.78	95.65	123.64	34.97	65.73	35.50	628.27

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.064	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.11	-
064 Pentachlorophenol	0.10	-
065 Phenol	1.01	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo(a)anthracene	0.018	-
076 Chrysene	0.017	-
077 Acenaphthylene	0.045	-
080 Fluorene	0.13	-
081 Phenanthrene	0.075	-
084 Pyrene	0.24	-
085 Tetrachloroethylene	0.061	-
114 Antimony	0.99	-

TABLE VIII-80
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Concentrations, mg/l	Raw Waste Level	Effluent Level
115 Arsenic	0.11	-
118 Cadmium	0.78	-
119 Chromium	0.29	-
120 Copper	4.32	-
122 Lead	110	-
124 Nickel	1.62	-
128 Zinc	2200	-
Ammonia (N)	13	-
Fluoride	74	-
Iron	230	-
Manganese	170	-
Phenols (4AAP)	1.91	-
Sulfide	5.31	-
Oil and Grease	23	-
TSS	3120	-
pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Caustic Addition
C: Clarifier
D: Coagulant Aid Addition
E: Vacuum Filter
F: Recycle 100%

TABLE VIII-81

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Gray Iron
: Melting Furnace Scrubber and Slag Quench Co-Treatment
: <250 employees

Model: Size-TPD: 91
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A	B	C	D	E	F	Total
Investment $ x 10^{-3}	84	50	139	27	100	40	440
Annual Cost $ x 10^{-3}							
Capital	3.62	2.16	5.98	1.15	4.31	1.70	18.92
Depreciation	8.42	5.03	13.91	2.68	10.02	3.96	44.02
Operation & Maintenance	2.95	1.76	4.87	0.94	3.51	1.39	15.42
Energy & Power[1]	1.12	0.15	0.56	0.08	0.41	0.37	2.69
Chemical Cost	-	2.17	-	0.90	-	-	3.07
Sludge Disposal	1.73	-	-	-	0.82	-	2.55
TOTAL	17.84	11.27	25.32	5.75	19.07	7.42	86.67

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.064	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.11	-
064 Pentachlorophenol	0.10	-
065 Phenol	1.01	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo(a)anthracene	0.018	-
076 Chrysene	0.017	-
077 Acenaphthylene	0.045	-
080 Fluorene	0.13	-
081 Phenanthrene	0.075	-

TABLE VIII-81
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Concentrations, mg/l	Raw Waste Level	Effluent Level
084 Pyrene	0.24	-
085 Tetrachloroethylene	0.061	-
114 Antimony	0.99	-
115 Arsenic	0.11	-
118 Cadmium	0.78	-
119 Chromium	0.29	-
120 Copper	4.32	-
122 Lead	110	-
124 Nickel	1.62	-
128 Zinc	2200	-
Ammonia (N)	13	-
Fluoride	74	-
Iron	230	-
Manganese	170	-
Phenols (4AAP)	1.91	-
Sulfide	5.31	-
Oil and Grease	23	-
TSS	3120	-
pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Caustic Addition
C: Clarifier
D: Coagulant Aid Addition
E: Vacuum Filter
F: Recycle 100%

TABLE VIII-82

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Gray Iron
: Melting Furnace Scrubber and Slag Quench Co-Treatment
: ≥250 employees

Model: Size-TPD: 480
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	A	B	C	D	E	F	Total
Investment $ x 10^{-3}	269	80	258	34	130	64	835
Annual Cost $ x 10^{-3}							
Capital	11.57	3.46	11.12	1.44	5.61	2.74	35.94
Depreciation	26.91	8.04	25.85	3.35	130.5	6.36	83.56
Operation & Maintenance	9.42	2.82	9.05	1.17	4.57	2.23	29.26
Energy & Power(1)	5.03	0.62	1.12	0.17	2.05	1.68	10.67
Chemical Cost	-	11.40	-	4.68	-	-	16.08
Sludge Disposal	9.11	-	-	-	4.34	-	13.45
TOTAL	62.04	26.34	47.14	10.81	29.62	13.01	188.96

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.064	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.11	-
064 Pentachlorophenol	0.10	-
065 Phenol	1.01	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo(a)anthracene	0.018	-
076 Chrysene	0.017	-
077 Acenaphthylene	0.045	-
080 Fluorene	0.13	-
081 Phenanthrene	0.075	-

TABLE VIII-82
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Concentrations, mg/l	Raw Waste Level	Effluent Level
084 Pyrene	0.24	-
085 Tetrachloroethylene	0.061	-
114 Antimony	0.99	-
115 Arsenic	0.11	-
118 Cadmium	0.78	-
119 Chromium	0.29	-
120 Copper	4.32	-
122 Lead	110	-
124 Nickel	1.62	-
128 Zinc	2200	-
Ammonia (N)	13	-
Fluoride	74	-
Iron	230	-
Manganese	170	-
Phenols (4AAP)	1.91	-
Sulfide	5.31	-
Oil and Grease	23	-
TSS	3120	-
pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Caustic Addition
C: Clarifier
D: Coagulant Aid Addition
E: Vacuum Filter
F: Recycle 100%

TABLE VIII-83

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Ferrous Foundry	Model: Size-TPD:	95
:	Malleable Iron	Oper. Days/Yr. :	250
:	Melting Furnace Scrubber and Slag Quench Co-Treatment	Turns/Day :	2
:	<250 employees		

C&TT Step	A	B	C	D	E	F	Total
Investment $ x 10^{-3}	86	50	139	27	100	40	442
Annual Cost $ x 10^{-3}							
Capital	3.72	2.16	5.98	1.15	4.31	1.70	19.02
Depreciation	8.64	5.03	13.91	2.68	10.02	3.96	44.24
Operation & Maintenance(1)	3.02	1.76	4.87	0.94	3.51	1.39	15.49
Energy & Power	1.12	0.15	0.56	0.08	0.41	0.37	2.69
Chemical Cost	-	2.25	-	0.94	-	-	3.19
Sludge Disposal	1.80	-	-	-	0.86	-	2.66
TOTAL	18.30	11.35	25.32	5.79	19.11	7.42	87.29

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.064	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.11	-
064 Pentachlorophenol	0.10	-
065 Phenol	1.01	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo(a)anthracene	0.0[illegible]8	-
076 Chrysene	0.01[illegible]	-
077 Acenaphthylene	0.045	-
080 Fluorene	0.13	-
081 Phenanthrene	0.075	-
084 Pyrene	0.24	-
085 Tetrachloroethylene	0.061	-
114 Antimony	0.99	-

TABLE VIII-83
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Concentrations, mg/l	Raw Waste Level	Effluent Level
115 Arsenic	0.11	-
118 Cadmium	0.78	-
119 Chromium	0.29	-
120 Copper	4.32	-
122 Lead	110	-
124 Nickel	1.62	-
128 Zinc	2200	-
Ammonia (N)	13	-
Fluoride	74	-
Iron	230	-
Manganese	170	-
Phenols (4AAP)	1.91	-
Sulfide	5.31	-
Oil and Grease	23	-
TSS	3120	-
pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Caustic Addition
C: Clarifier
D: Coagulant Aid Addition
E: Vacuum Filter
F: Recycle 100%

TABLE VIII-84

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Ferrous Foundry
: Malleable Iron
: Melting Furnace Scrubber and Slag Quench Co-Treatment
: ≥250 employees

Model: Size-TPD: 195
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A	B	C	D	E	F	Total
Investment $ x 10^{-3}	157	60	202	27	130	48	624
Annual Cost $ x 10^{-3}							
Capital	6.74	2.60	8.67	1.18	5.61	2.08	26.88
Depreciation	15.68	6.05	20.16	2.74	13.05	4.83	62.51
Operation & Maintenance	5.49	2.12	7.06	0.96	4.57	1.69	21.89
Energy & Power(1)	2.24	0.26	0.75	0.11	1.00	0.75	5.11
Chemical Cost	-	4.64	-	1.89	-	-	6.53
Sludge Disposal	3.70	-	-	-	1.76	-	5.46
TOTAL	33.85	15.67	36.64	6.88	25.99	9.35	128.38

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1300	0
Concentrations, mg/l		
024 2-chlorophenol	0.018	-
031 2,4-dichlorophenol	0.020	-
034 2,4-dimethylphenol	0.064	-
039 Fluoranthene	0.025	-
059 2,4-dinitrophenol	0.017	-
060 4,6-dinitro-o-cresol	0.025	-
062 N-nitrosodiphenylamine	0.11	-
064 Pentachlorophenol	0.10	-
065 Phenol	1.01	-
067 Butyl benzyl phthalate	0.035	-
072 Benzo(a)anthracene	0.018	-
076 Chrysene	0.017	-
077 Acenaphthylene	0.045	-
080 Fluorene	0.13	-
081 Phenanthrene	0.075	-
084 Pyrene	0.24	-
085 Tetrachloroethylene	0.061	-
114 Antimony	0.99	-

TABLE VIII-84
BPT/NSPS/PSES/PSNS MODEL COST DATA
PAGE 2

Concentrations, mg/l	Raw Waste Level	Effluent Level
115 Arsenic	0.11	-
118 Cadmium	0.78	-
119 Chromium	0.29	-
120 Copper	4.32	-
122 Lead	110	-
124 Nickel	1.62	-
128 Zinc	2200	-
Ammonia (N)	13	-
Fluoride	74	-
Iron	230	-
Manganese	170	-
Phenols (4AAP)	1.91	-
Sulfide	5.31	-
Oil and Grease	23	-
TSS	3120	-
pH (Units)	4-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Caustic Addition
C: Clarifier
D: Coagulant Aid Addition
E: Vacuum Filter
F: Recycle 100%

TABLE VIII-85

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Lead Foundry
: Continuous Strip Casting

Model: Size-TPD: 20
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A	B	Total
Investment $ x 10^{-3}	16	38	54
Annual Cost $ x 10^{-3}			
Capital	0.68	1.62	2.30
Depreciation	1.58	3.78	5.36
Operation & Maintenance	0.55	1.32	1.87
Energy & Power[(1)]	0.22	0.11	0.33
Chemical Cost	0.01	-	0.01
TOTAL	3.04	6.83	9.87

Wastewater Parameters	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	54.4	54.4
Concentrations, mg/l		
120 Copper	0.05	0.05
122 Lead	0.85	0.12
128 Zinc	0.015	0.015
Oil and Grease	<5	<5
TSS	5	5
pH (Units)	6-9	7.5-10

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Lime Addition
B: Clarifier

TABLE VIII-86

BAT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Lead Foundry
: Continuous Strip Casting

Model: Size-TPD: 20
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	Alternative No. 1 C	Alternative No. 1 Total	Alternative No. 2 D	Alternative No. 2 C	Alternative No. 2 Total
Investment $ x 10^{-3}	56	56	16	56	72
Annual Cost $ x 10^{-3}					
Capital	2.40	2.40	0.69	2.40	3.09
Depreciation	5.56	5.56	1.61	5.56	7.17
Operation & Maintenance	1.96	1.96	0.56	1.96	2.52
Energy & Power (1)	0.15	0.15	0.11	0.15	0.26
TOTAL	10.07	10.07	2.97	10.07	13.04

Wastewater Parameters	BPT Effluent Level	Alt. No. 1 Effluent Level	Alt. No.2 Effluent Level
Flow, gal/ton	54.4	54.4	0
Concentrations, mg/l			
120 Copper	0.05	0.05	-
122 Lead	0.12	0.08	-
128 Zinc	0.015	0.015	-
Oil and Grease	<5	<5	-
TSS	5	3	-
pH (Units)	7.5-10	7.5-1.0	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

C: Filter
D: Recycle 100%

KEY TO TREATMENT ALTERNATIVES

PSES-1 = BPT
PSES-2 = BPT + BAT-1
PSES-3/NSPS/PSNS = BPT + BAT-2

TABLE VIII-87

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Lead Foundry
: Grid Casting

Model: Size-TPD: 20
Oper. Days/Yr. : 250
Turns/Day : 2

C&TT Step	A	B	C	Total
Investment $ x 10^{-3}	16	38	16	70
Annual Cost $ x 10^{-3}				
Capital	0.68	1.62	0.69	2.99
Depreciation	1.58	3.78	1.61	6.97
Operation & Maintenance	0.55	1.32	0.56	2.43
Energy & Power(1)	0.22	0.11	0.11	0.44
Chemical Cost	0.01	-	-	0.01
TOTAL	3.04	6.83	2.97	12.84

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	54.4	0
Concentrations, mg/l		
120 Copper	0.05	-
122 Lead	0.85	-
128 Zinc	0.015	-
Oil and Grease	<5	-
TSS	5	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Lime Addition
B: Clarifier
C: Recycle 100%

TABLE VIII-88

BPT/NSPS/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Magnesium Foundry
: Grinding Scrubbers

Model: Size-TPD: 0.5
Oper. Days/Yr. : 250
Turns/Day : 1

C&TT Step	A(2)	B	Total
Investment $ x 10^{-3}	9	15	24
Annual Cost $ x 10^{-3}			
Capital	0.38	0.65	1.03
Depreciation	0.89	1.50	2.39
Operation & Maintenance	0.31	0.53	0.84
Energy & Power(1)	-	0.04	0.04
TOTAL	1.58	2.72	4.30

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	1600	0
Concentrations, mg/l		
128 Zinc	1.20	-
Manganese	0.30	-
Oil and Grease	5	-
TSS	38	-
pH (Units)	6-10	-

(1) Costs are all power unless otherwise noted.
(2) Any solids which may accumulate are recovered and reused.

KEY TO C&TT STEPS

A: Settling Tank
B: Recycle 100%

TABLE VIII-89

BPT/NSPS/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Magnesium Foundry
: Dust Collection

Model: Size-TPD: 100
Oper. Days/Yr. : 250
Turns/Day : 1

C&TT Step	A	B	Total
Investment $ x 10^{-3}	17	16	33
Annual Cost $ x 10^{-3}			
Capital	0.72	0.71	1.43
Depreciation	1.67	1.64	3.31
Operation & Maintenance	0.59	0.57	1.16
Energy & Power[(1)]	0.08	0.02	0.10
TOTAL	3.06	2.94	6.00

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	22	0
Concentrations, mg/l		
128 Zinc	0.36	-
Phenols (4AAP)	1.12	-
Sulfide	12	-
Oil and Grease	11	-
TSS	25	-
pH (Units)	6-9	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Dragout Tank
B: Recycle 100%

TABLE VIII-90

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Zinc Foundry	Model: Size-TPD:	12
:	Die Casting and Casting Quench Operations	Oper. Days/Yr. :	250
		Turns/Day :	3
:	<50 employees		

C&TT Steps	A	B	C	Total
Investment $ x 10^{-3}	4	4	12	20
Annual Cost $ x 10^{-3}				
Capital	0.18	0.18	0.50	0.86
Depreciation	0.41	0.41	1.15	1.97
Operations & Maintenance	0.14	0.14	0.40	0.68
Energy & Power[1]	-	0.06	0.06	0.12
Sludge Disposal	0.09	-	-	0.09
Oil Disposal	-	-	-	-
TOTAL	0.82	0.79	2.11	3.72

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	40	0
Concentrations, mg/l		
021 2,4,6-trichlorophenol	0.375	-
022 Parachlorometacresol	1.88	-
084 Pyrene	0.065	-
085 Tetrachloroethylene	0.780	-
122 Lead	3.9	-
128 Zinc	132	-
Manganese	1.8	-
Phenols (4AAP)	2.15	-
Sulfide	5.2	-
Oil and Grease	24000	-
TSS	9800	-
pH (Units)	6-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Settling Tank
B: Skimmer
C: Recycle 100%

TABLE VIII-91

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Zinc Foundry	Model: Size-TPD:	73
:	Die Casting and Casting Quench Operations	Oper. Days/Yr. :	250
		Turns/Day :	3
:	50 to 249 employees		

C&TT Steps	A	B	C	Total
Investment $ x 10^{-3}	10	5	15	30
Annual Cost $ x 10^{-3}				
Capital	0.41	0.19	0.63	1.23
Depreciation	0.95	0.45	1.47	2.87
Operations & Maintenance	0.33	0.16	0.52	1.01
Energy & Power (1)	-	0.08	0.11	0.19
Sludge Disposal	0.57	-	-	0.57
Oil Disposal	-	0.01	-	0.01
TOTAL	2.26	0.89	2.73	5.88

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	40	0
Concentrations, mg/l		
021 2,4,6-trichlorophenol	0.375	-
022 Parachlorometacresol	1.88	-
084 Pyrene	0.065	-
085 Tetrachloroethylene	0.780	-
122 Lead	3.9	-
128 Zinc	132	-
Manganese	1.8	-
Phenols (4AAP)	2.15	-
Sulfide	5.2	-
Oil and Grease	24000	-
TSS	9800	-
pH (Units)	6-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Settling Tank
B: Skimmer
C: Recycle 100%

TABLE VIII-92

BPT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Zinc Foundry	Model: Size-TPD:	37
:	Die Casting and Casting Quench Operations	Oper. Days/Yr. :	250
		Turns/Day :	3
:	≥250 employees		

C&TT Steps	A	B	C	Total
Investment $ x 10^{-3}	6	4	13	23
Annual Cost $ x 10^{-3}				
Capital	0.26	0.18	0.56	1.00
Depreciation	0.60	0.41	1.31	2.32
Operations & Maintenance	0.21	0.14	0.46	0.81
Energy & Power (1)	-	0.06	0.06	0.12
Sludge Disposal	0.29	-	-	0.29
Oil Disposal	-	-	-	-
TOTAL	1.36	0.79	2.39	4.54

Wastewater Parameters	Raw Waste Level	Effluent Level
Flow, gal/ton	40	0
Concentrations, mg/l		
021 2,4,6-trichlorophenol	0.375	-
022 Parachlorometacresol	1.88	-
084 Pyrene	0.065	-
085 Tetrachloroethylene	0.780	-
122 Lead	3.9	-
128 Zinc	132	-
Manganese	1.8	-
Phenols (4AAP)	2.15	-
Sulfide	5.2	-
Oil and Grease	24000	-
TSS	9800	-
pH (Units)	6-8	-

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Settling Tank
B: Skimmer
C: Recycle 100%

TABLE VIII-93

BPT MODEL COSTS DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Zinc Foundry	Model: Size-TPD:	88
:	Melting Furnace	Oper. Days/Yr. :	250
:	Scrubber Operations	Turns/Day :	3

C&TT Steps	A	B	C	D	E	F	G	H	Total
Investment $ x 10^{-3}	36	42	43	43	46	27	86	121	444
Annual Cost $ x 10^{-3}									
Capital	1.55	1.79	1.83	1.87	1.96	1.17	3.71	5.18	19.06
Depreciation	3.61	4.16	4.26	4.34	4.56	2.71	8.63	12.05	44.32
Operation & Maintenance	1.26	1.46	1.49	1.52	1.60	0.95	3.02	4.22	15.52
Energy & Power(1)	0.22	0.11	0.11	0.45	0.45	0.11	0.22	0.78	2.45
Chemical Cost	1.93	0.36	-	0.48	70.00	0.50	-	-	73.27
Oil Disposal	-	-	0.90	-	-	-	-	-	0.90
Sludge Disposal	-	-	-	-	-	-	-	2.14	2.14
TOTAL	8.57	7.88	8.59	8.66	78.57	5.44	15.58	24.37	157.66

Wastewater Parameters	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	755	755
Concentrations, mg/l		
021 2,4,6-trichlorophenol	1.28	0.100
022 Parachlorometacresol	0.085	0.050
031 2,4-dichlorophenol	1.19	0.050
034 2,4-dimethylphenol	4.03	4.03
055 Naphthalene	1.51	0.050
065 Phenol	14.6	0.100
067 Butyl benzyl phthalate	0.075	0.075
128 Zinc	17.2	0.30
Phenols (4AAP)	84	5.0
Oil and Grease	700	10
TSS	400	12
pH (Units)	4.5-6.0	7.5-10

(1) Costs are all power unless otherwise noted.

KEY TO C&TT STEPS

A: Alum Addition
B: Sulfuric Acid Addition
C: Inclined Plate Separator
D: Lime Addition
E: Potassium Permanganate Addition
F: Coagulant Aid Addition
G: Clarifier
H: Vacuum Filter

TABLE VIII-94

BAT/NSPS/PSES/PSNS MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Zinc Foundry : Melting Furnace Scrubber Operations

Model: Size-TPD: 88
Oper. Days/Yr. : 250
Turns/Day : 3

C&TT Step	Alternative No. 1		Alternative No. 2				Alternative No. 3
	I	Total	J	K	L	Total	M
Investment $ x 10^{-3}	37	37	22	137	261	420	0
Annual Cost $ x 10^{-3}							
Capital	1.57	1.57	0.94	5.89	11.24	18.07	-
Depreciation	3.66	3.66	2.18	13.70	26.13	42.01	-
Operation & Maintenance	1.28	1.28	0.76	4.80	9.15	14.71	-
Energy & Power (1)	0.22	0.22	0.17	0.34	0.11	0.62	-
Chemical Cost	-	-	6.53	-	-	6.53	-
Carbon Regeneration	-	-	-	-	216.00	216.00	-
Sludge Disposal	-	-	-	0.03	-	0.03	-
TOTAL	6.73	6.73	10.58	24.76	262.63	297.97	0
Credit-BPT Potassium Permanganate (2)						- 70.00	
						227.97	

Wastewater Parameters	BPT Effluent Level	Alt. No. 1 Effluent Level	Alt. No. 2 Effluent Level	Alt. No. 3 Effluent Level
Flow, gal/ton	755	0	755	0
Concentrations, mg/l				
021 2,4,6-trichlorophenol	0.100	-	0.025	-
022 Parachlorometacresol	0.050	-	0.050	-
031 2,4-dichlorophenol	0.050	-	0.050	-
034 2,4-dimethylphenol	4.03	-	0.050	-
055 Naphthalene	0.050	-	0.050	-
065 Phenol	0.100	-	0.050	-
067 Butyl benzyl phthalate	0.075	-	0.010	-
128 Zinc	0.30	-	0.23	-
Phenols (4AAP)	5.0	-	0.05	-
Oil and Grease	10	-	5	-
TSS	12	-	3	-
pH (Units)	7.5-10	-	7.5-10	-

(1) Costs are all power unless otherwise noted.
(2) Addition of potassium permanganate utilized in BPT/NSPS/PSES/PSNS no longer required with addition of steps J, K, and L.

KEY TO C&TT STEPS

I: Recycle 100% of Treated Effluent
J: Sulfide Addition
K: Filter
L: Activated Carbon Adsorption
M: Tighten Scrubber Internal Recycle Rate to 100%

KEY TO TREATMENT ALTERNATIVES

NSPS-1/PSES-1/PSNS-1 = BPT
NSPS-2/PSES-2/PSNS-2 = BPT + BAT-1
NSPS-3/PSES-3/PSNS-3 = BPT + BAT-2
NSPS-4/PSES-4/PSNS-4 = BPT + BAT-3

TABLE VIII-95

PROCEDURE FOR DETERMINING INDUSTRY WIDE TREATMENT COSTS FOR EACH PROCESS

Number of wet foundries, in the employee group/s, employing the particular process or process combination	×	Percentage of plants with or requiring the model treatment component	×	The cost of the model treatment component	=	Cost of the particular treatment step to the foundry industry

The cost of the various treatment stages are then added together for each model.

TABLE VIII-96
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
ALUMINUM SUBCATEGORY
DIRECT DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Investment Casting	-	12	0	BPT	248	44.7	1708	307.1
				BAT No. 1	0	0	396	71.3
				BAT No. 2	0	0	1404	252.4
Casting Quench	<50	2	0	BPT	0	0	52	9.6
	≥50	6	2	BPT	168	22.3	144	27.8
Die Casting	-	2	0	BPT	728	146.2	414	82.6
				BAT No. 1	0	0	20	4.0
				BAT No. 2	92	84.5	194	177.9
				BAT No. 3	92	84.5	214	181.9
Melting Furnace Scrubber and Die Casting	-	4	0	BPT	2004	386.3	1332	266.0
				BAT No. 1	132	24.1	164	30.0
				BAT No. 2	0	0	572	524.9
				BAT No. 3	20	4.0	592	528.9
Melting Furnace Scrubber and Casting Quench	≥50	2	0	BPT	226	41.0	352	64.8
				BAT No. 1	0	0	144	26.0
				BAT No. 2	0	0	0	0
				BPT	3374	640.5	4002	757.9
				BAT No. 1	132	24.1	724	131.3
				BAT No. 2	92	84.5	2170	955.2
				BAT No. 3	112	88.5	806	710.8

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-97
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
ALUMINUM SUBCATEGORY
POTW DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Investment Casting	-	10	0	PSES No. 1	810	145.0	820	148.1
				PSES No. 2	0	0	330	59.4
				PSES No. 3	0	0	1170	210.3
Melting Furnace Scrubber	-	0	3	PSES No. 1	354	0	0	0
				PSES No. 2	23	0	0	0
				PSES No. 3	0	0	0	0
Casting Quench	<50	1	9	PSES	69	0	26	4.8
	≥50	20	0	PSES	420	74.2	480	92.6
Die Casting	-	4	0	PSES No. 1	846	168.0	1514	305.7
				PSES No. 2	0	0	40	7.9
				PSES No. 3	0	0	572	524.9
				PSES No. 4	0	0	612	532.8
Die Lube	-	4	0	PSES	0	0	404	73.2
Casting Quench and Die Casting	<50	2	0	PSES	0	0	466	84.0
	≥50	2	0	PSES	179	34.5	671	128.3
Casting Quench, Die Casting, and Die Lube	≥50	2	0	PSES	0	0	1172	210.8
				PSES No. 1	2678	421.7	5553	1047.5
				PSES No. 2	23	0	370	67.3
				PSES No. 3	0	0	1742	735.2
				PSES No. 4	0	0	612	532.8

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-98
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
ALUMINUM SUBCATEGORY
ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Casting Quench	<50	31	0	BPT	248	44.6	0	0
Die Lube	-	2	0	BPT	322	58.0	0	0
				BPT	570	102.6	0	0

TABLE VIII-99
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
COPPER SUBCATEGORY
DIRECT DISCHARGES

Process(es)	Employee Group	Number of Plants		Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1)		Expenditures For Required Equipment ($ X 10^{-3})	
		Active	Shutdown or Changed Operation		Investment	Annual	Investment	Annual
Dust Collection	-	11	0	BPT	517	103.6	352	64.5
Mold Cooling and Casting Quench	-	16	0	BPT	688	123.5	736	143.1
Dust Collection and Mold Cooling and Casting Quench	-	2	0	BPT	180	34.2	156	29.6
				BPT	1385	261.3	1244	237.2

TABLE VIII-100
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
COPPER SUBCATEGORY
POTW DISCHARGES

Process(es)	Employee Group	Number of Plants		Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})[(1)]		Expenditures For Required Equipment ($ X 10^{-3})	
		Active	Shutdown or Changed Operation		Investment	Annual	Investment	Annual
Mold Cooling and Casting Quench	-	21	3	PSES No. 1	152	29.4	1574	294.6

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-101
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
COPPER SUBCATEGORY
ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants		Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})		Expenditures For Required Equipment ($ X 10^{-3})	
		Active	Shutdown or Changed Operation		Investment	Annual	Investment	Annual
Dust Collection	-	28	0	BPT	142	28.5	0	0

TABLE VIII-102
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (DUCTILE IRON) SUBCATEGORY
DIRECT DISCHARGES

Process(es)	Employee Group	Number of Plants		Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})		Expenditures For Required Equipment ($ X 10^{-3})	
		Active	Shutdown or Changed Operation		Investment	Annual	Investment	Annual
Mold Cooling and Casting Quench	≥250	1	0	BPT	87	24.0	93	18.6
Dust Collection and Slag Quench	≥250	2	0	BPT	1058	339.0	200	42.2
Dust Collection, Melting Furnace Scrubber, and Slag Quench	≥250	3	0	BPT	6716	2553.3	804	254.3
Dust Collection and Mold Cooling and Casting Quench	≥250	2	0	BPT	307	386.1	328	72.2
Dust Collection, Melting Furnace Scrubber, Slag Quench, and Mold Cooling and Casting Quench	≥250	1	0	BPT	2317	913.1	300	65.1
Melting Furnace Scrubber and Mold Cooling and Casting Quench	≥250	1	0	BPT	773	172.4	705	321.9
Melting Furance Scrubber, Slag Quench, and Mold Cooling and Casting Quench	50-249	2	0	BPT	2424	487.2	372	69.5
				BPT	13682	4875.1	2802	843.8

TABLE VIII-103
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (DUCTILE IRON) SUBCATEGORY
POTW DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	<50	10	0	PSES	0	0	190	33.9
	50-249	3	0	PSES	84	113.9	87	16.4
	≥250	1	0	PSES	0	0	55	11.0
Melting Furnace Scrubber	50-249	0	1	PSES	391	0	0	0
Dust Collection and Slag Quench	50-249	1	0	PSES	0	0	170	35.2
Dust Collection, Slag Quench, and Mold Cooling and Casting Quench	50-249	1	0	PSES	259	53.9	94	17.5
				PSES	734	167.8	596	114.0

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-104
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (DUCTILE IRON) SUBCATEGORY
ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	<50	1	0	BPT	0	0	0	0
	50-249	1	0	BPT	86	82.2	0	0
	≥250	1	0	BPT	0	0	0	0
Melting Furnace Scrubber	50-249	8	0	BPT	0	0	0	0
Slag Quench	≥250	1	0	BPT	377	76.2	0	0
Dust Collection and Melting Furnace Scrubber	≥250	2	(2)	BPT	840	393.4	0	0
Melting Furnace Scrubber, Slag Quench, and Mold Cooling and Casting Quench	≥250	1	0	BPT	1283	315.4	0	0
Melting Furnace Scrubber and Slag Quench	≥250	1	0	BPT	1937	431.9	0	0
				BPT	4523	1299.1	0	0

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

(2) At one of the two plants, the melting furnace operation has been converted to dry air pollution controls.

TABLE VIII-105
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (GRAY IRON) SUBCATEGORY
DIRECT DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	<50	3	0	BPT	133	64.5	26	12.8
	50-249	10	0	BPT	103	83.6	116	93.1
	≥250	12	0	BPT	3203	5387.6	740	136.6
Melting Furnace Scrubber	<50	9	0	BPT	0	0	0	0
	≥50	24	0	BPT	593	108.8	1349	247.9
Mold Cooling and Casting Quench	<250	1	7	BPT	580	0	172	39.5
	≥250	8	0	BPT	155	42.7	1277	295.7
Dust Collection and Melting Furnace Scrubber	50-249	8	0	BPT	0	0	432	80.0
Dust Collection, Melting Furnace Scrubber, and Slag Quench	<50	9	0	BPT	1656	467.8	1017	187.1
	50-249	9	0	BPT	0	0	756	160.6
	≥250	25	0	BPT	13394	9527.8	7586	1673.0
Dust Collection, Melting Furnace Scrubber, Slag Quench, and Sand Washing	≥250	1	0	BPT	1830	468.2	572	132.4
Dust Collection and Slag Quench	<250	8	0	BPT	0	0	1256	337.7
	≥250	1	0	BPT	258	99.7	76	15.2
Dust Collection, Slag Quench, and Mold Cooling and Casting Quench	≥250	3	0	BPT	1201	403.9	338	67.5
Dust Collection, Slag Quench and Sand Washing	≥250	2	0	BPT	2574	709.4	996	197.6
Melting Furnace Scrubber and Slag Quench	≥250	2	0	BPT	796	171.2	630	139.8
Melting Furnace Scrubber, Slag Quench, and Mold Cooling and Casting Quench	50-249	1	0	BPT	346	72.1	89	17.9
Dust Collection and Mold Cooling and Casting Quench	50-249	1	0	BPT	119	96.0	172	39.5
				BPT	26941	17703.3	17600	3873.9

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-106
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (GRAY IRON) SUBCATEGORY
POTW DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	<50	11	0	PSES	231	63.4	62	30.3
	50-249	1	0	PSES	0	0	119	96.0
	>250	3	0	PSES	409	618.3	165	234.8
Melting Furnace Scrubber	<50	17	0	PSES	782	141.6	1938	353.6
Mold Cooling and Casting Quench	<250	1	0	PSES	0	0	172	39.5
Dust Collection and Melting Furnace Scrubber	<50	8	0	PSES	176	32.0	0	0
	50-249	18	0	PSES	4530	1857.8	3421	788.8
	>250	2	0	PSES	75	13.6	133	25.3
Dust Collection, Melting Furnace Scrubber, and Slag Quench	50-249	10	8	PSES	1620	66.6	532	100.2
	>250	23	1	PSES	5177	5788.1	11467	2602.8
Dust Collection, Melting Furnace Scrubber, Slag Quench, and Sand Washing	>250	1	0	PSES	1693	442.8	709	157.8
Dust Collection and Slag Quench	<250	9	0	PSES	147	43.3	954	277.7
Melting Furnace Scrubber and Slag Quench	50-249	9	0	PSES	2400	481.4	292	56.7
	>250	1	0	PSES	641	146.2	194	42.6
Melting Furnace Scrubber, Slag Quench, and Mold Cooling and Casting Quench	>250	0	1	PSES	677	0	0	0
Dust Collection and Sand Washing	>250	1	0	PSES	1080	315.7	487	85.8
				PSES	19,638	10,010.8	20,645	4891.9

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-107
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (GRAY IRON) SUBCATEGORY
ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	<50	10	0	BPT	530	257.9	0	0
	50-249	33	0	BPT	302	243.9	0	0
	≥250	7	1	BPT	1514	146.9	0	0
Melting Furnace Scrubber	<50	36	0	BPT	861	154.3	0	0
	≥50	39	0	BPT	3415	645.7	0	0
Slag Quench	≥250	8	0	BPT	336	63.7	0	0
Dust Collection and Melting Furnace Scrubber	50-249	18	0	BPT	936	497.7	0	0
	≥250	12	9	BPT	13397	5300.8	0	0
Dust Collection, Melting Furnace Scrubber, and Slag Quench	50-249	1	0	BPT	377	96.0	0	0
	≥250	1	0	BPT	322	60.1	0	0
Dust Collection and Slag Quench	<250	9	0	BPT	1062	313.6	0	0
	≥250	1	0	BPT	334	115.2	0	0
Melting Furnace Scrubber and Slag Quench	50-249	8	0	BPT	2048	398.1	0	0
Dust Collection and Mold Cooling and Casting Quench	50-249	1	0	BPT	83	21.6	0	0
Dust Collection, Melting Furnace Scrubber, and Sand Washing	≥250	1	0	BPT	2646	724.9	0	0
				BPT	28,163	9040.4	0	0

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-108
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (MALLEABLE IRON) SUBCATEGORY
DIRECT DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Investment	Expenditures For Equipment In-Place ($ X 10^{-3})(1): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	50-249	10	0	BPT	223	183.6	887	624.6
	$\geq$250	2	0	BPT	583	871.1	73	14.7
Dust Collection and Melting Furnace Scrubber	$\geq$250	1	0	BPT	649	428.6	71	14.3
Dust Collection and Slag Quench	50-249	1	0	BPT	0	0	180	51.5
				BPT	1455	1483.3	1211	705.1

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-109
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (MALLEABLE IRON) SUBCATEGORY
POTW DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	50-249	2	0	PSES	0	0	222	161.7
Slag Quench	50-249	3	0	PSES	0	0	120	22.7
Dust Collection, Melting Furnace Scrubber, and Slag Quench	≥250	1	0	PSES	328	442.9	157	33.8
				PSES	328	442.9	499	218.2

TABLE VIII-110
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (MALLEABLE IRON) SUBCATEGORY
ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	50-249	18	0	BPT	234	170.2	0	0
	≥250	5	0	BPT	828	1118.3	0	0
Dust Collection and Mold Cooling and Casting Quench	≥250	1	0	BPT	412	460.4	0	0
Dust Collection and Melting Furnace Scrubber	50-249	1	0	BPT	441	145.7	0	0
Dust Collection, Melting Furnace Scrubber, and Slag Quench	50-249	1	0	BPT	376	131.8	0	0
	≥250	1	0	BPT	735	522.6	0	0
				BPT	3026	2549.0	0	0

TABLE VIII-111
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS STEEL SUBCATEGORY
DIRECT DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	50-249	1	0	BPT	40	43.0	23	4.4
	≥250	2	0	BPT	244	275.9	0	0
Mold Cooling and Casting Quench	50-249	16	0	BPT	196	46.3	437	82.3
	≥250	26	0	BPT	0	0	2600	537.9
Dust Collection, Sand Washing, and Mold Cooling and Casting Quench	≥250	2	0	BPT	474	91.2	2732	746.8
				BPT	954	456.4	5792	1371.4

TABLE VIII-112
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS (STEEL) SUBCATEGORY
POTW DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^3): Investment	Expenditures For Equipment In-Place ($ X 10^3): Annual	Expenditures For Required Equipment ($ X 10^3): Investment	Expenditures For Required Equipment ($ X 10^3): Annual
Dust Collection	50-249	25	0	PSES	1575	1182.6	0	0
Mold Cooling and Casting Quench	50-249	13	0	PSES	562	106.0	278	56.7
	$\geq$250	7	0	PSES	124	28.3	434	88.1
Dust Collection and Mold Cooling and Casting Quench	$\geq$250	7	0	PSES	79	15.3	905	451.1
Dust Collection, Sand Washing, and Mold Cooling and Casting Quench	$\geq$250	4	0	PSES	2514	697.8	3954	990.7
				PSES	4854	2030.0	5571	1586.6

TABLE VIII-113
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
FERROUS STEEL SUBCATEGORY
ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Dust Collection	50-249	27	0	BPT	0	0	0	0
Mold Cooling and Casting Quench	<250	13	0	BPT	241	50.0	0	0
Dust Collection and Mold Cooling and Casting Quench	≥250	7	0	BPT	662	392.2	0	0
				BPT	903	442.2	0	0

TABLE VIII-114
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
LEAD SUBCATEGORY
POTW DISCHARGES

Process	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Continuous Strip Casting	-	5	0	PSES No. 1	270	49.4	0	0
				PSES No. 2	224	40.3	56	10.1
				PSES No. 3	256	46.2	104	19.0

TABLE VIII-115
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
MAGNESIUM SUBCATEGORY
DIRECT AND ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Grinding Scrubbers	-	1	0	BPT	0	0	0	0
Dust Collection and Grinding Scrubbers	-	6	0	BPT	102	18.4	240	43.4
				BPT	102	18.4	240	43.4

TABLE VIII-116
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
ZINC SUBCATEGORY
DIRECT DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Casting Quench	50-249	1	0	BPT	15	3.2	15	2.7
	≥250	1	0	BPT	10	2.2	13	2.4
Casting Quench and Melting Furnace Scrubber	50-249	10	0	BPT	433	88.2	391	156.6
				BAT No. 1	44	7.9	0	0
				BAT No. 2	0	0	496	339.1
				BAT No. 3	0	0	0	0
				BPT	458	93.6	419	161.7
				BAT No. 1	44	7.9	0	0
				BAT No. 2	0	0	496	339.1
				BAT No. 3	0	0	0	0

TABLE VIII-117
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
ZINC SUBCATEGORY
POTW DISCHARGES

Process(es)	Employee Group	Number of Plants: Active	Number of Plants: Shutdown or Changed Operation	Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3}): Investment	Expenditures For Equipment In-Place ($ X 10^{-3}): Annual	Expenditures For Required Equipment ($ X 10^{-3}): Investment	Expenditures For Required Equipment ($ X 10^{-3}): Annual
Casting Quench	<50	37	0	PSES	111	19.6	559	103.9
	50-249	19	0	PSES	297	62.4	170	30.7
	≥250	1	0	PSES	10	2.2	13	2.4
Casting Quench and Melting Furnace Scrubber	50-249	1	0	PSES No. 1	292	58.0	182	105.7
				PSES No. 2	37	6.7	0	0
				PSES No. 3	0	0	420	298.0
				PSES No. 4	0	0	0	0
	≥250	2	0	PSES No. 1	427	85.3	485	234.8
				PSES No. 2	39	7.1	35	6.4
				PSES No. 3	144	26.0	696	570.0
				PSES No. 4	0	0	0	0
				PSES No. 1	1,137	227.5	1,409	477.5
				PSES No. 2	76	13.8	35	6.4
				PSES No. 3	144	26.0	1,116	868.0
				PSES No. 4	0	0	0	0

TABLE VIII-118
METALS CASTING INDUSTRY
WASTEWATER TREATMENT COST (JULY 1978 DOLLARS) SUMMARY
ZINC SUBCATEGORY
ZERO DISCHARGES

Process(es)	Employee Group	Number of Plants		Level of Treatment	Expenditures For Equipment In-Place ($ X 10^{-3})(1)		Expenditures For Required Equipment ($ X 10^{-3})	
		Active	Shutdown or Changed Operation		Investment	Annual	Investment	Annual
Casting Quench	<50	8	0	BPT	128	23.5	0	0
	≥250	1	9	BPT	175	0	0	0
				BPT	303	23.5	0	0

(1) Investment expenditures for equipment in-place at shutdown or changed operations are included in the in-place investment totals.

TABLE VIII-119

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
ALUMINUM FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct	Discharge	POTW	Discharge	Zero	Discharge
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Investment Casting	Less than 10	0	0	0	0	0	0
	10 to 49	10	0	10	0	0	0
	50 to 249	2	0	0	0	0	0
	250 or more	0	0	0	0	0	0
Melting Furnace Scrubber	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	1	0	0
	50 to 249	0	0	0	2	0	0
	250 or more	0	0	0	0	0	0
Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	2	0	1	9	31	0
	50 to 249	4	0	16	0	0	0
	250 or more	2	2	4	0	0	0
Die Casting	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	2	0	4	0	0	0
	250 or more	0	0	0	0	0	0
Die Lube	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	4	0	2	0

TABLE VIII-119
STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
ALUMINUM FOUNDRIES
PAGE 2

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct	Discharge	POTW	Discharge	Zero	Discharge
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Casting Quench and Die Casting	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	2	0	0	0
	50 to 249	0	0	2	0	0	0
	250 or more	0	0	0	0	0	0
Melting Furnace Scrubber and Die Casting	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	2	0	0	0	0	0
	250 or more	2	0	0	0	0	0
Melting Furnace Scrubber and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	2	0	0	0	0	0
	250 or more	0	0	0	0	0	0
Casting Quench, Die Casting, and Die Lube	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	2	0	0	0
	250 or more	0	0	0	0	0	0

TABLE VIII-120

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
COPPER FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct Discharge		POTW Discharge		Zero Discharge	
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Dust Collection	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	8	0
	50 to 249	11	0	0	0	20	0
	250 or more	0	0	0	0	0	0
Mold Cooling and Casting Quench	Less than 10	5	0	4	0	0	0
	10 to 49	0	0	4	0	0	0
	50 to 249	11	0	0	0	0	0
	250 or more	0	0	13	3	0	0
Dust Collection, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	2	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	0	0	0	0

TABLE VIII-121

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (DUCTILE IRON) FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct Discharge		POTW Discharge		Zero Discharge	
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Dust Collection	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	10	0	1	0
	50 to 249	0	0	3	0	1	0
	250 or more	0	0	1	0	1	0
Melting Furnace Scrubber	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	1	8	0
	250 or more	0	0	0	0	0	0
Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	0	0	1	0
Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	1	0	0	0	0	0
Dust Collection and Melting Furnace Scrubber	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	0	0	2	0

TABLE VIII-121
STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (DUCTILE IRON) FOUNDRIES
PAGE 2

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct	Discharge	POTW	Discharge	Zero	Discharge
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Dust Collection and Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	1	0	0	0
	250 or more	2	0	0	0	0	0
Dust Collection, Melting Furnace Scrubbers, and Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	3	0	0	0	0	0
Dust Collection, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	2	0	0	0	0	0
Dust Collection Melting Furnace Scrubber, Slag Quench, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	1	0	0	0	0	0
Dust Collection, Slag Quench, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	1	0	0	0
	250 or more	0	0	0	0	0	0

TABLE VIII-121
STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (DUCTILE IRON) FOUNDRIES
PAGE 3

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct	Discharge	POTW	Discharge	Zero	Discharge
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Melting Furnace	Less than 10	0	0	0	0	0	0
Scrubber and Slag	10 to 49	0	0	0	0	0	0
Quench	50 to 249	0	0	0	0	0	0
	250 or more	0	0	0	0	1	0
Melting Furnace	Less than 10	0	0	0	0	0	0
Scrubber, and Mold	10 to 49	0	0	0	0	0	0
Cooling and Casting	50 to 249	0	0	0	0	0	0
Quench	250 or more	1	0	0	0	0	0
Melting Furnace	Less than 10	0	0	0	0	0	0
Scrubber, Slag Quench,	10 to 49	0	0	0	0	0	0
and Mold Cooling and	50 to 249	2	0	0	0	0	0
Casting Quench	250 or more	0	0	0	0	1	0

TABLE VIII-122

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (GRAY IRON) FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries: Direct Discharge		POTW Discharge		Zero Discharge	
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Dust Collection	Less than 10	0	0	0	0	0	0
	10 to 49	3	0	11	0	10	0
	50 to 249	10	0	1	0	33	0
	250 or more	12	0	3	0	7	1
Melting Furnace Scrubber	Less than 10	0	0	0	0	0	0
	10 to 49	9	0	17	0	36	0
	50 to 249	24	0	0	0	39	0
	250 or more	0	0	0	0	0	0
Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	8	0
	250 or more	0	0	0	0	0	0
Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	1	7	1	0	0	0
	250 or more	8	0	0	0	0	0
Dust Collection and Melting Furnace Scrubber	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	8	0	0	0
	50 to 249	8	0	18	0	18	0
	250 or more	0	0	2	0	12	9

TABLE VIII-122
STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (GRAY IRON) FOUNDRIES
PAGE 2

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct	Discharge	POTW	Discharge	Zero	Discharge
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Dust Collection, Melting Furnace Scrubber, and Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	9	0	0	0	0	0
	50 to 249	9	0	10	8	1	0
	250 or more	25	0	23	1	1	0
Dust Collection Melting Furnace Scrubber, Slag Quench, and Sand Washing	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	1	0	1	0	0	0
Dust Collection and Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	8	0	9	0	9	0
	250 or more	1	0	0	0	1	0
Dust Collection, Slag Quench, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	3	0	0	0	0	0
Dust Collection, Slag Quench, and Sand Washing	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	2	0	0	0	0	0

TABLE VIII-122
STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (GRAY IRON) FOUNDRIES
PAGE 3

Process Group	Employee Group	Statistically Determined Number of Wet Foundries: Direct Discharge – Active	Direct Discharge – Shutdown or changed Operation	POTW Discharge – Active	POTW Discharge – Shutdown or changed Operation	Zero Discharge – Active	Zero Discharge – Shutdown or changed Operation
Melting Furnace Scrubber and Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	9	0	8	0
	250 or more	2	0	1	0	0	0
Melting Furnace Scrubber, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	1	0	0	0	0	0
	250 or more	0	0	0	1	0	0
Dust Collection and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	1	0	0	0	1	0
	250 or more	0	0	0	0	0	0
Dust Collection and Sand Washing	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	2	0	1	0	0	0
Dust Collection, Melting Furnace Scrubber, and Sand Washing	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	0	0	1	0

TABLE VIII-123

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (MALLEABLE IRON) FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries: Direct Discharge		POTW Discharge		Zero Discharge	
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Dust Collection	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	10	0	2	0	18	0
	250 or more	2	0	0	0	5	0
Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	3	0	0	0
	250 or more	0	0	0	0	0	0
Dust Collection, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	0	0	1	0
Dust Collection and Melting Furnace Scrubber	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	1	0
	250 or more	1	0	0	0	0	0
Dust Collection and Slag Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	1	0	0	0	0	0
	250 or more	0	0	0	0	0	

TABLE VIII-123
STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (MALLEABLE IRON) FOUNDRIES
PAGE 2

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct Discharge		POTW Discharge		Zero Discharge	
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Dust Collection,	Less than 10	0	0	0	0	0	0
Melting Furnace	10 to 49	0	0	0	0	0	0
Scrubber, and	50 to 249	0	0	0	0	1	0
Slag Quench	250 or more	0	0	1	0	1	0

TABLE VIII-124

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
FERROUS (STEEL) FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries: Direct Active	Direct Discharge Shutdown or changed Operation	POTW Active	POTW Discharge Shutdown or changed Operation	Zero Active	Zero Discharge Shutdown or changed Operation
Dust Collection	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	1	0	25	0	27	0
	250 or more	2	0	3	0	0	0
Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	9	0
	50 to 249	16	0	13	0	4	0
	250 or more	26	0	7	0	0	0
Dust Collection, and Mold Cooling and Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	7	0	7	0
Dust Collection, Mold Cooling and Casting Quench, and Sand Washing	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	2	0	4	0	0	0

TABLE VIII-125

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS
MAGNESIUM FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct	Discharge	POTW	Discharge	Zero	Discharge
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Grinding Scrubbers	Less than 10	0	0	0	0	0	0
	10 to 49	1	0	0	0	0	0
	50 to 249	0	0	0	0	0	0
	250 or more	0	0	0	0	0	
Dust Collection and Grinding Scrubbers	Less than 10	0	0	0	0	0	0
	10 to 49	1	0	0	0	0	0
	50 to 249	5	0	0	0	0	0
	250 or more	0	0	0	0	0	0

TABLE VIII-126

STATISTICAL ESTIMATES OF FOUNDRY OPERATIONS ZINC FOUNDRIES

Process Group	Employee Group	Statistically Determined Number of Wet Foundries					
		Direct Discharge		POTW Discharge		Zero Discharge	
		Active	Shutdown or changed Operation	Active	Shutdown or changed Operation	Active	Shutdown or changed Operation
Casting Quench	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	37	0	8	0
	50 to 249	1	0	19	0	0	0
	250 or more	1	0	1	0	1	9
Casting Quench and Melting Furnace Scrubber	Less than 10	0	0	0	0	0	0
	10 to 49	0	0	0	0	0	0
	50 to 249	10	0	1	0	0	0
	250 or more	0	0	2	0	0	0

TABLE VIII-127

ENERGY REQUIREMENTS DUE TO WATER POLLUTION CONTROL
METALS CASTING INDUSTRY

Subcategory and Process Segment	Employee Group	Proposed BPT (kwh/year) No. of Plants	Proposed BPT Model	Proposed BPT Segment	Proposed BAT (kwh/year) No. of Plants	Proposed BAT Model	Proposed BAT Segment	Proposed PSES (kwh/year) No. of Plants	Proposed PSES Model	Proposed PSES Segment
ALUMINUM										
Investment Casting	-	12	7,600	91,200	12	-	-	10	7,600	76,000
Melting Furnace Scrubber	-	6	48,000	288,000	6	-	-	0	48,000	0
Casting Quench	<50	2	4,800	9,600	*	-	-	1	4,800	4,800
	≥50	8	6,800	54,400	*	-	-	20	6,800	54,400
	<50 (1)	0	4,910	0	*	-	-	2	4,910	9,820
	≥50 (1)	0	15,870	0	*	-	-	4	15,870	63,480
Die Casting	-	6	97,200	583,200	6	4,400	26,400	4	101,600	406,400
	<50 (1)	0	19,490	0	0	-	-	2	23,890	47,780
	≥50 (1)	0	62,930	0	0	-	-	4	67,330	269,320
Die Lube	-	2	10,800	21,600	*	-	-	6	10,800	64,800
COPPER										
Dust Collection	-	16	31,200	499,200	*	-	-	0	31,200	0
Mold Cooling & Casting Quench	-	18	31,200	561,600	18	Negligible	-	21	31,200	655,200
FERROUS										
Dust Collection										
Ductile Iron	<50	0	6,000	0	*	-	-	10	6,000	60,000
	50-249	1	31,200	31,200	*	-	-	3	31,200	93,600
	≥250	6	179,200	1,075,200	*	-	-	1	179,200	179,200
	<250 (2)	0	14,300	0	*	-	-	2	14,300	28,600
	≥250 (2)	2	194,340	388,680	*	-	-	0	194,340	0
Gray Iron	<50	22	12,000	264,000	*	-	-	19	12,000	240,000
	50-249	11	44,800	492,800	*	-	-	29	44,800	1,344,000
	≥250	57	268,400	15,298,800	*	-	-	14	268,400	3,757,600
	<250 (2)	17	44,740	760,580	*	-	-	0	44,740	0
	≥250 (2)	5	128,100	640,500	*	-	-	0	128,100	0
	≥250 (3)	4	115,960	463,840	*	-	-	1	115,960	115,960
Malleable Iron	<250	10	38,800	388,000	*	-	-	2	38,800	77,600
	≥250	8	268,400	2,147,200	*	-	-	1	268,400	268,400
	<250 (2)	1	62,690	62,690	*	-	-	0	62,690	0
Steel	<250	1	31,200	31,200	*	-	-	25	31,200	780,000
	≥250	4	67,200	268,800	*	-	-	2	67,200	134,400
	≥250 (3)	2	115,960	231,920	*	-	-	4	115,960	463,840
Melting Furnace Scrubber										
Ductile Iron	<250 (4)	2	128,400	256,800	*	-	-	0	128,400	0
	≥250 (4)	5	702,800	3,514,000	*	-	-	0	702,800	0
Smaller Operations	<250	0	9,200	0	*	-	-	0	9,200	0
	≥250	1	13,200	13,200	*	-	-	0	13,200	0
Larger Operations	<250	0	110,800	0	*	-	-	0	110,800	0
	≥250	1	692,400	692,400	*	-	-	0	692,400	0

TABLE VIII-127
ENERGY REQUIREMENTS DUE TO WATER POLLUTION CONTROL
METALS CASTING INDUSTRY
PAGE 2

Subcategory and Process Segment	Employee Group	Proposed BPT (kwh/year) No. of Plants	Proposed BPT Model	Proposed BPT Segment	Proposed BAT (kwh/year) No. of Plants	Proposed BAT Model	Proposed BAT Segment	Proposed PSES (kwh/year) No. of Plants	Proposed PSES Model	Proposed PSES Segment
FERROUS (Cont)										
Melting Furnace Scrubber (Cont)										
Gray Iron	<250 (4)	8	62,800	502,400	*	-	-	10	62,800	628,000
	≥250 (4)	30	225,600	6,768,000	*	-	-	23	225,600	5,188,800
Smaller Operations	≤50	18	5,200	93,600	*	-	-	17	5,200	88,400
	≥50	32	17,600	563,200	*	-	-	2	17,600	35,200
Larger Operations	≤50	0	34,000	0	*	-	-	0	34,000	0
	50-249	25	126,800	3,170,000	*	-	-	16	126,800	2,028,800
	≥250	12	527,600	6,331,200	*	-	-	1	527,600	527,600
Malleable Iron	≤250	1	126,800	126,800	*	-	-	0	126,800	0
	≥250	1	219,200	219,200	*	-	-	0	219,200	0
	≤250 (4)	1	62,800	62,800	*	-	-	0	62,800	0
	≥250 (4)	1	114,800	114,800	*	-	-	0	114,800	0
Slag Quench										
Ductile Iron	<250	0	41,200	0	*	-	-	0	41,200	0
	≥250	1	335,600	335,600	*	-	-	0	335,600	0
	≤250 (2)	0	26,900	0	*	-	-	2	26,900	53,800
	≥250 (2)	2	387,660	775,320	*	-	-	0	387,660	0
	≤250 (4)	2	134,400	268,800	*	-	-	0	134,400	0
	≥250 (4)	6	1,073,600	6,441,600	*	-	-	0	1,073,600	0
Gray Iron	≤250	0	20,800	0	*	-	-	0	20,800	0
	≥250	10	179,200	1,792,000	*	-	-	0	179,200	0
	≤250 (2)	17	14,860	252,620	*	-	-	9	14,860	133,740
	≥250 (2)	5	73,500	367,500	*	-	-	0	73,500	0
	≤250 (4)	27	44,800	1,209,600	*	-	-	19	44,800	851,200
	≥250 (4)	28	201,200	5,633,600	*	-	-	25	201,200	5,030,000
Malleable Iron	≤250	0	18,000	0	*	-	-	3	18,000	54,000
	≥250	0	59,600	0	*	-	-	0	59,600	0
	≤250 (2)	1	19,310	19,310	*	-	-	0	19,310	0
	<250 (4)	1	44,800	44,800	*	-	-	0	44,800	0
	≥250 (4)	1	89,600	89,600	*	-	-	1	89,600	89,600
Casting Quench & Mold Cooling										
Ductile Iron	<250	2	49,600	99,200	*	-	-	1	49,600	49,600
	≥250	6	147,600	885,600	*	-	-	0	147,600	0
Gray Iron	≤250	4	125,200	500,800	*	-	-	1	125,200	125,200
	≥250	11	147,600	1,623,600	*	-	-	0	147,600	0
Malleable Iron	≥250	1	46,000	46,000	*	-	-	0	46,000	0
Steel	≤250	12	44,800	537,600	*	-	-	13	44,800	582,400
	≥250	33	53,600	1,768,800	*	-	-	18	53,600	964,800
Sand Washing										
Gray Iron	≥250	0	752,400	0	*	-	-	0	752,400	0
	≥250 (3)	4	927,640	3,710,560	*	-	-	2	927,640	1,855,280

TABLE VIII-127
ENERGY REQUIREMENTS DUE TO WATER POLLUTION CONTROL
METALS CASTING INDUSTRY
PAGE 3

Subcategory and Process Segment	Employee Group	Proposed BPT (kwh/year) No. of Plants	Model	Segment	Proposed BAT (kwh/year) No. of Plants	Model	Segment	Proposed PSES (kwh/year) No. of Plants	Model	Segment
FERROUS (Cont)										
Steel	≥250(3)	0	304,400	0	*	-	-	0	304,400	0
	≥250	2	927,640	1,855,280	*	-	-	4	927,640	3,710,560
LEAD										
Continuous Strip Casting	-	1	13,200	13,200	1	-	-	4	13,200	52,800
Grid Casting	-	N/A	17,600	N/A	*	-	-	N/A	17,600	N/A
Melting Furnace Scrubber	-	NA	NA	NA	*	-	-	NA	NA	NA
MAGNESIUM										
Grinding Scrubber	-	6	1,600	9,600	*	-	-	0	1,600	0
Dust Collection	-	6	4,000	24,000	*	-	-	0	4,000	0
ZINC										
Casting Quench	<50	8	4,800	38,400	*	-	-	37	4,800	177,600
	50-249	11	7,600	83,600	*	-	-	20	7,600	152,000
	≥250	3	4,800	14,400	*	-	-	1	4,800	4,800
Melting Furnace Scrubber	-	1	98,000	98,000	1	8,800	8,800	3	106,800	320,400
TOTALS				75,621,600			35,200			31,899,780

(1) Apportioned contribution to the Casting Quench and Die Casting co-treatment system
(2) Apportioned contribution to the Dust Collection and Slag Quench co-treatment system
(3) Apportioned contribution to the Dust Collection and Sand Washing co-treatment system
(4) Apportioned contribution to the Melting Furnace Scrubber and Slag Quench co-treatment system

* : The proposed BPT level of treatment achieves "zero discharge."
NA : Not Applicable
N/A: Data are Not Available.

TABLE VIII-128

SOLID AND LIQUID WASTE GENERATION DUE TO WATER POLLUTION CONTROL
METALS CASTING INDUSTRY

Subcategory and Process Segment	Employee Group	Proposed BPT (tons/year) No. of Plants	Proposed BPT Model	Proposed BPT Segment	Proposed BAT (tons/year) No. of Plants	Proposed BAT Model	Proposed BAT Segment	Proposed PSES (tons/year) No. of Plants	Proposed PSES Model	Proposed PSES Segment
ALUMINUM										
Investment Casting	-	12	35.1	421	12	-	-	10	35.1	351
Melting Furnace Scrubber	-	6	5.1	31	6	-	-	0	5.1	0
Die Casting	-	6	497.4	2,984	6	-	-	4	497.4	1,990
	<50 (1)	0	21.1	0	0	-	-	2	21.1	42
	≥50 (1)	0	530.6	0	0	-	-	4	530.6	2,122
Die Lube	-	2	7.6	15	*	-	-	6	7.6	46
COPPER										
Dust Collection	-	41	91.4	3,747	*	-	-	0	91.4	0
Mold Cooling and Casting Quench	-	18	Negligible		18	Negligible		21	Negligible	
FERROUS										
Dust Collection										
Ductile Iron	<50	1	911	911	*	-	-	10	911	9,110
	50-249	1	13,233	13,233	*	-	-	3	13,233	39,699
	≥250	9	63,938	575,442	*	-	-	1	63,938	63,938
	<250(2)	0	3,972	0	*	-	-	2	3,972	7,944
	≥250(2)	2	63,938	127,876	*	-	-	0	63,938	0
Gray Iron	<50	22	3,197	70,334	*	-	-	19	3,197	60,743
	50-249	81	14,764	1,195,884	*	-	-	29	14,764	428,156
	≥250	57	83,119	4,737,783	*	-	-	28	83,119	2,327,332
	<250(2)	17	13,950	237,150	*	-	-	9	13,950	125,550
	≥250(2)	5	46,888	234,440	*	-	-	0	46,888	0
	≥250(3)	5	34,875	174,375	*	-	-	1	34,875	34,875
Malleable Iron	<250	30	12,012	360,360	*	-	-	2	12,012	24,024
	≥250	10	75,562	755,620	*	-	-	1	75,562	75,562
	<250(2)	1	18,600	18,600	*	-	-	0	18,600	0
Steel	<250	28	7,072	198,016	*	-	-	25	7,072	176,800
	≥250	9	22,940	206,460	*	-	-	10	22,940	229,400
	≥250(3)	2	34,875	69,750	*	-	-	4	34,875	139,500
Melting Furnace Scrubber										
Ductile Iron	<250(4)	2	5,253	10,506	*	-	-	0	5,253	0
	≥250(4)	6	43,946	263,676	*	-	-	0	43,946	0
Smaller Operations	<250	8	354	2,832	*	-	-	0	354	0
	≥250	1	572	572	*	-	-	0	572	0
Larger Operations	<250	0	3,064	0	*	-	-	0	3,064	0
	≥250	1	32,328	32,328	*	-	-	0	32,328	0
Gray Iron	<250(4)	9	1,532	13,788	*	-	-	10	1,532	15,320
	≥250(4)	30	8,082	242,460	*	-	-	25	8,082	202,050
Smaller Operations	<50	54	189	10,206	*	-	-	25	189	4,725
	≥50	52	655	34,060	*	-	-	12	655	7,860
Larger Operations	<50	0	185	0	*	-	-	0	185	0
	50-249	47	1,852	87,044	*	-	-	16	1,852	29,632
	≥250	12	17,174	206,088	*	-	-	1	17,174	17,174

TABLE VIII-128
SOLID AND LIQUID WASTE GENERATION DUE TO WATER POLLUTION CONTROL
METALS CASTING INDUSTRY
PAGE 2

Subcategory and Process Segment	Employee Group	Proposed BPT (tons/year) No. of Plants	Model	Segment	Proposed BAT (tons/year) No. of Plants	Model	Segment	Proposed PSES (tons/year) No. of Plants	Model	Segment
FERROUS (Continued)										
Melting Furnace Scrubber (Continued)										
Malleable Iron	<250	1	2,054	2,054	*	-	-	0	2,054	0
	≥250	1	5,169	5,169	*	-	-	0	5,169	0
	≤250[4]	1	1,600	1,600	*	-	-	0	1,600	0
	≥250[4]	1	3,283	3,283	*	-	-	1	3,283	3,283
Slag Quench										
Ductile Iron	<250	0	20.7	0	*	-	-	0	20.7	0
	≥250	1	176	176	*	-	-	0	176	0
	≤250[2]	0	13.5	0	*	-	-	2	13.5	27
	≥250[2]	2	230	460	*	-	-	0	230	0
	≤250[4]	2	28.1	56	*	-	-	0	28.1	0
	≥250[4]	6	235	1,410	*	-	-	0	235	0
Gray Iron	≤250	0	9.3	0	*	-	-	0	9.3	0
	≥250	10	90.9	909	*	-	-	0	90.9	0
	≤250[2]	17	8.4	143	*	-	-	9	8.4	76
	≥250[2]	5	48.6	243	*	-	-	0	48.6	0
	≤250[4]	28	8.2	230	*	-	-	19	8.2	156
	≥250[4]	29	43.2	1,253	*	-	-	25	43.2	1,080
Malleable Iron	≤250	0	7.4	0	*	-	-	3	7.4	22
	≥250	0	35.1	0	*	-	-	0	35.1	0
	≤250[2]	1	10.4	10	*	-	-	0	10.4	0
	<250[4]	1	8.6	9	*	-	-	0	8.6	0
	≥250[4]	1	17.6	18	*	-	-	1	17.6	18
Casting Quench and Mold Cooling										
Ductile Iron	<250	2	479	958	*	-	-	1	479	479
	≥250	6	1,354	8,124	*	-	-	0	1,354	0
Gray Iron	≤250	4	1,168	4,672	*	-	-	1	1,168	1,168
	≥250	11	1,335	14,685	*	-	-	0	1,335	0
Malleable Iron	≥250	1	376	376	*	-	-	0	376	0
Steel	≤250	29	228	4,332	*	-	-	13	228	2,964
	≥250	35	350	12,250	*	-	-	18	350	6,300
Sand Washing										
Gray Iron	≥250	0	293	0	*	-	-	0	293	0
	≥250[3]	4	443	1,772	*	-	-	2	443	886
Steel	≥250	0	103	0	*	-	-	0	103	0
	≥250[3]	2	443	886	*	-	-	4	443	1,772

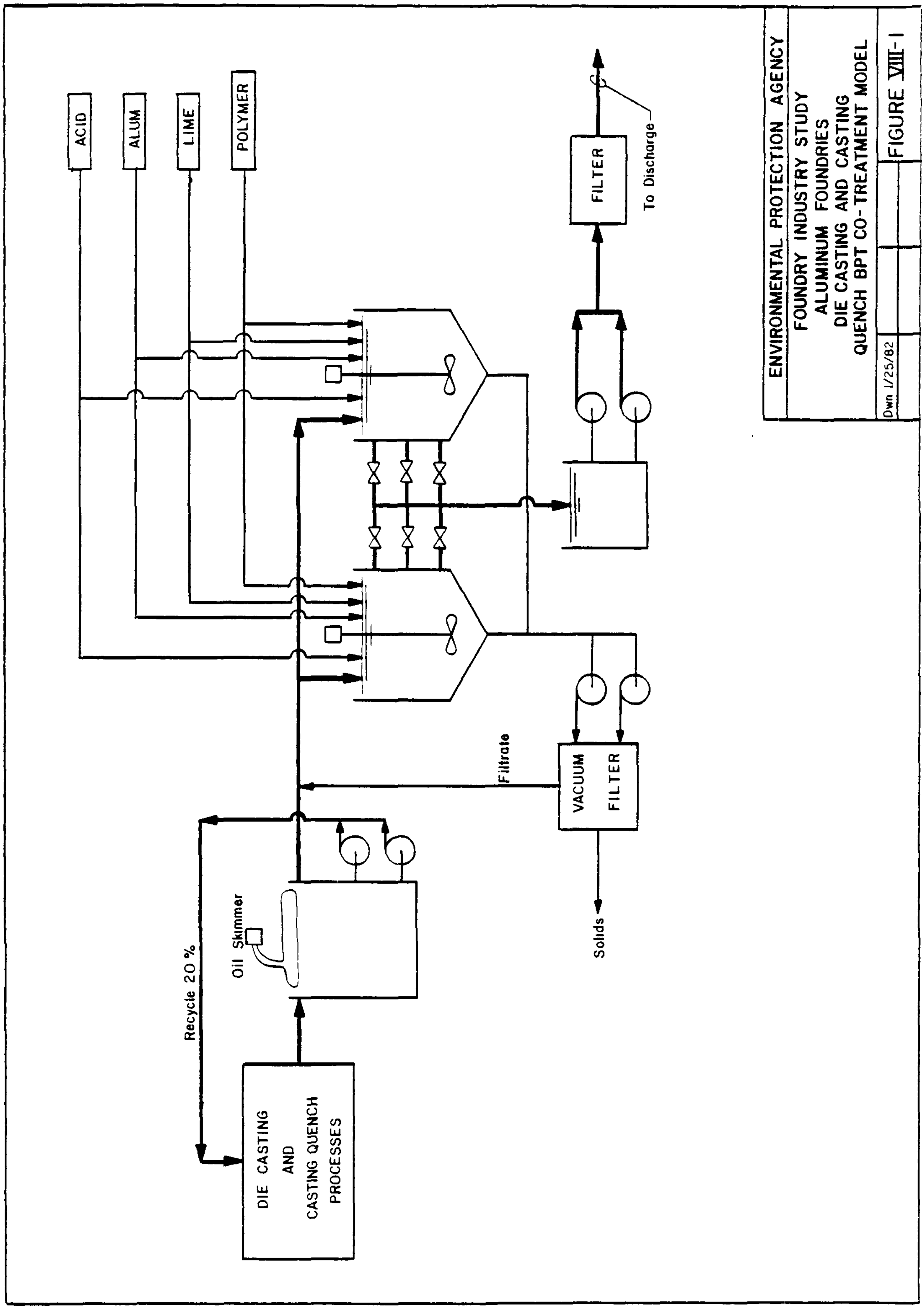
TABLE VIII-128
SOLID AND LIQUID WASTE GENERATION DUE TO WATER POLLUTION CONTROL
METALS CASTING INDUSTRY
PAGE 3

Subcategory and Process Segment	Employee Group	Proposed BPT (tons/year) No. of Plants	Proposed BPT (tons/year) Model	Proposed BPT (tons/year) Segment	Proposed BAT (tons/year) No. of Plants	Proposed BAT (tons/year) Model	Proposed BAT (tons/year) Segment	Proposed PSES (tons/year) No. of Plants	Proposed PSES (tons/year) Model	Proposed PSES (tons/year) Segment
LEAD										
Continuous Strip Casting	-	1	Negligible		1	Negligible		4	Negligible	
Grid Casting	-	N/A	Negligible		*	-	-	N/A	Negligible	
Melting Furnace Scrubber	-	NA	NA	NA	*	-	-	NA	NA	NA
MAGNESIUM										
Grinding Scrubber	-	6	Solids are reclaimed		*	-	-	0	Solids are reclaimed	
Dust Collection	-	6	Negligible		*	-	-	0	Negligible	
ZINC										
Casting Quench	<50	8	18.8	150	*	-	-	37	18.8	696
	50-249	11	114	1,254	*	-	-	20	114	2,280
	≥250	3	58.0	174	*	-	-	3	58.0	174
Melting Furnace Scrubber	-	10	429	4,290	10	Negligible		3	429	1,287
TOTAL SOLID WASTES				9,957,938			Negligible			4,046,613

Subcategory and Process Segment	Employee Group	Proposed BPT (gallons/year) No. of Plants	Proposed BPT (gallons/year) Model	Proposed BPT (gallons/year) Segment	Proposed BAT (gallons/year) No. of Plants	Proposed BAT (gallons/year) Model	Proposed BAT (gallons/year) Segment	Proposed PSES (gallons/year) No. of Plants	Proposed PSES (gallons/year) Model	Proposed PSES (gallons/year) Segment
ALUMINUM										
Casting Quench	<50	33	356	11,748	*	-	-	1	356	356
	≥50	8	3,733	29,864	*	-	-	20	3,733	74,660
	<50(1)	0	302	0	*	-	-	2	302	604
	≥50(1)	0	7,584	0	*	-	-	4	7,584	30,336
Die Casting	-	6	25,710	154,260	6	-	-	4	25,710	102,840
	<50(1)	0	1,093	0	0	-	-	2	1,093	2,186
	≥50(1)	0	27,424	0	0	-	-	4	27,424	109,696
ZINC										
Casting Quench	<50	8	22.5	180	*	-	-	37	22.5	832
	50-249	11	91.2	1,003	*	-	-	20	91.2	1,824
	≥250	3	46.2	139	*	-	-	3	46.2	139
Melting Furnace Scrubber	-	10	12,870	128,700	10	Negligible		3	12,870	38,610
TOTAL LIQUID WASTES				325,894			Negligible			362,083

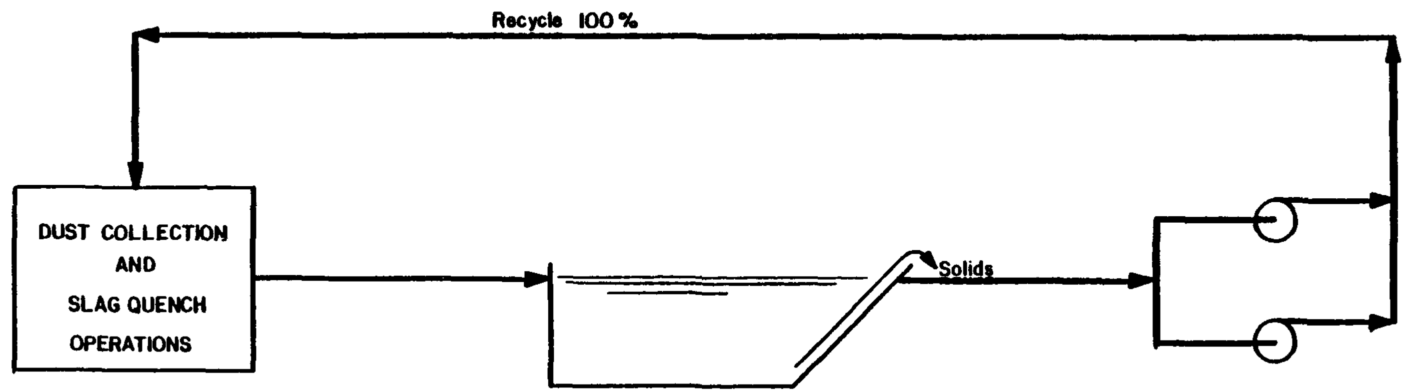
(1) Casting Quench and Die Casting co-treatment system
(2) Dust Collection and Slag Quench co-treatment system
(3) Dust Collection and Sand Washing co-treatment system
(4) Melting Furnace Scrubber and Slag Quench co-treatment system

* : The proposed BPT level of treatment achieves "zero discharge."
NA : Not Applicable
N/A: Data are Not Available.



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM FOUNDRIES
DIE CASTING AND CASTING
QUENCH BPT CO-TREATMENT MODEL

FIGURE VIII-1

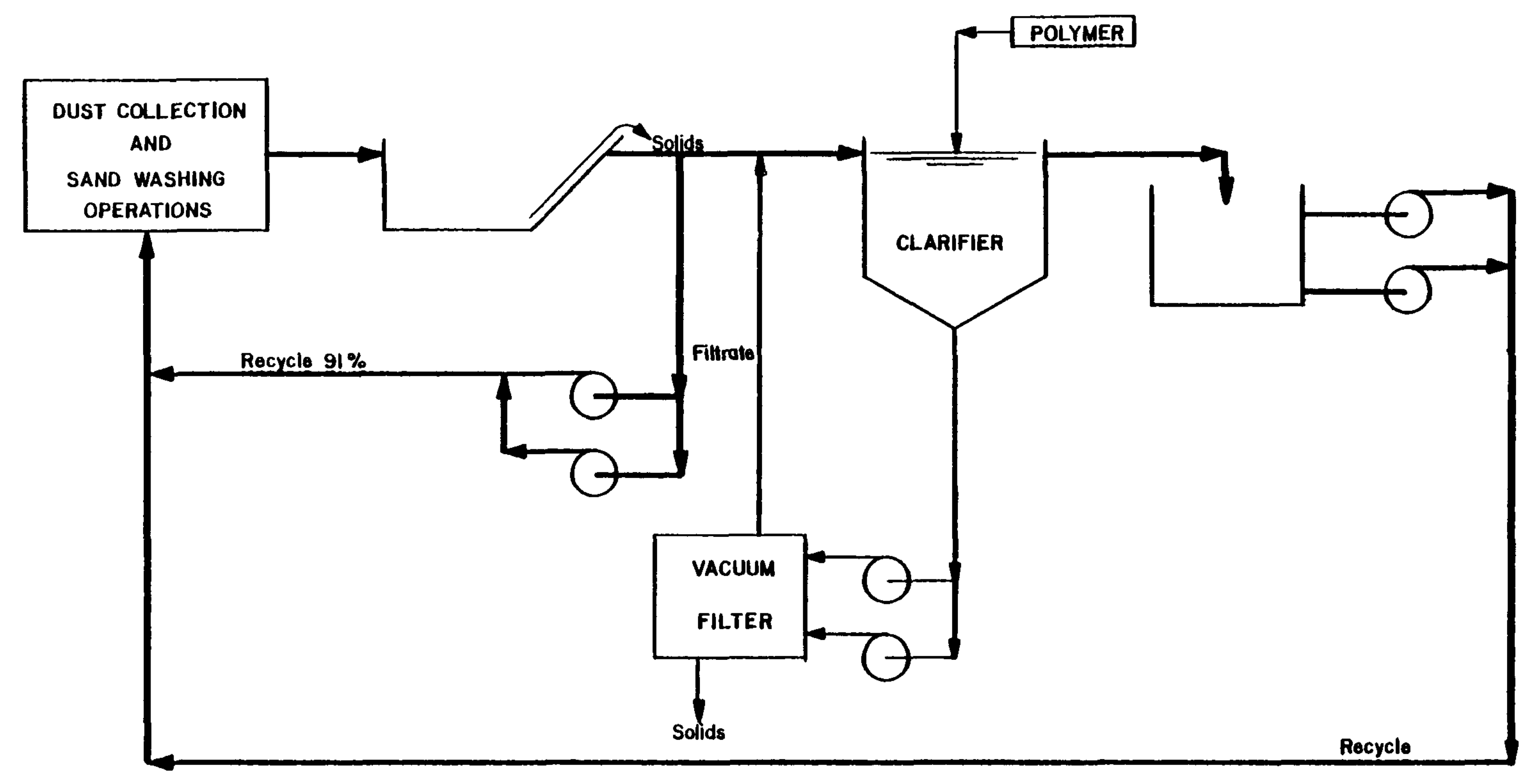


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
FERROUS FOUNDRIES
DUST COLLECTION AND SLAG
QUENCH BPT CO-TREATMENT MODEL

Dwn. 1/25/82

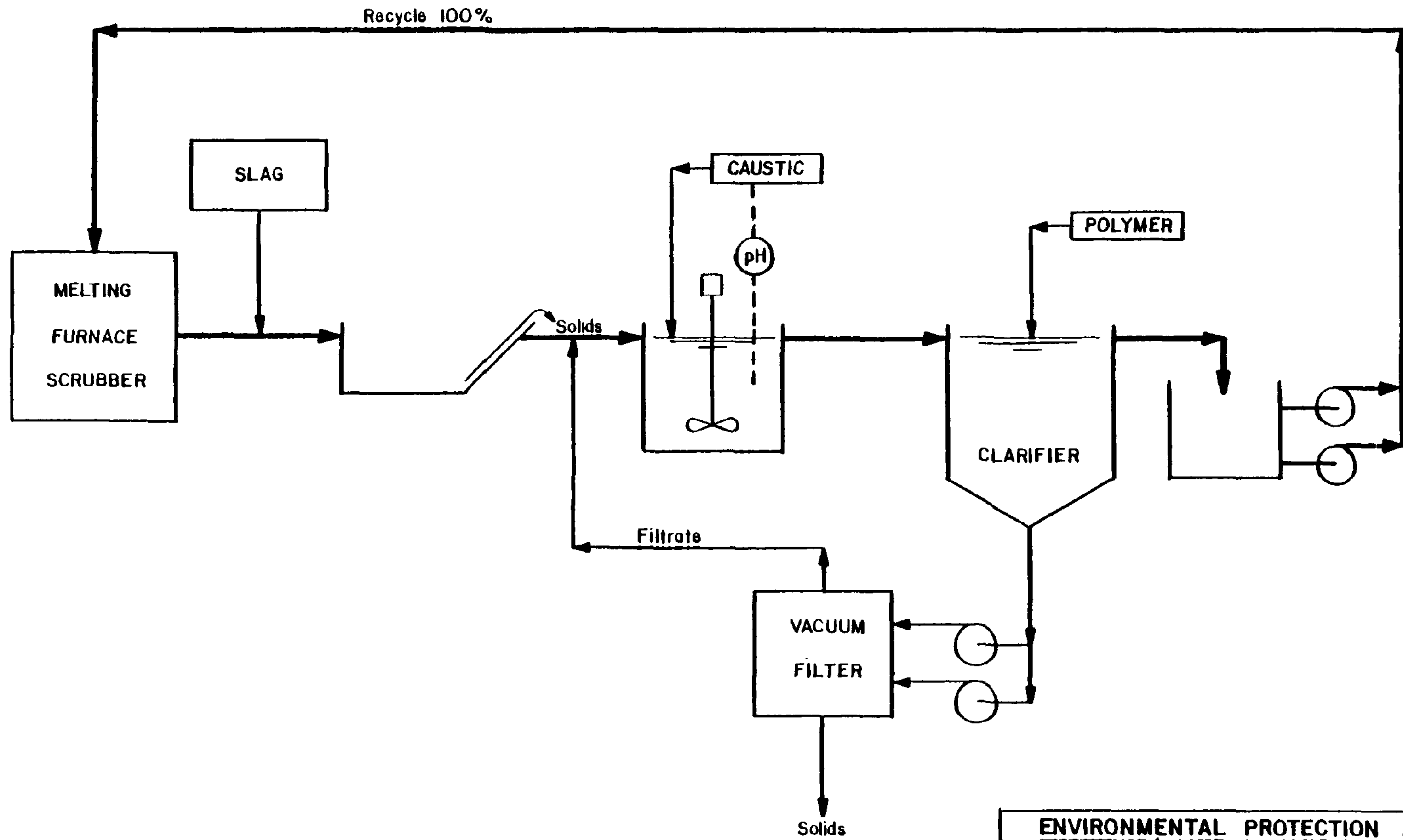
FIGURE VIII-2



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
FERROUS FOUNDRIES
DUST COLLECTION AND SAND WASHING
BPT CO-TREATMENT MODEL

Dwn. 1/25/82

FIGURE VIII-3



ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
FERROUS FOUNDRIES
SLAG QUENCH AND MELTING FURNACE
SCRUBBER BPT CO-TREATMENT MODEL

Dwn. 1/25/82

FIGURE VIII-4

SECTION IX

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

INTRODUCTION

Effluent limitations, required by the Act and based upon the degree of effluent reduction attainable through application of the best practicable control technology currently available (BPT), have not been previously proposed nor promulgated by EPA for the Metal Molding and Casting Category. As a result, National Pollutant Discharge Elimination System (NPDES) Permits have been issued on a plant by plant basis by states with approved NPDES permit programs and by EPA through its regional offices.

The BPT technology described in this section is reflective of the technology installed and in use as of 1980. In fact, many plants had BPT technologies installed several years prior to 1980.

The BPT technologies form the foundation for the development and application of the best available technologies (BAT). As such, the BPT technologies are an integral part of the BAT treatment schemes. In addition, BPT provides a floor which may not be exceeded by exceptions which may be granted under the provisions of Sections 301(c) and (g) of the Act.

BPT technology is based upon the "average of the best" existing performance by plants of various sizes, ages, and unit processes within each subcategory. This average, however, is not based upon a broad range of plants but, rather, upon performance levels achieved by exemplary plants. In subcategories or processes where present control and treatment practices are uniformly inadequate, a higher level of control may be required, if the technology to achieve the higher levels can be practicably applied. BPT can not only include treatment facilities at the end of the manufacturing process (end-of-pipe), but also technologies within the process itself, if such in-plant control technologies are considered to be typical practice within the industry.

FACTORS CONSIDERED

When BPT was developed, the following factors were considered:

1. The manufacturing processes employed.

2. The size and age of equipment and facilities involved.

3. The non-water quality environmental impacts (including energy requirements).

4. The total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application.

5. The engineering aspects of the application of various types of control techniques.

When the subcategorization of the metal molding and casting category was developed, the manufacturing processes employed, and the size and age of equipment and facilities involved were considered. Section IV presents the details on those subcategorization factors. The non-water quality environmental impacts, including energy requirements, and the consideration of the total cost of application of technology in relation to the effluent reduction benefits to be achieved from the application of BPT, are detailed in Section VIII. Specific engineering aspects of the application of various types of control techniques have also been considered, and these are discussed below.

APPROACH TO BPT DEVELOPMENT

BPT limitations for metal molding and casting operations were developed by analyzing the best treatment systems existing in the category, as well as the "best" achievable flows and treated effluent concentrations. The rationale for the selection of the BPT model treatment systems, model flows, and effluent concentrations is discussed below.

The Agency developed and evaluated several BPT treatment options. The technologies which form the bases of the proposed BPT limitations are presented and discussed first. The analysis of the BPT discharge options which the Agency considered before proposing a regulation for this industry, follows.

Selection of Pollutants

An initial step in the development of BPT involved the selection of pollutants to be considered for regulation at BPT. What results is a two-fold review in which pollutants are considered for regulation which are: (1) characteristic of the process, and (2) amenable to treatment with BPT-type technologies. Reference can be made to Table VI-6, which presents a summary of those pollutants found to be characteristic of each process' wastewaters and which, therefore, were considered for specific regulation.

The selection of technologies to be used as the basis for developing BPT effluent limitations is to be based upon the average of the best existing capabilities. These existing capabilities may not be effective in controlling all pollutants found in the various process wastewaters. This consideration applies particularly to the toxic organic pollutants. Advanced control and treatment technologies, which are addressed and developed as BAT technologies in Section X, would be needed to control discharges of these other pollutants.

The Agency's selection of pollutants for which BPT limitations are being proposed is based upon the following considerations: the ability of the BPT technologies to control a pollutant; the relative level, discharge load, and impact of each pollutant; the need to establish practical monitoring requirements; and the ability of one pollutant to indicate the control of other pollutants considered roe regulation.

Table IX-1 presents a summary, by process, of those pollutants selected for regulation at the proposed BPT level in the Metal Molding and Casting Category. However, limitations requiring no discharge of process wastewater pollutants are actually providing limitations on the discharge of all pollutants present.

<u>Model Flow Rates</u>

After BPT pollutants were selected, BPT model effluent flows were determined. Again, the plants within each subcategory were compared using the plant survey and sampling data. This comparison of plants was used to determine average process flow rates and the degree of recycle that can be achieved at each process. This evaluation was then used to develop the BPT model treatment applied, recycle and effluent flows.

Initially, the BPT model treatment system flow (the volume of process wastewater through the treatment system) was determined. These volumes were than converted to a flow rate in gallons/ton using production normalizing parameters (i.e., tons of metal poured and tons of sand processed) as discussed in Section IV. The production normalized flow rates account for differences in the actual production levels from plant to plant and place the flow of all plants within any process segment on a similar basis for comparison and analysis.

The "best" flow rates used in determining the BPT model treatment system flows are based upon the production normalized flow rates of plants which have demonstrated conservative water use in the metal molding and casting processes identified in Section IV. In some instances, for the purpose of evaluation, the process wastewater flow through the treatment system was equated to the applied water flow through the manufacturing process. For those processes where the process water is recycled prior to treatment (i.e., internal recycle in dust collection scrubbers), the BPT model treatment system flows for those processes are higher than the actual process wastewater flows. In effect, for those processes the size of the treatment system is overstated.

The BPT model treatment system flow rate for each process segment was derived by determining the average of the best applied water flow rates as identified in the plant survey and sampling data. The "best" applied water flow rates were identified by ranking all of the production normalized plant applied flow data from lowest to highest and analyzing the resulting distribution.

For some process segments, a distinct partitioning of the flow data occurred, with a clustering of plants with lower flow rates as compared to the flow rates of the remaining surveyed plants. For the purpose of determining BPT model treatment system flows, the plants with the lower flow rates were considered to be the "best" plants. However, the whole body of survey data from these "best" plants was compared to the survey data from other plants in the process segment to identify any fundamental differences between these plants and the other plants. No fundamental technological differences were identified in any of these process segments. What did become apparent, after visits to several plants and after numerous phone calls to other plants, was that many plants had implemented water management policies. Many of these plants reduced their water use to save money. The flow rates of the best plants were then averaged to determine the average of the best plants for the sizing and, therefore, the costing of the BPT treatment model.

For those subcategory process segments in which a distinct partitioning of the flow rate data did not occur, the median of the distribution of the flow rate data was identified and all plants with production normalized flow rates lower than the median value were defined as the "best" plants. The flow rates for these plants were then averaged to determine the average of the best plants for that process segment. This analysis was used to size the BPT treatment models.

Treatment Technologies

The BPT level of treatment represents the average of the best performance achieved by existing treatment systems at plants of various sizes, ages, processes, or other common characteristics. For a proper determination of the best performance, only plants of similar characteristics are compared. The subcategorization factors enumerated in Section IV assure that plants grouped into a subcategory or subcategory process segment are sufficiently similar in various characteristics (i.e., type of metal cast, process employed, etc.), that a reasonable comparison of plants and their treatment performances can be made.

Plant performances were evaluated in light of the treatment technologies installed, process wastewater flow, and effluent levels achieved by the technologies. The evaluation was based upon levels achieved by the technologies. process wastewater sampling data, and the other sources of information identified in Sections III, V, and VII. The plants which have demonstrated exemplary performance through reduced effluent flow and superior pollutant removal practices provide support for the BPT levels of treatment. Many of these plants were sampled because of their exemplary performance.

The development of BPT involved a review of the wide variety of technologies available for the removal of pollutants characteristic of foundry process wastewaters. First, each technology was evaluated in terms of the degree of effluent reduction attainable through its application to plants within a subcategory and process segment. The analytical data developed from the sampling program, and analytical data from other categories with process wastewaters similar in characteristics to foundry process wastewaters, were used to determine the effluent levels which can be achieved with the various technologies. By comparing the capabilities of various technologies, plants which demonstrated exemplary performance with existing technologies were identified. These plants formed the basis for determining an appropriate BPT level of treatment. In most cases, BPT treatment is identical to the technologies installed at these selected plants in each process segment. In some instances, BPT technology was transferred from another process segment, subcategory, or category. Such technology transfers are detailed where appropriate.

Several types of treatment were given special consideration for use as BPT treatment models. Precipitation and sedimentation technology is in use at many foundry operations in all process segments, and was one of the systems considered for BPT. Another system evaluated for BPT was filtration. Filtration is not widely demonstrated in the industry but was considered by the Agency as an alternate means to reduce conventional and toxic metal pollutants at BPT at a reasonable cost. And finally, the Agency evaluated high rate, and complete recycle following sedimentation as potential treatment models for BPT. Recycle technology is widely demonstrated in the industry and can be installed at relatively low cost. The effluent quantities achieved using these technologies are discussed below.

Precipitation - Sedimentation Technology

The effluent qualitites attainable with precipitation and sedimentation treatment components were established on the basis of a transfer of data from several industrial categories. The Agency has determined that the transfer of data from the coil coating, porcelain enameling, battery manufacturing, copper forming, and aluminum forming categories is appropriate on the basis of similarities in wastewater characteristics. These similarities are related to the treatment behavior of dissolved and particulate toxic metals, to the sedimentation and filterability characteristics of the suspended particulate matter, and to the treatment behavior of surface oils and greases.

In the reference categories, precipitation involved the addition of lime or caustic, and, in many instances, a coagulant aid. Sedimentation occurred in a settling tank, lagoon or clarifier. After determining the mean effluent concentration for each pollutant, variability factors were applied to determine the 10 and 30-day averages, and one day maximum values to be used in developing effluent limitations. Refer to Section VII for a discussion of the development of these data. mean values. Following is a summary of the pertinent treatment performance data for precipitation and sedimentation operations:

Pollutant		Mean (mg/l)	One Day Max. (mg/l)	Ten Day Avg. (mg/l)	Thirty Day Avg. (mg/l)
114	Antimony	0.05	0.21	0.09	0.08
115	Arsenic	0.51	2.09	0.86	0.83
118	Cadmium	0.079	0.32	0.15	0.13
119	Chromium	0.080	0.42	0.17	0.12
120	Copper	0.58	1.90	1.00	0.73
122	Lead	0.12	0.15	0.13	0.12
124	Nickel	0.57	1.41	1.00	0.75
128	Zinc	0.30	1.33	0.56	0.41
	Iron	0.41	1.23	0.63	0.51
	TSS	12.0	41.0	20.0	15.5
	Oil and Grease	-	20.0	12.0	10.0

Filtration Technology

Following the evaluation of precipitation and sedimentation treatment capabilities, long-term effluent analytical data from two plants with multi-category metal processing and finishing operations and one nonferrous metals plant were reviewed to determine the performance capabilities of filtration (following precipitation and sedimentation) treatment systems. As with the precipitation and sedimentation data, variability factors were developed to determine the 10 and 30-day averages and one day maximum values to be used in developing effluent limitations. A summary of the effluent values noted for filtration systems follows.

Pollutant		Mean (mg/l)	One Day Max. (mg/l)	Ten Day Avg. (mg/l)	Thirty Day Avg. (mg/l)
114	Antimony	0.034	0.14	0.06	0.06
115	Arsenic	0.34	1.39	0.57	0.55
118	Cadmium	0.049	0.20	0.08	0.08
119	Chromium	0.07	0.37	0.15	0.10
120	Copper	0.39	1.28	0.61	0.49
122	Lead	0.08	0.10	0.09	0.08
124	Nickel	0.22	0.55	0.37	0.29
128	Zinc	0.23	1.02	0.42	0.31
	Iron	0.28	1.23	0.63	0.51
	TSS	2.6	15.0	12.0	10.0
	Oil and Grease	-	10.0	10.0	10.0

Recycle Technology

Recycle of process wastewaters is the predominant treatment component used in the foundry industry due to the effectiveness of this technology at reducing effluent flows and loads at low installation and operating costs. Of the 432 total wet operations responding to the basic questionnaires, 66% have installed some degree of recycle, with many of these being high-rate or complete recycle systems. Table IX-2 presents a summary of the use of recycle in the foundry industry.

As noted in Table IX-2, plants in all of the subcategories have eliminated their discharges to navigable notes by completely recycling all process wastewater. A list of the plants which reported achieving 100% recycle is presented in Table IX-3. The data presented in Table IX-3 demonstrate that complete recycle achieved at all types of foundry processes including both large and small producers, and continuous and intermittant operations.

The survey information provided by the plants achieving complete recycle was examined and compared with the information from plants not achieving as high a level of performance to determine if any fundamental technical differences existed that would prevent other plants from achieving no discharge of process wastewater pollutants. Many plants which have not implemented complete recycle are similar with respect to the type of metal cast, manufacturing process employed, air pollution control devices used, products, and other aspects, to those plants which have implemented complete recycle. In attempting to identify factors which would prevent a plant from achieving no discharge of process wastewater pollutants, the engineering aspects of the application of various types of control and treatment technologies, particularly recycle, were examined.

By far, the largest volume of foundry process wastewater is generated by air pollution control equipment, i.e., scrubbers. The recycled scrubber process wastewaters do not come into intimate contact with the casting, therefore, the quality of the casting surface cannot be affected by the process wastewater. In those processes where the casting comes into intimate contact with the process wastewater, casting quench for example, the duration of contact with process wastewaters and the effects of water contaminants on the surface of the castings are minimal. Many plants repeatedly quench castings in the same quench solutions.

When complete recycle systems were evaluated, the effects of total dissolved solids in the recycle system on the manufacturing processes and air pollution control equipment were considered. The concentration of total dissolved solids (TDS) increases and decreases repeatedly depending upon various conditions within the recycle system. The concentration of TDS increases through; the addition of dissolved solids in the makeup water, the addition of chemicals to the system, and changes in pollutant solubilities brought on by changes in pH and temperature of the process wastewater. The concentration of TDS decreases when the dissolved solids precipitate out of solution, form suspended solids, or when sludge is removed from the treatment system. The water removed with the sludge also carries dissolved solids away from the recycle system.

The precipitates formed when the solubility limits of the dissolved solids are exceeded, settle out and add to the volume of sludge. While some of the precipitates may form scale within pipes and inhibit flow, this scale is continuously eroded by the larger particulate matter characteristicly found in foundry process wastewaters. This particulate matter may take the form of metallic oxides from melting furnaces, granular slag from slag quenching, sand grains from dust collection and sand washing processes, or other large abrasive matter such as metal chips from the process.

During plant visits and phone calls to many plants with high recycle rates, inquiries were made to identify operating and maintenance problems and the solutions implemented to overcome the problems encountered. Information from plants operating under conditions of high TDS or other conditions conducive to fouling and scaling of pipes, pumps, air pollution control equipment, etc. indicates that fouling and scaling conditions are manageable plant operating problems which are within the scope of routine maintenance activity. Procedures which would facilitate the use of recycle are: conducting periodic maintenance; maintaining a proper water balance within the recycle system; and properly operating a well designed treatment system (i.e., controlling pH within recommended limits, adding biocides as needed, adding scale inhibitors as needed, etc.).

The analytical water chemistry test data indicate that many plants operating with complete or high-rate recycle should be experiencing severe fouling or scaling conditions. This determination was made by calculating Langelier Saturation and Ryzner's Stability Indices for these recycle systems. These calculations are summarized in the table presented below. These indices provide a means of characterizing the tendency of wastewater streams to form scale deposits or to be corrosive. These plants continue to operate, and have operated for many years, with the complete recycle of process wastewater.

Langelier Saturation and Ryzner's Stability Index Data

Plant	Subcategory	Process	Recycle Rate	Langelier Saturation Index Result	Ryzner's Stability Index Result
57775	Ferrous	Melting Furnace Scrubber	100%	Strong scaling tendency	Strong scaling tendency
56879	Ferrous	Melting Furnace Scrubber	100%	Strong corrosion tendency	Strong corrosion tendency
00001	Ferrous	Melting Furnace Scrubber	100%	Strong corrosion tendency	Strong corrosion tendency
00002	Ferrous	Melting Furnace Scrubber	100%	Strong scaling tendency	Strong scaling tendency
07170	Ferrous	Melting Furnace Scrubber	100%	Strong corrosion tendency	Strong corrosion tendency
07929	Ferrous	Dust Collection	100%	At or near equilibrium	At or near equilibrium
56771	Ferrous	Dust Collection	96%	Strong corrosion tendency	Strong corrosion tendency
15520	Ferrous	Melting Furnace Scrubber	99%	At or near equilibrium	At or near equilibrium
59212	Ferrous	Melting Furnace Wet Cap	99%	Strong scaling tendency	Strong scaling tendency

The transition to a complete recycle mode at foundry operations can often cause several temporary operational problems. The elimination of the blowdown often affects the volume of water recirculated within the recycle system. Water usage becomes unbalanced and steps must be taken to readjust the various flows within the system. This is accomplished by changing valve settings, float or level sensitive switches, and pumping sequences. Many of these adjustments can be anticipated and steps can be taken before closing the loop to reduce upsets in the water balance. In some instances, a balance tank is installed to collect water which surges in the system as pumps are started or stopped. This water is later returned to the recycle system.

One of the more noticeable problems encountered after the transition to the complete recycle mode of operation is the accumulation of excessive sludge or mud in the settling tanks. As previously indicated, the purpose of the settling tanks, clarifiers, or any other sedimentation units is to allow for the removal of solids within the system. Solids removal may be accomplished by suspended solids sedimentation or the precipitation and sedimentation of dissolved solids. After closing the loop, however, some plants experienced greater than normal sludge generation rates or an above normal amount of solids remaining in suspension within the process wastewater. These conditions were overcome by adjusting the pH and water balance levels, and by adding settling aids such as polymers. After transition to complete recycle, more careful attention to these operating conditions was usually necessary. However, this did not require a prohibitive amount of additional labor. In fact, any problems occurring as a result of tightening recycle loops were successfully solved by the plants involved through the use of sound water management practices.

After considering various engineering aspects and determining what plants have accomplished in resolving potential problems, no technical reasons could be identified which would prohibit plants in most process segments from recycling all of their process wastewater. Therefore, with no fundamental differences identified, plants with complete recycle were naturally considered the best performers, and the average of the best performance of these plants resulted in the conclusion that no discharge of process wastewater pollutants was an appropriate BPT level of treatment for some processes.

For those subcategories and process segments where complete recycle has not been demonstrated and could not be transferred, the exemplary effluent flows and exemplary pollutant effluent concentrations were examined to determine the "best" effluent loads. The high level of performance of the "best" plants is generally achieved through preliminary treatment followed by extensive recycle of process wastewaters. Extensive recycle of process wastewater results in significant effluent flow reductions. Therefore, a review of the degree of recycle achieved by plants helped to quantify the "best" effluent flows. In addition, since the effluent load is a product of flow times the pollutant concentration (with appropriate conversion factors), the "best" achievable pollutant effluent levels were developed. Refer to the above discussions pertaining to effluent quality.

IDENTIFICATION OF PROPOSED BPT

Aluminum Casting

Plants within the Aluminum Casting Subcategory employ a variety of manufacturing processes. Comparisons among these processes identify enough dissimilarities with water usage, and the types of pollutants generated, to warrant grouping the plants into five process segments. These segments are:

- Investment Casting
- Melting Furnace Scrubbers
- Casting Quench
- Die Casting
- Die Lubricants

No plant was found to employ all of these manufacturing processes. At most, no more than three of these processes are likely to exist at any plant. For some plants, only investment casting is performed. With other plants, only casting quenching is performed. Due to differences in the processes, water usage and resulting pollutants, and the various process combinations which exist within a plant, it would be impractical to develop BPT with the intent of proposing limitations for combined waste streams from all possible process combinations. Therefore, in developing the BPT level of treatment, the plant data was arrayed by process segment, so that appropriate technical comparisons among similar processes could be made. From these comparisons, the average of the best performances of plants was determined for each process segment.

This approach to BPT development does not prohibit a plant with several of these processes from cotreating the combined process wastewaters. In fact, this approach provides the permit writer with the appropriate building blocks to determine the discharge requirements for a plant cotreating any combination of process wastewaters covered under the Aluminum Casting Subcategory.

Investment Casting Process

Only one plant was identified with any degree of treatment installed. The treatment provided by the other two plants performing this method of aluminum casting is uniformly inadequate in light of the pollutants originating from this process. Therefore the BPT treatment level is based on; (1) the performance of plant 04704 which achieves the degree of effluent reduction attainable through the application of those technologies considered in BPT, and (2) the design effluent levels of well operated commercially available clarifiers, together with coagulant aid addition, in the treatment of other process wastewaters similar in character to investment casting process wastewaters.

Comparison of the plant data indicates that plants 06389 and 04704 have the best effluent flows of the three plants in the survey data base. In addition, plant 04704 has the largest yearly production but uses the least amount of water. Plant 5206 was not considered an exemplary plant due to the large volume of process wastewater generated and the minimal treatment provided. The average effluent flow is therefore based upon the average of the effluent flows of plants 06389 and 04704 (i.e., no recycle).

Sampling data from plant 04704 indicates the presence of the two toxic organic pollutants, tetrachloroethylene and trichloroethylene, in addition to copper and zinc in the raw and treated process wastewaters. The approach taken in the development of the BPT model treatment system for this process segment does not provide for the removal of these toxic organic pollutants, though incidental removal may occur. The control of the toxic organic pollutants remaining in the BPT effluent will be addressed in the BAT discussions, as the intent of BAT is to provide for the control and treatment of the various toxic pollutants.

1. Model Treatment System

Process wastewaters drain to a treatment facility in which the wastewaters are treated in a clarifier. A coagulant aid is added to the process wastewaters prior to clarification in order to enhance floc formation and, in turn, suspended solids removal. The clarifier overflow is discharged, while the underflow is dewatered using a vacuum filter. The filter cake is disposed of via landfilling, while the filtrate is returned to the mix tank. Figure IX-1 depicts the BPT model treatment system.

2. Resulting BPT Effluent Limitations

PROPOSED BPT EFFLUENT LIMITATIONS

Aluminum-Investment Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
TSS	1.103	0.538
Oil and Grease	0.538	0.323
pH	Within the range of 7.5 to 10	

3. Supporting Basis

Flow

The treatment model effluent flow rate of 26,897 l/kkg (6450 gal/ton) is deemed to be practical, as it is the average of the best plants. Plant 04704 achieves this effluent flow. Process wastewater recycle is not reported in the plant survey responses in this process segment.

Concentrations

The concentration levels use to derive the limitations listed above are shown below:

	Concentration (mg/l) Monthly Avg.	One Day Max.
TSS	20.0	41.0
Oil and Grease	12.0	20.0
pH	7.5 - 10	

One plant in the plant survey data base has any degree of treatment in place; this plant uses precipitation and sedimentation. However, the treatment provided at this plant by these technologies was judged by the Agency as inadequate. Therefore, these concentrations, with the exception of pH, are based upon the precipitation-sedimentation and oil skimmming performance data presented earlier in this section. The Agency has determined that these concentrations can be achieved using well-designed, properly operated clarification systems. Additionally, pH is limited to between 7.5 to 10 since this effluent level reflects the operating conditions observed and expected in this particular process. Plant 04704 maintains an effluent pH within this range, and on this basis and on the basis of knowledge of the operating pH conditions of this process, this range is considered practicable and resonable. No toxic metals are limited since they were detected at below a treatable levels. No toxic organic pollutants were selected for regulation in this process segment.

From the current to the proposed BPT level of treatment in the aluminum investment casting process segment, the Agency estimates that 0.1 kg/year of toxic metal pollutants, no toxic organic pollutants, 857.4 kg/year of conventional pollutants, and no nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Melting Furnace Scrubber Process

Scrubbers are used in aluminum melting furnaces to reduce the levels of smoke and fumes given off during the melting process. Data from the five surveyed plants indicate that the scrubbers at three of these plants have internal recycle systems (internal holding tanks). All three of these plants have achieved rates of 95 percent recycle or greater. The other two plants have central treatment systems from which process wastewaters are recycled or reused.

In addition to recycle and basic sedimentation, additional treatment is required at BPT to remove the pollutants present in scrubber effluents. Due to the variability in the quality of scrap charged to the furnaces, fumes can contain significant quantities of oily particles, solids and toxic metals, which are then transferred to the scrubber waters. For this reason, the BPT treatment model must provide the capability for effective oil and grease and metals removal. Facilities for oil skimming (a component demonstrated in this and other processes and subcategories), and for lime and coagulant aid addition (demonstrated in a variety of treatment applications in this and other subcategories and categories), are included in the treatment model to insure proper pH adjustment, oil, solids, and metals removal.

The sampling data from plants 17089 and 18139 indicate the presence of 2,4,6-trichlorophenol, fluoranthene, benzo(a)pyrene, ammonia, phenols and zinc in the raw and treated process wastewaters. However, as the BPT model treatment system components are not specifically designed for ammonia and organic pollutant removal, the control of these pollutants will be addressed under BAT.

1. Treatment Scheme

The BPT model treatment system incorporates batch treatment of the blowdown of a recycle loop with a 95 percent recycle rate. This recycle loop includes a settling tank. The process wastewater overflows from the recycle loop, undergoes emulsion breaking, neutralization with lime, and clarification treatment. The skimmed oil and grease is collected for contractor disposal. The sludge is dewatered using a vacuum filter, with the filter cake being disposed of at a landfill. prior to discharge. Figure IX-2 presents a flow schematic of the BPT model treatment system.

2. Resulting Effluent Limitations

PROPOSED BPT EFFLUENT LIMITATIONS

Aluminum-Melting Furnace Scrubbers

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly average (kg/kkg)
TSS	0.0166	0.00809
Oil and Grease	0.00809	0.00486
pH	Within the range of 7.5 to 10	

3. Supporting Basis

Flow

The BPT model flow was established by averaging the applied flows of the "best" plants, the three with the lowest flows, and then applying a 95 percent recycle rate from the primary settling tank. The settling tank provides more extensive settling (3 to 9 times increased retention time) than that typically provided in settling tanks integrated into the scrubber equipment packages, and more than that found at 3 of the 5 plants in this segment's data base that have 95% recycle or greater.

The average applied flow for the three "best" plants is 8,062 l/kkg (1936 gal/ton). Applying a 95 percent recycle to this value yields an effluent flow of 404 l/kkg (97 gal/ton). The Agency believes that this effluent flow is reasonable, practicable, and achievable.

Concentrations

The concentration levels used to derive the above limitations are shown below:

	Concentration (mg/l)	
	One Day Max.	Monthly Avg.
TSS	41.0	20.0
Oil and Grease	20.0	12.0
pH	7.5 - 10	

These concentrations, with the exception of pH, are based upon the precipitation-sedimentation and oil skimming performance data presented earlier in this section. The Agency has determined that these concentrations can be achieved using well-designed, properly operated clarification systems. The pH is limited to between 7.5 to 10 since this effluent level reflects operating conditions necessary for proper waste neutralization, flocculation, and effective clarification. No toxic metal pollutants are limited since they were detected at below treatable levels. No toxic organic pollutants were selected for regulation in this process segment.

From the current to the proposed BPT level of treatment in the aluminum melting furnace scrubber process segment, the Agency estimates that 101.3 kg/year of toxic metal pollutants, no toxic organic pollutants, 15,870 ky/year of conventional pollutants, and 91.4 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Casting Quench Process

Most plants provide little or no treatment for aluminum casting quench process wastewaters. The pollutants and the associated concentration levels found in these quench solutions at plants 10308, 17089, and 18139 require some form of control. Therefore, treatment information from outside of the Aluminum Casting Subcategory was examined to determine an appropriate transfer of treatment technology. The zinc casting quench data provided sufficient technical justification to apply the zinc casting quench BPT treatment technology to the treatment of aluminum casting quench process wastewaters. Both aluminum and zinc casting quenches contain oils and metal particulates that result from the die casting process and are contained in the wastewaters from the process. Because of these similaries, the zinc casting quench BPT technology, specifically designed to control oils and greases and toxic metal pollutants, and to facilitate the complete recycle of the quench water, is an appropriate technology for transfer to this process segment.

After consideration of the engineering aspects of transferring this technology, there is no indication that the performance of this technology in the treatment of aluminum casting quench wastewaters would be significantly inferior to the performance achieved in the treatment of zinc casting quenches.

The use of complete recycle is based upon the two aluminum casting plants, plants 04809 and 26767 which have achieved a "zero discharge" level of operation. No fundamental differences have been identified which would preclude the use of complete recycle in all plants.

1. Treatment Scheme

This is a complete recycle system. Treatment involves primary sedimentation in a settling tank and oil removal using a skimmer. Settled solids can be removed periodically by either manual or mechanical methods. The solids may either be delivered to an approved landfill, or reused in aluminum melting furnaces. Figure IX-3 illustrates the BPT model treatment system.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

Plant survey responses from 12 plants with aluminum casting quench operations are summarized in Section III. The recycle rate was established on the basis of the average of the best plants. The best plants employ complete recycle of process wastewaters. Plants 04809 and 26767 continuously reuse their aluminum casting quench solutions. Reference can also be made to the transfer of technology from zinc casting quench operations. The BPT treatment model applied flow was established by averaging the six lowest applied flow rates.

From the current to the proposed BPT level of treatment in the aluminum casting quench process segment, the Agency estimates that 7.6 kg/year of toxic metal pollutants 1.3 kg/year of toxic organic pollutants, 881.2 kg/year of conventional pollutants and 2.2 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Die Casting Process

Significant amounts of oils and greases and toxic organic pollutants were found in raw process wastewaters during sampling at plants 17089, 12040 and 20147. Exemplary treatment technology at a minimum would be that which provides some form of oil and grease removal. Therefore, the BPT treatment focuses on the removal of the oils and greases through emulsion breaking and skimming. Five out of the ten surveyed plants use this technology. The additional technologies, settling and filtration, comprising the BPT model treatment system are modeled after the technology installed at plant 17089 and the settling and filtration technology discussed in Section VII. However, even after filtration, several toxic organic pollutants would remain in the effluent of the BPT model treatment system and must therefore be addressed at BAT.

Three plants have demonstrated exemplary effluent flow reduction through the use of extensive recycle of treated process wastewaters. Plant 17089 achieves a 79 percent recycle rate after extensive treatment, plant 14401 achieves a recycle rate of 90 percent after minimal treatment, and plant 20223 achieves a recycle rate of 95%. An average of these recycle rates results in an achievable recycle rate of at least 85 percent (demonstrated by plants 14401 and 20223). Through application of the treatment technologies installed at plants 11665, 12040, 13562, 15265, 17089, and 20223, and implementation of the 85 percent recycle rate, a high degree of effluent reduction and toxic pollutant control (the Agency estimates a 77% reduction from current treatment levels) is achieved.

1. Treatment Scheme

The BPT model system treats process wastewaters from various sources which have been combined during collection. These sources include: die surface cooling sprays, hydraulic fluid leakage, splash over from casting quench tanks, and leakage from non contact cooling water systems (hydraulic fluid heat exchangers). The treatment involves several component process wastewater treatment stages. In the first stage, oils and greases are removed via emulsion breaking with the oil skim being hauled away by a contractor. In the next stage the process wastewater undergoes neutralization and clarification. Lime is added for pH control and a coagulant is added to promote floc formulation. The clarifier underflow is dewatered by a vacuum filter and the filter cake is disposed of at a landfill. The final stage of treatment involves the filtration of the clarifier discharge. Eighty-five percent of the filtrate process wastewater is recycled back to the process, while 15 percent is discharged. Figure IX-4 presents a flow schematic of the BPT treatment model.

2. Resulting Effluent Limitations

PROPOSED BPT EFFLUENT LIMITATIONS

Aluminum-Die Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly average (kg/kkg)
Lead	0.0000726	0.0000653
Zinc	0.000740	0.000305
Phenols (4AAP)	0.000322	0.000161
TSS	0.0109	0.00799
Oil and Grease	0.00726	0.00726
pH	Within the range of 7.5 to 10	

3. Supporting Basis

Flow

The BPT model applied flow rate was established by averaging the applied flow rates of six of the eight plants in the survey data. These flows were markedly less than the other applied flows which were reported. The model recycle rate of 85 percent is based upon the average of the two highest recycle rates (79 percent and 90 percent) noted in the plant survey data.

The model recycle rate (85%) and effluent flow (726 l/kkg, 174 gal/ton) are considered to be reasonable, practicable and achievable.

Concentrations

The concentration levels used to derive the limitations listed above are shown below:

	Concentration (mg/l) One Day Max.	Concentration (mg/l) Monthly Avg.
TSS	15.0	11.0
Oil and Grease	10.0	10.0
Lead	0.10	0.09
Zinc	1.02	0.42
Phenols	0.444	0.222
pH	7.5 - 10	

These concentrations, with the exception of pH and phenols, are based upon the oil skimming, precipitation, sedimentation, and filtration performance data presented. The Agency has determined that these concentrations can be achieved using well-designed, properly operated filtration systems. Additionally, pH is limited to between 7.5 to 10 since this effluent level reflects operating conditions necessary for proper waste neutralization, flocculation, and effective clarification.

The phenols effluent level is based upon the effluent levels observed in the sampling data from Plants 17089 and 12040. Both of these plants provide treatment for the control of oils and greases (and associated organic pollutants) similar to that of the BPT treatment model. In fact, the raw waste phenols concentration at plant 17089 is more than 80 percent greater than the model raw waste concentration. Additional details on the treatment performance capabilities of these plants are presented in Section X. On the basis of this demonstrated performance, this effluent level is considered to be reasonable, practicable, and achievable.

From the current to the proposed BPT level of treatment in the aluminum die casting process segment, the Agency estimates that 169.2 kg/year of toxic metal pollutants, 194.6 kg/year of toxic organic pollutants, 30,240 kg/year of conventional pollutants, and no nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Die Lube Process

The separate collection of die lubricants, for recovery or disposal, occurs at 4 plants. These die lubricants contain substantial amounts of toxic organic pollutants, particularly phenolic compounds, as shown by the sampling data from plant 20147. In addition, the data indicates that the presence of toxic pollutants in die casting process wastewaters is, in part, due to the lubricants dripping from the die molds into a common wastewater collection system. Plants which collect and segregate the die lubricants substantially reduce pollutant concentrations in die casting process wastewaters, but are confronted with the treatment or disposal of the die lubricants collected separately.

These die lubricants are oily in nature, therefore, BPT treatment should at least provide for oil and grease removal. Three of the 4 plants with treatment provide equipment for oil and grease removal, however, each plant approaches this treatment requirement differently. One plant uses ultrafiltration and discharges the filtrate while a contractor disposes of the concentrate. Another plant uses biological treatment, but only 7 percent of the total flow through this central treatment system is from casting processes. The remaining plant uses skimming, cyclone separation, and paper media filtration technologies to recover and reuse the die lubricants. Therefore, comparisons between dissimilar technologies are difficult in developing an average of the best plants. For this process segment, the development of the BPT model treatment system requires a different approach.

A wide variety of treatment technologies, including those installed at the plants in the survey data, were examined. The technology that would fulfill the requirements of BPT had to be demonstrated, commercially available, and practicable. In addition, the examination of technologies included consideration of the specific factors to be evaluated in determining the model control measures and practices for die lube operations. These factors were detailed in Section IV.

After review of the various available technologies, it was concluded that the most appropriate BPT model treatment system would be similar to one of the three demonstrated systems which treat die lubricant discharges. The total cost of application of the BPT technology, in relation to the effluent reduction benefits to be achieved by such application, was also considered. A technology that would provide an economic incentive was considered to be advantageous. As a result of this evaluation, the model technologies selected for the treatment of die lubricant process wastewaters are identical to the recovery technologies demonstrated at plant 20147. Application of this model treatment system not only eliminates the discharge of toxic organic pollutants, but, based upon the cost data from plant 20147, considerably reduces the amount of new die lubricant purchased.

1. Treatment Scheme

This model incorporates a complete recycle system. Die lube process wastewaters drain to a holding tank with an oil skimmer mounted above the tank to remove surface oils and greases. The die lube wastes are pumped from the holding tank to a cyclone separator in which the wastes undergo inertial solids separation on a batch basis. The cyclone concentrate is processed through a paper filter and the filtrate is returned to the cyclone. The paper filter media and the solids deposited on the filter media are removed by a contractor. The cyclone separator effluent is delivered to a storage tank from which it is recycled. Figure IX-5 illustrates the BPT treatment model.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The information contained in the plant survey responses which indicated the use of die lube operations is summarized in Table III-7. The BPT model flow was established by averaging the lowest three of the four indicated applied flows. The complete recycle system flow is based upon the practices observed at plant 20147. charge" flow are based upon the practices observed at plant 20147. This plant was visited as part of the sampling program. The BPT level of treatment for this process is reasonable, practicable, and achievable on the basis of data obtained and practices observed during the sampling program.

From the current to the proposed BPT level of treatment in the aluminum die lube process segment, the agency estimates that 10.7 kg/year of toxic metal pollutants, 322.3 kg/year of toxic organic pollutants, 38,680 kg/year of conventional pollutants, and 33.9 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Copper Casting

Plants within the Copper Casting Subcategory employ a variety of manufacturing processes. Comparisons among these processes identify enough dissimilarities between water usage and types of pollutants generated to warrant further grouping of plants into process segments. These segments are: Dust Collection Scrubbers and Molding Cooling and Casting Quench.

In determining the BPT level of performance, the plant data was arrayed by process segment so that appropriate technical comparisons among similar plants could be made. From these comparisons, the average of the best performances of plants was determined for each process segment.

Dust Collection Scrubber Process

Four of the six surveyed plants indicate the use of complete recycle dust collection operations. These 4 plants exhibit superior performance and are considered the best plants. Although three of these four systems are internal recycle systems, (with internal settling tanks) the design of the BPT model treatment system provides additional settling equipment beyond that required at those plants achieving complete internal recycle.

1. Treatment Scheme

Process wastewater discharges from dust collection operations drain into a settling tank equipped with a dragout mechanism for continuous solids removal. Recycle pumps return all settled process wastewaters to the dust collectors. Figure IX-6 presents a flow schematic for the BPT model treatment system.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

Flow

The BPT model flow was based on an average of the best (lowest) applied flows.

From the current to the proposed BPT level of treatment in the copper dust collection process segment, the Agency estimates that 77.6 kg/year of toxic metal pollutants, 0.3 kg/year of toxic organic pollutants, 191.9 kg/year of conventional pollutants, and 5.3 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Mold Cooling and Casting Quench Process

Plants engaged in mold cooling and the quenching of castings provide minimal treatment of these process wastewaters. Settling is provided by the majority of the plants, while recycle is employed by one plant. A review of the process requirements and wastewater sources, quality and flow rates indicates that copper mold cooling and casting quench operations are similar to ferrous mold cooling and casting quench operations. In the ferrous mold cooling and casting quench segment, complete recycle is a demonstrated treatment technique. Moreover, the one copper plant practicing recycle, Plant 16446, achieves a recycle rate of 99.5 percent. These comparisons led the Agency to conclude that the BPT technology applicable to these copper casting plants is no discharge of process wastewater pollutants. There are no significant differences between plants in these subcategories which would prevent achievement of that level of treatment.

The BPT model treatment system incorporates solids removal equipment, complete recycle of treated wastewaters, and a cooling tower to reduce the heat load on the recycle system.

1. Treatment Scheme

Process wastewaters drain to a settling tank. The settled waters are pumped to a cooling tower and collect in the cold well from which 'all of the process wastewater is recycled to the mold cooling or casting quench operations. Figure IX-7 presents a flow schematic for the BPT model treatment system.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The model applied flow rate used for the copper mold cooling and casting quench process segment is the average of the four plants which furnished information on flow. Although no copper casting plants achieved total recycle of thier applied flow, Plant 16446 practices 99+% recycle. Moreover, the total daily flow and total daily TSS loads for copper mold cooling and casting quench operations are mere fractions of the flows and loads for ferrous operations which demonstrate 100% recycle of treated wastewaters. Therefore, a transfer of technology from the ferrous to the copper mold cooling and casting quench segment is practicable. On this basis, limitations based upon no discharge of process wastewater pollutants to navigable waters are appropriate at BPT.

From the current to the proposed BPT level of treatment in the copper mold cooling and casting quench process segment, the Agency estimates that 115.0 kg/year of toxic metal pollutants no toxic organic pollutants 1659 ky/year of conventional pollutants, and no nonconventional pollutants are removed. Refer to Tablel VI-6 for the individual pollutants.

Ferrous Casting

Plants within the Ferrous Casting Subcategory employ a variety of manufacturing processes. Comparisons among these processes exhibit enough dissimilarities with water usage and types of pollutants generated to warrant the grouping of ferrous casting plants into five process segments.

- Dust Collection Scrubbers
- Melting Furnace Scrubbers
- Slag Quenching
- Mold Cooling and Casting Quench
- Sand Washing

No plant was found to employ all of these manufacturing processes, but a few of the larger plants employ as many as four of these processes. Combinations of two or three processes occur most commonly. Due to the differences in the processes, water usage, and resulting pollutants and the multitude of process combinations which may exist, it would be impractical to develop BPT for the treatment of combined waste streams from various processes. Therefore, in developing BPT, the plant data was arrayed by process segment so that appropriate technical comparisons could be made. From these comparisons, the average of the best performances of plants was determined for each process segment.

This approach to BPT development does not prohibit a plant with several of these processes from cotreating the combined wastewaters. In fact, many plants treat combined wastewaters and extensively recycle the treated effluent back to the processes.

As the plant summary data tables in Section III show, many plants have implemented the complete recycle of process wastewater. For all process segments, the average of the best performances of plants leads to the conclusion that complete recycle of process wastewater pollutants is demonstrated, practicable, and widely employed.

Dust Collection Scrubber Process

Comparisons of the 147 plants using dust collection scrubbers in the survey data base indicate that 65 of these plants settle and completely recycle process wastewater to eliminate the discharge of process wastewater pollutants. Plants which have eliminated the discharge of process wastewater pollutants are similar, with regard to products, manufacturing processes, and air pollution control sources and equipment, to plants which have a discharge. No fundamental differences between "zero discharge" and discharging plants have been identified. The BPT model treatment system incorporates an external sedimentation and recycle system, although many plants use internal complete recycle systems with limited settling capacity. The BPT model treatment system incorporates additional solids removal capability beyond that required by many plants which presently practice complete recycle.

1. Treatment Scheme

Dust collector process wastewater discharges drain to a dragout tank in which the solids are allowed to settle out and are continuously removed for disposal or reuse. Recycle pumps return all process wastewaters from the dragout tanks to the dust collectors. This is a complete recycle system. Figure IX-8 depicts this process BPT treatment model.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT applied model flow rate was established by averaging the best (the lowest) of the applied flows as indicated in the Summary Table III-10. The best plants, with complete recycle systems, are identified in Table III-10.

From the current to the proposed BPT level of treatment in the ferrous dust collection process segment, the Agency estimates that 34,010 kg/year of toxic metal pollutants, 12,470 kg/year of toxic organic pollutants, 1,251, 400 kg/year of conventional pollutants, and 291,850 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Melting Furnace Scrubber Process

The use of a complete recycle system as BPT was established on the basis of 1) a majority (10 of 16) of the plants sampled, 2) a majority (42 of 82) of the plant survey respondents, 3) confirming communications with state and regional environmental authorities, and 4) a phone survey of plants with treatment systems designed by engineering firms which, upon request, will design complete recycle treatment systems. Twenty-four of 32 plants contacted by phone operated melting furnace scrubbers with complete recycle of process wastewaters.

Those sampled plants with complete recycle systems are fundamentally the same, with respect to products, manufacturing processes and air pollution control sources and equipment, as those foundries which do not completely recycle process wastewaters. No information was found to indicate that size, age, or the engineering aspects of application of control techniques would prevent the achievement of complete recycle by plants which have not already done so.

1. Treatment Scheme

The melting furnace scrubber process wastewaters drain to a treatment system which employs pH adjustment with sodium hydroxide as the first step in treatment. The process wastewaters then overflow from the mix tank to a clarifier in which coagulant aid is added to enhance the removal of suspended particulate matter. The clarifier underflow is dewatered by using a vacuum filter, with the resulting filter cake being disposed of at an approved landfill. The clarifier overflow is completely recycled to the melting furnace scrubbers. This is a complete recycle system. Figures IX-9 and IX-10 depict the model treatment systems.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT model applied flow rate was established by averaging the "best" (lowest) flows as indicated in the Summary Table III-11 Plants with complete recycle systems are identified on Table III-11.

From the current to the proposed BPT level of treatment in the ferrous melting furnaces scrubber process segment, the Agency estimates that 177,330 kg/year of toxic metal pollutants, 19,370 kg/year of toxic organic pollutants, 1,467,100 kg/year of conventional pollutants, and 905, 870 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Slag Quench Process

Comparisons of the 62 survey respondents using the slag quenching process indicate that 16 of these plants completely recycle their slag quenching process wastewaters. In addition 3 of the 6 plants sampled completely recycle their process wastewaters. The BPT model treatment system technologies are identical to those in use at plants which have eliminated their process wastewater discharges. The water required to quench slag and sluice it to a drag tank for solids removal need not be of high quality. Therefore, the complete recycle of this process wastewater is practical, is currently practiced by many plants, and can be implemented by other plants which have not yet done so. Based upon observations made at the sampled plants and a review of the survey data, no fundamental differences were ascertained between plants which recycle all of their slag quench process wastewaters and those which do not.

1. Treatment Scheme

Slag quench process wastewaters drain to a dragout tank in which the solids are allowed to settle and are continuously removed for disposal. Recycle pumps return all process wastewaters to the slag quench process. Figure IX-11 illustrates this treatment model.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT model applied flow was established by averaging the "best" (lowest) of the flows on the summary Tables III-12. Plants with complete recycle systems are identified on Table III-12.

From the current to the proposed BPT level of treatment in the ferrous slag quench process segment, the Agency estimates that 36,430 kg/year of toxic metal pollutants, 415.0 kg/year of toxic organic pollutants, 910,780 kg/year of conventional pollutants, and 650,230 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Casting Quench & Mold Cooling Process

Eleven of forty-eight plants have indicated the practicality of completely recycling mold cooling and casting quench process wastewaters. One of the 2 sampled plants recycles all of its process wastewaters. The comparisons of these plants leads to the conclusion that the best performance of these plants is demonstrated by those plants which have achieved no discharge of process wastewater pollutants. All plants were compared with each other to identify any fundamental differences, such as products and manufacturing processes. No significant differences were found.

The BPT model treatment system incorporates solids removal equipment similar to that installed at plants which provide treatment. A cooling tower is included as part of the BPT model treatment system to reduce the heat load on the recycle system.

1. Treatment Scheme

Process wastewaters drain to a settling tank which is equipped with a dragout mechanism to remove settled solids. The accumulated solids are removed for disposal. A process wastewater sidestream is pumped from the settling tank to a cooling tower and is returned to the settling tank. Recycle pumps then return all process wastewaters to the mold cooling and/or casting quench operations. Figure IX-12 illustrates the BPT model treatment system.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT model treatment system applied flow was established by averaging the "best" (lowest) applied flows indicated on the Summary Table III-13. Plants with complete recycle systems are identified on Table III-13.

From the current to the proposed BPT level of treatment in the ferrous mold cooling and casting quench process segment, the Agency estimates that no toxic metal pollutants, no toxic organic pollutants, 228,720 kg/year of conventional pollutants, and 15,400 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Sand Washing Process

Comparisons of the ten foundries noted in the sampling and data base as employing sand washing as a method to reclaim and reuse sand, show that two plants have demonstrated superior performance through the application of treatment technologies and the complete recycle of treated process wastewaters. Further examination of the sampling and plant survey data was performed to determine the appropriateness of establishing a BPT level of treatment based on the performance of these two plants.

Five of the six sampled plants recycle their sand washing process wastewater following sedimentation. These 5 plants and nearly all of the 9 plants in the survey data base have the basic BPT model treatment system sedimentation components in place. Plant 51115, a sampled plant which achieves complete recycle, uses technology that is essentially identical to the BPT model treatment system. In addition, Plant 01381 achieves the proposed BPT effluent limitations. Furthermore, many of the surveyed plants which maintain a discharge provide treatment similar to the BPT model system. These plants treat and extensively recycle their treated process wastewaters prior to discharge.

For some of those plants which practice extensive recycle, plant 15520 for example, no discharge of process wastewater pollutants could be easily achieved through the elimination of the overflow or blowdown from the recycle system. For other plants, increased solids removal may be accomplished through the addition of polymers or other treatment chemicals, as incorporated in the BPT model treatment system. For some plants, more careful attention to operation of the existing treatment system may be all that is required when the discharge is eliminated. Many plants have the equipment in place to reduce pollutant concentrations to levels sufficient for recycle back to the sand washing processes, providing of course, that the equipment is operated properly and has the capacity required for the hydraulic load.

Another factor was also considered in determining the appropriateness of this level of treatment. The total cost of application of BPT technology in relation to the effluent reduction benefits to be achieved by such application was weighed. Cost data received from Plant 51115 shows that no large expenditure in capital was required, and an operating cost reduction after implementation of complete recycle was realized. Therefore, a maximum benefit through the elimination of the discharge of process wastewater pollutants was achieved at an actual reduction in cost. An additional cost reduction is realized since monitoring costs are reduced when process wastewater pollutants are no longer discharged.

1. Treatment Scheme

Sand washing process wastewaters drain to a settling tank, which is equipped with a dragout mechanism for the continuous removal of solids, and from which 90 percent of all process wastewaters are recycled back to the sand washing operation. The settling tank overflow (10 percent of the applied flow) is pumped to a mix tank, where lime is added for pH adjustment. The wastewater in the mix tank, overflows into the clarifier, where polymer is added to enhance floc formation. The clarifier underflow is dewatered using a vacuum filter, with the filter cake being landfilled. The clarifier effluent is recycled back to the sand washing process. Figure IX-13 depicts this process' BPT treatment model.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT treatment model applied flow was determined by averaging the best (the lowest) flows indicated in the data summary, refer to Table III-14.

The application of recycle to the effluent of the primary settling operation was based upon the plant survey data, plant visit observations, and analytical data which indicated that the effluent of this primary settling operation would be of adequate partial recycle quality. The solids from this primary settling operation could also be used again in the sand reclamation process, as no treatment chemicals are added up to that point. The overflow, 10 percent of the total applied flow, of the primary settling tank undergoes further treatment prior to recycle.

Plants 51115 and 01381 achieve the proposed BPT effluent limitations through the complete recycle of sand washing process wastewaters.

From the current to the proposed BPT level of treatment in the ferrous sand washing process segment, the Agency estimates that 1813 kg/year of toxic metal pollutants, 82.5 kg/year of toxic organic pollutants, 473,760 kg/year of conventional pollutants, and 14,040 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Lead Casting

Plants within the Lead Casting Subcategory employ three manufacturing processes which generate process wastewaters. Comparisons among these processes reveal enough process and wastewater quality dissimilarities to warrant the further subdivision of lead casting plants into the following process segments:

Continuous Strip Casting
Grid Casting
Melting Furnace Scrubber

As no single plant employs more than one of these processes, there is no need to develop and implement a BPT level of treatment which provides for the co-treatment of any of the above process wastewaters. Therefore, BPT model treatment systems and effluent criteria were developed separately for each process.

Continuous Strip Casting Process

The sampling survey data from Plant 10145 indicate that wastewater treatment efforts should be directed toward the removal of the toxic metal pollutant, lead. At this plant the raw waste concentrations of the other toxic metals were below those levels attainable with available treatment methods. Referring to Table III-15, a review of the treatment practices employed at the five plants in the survey data base (these are the only plants in this process segment) indicates that all of the plants in this process segment practice equalization, pH adjustment, and solids removal (via sedimentation or filtration). As these technologies are capable of achieving significant reductions in lead effluent levels and loads, and are demonstrated at all plants in the process segment, the BPT model treatment system incorporated these treatment technologies. Recycle is not incorporated in the model treatment system because it is not widely demonstrated in this process segment, and cannot be readily transfered.

1. Treatment Scheme

The BPT model treatment system in this process segment incorporates the pH controlled addition of lime and sedimentation. While assuring that the discharged wastewaters will not exert an adverse impact with regard to pH, the lime addition's primary function is to facilitiate the precipitation of lead. The sedimentation component provides for the removal of lead in both the particulate and hydroxide precipitate forms. Figure IX-14 depicts the model treatment system for this process segment. Precipitation and sedimentation technologies are in use at four of the five plants in this process segment.

2. Resulting Effluent Limitations

CONSIDERED BPT EFFLUENT LIMITATIONS
Lead Continuous Strip Casting Process

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
Lead	0.0000340	0.0000295
TSS	0.00932	0.00454
Oil and Grease	0.00454	0.00272
pH	Within the range 7.5 to 10	

3. Supporting Basis

Flow

The model treatment system does not provide for the recycle of any of the wastewaters generated in the continuous strip casting process. The model treatment system raw waste and treated effluent flow of 227 liters/kkg (54.4 gal/ton) is based upon the average of the plant survey response flows.

Concentrations

The concentration levels used to derive the limitations listed above are shown below:

	Concentration (mg/l) One Day Max.	Concentration (mg/l) Monthly Avg.
TSS	41.0	20.0
Oil and Grease	20.0	12.0
Lead	0.15	0.13
pH	7.5 - 10	

These concentrations, with the exception of pH, are based upon the precipitation-sedimentation and oil skimming performance data presented earlier in this section. These data reflect the performance of the technologies (precipitation- sedimentation) in use at four of the five plants in this segment. The Agency had determined that these concentrations can be achieved using well-designed, properly operated clarification systems. pH is limited to between 7.5 to 10 since this effluent level reflects operating conditions observed and expected in this process.

As there are presently no direct dischargers in this process segment, BPT limitations are not appropriate. Therefore, BPT limitations for the lead subcategory continuous strip casting segment are not being proposed.

Melting Furnace Scrubber Process

Referring to summary Table III-16, of the five plants in the plant survey data base (representing all of the plants which employ the melting furnace scrubber process), four operate with no discharge of process wastewater pollutants. The performance of these plants is, therefore, considered to be exemplary and a demonstration of the best, currently available, practicable technology. Based upon demonstrated capabilities, the BPT level of treatment in this process segment achieves no discharge of process wastewater pollutants.

1. Treatment Scheme

The treatment model achieves no discharge of process wastewater pollutants via the complete recycle of process wastewaters within the manufacturer's scrubber equipment package (i.e., complete internal recycle). Figure IX-16 refers to this mode of treatment.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT level of treatment (complete recycle) is based upon the treatment performance achieved by four of the five plants in this process segment's data base. It should be noted that the data base reflects the operations of all plants within this process segment. Refer to Table III-16 for a summary of pertinent operational data for these plants.

Grid Casting Process

Data on this segment of the category was solicited and compiled by a different study contractor. Therefore, the Agency does not have specific process wastewater flow information for this process segment. Wastewaters are generated in this segment by air pollution control devices which are used to scrub the fumes generated in the pouring and casting of lead into battery grids. After conducting an engineering evaluations of the data and informtion provided by air pollution control equipment vendors and the industry, the Agency has concluded that the grid casting and lead melting furnace scrubber process segments are similar with respect to the generation of process wastewaters and wastewater characteristics.

The treatment data for this segment is uniformly inadequate. Therefore, the Agency has technologies from the lead melting furnace scrubber segment. As noted above, the Agency believes that these segments are related and thus justify the technology transfer. In the lead melting furnace scrubber process segment, four of the five operations in the indsutry achieve zero discharge. Wastewater treatment in the melting furnace scrubber segment is provided in the scrubber packages. The treatment components of the grid casting model treatment system provide treatment at least equivalent to that (settling and recycle) provided in the scrubber packages. The scrubbers in these two process segments are similar in design and function.

1. Treatment Scheme

The treatment model for the grid casting process segment consists of lime addition and sedimentation followed by complete recycle. Figure IX-15 depicts this system. This system provides treatment equivalent to that achieved in the scrubber equipment packages in us the lead melting furnaces scrubber process segment.

2. Resulting Effluent Loads

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT level of treatment (complete recycle) is based upon the treatment performance achieved by four of the five plants in the lead melting furnace scrubber process segment. The Agency considered this to be on appropriate technology transfer.

Magnesium Casting

Plants within the Magnesium Casting Subcategory employ two manufacturing processes which generate process wastewaters. Comparisons between these two processes exhibit enough dissimilarities, relating to processes and water use, to warrant further division of these plants into the process segments. These segments are:

Grinding Scrubbers
Dust Collection Scrubbers

Either one or both of these processes may be operated at a plant. If a plant performs any grinding on the casting to remove excess metal or unwanted material from the casting surface or to impart a desired surface characteristic, a scrubber is required to control the magnesium dust produced from the grinding operation. Dry type dust collectors, such as baghouses, are undesireable due to the explosive nature of the dry magnesium dust. Dust collection scrubbers or baghouses are used to clean dust arising from shake out, core and mold making activities, and other sand handling activities. Dusts from sand handling activities may be controlled using either wet or dry air pollution control devices.

BPT was developed for each process. However, this approach does not prohibit a plant with both of these processes from cotreating the combined process wastewaters. This approach provides the permit writer (using a building block approach) with the means to write a permit for magnesium casting plants with one or both of these processes.

The scrubbers used for cleaning emissions from both the grinding and dust collection operations are similar in design and function. Both scrubbers provide internal settling of process wastewaters prior to recycle or discharge.

Grinding Scrubber Process

The scrubbers used to clean magnesium dusts are similar in design and function to those scrubbers used in the collection of dusts associated with the casting of ferrous metals. As the level of treatment indicated in the survey data summary for this segment is considered to be uniformly inadequate, the Agency reviewed data from other process segments to determine the appropriate technology transfer. The industry survey data indicate that the majority of the dust collection scrubbers at ferrous foundries are operated with complete recycle of process wastewaters. Consideration was therefore given to the appropriateness of transferring ferrous casting BPT model treatment technologies to the magnesium grinding scrubber segment.

The mechanism of dust cleaning, i.e., the removal of airborne particulates through the use of water, is the same for both the ferrous dust collection and magnesium grinding scrubber processes. The sizes of the particulates in the casting sand dusts and in the magnesium dusts are roughly similar. The magnesium and other particulates present in the grinding scrubber are likely to settle in a manner similar to the particulates present in the ferrous casting dust collection scrubber process wastewaters, given the same particle size, geometry of the settling chamber, and flow. After consideration of the similarities between the two processes and waste characteristics, especially particle size, the transfer of technology is reasonable, feasible, and practicable. Therefore, limitations providing no discharge of process wastewater pollutants are appropriate for BPT.

1. Treatment Scheme

Grinding dusts from magnesium castings exhibit flammable properties when dispersed in the atmosphere. Therefore, scrubbers are used to collect the magnesium dusts and eliminate these hazards. The process wastewaters from the scrubber drain to a settling tank, and are completely recycled back to the scrubber. The solids which accumulate in this tank are periodically removed.

Figure IX-17 illustrates the BPT model treatment system for this process.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT model applied flow is based upon the process wastewater flow observed during the sampling program conducted at plant 08146.

From the current to the proposed BPT level of treatment in the magnesium grinding scrubber process segment, the Agency estimates that 2.1 kg/year of toxic metal pollutants, no toxic organic pollutants, 54.6 kg/year of conventional pollutants, and 0.5 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Dust Collection Scrubber Process

Plant 08146 is the only magnesium casting plant in the data base with a dust collection scrubber. The scrubber process wastewater is settled and partially recycled internally. However, the internal recycle overflow is not treated before discharge. The opportunity for sedimentation provided within the scrubber equipment package is inadequate to achieve a level of pollutant removal suitable for discharge, particularly zinc, found in the effluent from plant 08146. This level of treatment is considered to be inadequate. The Agency developed a BPT model treatment system for magnesium dust scrubbers based on transfer of treatment technologies. The technology for this process segment is identical to that approach taken in the development of a BPT model treatment system for the magnesium grinding scrubber process segment. The considerations and evaluations made for the grinding scrubber technology transfer apply to this process segment as well. The BPT model treatment technologies for magnesium dust collection scrubbers were transferred from those in use and demonstrated in the control of process wastewater pollutant discharges from ferrous foundry dust collection scrubbers.

1. Treatment Scheme

Dust collection wastewaters drain to a settling tank equipped with a dragout conveyor to remove solids. Pumps recycle all process wastewaters back to the dust collectors. Figure IX-18 depicts this model treatment system.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

The BPT model applied flow is based upon the flow observed during the sampling visit conducted at plant 08146.

From the current to the proposed BPT level of treatment in the magnesium dust collection process segment, the Agency estimates the 1.0 kg/year of toxic metal pollutants, no toxic organic pollutants, 104.0 kg/year of conventional pollutants, and 27.2 kg/year of nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Zinc Casting

Plants within the Zinc Casting Subcategory employ two manufacturing processes which result in a process wastewater. Comparisons between these two processes reveal enough dissimilarities between processes and water use to warrant further grouping of these plants into separate process segments. These segments are:

Die Casting and Casting Quench
Melting Furnace Scrubber

Both of these processes may be operated at a plant. The BPT limitations were developed for each process separately. However, this approach does not prohibit a plant with both of these processes from cotreating the combined process wastewaters. This approach to BPT development provides the permit writer with the means (via a building block approach) to write a permit for zinc casting plants with either one or both of these processes.

Die Casting and Casting Quench Process

Generally, the survey data indicate that plants which provide extensive treatment, jointly treat zinc die casting and casting quench process wastewaters with process wastewaters from sources not included in this category. The toxic pollutant loads and concentrations found in the quench solutions at the sampled plants (10308, 18139, 04622, and 12040) require some form of control other than dilution with other process wastewaters.

The oil and grease concentrations found at the sampled plants justify some form of oil and grease removal. The toxic metal pollutants found in the die casting and casting quench process wastewaters are in the particulate form and settle rapidly. The plants in the survey data were compared with each other, and four plants (01334, 05947, 10308, and 10475) were found to exhibit exemplary performance. These plants completely recycle their zinc casting quench process wastewaters. In addition, two other plants (06606 and 09105) do not continuously discharge. Plant 06606 only discharges casting quench process wastewaters once per month, and plant 09105 removes its quench wastewaters only once per year. However, neither plant provides oil removal treatment. In a number of plants, die casting and casting quench process wastewater discharges only occur as a result of splashing, leakage, and carry over as the castings are removed.

The quenching process was found to be uniform from plant to plant. The oils and greases found in the quench tank require removal. Many plants periodically discharge in order to remove this oil. Providing oil and grease removal equipment, as incorporated with the BPT model treatment system, eliminates the need to have this discharge. Therefore, based upon the average of the best performances, and upon the design of the BPT model treatment system, limitations providing no discharge of process wastewater pollutants are appropriate for BPT.

1. Treatment Scheme

This system incorporates complete recycle. Treatment involves primary solids removal in a settling tank and oil removal using a skimmer. Settled solids can be removed periodically by either manual or mechanical methods and then allowed to drain on-site in a designated area. Solids may then be delivered to a sanitary landfill or reused as scrap. Refer to Figure IX-19 for this model treatment system's flow diagram.

2. Resulting Effluent Limitations

No discharge of process wastewater pollutants to navigable waters.

3. Supporting Basis

In order to provide a measure of prudent water management (i.e., care in maintenance, leak prevention, water conservation, etc.), the BPT model treatment system applied flow for die casting and casting quench operations was determined by averaging the lowest 5 of the 12 plant survey responses with available flow information. All five of the plants used for this flow average have applied flows of less than 100 (gal/ton), while the remaining plants have flows in excess of 500 (gal/ton). It should be noted that the 5 plants used for the average applied flow cover all employee groups and also include one of the highest and also one of the lowest production operations. Refer to Table III-19 for a summary of plant survey data.

From the current to the proposed BPT level of treatment in the zinc casting quench process segment, the agency estimates that 318.2 kg/year of toxic metal pollutants, 18.2 kg/year of toxic organic pollutants, 13,550 kg/year of conventional pollutants, and 11.6 kg/year of nonconcentional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

Melting Furnace Scrubber Process

Extensive internal recycle of melting furnace scrubber process wastewaters was found to be the norm of operation for zinc casting plants required to use air pollution control devices on zinc melting furnaces. The scrubber equipment package provides sufficient settling to enable high internal recycle rates. Most scrubber blowdown flows are uncontrolled overflows.

Plants within this process segment were compared with each other to identify those plants with the "best" performance. General practice for these plants involves extensive internal recycle followed by treatment. Emulsion breaking, skimming, sedimentation, and discharge are performed by some of these plants.

A review of the plant data and engineering information furnished by scrubber manufacturers led to the selection of 95 percent internal recycle as an appropriate value. The equipment used by plants treating this process wastewater and the effluent concentrations achieved by this technology provide an adequate basis for defining treatment capabilities, when potassium permanganate is added for the destruction of phenolic compounds.

The treatment equipment installed at the surveyed plants was found to be uniformly inadequate with respect to phenols treatment. Phenols were present in significant amounts in the raw and treated process wastewater from Plant 18139. Phenols concentrations are dependent on the type of oils and the degree of contamination of the scrap. With the level of phenols present in process wastewaters, BPT, at a minimum, should provide some form of phenols removal. Therefore, after consideration of the various phenols treatment methods available, as discussed in Section VII, potassium permanganate addition was considered to be the most appropriate for phenols control in this process segment. The use of potassium permanganate for phenols destruction allows maximum flexibility in the treatment of phenols. The amount of potassium permanganate added to the treatment system can be easily increased or decreased depending on the fluctuations in phenols raw waste levels. In addition, this technology requires only minor modification of and/or addition to existing treatment facilities.

1. Treatment Scheme

This scheme involves treatment of the discharge of a melting furnace scrubber system with an internal recycle rate of 95 percent. The treatment includes emulsion breaking, neutralization in conjunction with potassium permanganate feed for phenols destruction, and clarification. These technologies are demonstrated at 60% of the plants in the plant survey data base. The oils and greases are collected in a scum tank and hauled away. The clarifier underflow (sludge) is dewatered using a vacuum filter, and the filter cake is landfilled. The clarifier effluent is discharged. Figure IX-20 illustrates the treatment model for this process segment.

2. Proposed BPT Effluent Limitations

Zinc-Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
Zinc	0.00419	0.00176
Phenols (4AAP)	0.0315	0.0157
TSS	0.129	0.0630
Oil and grease	0.0630	0.0378
pH	Within the range of 7.5 to 10	

3. Supporting Basis

Flow

Flow information in the five plant survey responses provided usable flow information on only two scrubber systems. The average of these two applied flows is 62535 liters per kkg (15,000 gallons per ton). All of the plants in the data base indicated that the process wastewater discharge from each melting operation was simply the blowdown or overflow from a scrubbing equipment package as supplied by a manufacturer. This scrubber package provides sufficient wastewater treatment and handling capabilities to enable extensive process wastewater recycle. For the purpose of BPT model development, the average internal (within the scrubber equipment package) recycle rate was determined to be 95 percent. This rate is based upon an average of three plants with the highest recycle rates. These plants have recycle rates of 100 percent, 98 percent, and 90 percent. The recycle rate of at least 95 percent was obtained by evaluating the information available in light of equipment capabilities, engineering experience, and current industry operational practices. With the use of an internal recycle rate of 95 percent and a discharge rate of 5 percent, the resulting treatment model discharge flow is 3147.6 l/kkg (755 gal/ton) of metal poured.

Information indicates that three of the four plants with process wastewater discharges already have effluent flows below this level, and that the remaining plant's flow is only slightly greater.

Concentrations

The concentration levels used to derive the limitations listed above are shown below:

	Concentration (mg/l) One Day Max.	Monthly Avg.
TSS	41.0	20.0
Oil and Grease	20.0	12.0
Zinc	1.33	0.56
Phenols	10	5.0
pH	7.5 - 10	

These concentrations, with the exception of pH, are based upon the precipitation-sedimentation and oil skimming performance data presented earlier in this section. These data reflect the performance of the treatment technologies demonstrated at 60% of the plants in the plant survey data base. The Agency has determined that these concentrations can be achieved using well-designed, properly operated clarification and permanganate oxidation system. pH is limited to between 7.5 to 10.0 since this effluent level reflects operating conditions necessary for proper waste neutralization, clarification, and, in particular, effective phenols destruction.

From the current to the proposed BPT level of treatment in the zinc melting furnace scrubber process segment, the agency estimates that 46.0 kg/year of toxic metal pollutants, no toxic organic pollutants, 2604 kg/year of conventional pollutants, and no nonconventional pollutants are removed. Refer to Table VI-6 for the individual pollutants.

ANALYSIS OF BPT DISCHARGE ALTERNATIVES

Review

For the fourteen process segments (identified on Table IX-4) for which the Agency is proposing 100 percent recycle of process wastewater at BPT, the Agency considered two less stringent treatment alternatives. These alternatives incorporate treatment and and partial recycle. Both discharge alternatives are designed to be compatible with in-place treatment technologies and are based upon solids and metals removal technologies currently used by foundries, i.e., lime addition followed by sedimentation. The options differ by the extent of partial recycle. One option is based upon 90 percent recycle and the other is based upon 50 percent recycle. Oil skimming devices are included as required, for both options.

In developing these alternatives the Agency examined its data base and found that approximately 86 percent of the 287 direct dischargers and 327 POTW dischargers place or have only simple settling and partial recycle with a discharge. Six percent of these dischargers (40 plants) now have lime precipitation and sedimentation treatment in place with recycle rates of 90 percent. The remaining eight percent of these dischargers (47 plants) have lime precipitation and sedimentation technology in place but predominantly do not recycle their treated wastewaters. Those few plants that do recycle do so at rates of less than 40 percent. Table IX-5 summarizes this information.

Using the current practices of plants dischargeing process wastewaters, the Agency developed model treatment systems and engineering cost estimates for several typical subcategories and process segments. Treatment models were developed for the treatment of wastewaters from a single process source and from multiple casting wastewater sources that are co-treated in the same treatment system. The component technologies of these discharge models are summarized on Table IX-6 together with model treatment system costs. This table also summarizes the components and costs of the proposed BPT complete recycle treatment models.

For 12 of the 14 process segments, both discharge alternatives are based upon simple sedimentation followed by partial recycle and treatment of the discharge. These technologies are similar to those of the complete recycle systems but the wastewaters not recycled are treated by lime and settle technology prior to discharge. The model treatment systems for these 12 process segments are identified on Figure IX-21. This model depicts the general treatment model for simple settling, partial recycle and lime precipitation and sedimentation treatment of the blowdown.

For process reasons, treatment is required before recycle for two process segments; i.e., the ferrous melting furnace scrubber and the aluminum die lube process segments. Hydroxide addition for corrosion control and flocculation of suspended solids is necessary before recycle in ferrous melting furnace scrubbers to prevent severe corrosion of pipes, pumps and scrubber parts. Dissolved furnace combustion gases in the scrubber wastewaters lower the pH of the wastewater and hydroxide is added to raise the pH to a non-corrosive level.

The complete recycle technology of the aluminum die lube process reclaims used die lubricant for reuse. After application of the die lubricant to the die face and mold, several plants collect the used die lubricant separately from other die casting wastewaters. These used die lubricants are either reclaimed for further use or are treated before recycle and discharge. All plants that recycle this wastewater provide solids removal prior to recycle. The discharge alternatives for this process segment reflect this industry practice. Figure IX-22 displays the general treatment model for the ferrous melting furnace scrubber and aluminum die lube processes.

<u>Cost Comparison of BPT Alternatives</u>

For the selected model treatment systems, Figure IX-23 graphically depicts the BPT costs detailed on Table IX-6. Capital and operating costs increase as the discharge volume increases because of the additional precipitation and sedimentation treatment equipment treating the wastewaters after primary settling. As the amount of recycle decreases, the size and cost of the precipitation and sedimentation treatment system increases due to the larger discharge flow requiring treatment.

Figure IX-24 illustrates the model simple settling and recycle system of a ferrous dust collection scrubber. This system provides for the treatment of the wastewaters from the dragout tank (simple settling). With 90 percent recycle, the flow at point 4 is 10 percent of the flow at point 1. Ninety percent of the flow at point 1 is recycled back to the scrubber. With 50 percent recycle the flow at point 4 is half of that at point 1 and the same as that at point 2.

At 100 percent recycle, the flow at point 4 (Figure IX-24) is zero and the precipitation and sedimentation equipment is not needed. As indicated by the data on Table IX-7 which characterizes the waste water quality of several sampled plants at sample points 2 or 4, the wastewater requires further treatment before discharge.

Table IX-6 shows that for plants with little or no treatment in place, it is substantially less costly to install simple settling with complete recycle than it is to install precipitation and sedimentation and recycle. For example, for a medium-sized ferrous foundry with no existing technology for treating dust collection scrubber wastewaters, simple settling with complete recycle would require investment costs of $119,000 and annual costs of $96,000 (primarily for sludge disposal). Treatment would consist of a a dragout tank and recycle pumps and piping.

The comparative figures for installing and operating equipment of the 90 percent and 50 percent recycle systems are significantly higher. For the 90 percent recycle option, investment costs would be $247,000 and annual costs would be $119,000. Treatment of the 10 percent discharge would include chemical feed equipment, a clarifier and a vacuum filter (Figure IX-23). For the 50 percent recycle option, investment costs would be $360,000 and annual costs would be $140,000. The technologies would be the same as for the 90 percent recycle alternative but the chemical feed equipment, clarifier and vacuum filter would be larger. Costs are higher for the 50 percent recycle option than for the 90 percent recycle option because the system must treat five times as much water.

With complete recycle of process wastewaters, no monitoring of discharge is required therefore, no monitoring costs are incurred. With the discharge alternatives monitoring of treated discharged wastewaters is required. The monitoring criteria and costs that would be incurred for the processes and process combinations listed in Table IX-6 are detailed in Table IX-7.

These costs are graphically depicted in the bar charts of Figure IX-25. Monitoring costs are not included in the cost comparison shown in Table IX-6.

A comparison of the costs appearing in Table IX-6 slows a slight increase in annual costs for both discharge alternatives above the proposed BPT. Increases in annual costs arise from the increase in energy and sludge disposal costs, as illustrated on Figure IX-26.

Comparison of Discharge Loads Among BPT Alternatives

The Agency also compared the pollutants discharged for the two alternatives. At BPT, the precipitation and sedimentation treatment systems of the discharge alternatives are designed for suspended solids and toxic metal pollutant removals by lime addition and sedimentation technologies. Precipitation and sedimentation technologies are not designed to remove toxic organic pollutants. Oil skimming may remove some of these pollutants, but the removals have not been clearly quantified. For purposes of this analysis, it is assumed that the toxic organic pollutants are not removed and for the two discharge alternatives, the BPT waste loads remain the same as the current discharge levels.

For the processes identified on Table IX-6 the Agency has tabulated the model treatment waste loads for toxic pollutants, conventional and conconventional pollutants. This tabulation appears in Table IX-9 and is presented graphically oin Figures IX-27 and IX-28. The bar charts are labeled Alternatives 1, 2, and 3. Alternative 1 represents the BPT proposed levels. Alternative 2 represents the 90 percent recycle level and alternative 3 represents the 50 percent recycle levels. All following bar graphs are labeled in this manner.

The Agency has also estimated total industry discharge waste loads for the proposed BPT level of treatment and for the two discharge alternatives. The trend toward greater discharge levels for each discharge alternative appearing in Figures IX-26 and IX-27 continues with industry wide estimates of discharge waste loads for toxics, conventional and non-conventional pollutants. The toxic organic polutants not controlled at the alternative BPT levels appear in Table IX-11. For the discharge alternatives, these pollutants are discussed briefly in Section X of this document. The waste loads of the discharge alternatives are calculated from the effluent limitations that would be established if either the 90 percent or 50 percent recycle alternative were proposed. These alternative limitations are detailed in Table IX-15 for the 90 percent recycle alternatives and in IX-16 for the 56 percent recycle alternatives.

The Agency did not sample the effectiveness of the precipitation and sedimentation technologies in plants for which complete recycle is proposed since so many foundries in these process segments are achieving complete recycle. Accordingly, the data that indicate what precipitation and sedimentation can be expected to achieve in the category was derived from the process segments for which some discharge would be allowed at BPT and PSES.

The wastewaters of the process segments for which complete recycle is proposed for BPT (and for PSES) are similar to the wastewaters of the categories from which the precipitation and sedimentation treatment effectiveness data were compiled (See Section VII). The processes and technologies used in these process segments are similar to the processes and technologies used in the categories from which the precipitation and sedimentation data were compiled. Where plants have installed waste treatment technologies but have not implemented complete recycle, precipitation-sedimentation treatment technology and partial recycle is the most frequently selected technology.

Major Assumptions of BPT Discharge Analysis

In making its analysis, the Agency has estimated the expected compliance strategy the industry would follow given a choice of alternative limitations. To compute cost and discharge comparisons, it was necessary to determine what technology would be installed in response to the Agency's selection of a BPT option.

Treatment in place for the industry varies widely (see Table IX-5). OF the 965 foundries that generate process wastewaters ("wet" plants), 351 have implemented complete recycle. Five hundred and twenty-seven of the remaining 614 plants have little or no treatment in place. Based on treatment model systems, the Agency concludes that for these 527 plants, complete recycle is considerably less costly than the other options because expensive precipitation and sedimentation equipment is unnecessary to implement complete recycle. The Agency's analysis assumed that these plants would implement complete recycle regardless of the BPT alternative proposed. Table IX-12 illustrates the strategy which the Agency expects plants with various levels of treatment equipment in place will implement to the various alternatives.

For 87 plants, the 90 percent and 50 percent recycle alternatives are less costly than the proposed BPT level of treatment. This is because these 87 plants already have precipitation and sedimentation technology in place. The cost of additional recycle pumps and pipes varies depending on the alternative and the extent to which the plant has existing recycle. The cost increases as the amount of recycle increases. However, the Agency believes that the differences in cost are not substantial because pumps and pipes are less expensive than precipitation and sedimentation equipment.

The Agency estimated the total industry cost of the discharge alternatives, in accordance with these assumptions, as follows.

The capital and annual costs of the proposed BPT for the 14 complete recycle process segments include the cost of complete recycle. The costs of the alternatives using 90 or 50 percent recycle systems are somewhat less than complete recycle systems due to the smaller pumps and pipes required to carry smaller volumes of recycled water. Using model plant recycle system costs (Table IX-6) for each alternative, the Agency determined the maximum cost difference between the model complete recycle system and the model recycle systems associated with each alternative. The Agency used the recycle costs of the gray iron dust collection process (See Table IX-6) in determining a maximum cost difference. The model cost differences appear in Table IX-13. The Agency multiplied the maximum unit cost difference by the number of plants expected to implement one or the other alternative treatment systems. Table IX-5 details the number of plants and Table IX-6 shows the alternative treatment a plant is likely to use based on its existing treatment.

Under the 90 percent recycle alternative, 40 plants would have no additional expenditures because they have the model technology in place. Forty-seven plants would add 90 percent recycle to existing precipitation and sedimentation components. The Agency assumed that the 527 plants with little or no treatment in place would recycle is less costly than precipiration-sedimentation implement complete recycle because, for thes plants, complete technology. The Agency also assumed that the 351 plants with complete recycle now would not downgrade their systems.

The small difference in total cost between the complete recycle option and the 90 percent recycle option is attributable to the following:

1. 40 plants with existing precipitation-sedimentation technology and 90 percent recycle would not be required

to expend the $200,000 (total) to increase their recycle systems from 90 percent to 100 percent.

2. 47 plants with existing precipitation-sedimentation technology and no recycle would save about $235,000 (total). This amount is the cost difference between 90 percent recycle and 100 percent recycle.

Under the 90 percent recycle option, discharged pollutant loads are greater than for the complete recycle option due to the additonal discharge from 87 plants. Although this difference is a small percentage, in absolute numbers the increase in discharged pollutant loads is substantial because present discharge levels for the industry are high. (The 614 wet plants in the industry now discharge 315,000 kg annually of toxic pollutants.)

A comparison of the 50 percent recycle option with the 90 percent recycle option focuses on the 47 plants with precipitation-sedimentation, but no recycle. It is assumed that the 40 plants with precipiration and sedimentation and 90 percent recycle and the 351 plants that have complete recycle would not downgrade their systems. It is also assumed that the 527 plants with little or no treatment in place would implement complete recycle, as they would if the 90 percent recycle option were selected. Each of the 47 plants would save about $24,000, (the difference between implementing 50 percent and 100 percent recycle), and would discharge more pollutants than under the higher-recycle options. Table IX-14 compares the proposed BPT level of treatment with the alternative levels of treatment with respect to total industry costs and discharge loads.

TABLE IX-1

POLLUTANTS SELECTED FOR REGULATION AT BPT
METAL MOLDING AND CASTING INDUSTRY

	Aluminum Casting					Copper Casting	
Pollutant	Investment Casting	Melting Furnace Scrubber	Casting Quench	Die Casting	Die Lube	Dust Collection	Mold Cooling And Casting Quench
005 Benzidine	-	-	-	-	X	-	-
006 Carbon tetrachloride	-	-	-	-	X	-	-
007 Chlorobenzene	-	-	-	-	X	-	-
010 1,2-dichloroethane	-	-	-	-	X	-	-
011 1,1,1-trichloroethane	-	-	-	-	X	-	-
013 1,1-dichloroethane	-	-	-	-	X	-	-
021 2,4,6-trichlorophenol	-	-	-	-	X	-	-
023 Chloroform	-	-	-	-	X	-	-
039 Fluoranthene	-	-	-	-	X	-	-
044 Methylene chloride	-	-	-	-	X	-	-
055 Naphthalene	-	-	-	-	X	-	-
058 4-nitrophenol	-	-	-	-	X	-	-
064 Pentachlorophenol	-	-	-	-	X	-	-
065 Phenol	-	-	-	-	X	-	-
066 bis-(2-ethylhexyl)phthalate	-	-	-	-	X	-	-
067 Butyl benzyl phthalate	-	-	-	-	X	-	-
072 Benzo (a) anthracene	-	-	-	-	X	-	-
077 Acenaphthylene	-	-	-	-	X	-	-
078 Anthracene	-	-	-	-	X	-	-
080 Fluorene	-	-	-	-	X	-	-
081 Phenanthrene	-	-	-	-	X	-	-
084 Pyrene	-	-	-	-	X	-	-
085 Tetrachloroethylene	-	-	-	-	X	-	-
087 Trichloroethylene	-	-	-	-	X	-	-
091 Chlordane	-	-	-	-	X	-	-
114 Antimony	-	-	-	-	-	-	-
115 Arsenic	-	-	-	-	-	-	-
118 Cadmium	-	-	-	-	-	-	-
119 Chromium (Total)	-	-	-	-	-	-	-
120 Copper	-	-	X	-	X	X	X
122 Lead	-	-	-	X	X	X	-
124 Nickel	-	-	-	-	-	X	-
128 Zinc	-	-	X	X	X	X	X
Ammonia (N)	-	-	-	-	X	-	-
Fluoride	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	X	-
Iron	-	-	-	-	-	-	-
Phenols (4AAP)	-	-	-	X	X	X	-
Sulfide	-	-	-	-	X	-	-
Xylene	-	-	-	-	X	-	-
TSS	X	X	X	X	X	X	X
Oil & Grease	X	X	X	X	X	X	X
pH (Units)	X	X	X	X	X	X	X

TABLE IX-1
POLLUTANTS SELECTED FOR REGULATION AT BPT
METAL MOLDING AND CASTING INDUSTRY
PAGE 2

	Ferrous					Lead		
Pollutant	Dust Collection	Melting Furnace Scrubber	Slag Quench	Mold Cooling And Casting Quench	Sand Washing	Continuous Strip Casting	Melting Furnace Scrubber	Grid Casting
005 Benzidine	-	-	-	-	-	-	-	-
006 Carbon tetrachloride	-	-	-	-	-	-	-	-
007 Chlorobenzene	-	-	-	-	-	-	-	-
010 1,2-dichloroethane	-	-	-	-	-	-	-	-
011 1,1,1-trichloroethane	-	-	-	-	-	-	-	-
013 1,1-dichloroethane	-	-	-	-	-	-	-	-
021 2,4,6-trichlorophenol	-	-	-	-	-	-	-	-
023 Chloroform	-	-	-	-	-	-	-	-
039 Fluoranthene	-	-	-	-	-	-	-	-
044 Methylene chloride	-	-	-	-	-	-	-	-
055 Naphthalene	-	-	-	-	-	-	-	-
058 4-nitrophenol	-	-	-	-	-	-	-	-
064 Pentachlorophenol	-	-	-	-	-	-	-	-
065 Phenol	-	-	-	-	-	-	-	-
066 bis-(2-ethylhexyl)phthalate	-	-	-	-	-	-	-	-
067 Butyl benzyl phthalate	-	-	-	-	-	-	-	-
072 Benzo (a) anthracene	-	-	-	-	-	-	-	-
077 Acenaphthylene	-	-	-	-	-	-	-	-
078 Anthracene	-	-	-	-	-	-	-	-
080 Fluorene	-	-	-	-	-	-	-	-
081 Phenanthrene	-	-	-	-	-	-	-	-
084 Pyrene	-	-	-	-	-	-	-	-
085 Tetrachloroethylene	-	-	-	-	-	-	-	-
087 Trichloroethylene	-	-	-	-	-	-	-	-
091 Chlordane	-	-	-	-	-	-	-	-
114 Antimony	-	X	-	-	-	-	-	-
115 Arsenic	-	X	-	-	-	-	-	-
118 Cadmium	-	X	X	-	-	-	-	-
119 Chromium (Total)	-	X	X	-	X	-	-	-
120 Copper	X	X	X	-	X	X	X	X
122 Lead	X	X	X	-	X	X	X	X
124 Nickel	X	X	X	-	X	-	-	-
128 Zinc	X	X	X	-	X	X	X	X
Ammonia (N)	X	X	X	-	X	-	-	-
Fluoride	-	X	X	-	-	-	-	-
Manganese	X	X	X	-	X	-	-	-
Iron	X	X	X	X	X	-	-	-
Phenols (4AAP)	X	X	X	-	X	-	-	-
Sulfide	X	X	X	-	X	-	-	-
Xylene	-	-	-	-	-	-	-	-
TSS	X	X	X	X	X	X	X	X
Oil & Grease	X	X	X	X	X	X	X	X
pH (Units)	X	X	X	X	X	X	X	X

TABLE IX-1
POLLUTANTS SELECTED FOR REGULATION AT BPT
METAL MOLDING AND CASTING INDUSTRY
PAGE 3

Pollutant	Magnesium: Dust Collection	Magnesium: Grinding Scrubber	Zinc: Die Casting And Casting Quench	Zinc: Melting Furnace Scrubber
005 Benzidine	-	-	-	-
006 Carbon tetrachloride	-	-	-	-
007 Chlorobenzene	-	-	-	-
010 1,2-dichloroethane	-	-	-	-
011 1,1,1-trichloroethane	-	-	-	-
013 1,1-dichloroethane	-	-	-	-
021 2,4,6-trichlorophenol	-	-	-	-
023 Chloroform	-	-	-	-
039 Fluoranthene	-	-	-	-
044 Methylene chloride	-	-	-	-
055 Naphthalene	-	-	-	-
058 4-nitrophenol	-	-	-	-
064 Pentachlorophenol	-	-	-	-
065 Phenol	-	-	-	-
066 bis-(2-ethylhexyl)phthalate	-	-	-	-
067 Butyl benzyl phthalate	-	-	-	-
072 Benzo (a) anthracene	-	-	-	-
077 Acenaphthylene	-	-	-	-
078 Anthracene	-	-	-	-
080 Fluorene	-	-	-	-
081 Phenanthrene	-	-	-	-
084 Pyrene	-	-	-	-
085 Tetrachloroethylene	-	-	-	-
087 Trichloroethylene	-	-	-	-
091 Chlordane	-	-	-	-
114 Antimony	-	-	-	-
115 Arsenic	-	-	-	-
118 Cadmium	-	-	-	-
119 Chromium (Total)	-	-	-	-
120 Copper	-	-	-	-
122 Lead	-	-	X	-
124 Nickel	-	-	-	-
128 Zinc	X	X	X	X
Ammonia (N)	-	-	-	-
Fluoride	-	-	-	-
Manganese	-	X	-	-
Iron	-	-	-	-
Phenols (4AAP)	X	-	X	X
Sulfide	X	-	-	-
Xylene	-	-	-	-
TSS	X	X	X	X
Oil & Grease	X	X	X	X
pH (Units)	X	X	X	X

X: Pollutant selected for regulation.
-: Pollutant not considered for regulation.

TABLE IX-2

OPERATIONS WITH RECYCLE SYSTEMS INSTALLED

Subcategory	No. of Process Operations[1]	Operations with Listed Degree of Recycle: Some Degree of Recycle No.	Some Degree of Recycle %[2]	>90% Recycle No.	>90% Recycle %[2]	100% Recycle No.	100% Recycle %[2]
Aluminum Casting	34	15	44.1	10	29.4	3	8.8
Copper Casting	12	5	41.7	5	41.7	4	33.3
Ferrous Casting	348	246	70.7	202	58.0	98	28.2
Lead Casting	10	7	70.0	6	60.0	5	50.0
Magnesium Casting	3	1	33.3	1	33.3	1	33.3
Zinc Casting	25	11	40.0	8	32.0	5	20.0
Total	432	285	66.0	232	53.7	116	26.8

(1) Number of operations providing questionnaire responses. See Summary Tables in Section III.

(2) This value reports the number of recycle operations as a percentage of the number of process operations.

TABLE IX-3

ZERO DISCHARGE OPERATION DATA SUMMARY

Subcategory	Process Segment	Plant Code	Production - Tons/Shift of Sand or Metal	Shifts per Day	Source of Data
Aluminum	Casting Quench	04809	0.15	1.25	Update
		26767	3.1	2	Update
	Die Lube	20147	44.6	3	Update, Visit
Copper	Dust Collection	05946	45	1	Update
		09094	256	2	Update, Visit
		19872	333	1.5	Visit
		40001	40	1	DCP
Ferrous	Dust Collection	00396	250	1	Update
		00698	447	1	DCP
		00839	1,640	2	Update
		00880	140	1	DCP
		01381	300	1	Update
		01644	220	1	DCP
		01801	1,095	1.75	Update
		01834	240	2	Update
		02121	200	1	Update
		02195	160	1	Update
		02236	175	1	Update
		02243	128	2	DCP
		02365	232	2	DCP
		02511	140	1	Update
		03118	280	1	DCP
		03313	659	3	Update
		03432	343	2	DCP
		03901	1,500	1	Update
		03913	178	1	Update
		04100	312	1	DCP
		04688	1,600	2	Update
		05333	80	2	DCP
		05417	12.5	2	DCP
		05560	11.8	1	DCP

TABLE IX-3
ZERO DISCHARGE OPERATION DATA SUMMARY
PAGE 2

Subcategory	Process Segment	Plant Code	Production - Tons/Shift of Sand or Metal	Shifts per Day	Source of Data
Ferrous	Dust Collection (Continued)	05640	2,440	1	DCP
		06123	24.8	2	Update
		06265	133	3	DCP
		06426	40	1	Update
		06565	53.4	2	Udpate
		06977	152	3	DCP
		07298	2,144	2	DCP
		07472	661	2	Update
		07929	650	2	Update, Visit
		08301	160	1	DCP
		08436	160	2	Update
		08868	360	3	DCP
		09148	1,240	1	Update
		09306	31.9	2	DCP
		09593	286	1	DCP
		10435	40	1	DCP
		11111	1,368	3	Update
		11197	875	2	DCP
		11865	220	1	Update
		12203	600	3	DCP
		12393	1,800	2	Update
		13416	4,800	2	DCP
		13460	832.5	1	Update
		14104	240	3	Update
		14761	50	2	DCP
		15104	154	1.7	Update
		15372	20	3	Update
		15654	80	3	Update, Visit
		15873	182.5	2	DCP
		16502	228	2	DCP
		17015	350	2	DCP
		17018	3.15	1	Update

TABLE IX-3
ZERO DISCHARGE OPERATION DATA SUMMARY
PAGE 3

Subcategory	Process Segment	Plant Code	Production - Tons/Shift of Sand or Metal	Shifts per Day	Source of Data
Ferrous	Dust Collection (Continued)	17230	384	1	Update
		17746	1,000	2	Update
		18073	5,238	3	Update
		19347	350	2	Updte
		19533	121.6	1	DCP
		19820	48	2	Update
		19933	128	1	Update
		20208	66.5	2	DCP
		20249	1,950	2	DCP
		20345	1,154	2	DCP
		20408	150	2	DCP
		24595	408	1	DCP
		26777	1,800	1	DCP
		27500	2,240	2	Update
		51115	453	1.5	Visit
		53772	75	2	Update
		63773	175	2	Update
		77775	50	2	Update
Ferrous	Melting Furnace Scrubber	00396	55	1	Update
		01381	59	1	Update
		01801	141.8	1.75	Update
		01942	115.7	1	Update
		02195	16	1	Update
		02236	18	1	DCP
		02418	5.2	1	Update
		03399	11	1	Update
		03868	8	1	Update
		03901	200	1	Update
		03913	52	1	Update
		04955	25	1	DCP
		05584	67.3	1	Update

TABLE IX-3
ZERO DISCHARGE OPERATION DATA SUMMARY
PAGE 4

Subcategory	Process Segment	Plant Code	Production - Tons/Shift of Sand or Metal	Shifts per Day	Source of Data
Ferrous	Melting Furnace Scrubber	05640	122	1	DCP
		05658	60	1	DCP
		05691	403.4	2	DCP
		06213	52	2	Update
		06265	113	3	DCP
		06343	72.7	2	DCP
		06426	19.4	1	Update
		07170	4	1	Update, Visit
		07225	1.5	1	DCP
		07234	11	1	DCP
		07438	21	1	DCP
		07472	95	2	Update
		07524	6	1	DCP
		08092	15	1	Visit
		08436	27	2	Update
		09148	34	1	Update
		09151	30	2	DCP
		09183	NA	1	Update
		09441	65.5	2	Update
		12393	180	2	DCP
		17230	91.6	1	Update
		18073	962	3	Update
		18947	423	2	DCP
		19347	64	2	DCP
		19820	123	2	Update
		28822	114	2	Update
		30160	115	1	Update
		58589	40	1	Visit
		58823	58.2	2	Update
		63773	113	2	Update
		77775	72	2	Update

TABLE IX-3
ZERO DISCHARGE OPERATION DATA SUMMARY
PAGE 5

Subcategory	Process Segment	Plant Code	Production - Tons/Shift of Sand or Metal	Shifts per Day	Source of Data
Ferrous	Slag Quench	01942	155.7	1	Update
		02236	18	1	DCP
		03901	2,000	1	Update
		04577	70	1	Update
		05691	201.7	2	DCP
		06565	69.5	1	Update
		07472	95	2	Update
		08663	31	2	Update
		09441	65.5	2	Update
		13416	408	2	DCP
		16666	237	2	DCP
		17746	131	2	Update
		18919	61.8	1	DCP
		18947	423	2	Update
		19347	64	2	DCP
		19820	123	2	Update
		27500	319.6	2	Update
		30160	115	1	Update
Ferrous	Mold Cooling and Casting Quench	01834	42.6	3	Update
		06123	222	2	Update
		06937	5	1	DCP
		11643	70	3	DCP
		15654	173.6	3	Update, Visit
		17015	114.7	2	DCP
		17746	131	2	Update
		18947	212	2	Update
		20408	39	2	DCP
		20719	11.3	1.5	DCP
		21175	12.4	1	DCP
		24566	82.5	2	Update
Ferrous	Sand Washing	01381	75	1	Update
		5115	72	1.5	Visit

TABLE IX-3
ZERO DISCHARGE OPERATION DATA SUMMARY
PAGE 6

Subcategory	Process Segment	Plant Code	Production - Tons/Shift of Sand or Metal	Shifts per Day	Source of Data
Lead	Continuous Strip Casting	10169	15	2	DCP
Lead	Melting Furnace Scrubber	10041	7.5	3	DCP
		10131	12	2	DCP
		10137	9	3	DCP
		10142	7.3	3	DCP
Magnesium	Grinding Scrubber	05244	0.2	1	Update
Zinc	Die Casting and Casting Quench	01334	15	2	DCP
		05947	14	1	Update
		10308	15.6	3	Update
		10475 (1)	25	2	DCP
		29697	3.75	3	Update
Zinc	Melting Furnace Scrubber	04622	22.2	2	Visit

(1)Since the DCP survey, this plant has shifted from casting mostly alumimum products to casting only zinc products.

TABLE IX-4

PROCESS SEGMENTS IN WHICH THE PROPOSED BPT LIMITATIONS ARE NO DISCHARGE OF PROCESS WASTEWATER POLLUTANTS METALS CASTING INDUSTRY

Subcategory	Process Segment
Aluminum	Casting Quench Operations Die Lube Operations
Copper	Dust Collection Operations Mold Cooling and Casting Quench Operations
Ferrous	Dust Collection Operations Melting Furnace Scrubber Operations Slag Quench Operations Casting Quench and Mold Cooling Operations Sand Washing Operations
Lead	Melting Furnace Scrubber Operations Grid Casting Operations
Magnesium	Grinding Scrubber Operations Dust Collection Operations
Zinc	Die Casting and Casting Quench Operations

TABLE IX-5

SUMMARY OF TREATMENT IN-PLACE
METALS CASTING INDUSTRY

Treatment Equipment	Number of Plants		
	Direct Dischargers	POTW Dischargers	Total
Little or no treatment	228	299	527
Chemical addition, sedimentation, and 90% recycle	21	19	40
Chemical addition, sedimentation, but no recycle	38	9	47
Complete recycle	NA	NA	351
Total	287	327	965

NA: Not Applicable

TABLE IX-6

COMPARISON OF BPT MODEL COSTS ($$x10^{-3}$)
SELECTED BPT MODELS VS. DISCHARGE OPTIONS
METALS CASTING INDUSTRY
(Basis 7/1/78 Dollars)

			Selected BPT Model						90% Recycle Option					
Subcategory	Process Segment(s)	Employee Group	Model Capital Cost	Model Annual Cost	Annual Monitoring Cost	Treatment Components (1)	Recycle Capital Cost	Recycle Annual Cost	Model Capital Cost	Model Annual Cost	Annual Monitoring Cost	Treatment Components (1)	Recycle Capital Cost	Recycle Annual Cost
Aluminum	Casting Quench & Die Casting Co-treatment	<50	245	45.39	0.96	EB,NL,FLP, CL,VF,FP, RTP-85	16	2.98	246	45.42	0.96	EB,NL,FLP CL,VF,FP, RTP-90	17	3.01
Copper	Mold Cooling & Casting Quench	-	89	16.66	0	SB,CT, RTP-100	23	4.26	149	27.38	0.79	SB,CT, RTP-90,FLL, FLP,CL	22	4.03
Ferrous (Gray Iron)	Dust Collection	<50	53	25.79	0	DT,RTP-100	22	4.00	156	44.30	0.85	DT,RTP-90, FLL,FLP, CL,VF	21	3.75
		50-249	119	96.00	0	DT,RTP-100	36	6.73	247	119.07	1.70	DT,RTP-90, FLL,FLP, CL,VF	34	6.33
		≥250	341	483.02	0	DT,RTP-100	71	14.38	549	522.59	3.68	DT,RTP-90 FLL,FLP, CL,VF	66	13.52
	Smaller Melting Furnace Scrubber Operations	<50	160	29.13	0	O(2),FLP, NC,RTP-100	47	8.33	172	31.22	0.85	O(2),FLP, NC,RTP,SB	47	8.33
	Melting Furnace Scrubber & Slag Quench Co-treatment	<250	440	91.82	0	DT,NC,CL, FLP,VF,RTP-100	40	7.42	437	91.39	1.70	DT,NC,CL, FLP,VF, RTP-90	37	6.99
Zinc	Casting Quench	<50	20	3.72	0	SB,SS,RTP-100	12	2.11	25	4.73	0.79	SB,SS,RTP-90,FLL,FLP, SB	11	1.98
		50-249	30	5.88	0	SB,SS,RTP-100	15	2.73	45	8.75	0.79	SB,SS,RTP-90,FLL,FLP, SB	14	2.56
		≥250	23	4.54	0	SB,SS,RTP-100	13	2.39	33	6.40	0.79	SB,SS,RTP-90,FLL,FLP, SB	12	2.25

(1): For definitions of C&TT codes, refer to Table III-21.
O(2): Decant and Recirculation Tank.

TABLE IX-6
COMPARISON OF BPT MODEL COSTS ($\$x10^{-3}$)
SELECTED BPT MODELS VS. DISCHARGE OPTIONS
METALS CASTING INDUSTRY
(Basis 7/1/78 Dollars)
PAGE 2

			50% Recycle Option					
Subcategory	Process Segment(s)	Employee Group	Model Capital Cost	Model Annual Cost	Annual Monitoring Cost	Treatment Components (1)	Recycle Capital Cost	Recycle Annual Cost
Aluminum	Casting Quench & Die Casting Co-treatment	<50	241	44.57	0.96	EB,NL,FLP, CL,VF,FP, RTP-50	12	2.16
Copper	Mold Cooling & Casting Quench	-	150	27.25	1.57	SB,RTP-50 FLL,FLP,CL	18	3.28
Ferrous (Gray Iron)	Dust Collection	<50	181	49.06	1.70	DT,RTP-50, FLL,FLP,CL,VF	15	2.66
		50-249	360	140.50	3.68	DT,RTP-50, FLL,FLP,CL,VF	24	4.34
		≥250	766	567.63	7.36	DT,RTP-50, FLL,FLP,CL,VF	47	9.15
	Smaller Melting Furnace Scrubber Operations	<50	191	34.59	3.89	O(2),FLP, NC,RTP,SB	47	8.33
	Melting Furnace Scrubber & Slag Quench Co-treatment	<250	428	89.55	3.61	DT,NC,CL, FLP,VF, RTP-50	28	5.15
Zinc	Casting Quench	<50	32	5.81	0.79	SB,SS,RTP-50,FLL,FLP,SB	8	1.39
		50-249	69	12.90	0.79	SB,SS,RTP-50,FLL,FLP,SB	10	1.79
		≥250	48	9.00	0.79	SB,SS,RTP-50,FLL,FLP,SB	9	1.59

TABLE IX-7

DRAGOUT TANK EFFLUENT QUALITY (mg/1)
METALS CASTING INDUSTRY

Plant Code	Sampling Day	Pollutants				
		TSS	Copper	Lead	Zinc	Phenols (4AAP)
06956	1	2390	0.25	0.58	1.5	3.99
	2	7660	0.19	0.63	1.4	30.70
	3	3590	0.11	0.53	1.2	3.92
07929	1	1370	-	0.35	0.42	1.18
	2	700	0.15	0.15	0.34	0.85
	3	1700	0.16	0.23	0.22	0.50
09094	1	1000	-	5.8	38.0	1.98
	2	374	3.3	6.4	38.0	3.30
	3	446	1.1	2.1	7.5	0.16
20009	1	1920	-	0.47	0.65	7.8
	2	16,550	0.65	0.84	0.11	4.0
	3	14,260	0.56	0.17	0.19	3.3

Note: The sample points at each of these sampled plants correspond to sample points 2 and 4 on Figure IX-24.

TABLE IX-8

BPT AND DISCHARGE OPTION MONITORING COST CRITERIA
METALS CASTING INDUSTRY

Sampling frequencies are based upon the following discharge flow values:

Discharge Flow (liters/day)	Sample Collection Frequency
0-37,850	1 per month
37,850-189,250	2 per month
189,250-378,500	1 per week
378,500-946,250	2 per week
>946,250	3 per week

Monitoring costs include analytical costs for the following pollutants (indicated by x):

Subcategory	Process Segment(s)	Pollutants						
		TSS	O&G	pH	Copper	Lead	Zinc	Phenols(4AAP)
Aluminum	Die Casting & Casting Quench Co-treatment	X	X	X		X	X	X
Copper	Mold Cooling & Casting Quench	X	X	X	X		X	
Ferrous	Dust Collection	X	X	X	X	X	X	
	Melting Furnace Scrubber	X	X	X	X	X	X	
	Melting Furnace Scrubber & Slag Quench Co-treatment	X	X	X	X	X	X	
Zinc	Casting Quench	X	X	X		X	X	

TABLE IX-9

COMPARISON OF BPT MODEL WASTE LOADS (KG/YEAR)
SELECTED BPT MODELS VERSUS DISCHARGE OPTIONS
METALS CASTING INDUSTRY

			Selected BPT Model				90% Recycle Option			
Subcategory	Process Segment(s)	Employee Group	Toxic Organics	Toxic Metals	Conventional Pollutants	Non-Conventional Pollutants	Toxic Organics	Toxic Metals	Conventional Pollutants	Non-Conventional Pollutants
Aluminum	Casting Quench and Die Casting Co-Treatment	<50	0.24	0.34	8.40	0.10	0.16	0.23	5.60	0.07
Copper	Mold Cooling and Casting Quench	-	0	0	0	0	0	1.40	68.21	0
Ferrous (Gray Iron)	Dust Collection	<50	0	0	0	0	31.83	1.77	48.09	9.25
		50-249	0	0	0	0	147.0	8.18	222.1	42.70
		≥250	0	0	0	0	827.5	46.03	1,250	240.4
	Smaller Melting Furnace Scrubber Operations	<50	0	0	0	0	13.63	0.81	30.31	35.16
	Melting Furnace Scrubber and Slag Quench Co-treatment	<250	0	0	0	0	111.3	6.72	246.3	315.9
Zinc	Casting Quench	<50	0	0	0	0	0.05	0.02	1.00	0.00
		50-249	0	0	0	0	0.30	0.12	6.08	0.02
		≥250	0	0	0	0	0.15	0.06	3.08	0.01

TABLE IX-9
COMPARISON OF BPT MODEL WASTE LOADS (KG/YEAR)
SELECTED BPT MODELS VERSUS DISCHARGE OPTIONS
METALS CASTING INDUSTRY
PAGE 2

			50% Recycle Option			
Subcategory	Process Segment(s)	Employee Group	Toxic Organics	Toxic Metals	Conventional Pollutants	Non-Conventional Pollutants
Aluminum	Casting Quench and Die Casting Co-Treatment	<50	0.79	1.13	27.99	0.35
Copper	Mold Cooling and Casting Quench	-	0	6.98	341.1	0
Ferrous (Gray Iron)	Dust Collection	<50	31.83	8.85	240.4	46.23
		50-249	147.0	40.88	1,110	213.5
		≥250	827.5	230.2	6,251	1,202
	Smaller Melting Furnace Scrubber Operations	<50	13.63	4.03	151.6	175.8
	Melting Furnace Scrubber and Slag Quench Co-treatment	<250	111.3	33.58	1,231	1,579
Zinc	Casting Quench	<50	0.05	0.10	5.00	0.02
		50-249	0.30	0.58	30.39	0.10
		≥250	0.15	0.29	15.40	0.05

TABLE IX-10

COMPARISON OF METALS CASTING INDUSTRY
POLLUTANT WASTE LOADS (KG/YEAR X 10^{-3})
DIRECT DISCHARGERS

	Toxic Organic Pollutants	Toxic Metal Pollutants	Conventional Pollutants	Non-Conventional Pollutants
Raw Wastewaters	319.22	14,842	412,260	24,599
Current Level of Treatment Effluent	33.02	250.49	4,404	1,875
Proposed BPT Level of Treatment Effluent	0.14	0.05	3.18	0.01
90% Recycle BPT Level of Treatment Effluent	32.50	3.94	141.30	106.96
50% Recycle BPT Level of Treatment Effluent	32.60	14.26	528.32	413.88

TABLE IX-11

TOXIC ORGANIC POLLUTANTS NOT TREATED BY
THE BPT DISCHARGE ALTERNATIVE TREATMENT TECHNOLOGIES
METALS CASTING INDUSTRY

Pollutant	Aluminum Casting Subcategory	Copper Casting Subcategory	Ferrous Casting Subcategory	Lead Casting Subcategory	Magnesium Casting Subcategory	Zinc Casting Subcategory
001 Acenaphthene	-	-	X	-	-	-
005 Benzidine	X	-	-	-	-	-
006 Carbon Tetrachloride	X	-	-	-	-	-
007 Chlorobenzene	X	-	-	-	-	-
010 1,2-dichloroethane	X	-	-	-	-	-
011 1,1,1-trichloroethane	X	-	-	-	-	-
013 1,1-dichloroethane	X	-	-	-	-	-
021 2,4,6-trichlorophenol	X	-	-	-	-	X
022 Parachlorometa cresol	-	-	-	-	-	X
023 Chloroform	X	-	-	-	-	-
024 2-chlorophenol	-	-	X	-	-	-
031 2,4-dichlorophenol	X	-	X	-	-	X
034 2,4-dimethylphenol	-	-	X	-	-	X
039 Fluoranthene	X	-	X	-	-	-
044 Methylene chloride	X	-	-	-	-	-
055 Naphthalene	X	-	-	-	-	X
058 4-nitrophenol	X	-	-	-	-	-
059 2,4-dinitrophenol	-	-	X	-	-	-
060 4,6-dinitro-o-cresol	-	-	X	-	-	-
062 N-nitrosodiphenylamine	-	-	X	-	-	-
063 N-nitrosodi-n-propylamine	X	-	-	-	-	-
064 Pentachlorophenol	X	-	X	-	-	-
065 Phenol	X	-	X	-	-	X
066 bis(2-ethylhexyl)phthalate	X	-	-	-	-	-
067 Butyl benzyl phthalate	X	X	X	-	-	X
072 Benzo(a)anthracene	X	-	X	-	-	-
073 Benzo(a)pyrene	X	-	-	-	-	-
074 3,4-benzofluoranthene	-	X	-	-	-	-
075 Benzo(k)fluoranthane	-	X	-	-	-	-
076 Chrysene	-	-	X	-	-	-
077 Acenaphthylene	X	-	X	-	-	-
078 Anthracene	X	-	-	-	-	-
080 Fluorene	X	-	X	-	-	-
081 Phenanthrene	X	-	X	-	-	-
084 Pyrene	X	X	X	-	-	-
085 Tetrachloroethylene	X	-	X	-	-	X
087 Trichloroethylene	X	-	-	-	-	X
091 Chlordane	X	-	-	-	-	-
130 Xylene	X	-	-	-	-	-

TABLE IX-12

EXPECTED COMPLIANCE STRATEGY
SELECTED BPT TREATMENT MODELS VERSUS DISCHARGE OPTIONS
METALS CASTING INDUSTRY

Treatment Technologies In-Place	Number of Plants	Selected BPT Treatment Models	90% Recycle Option	50% Recycle Option
Complete Recycle	351	No additional treatment required	No additional treatment required	No additional treatment required
Little or No Treatment	527	Install sedimentation and add BPT recycle	Install sedimentation and add BPT recycle	Install sedimentation and add BPT recycle
Chemical Addition, Sedimentation, and 90% Recycle	40	Increase recycle rate to that of the BPT model	No additional treatment required	No additional treatment required
Chemical Addition, Sedimentation, and No Recycle	47	Increase recycle rate to that of the BPT model	Increase recycle rate to 90%	Increase recycle rate to 50%

TABLE IX-13

DIFFERENCES IN COST BETWEEN COMPLETE RECYCLE AND PARTIAL RECYCLE(1)

METALS CASTING INDUSTRY

	90% Recycle Discharge Alternative		50% Recycle Discharge Alternative	
	Investment Cost	Annual Cost	Investment Cost	Annual Costs
Complete Recycle	$ 71,000	$14,380	$ 71,000	$14,380
Discharge Alternative	66,000	13,520	47,000	9,150
Cost Difference	$ 5,000	$ 860	$ 24,000	$ 5,230

(1): Based upon the recycle component from the ferrous subcategory dust collected process gray iron (≥250 employees) treatment model to determine the maximum cost difference.

TABLE IX-14

COMPARISON OF METALS CASTING INDUSTRY
TREATMENT COSTS AND TOTAL POLLUTANT WASTE LOADS
PROPOSED BPT LEVELS OF TREATMENT VERSUS DISCHARGE OPTIONS

	Proposed Level of Treatment			90% Recycle BPT Level of Treatment			50% Recycle BPT Level of Treatment		
	Direct Dischargers	Indirect Dischargers	Total	Direct Dischargers	Indirect Dischargers	Total	Direct Dischargers	Indirect Dischargers	Total
Treatment Costs									
Investment ($ x 10^{-6})	33.3	35.8	69.1	33.0	35.7	68.7	32.5	35.5	68.0
Annual ($ x 10^{-6})	7.99	8.63	16.62	7.94	8.61	16.55	7.81	8.57	16.38
Discharged Pollutant Waste Loads (kg/Year)				Increment Over the Proposed BPT Level of Treatment			Increment Over the 90% Recycle BPT Level of Treatment		
Toxic Pollutants	192	54	246	19,399	17,368	36,767(1)	4,313	541	4,854(2)
Conventional and Non-Conventional Pollutants	3,200	4,985	8,185	74,137	48,711	122,848	151,592	17,673	169,265

(1): Contains both toxic organics and toxic metal pollutants.
(2): The incremental increase is related to increased toxic metal pollutant waste loads. This increase is due to the increase in discharge flow.

TABLE IX-15
ALTERNATIVE EFFLUENT LIMITATIONS
90% RECYCLE DISCHARGE ALTERNATIVE

Subpart A-Aluminum Casting Subcategory

(a) Investment Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.110	0.0538
Oil and Grease	0.0538	0.0323
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0332	0.0162
Oil and Grease	0.0162	0.00971
pH	Within the range of 7.5 to 10	

(c) Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.00499	0.00244
Oil and Grease	0.00244	0.00146
Zinc	0.000162	0.0000682
pH	Within the range of 7.5 to 10	

(d) Die Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.00726	0.00532
Oil and Grease	0.00484	0.00484
Lead	0.0000484	0.0000436
Zinc	0.000494	0.000203
Phenols (4AAP)	0.000215	0.000107
pH	Within the range of 7.5 to 10	

(e) Die Lube Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.000144	0.000106
Oil and Grease	0.0000960	0.0000960
Copper	0.0000123	0.0000059
Lead	0.0000010	0.0000009
Zinc	0.0000098	0.0000040
Phenols (4AAP)	0.0000043	0.0000021
pH	Within the range of 7.5 to 10	

Subpart B - Copper Casting Subcategory

(a) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.00352	0.00172
Oil and Grease	0.00172	0.00103
Copper	0.000163	0.0000859
Lead	0.0000129	0.0000112
Zinc	0.000114	0.0000481
pH	Within the range of 7.5 to 10	

(b) Mold Cooling and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0193	0.00943
Oil and Grease	0.00943	0.00566
Copper	0.000896	0.000471
Zinc	0.000627	0.000264
pH	Within the range of 7.5 to 10	

Subpart C- Ferrous Casting Subcategory

(a) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.00239	0.00117
Oil and Grease	0.00117	0.000701
Copper	0.000111	0.0000584
Lead	0.0000088	0.0000076
Zinc	0.0000777	0.0000327
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0222	0.0108
Oil and Grease	0.0108	0.00651
Copper	0.00103	0.000542
Lead	0.0000814	0.0000705
Zinc	0.000721	0.000304
pH	Within the range of 7.5 to 10	

(c) Slag Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.00616	0.00300
Oil and Grease	0.00300	0.00180
Copper	0.000285	0.000150
Lead	0.0000225	0.0000195
Zinc	0.000200	0.0000841
pH	Within the range of 7.5 to 10	

(d) Casting Quench and Mold Cooling Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.00376	0.00184
Oil and Grease	0.00184	0.00110
Copper [1]	0.000174	0.0000918
Lead [1]	0.0000138	0.0000119
Zinc [1]	0.000122	0.0000514
pH	Within the range of 7.5 to 10	

[1] These limitations would be applicable only when casting quench and mold cooling wastewaters are treated with other ferrous casting subcategory process wastewaters.

(e) Sand Washing Operations

Pollutant or Pollutant Property	Maximum for Any One day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.0192	0.00935
Oil and Grease	0.00935	0.00561
Copper	0.000888	0.000467
Lead	0.0000701	0.0000607
Zinc	0.000621	0.000262
pH	Within the range of 7.5 to 10	

Subpart D- Lead Casting Subcategory

(a) Grid Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.000931	0.000454
Oil and Grease	0.000454	0.000272
Lead	0.0000034	0.0000030
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0127	0.00617
Oil and Grease	0.00617	0.00370
Lead	0.0000462	0.0000401
pH	Within the range of 7.5 to 10	

Subpart E- Magnesium Casting Subcategory

(a) Grinding Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0274	0.0134
Oil and Grease	0.0134	0.00801
Zinc	0.000888	0.000374
pH	Within the range of 7.5 to 10	

(b) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.000376	0.000184
Oil and Grease	0.000184	0.000110
Zinc	0.0000122	0.0000051
pH	Within the range of 7.5 to 10	

Subpart F- Zinc Casting Subcategory

(a) Die Casting and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.000684	0.000334
Oil and Grease	0.000334	0.000200
Zinc	0.0000222	0.0000093
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 llb) of Metal Poured	
TSS	0.0129	0.00630
Oil and Grease	0.00630	0.00378
Zinc	0.000419	0.000176
Phenols (4AAP)	0.00315	0.00157
pH	Within the range of 7.5 to 10	

TABLE IX-16
ALTERNATIVE EFFLUENT LIMITATIONS
50% RECYCLE DISCHARGE ALTERNATIVE

Subpart A - Aluminum Casting Subcategory

(a) Investment Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.552	0.269
Oil and Grease	0.269	0.161
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.166	0.0809
Oil and Grease	0.0809	0.0485
pH	Within the range of 7.5 to 10	

(c) Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0250	0.0122
Oil and Grease	0.0122	0.00731
Zinc	0.000810	0.000341
pH	Within the range of 7.5 to 10	

(d) Die Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0363	0.0266
Oil and Grease	0.0242	0.0242
Lead	0.000242	0.000218
Zinc	0.00247	0.00102
Phenols (4AAP)	0.00107	0.000537
pH	Within the range of 7.5 to 10	

(e) Die Lube Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.000720	0.000528
Oil and Grease	0.000480	0.000480
Copper	0.0000614	0.0000293
Lead	0.0000048	0.0000043
Zinc	0.0000489	0.0000202
Phenols (4AAP)	0.0000213	0.0000107
pH	Within the range of 7.5 to 10	

Subpart B - Copper Casting Subcategory

(a) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.0176	0.00859
Oil and Grease	0.00859	0.00516
Copper	0.000816	0.000430
Lead	0.0000645	0.0000559
Zinc	0.000572	0.000241
pH	Within the range of 7.5 to 10	

(b) Mold Cooling and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0966	0.0471
Oil and Grease	0.0471	0.0283
Copper	0.00448	0.00236
Zinc	0.00314	0.00132
pH	Within the range of 7.5 to 10	

Subpart C - Ferrous Casting Subcategory

(a) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.0120	0.00584
Oil and Grease	0.00584	0.00350
Copper	0.000555	0.000292
Lead	0.0000438	0.0000380
Zinc	0.000388	0.000164
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.111	0.0542
Oil and Grease	0.0542	0.0325
Copper	0.00515	0.00271
Lead	0.000407	0.000353
Zinc	0.00361	0.00152
pH	Within the range of 7.5 to 10	

(c) Slag Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0308	0.0150
Oil and Grease	0.0150	0.00901
Copper	0.00143	0.000751
Lead	0.000113	0.0000976
Zinc	0.000999	0.000421
pH	Within the range of 7.5 to 10	

(d) Mold Cooling and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0188	0.00918
Oil and Grease	0.00918	0.00551
Copper[1]	0.000872	0.000459
Lead[1]	0.0000688	0.0000597
Zinc[1]	0.000610	0.000257
pH	Within the range of 7.5 to 10	

[1] These limitations would be applicable only when casting quench and mold cooling wastewaters are treated with other ferrous casting subcategory process wastewaters.

(e) Sand Washing Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.0958	0.0467
Oil and Grease	0.0467	0.0280
Copper	0.00444	0.00234
Lead	0.000350	0.000304
Zinc	0.00311	0.00131
pH	Within the range of 7.5 to 10	

Subpart D - Lead Casting Subcategory

(a) Grid Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.00465	0.00227
Oil and Grease	0.00227	0.00136
Lead	0.0000170	0.0000148
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0632	0.0308
Oil and Grease	0.0308	0.0185
Lead	0.000231	0.000200
pH	Within the range of 7.5 to 10.0	

Subpart E - Magnesium Casting Subcategory

(a) Grinding Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.137	0.0668
Oil and Grease	0.0668	0.0401
Zinc	0.00444	0.00187
pH	Within the range of 7.5 to 10.0	

(b) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
TSS	0.00188	0.000918
Oil and Grease	0.000918	0.000551
Zinc	0.0000610	0.0000260
pH	Within the range of 7.5 to 10	

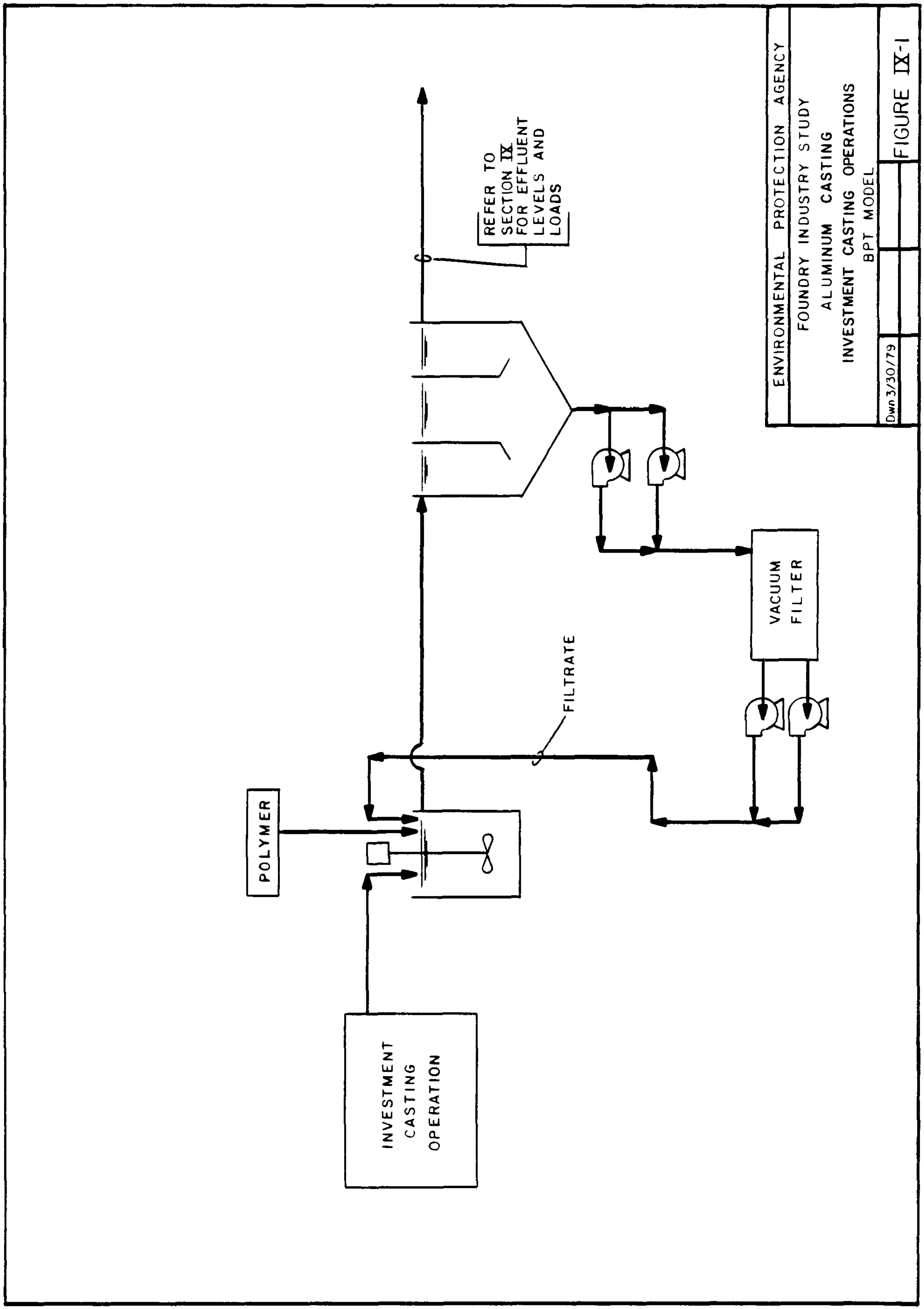
Subpart F - Zinc Casting Subcategory

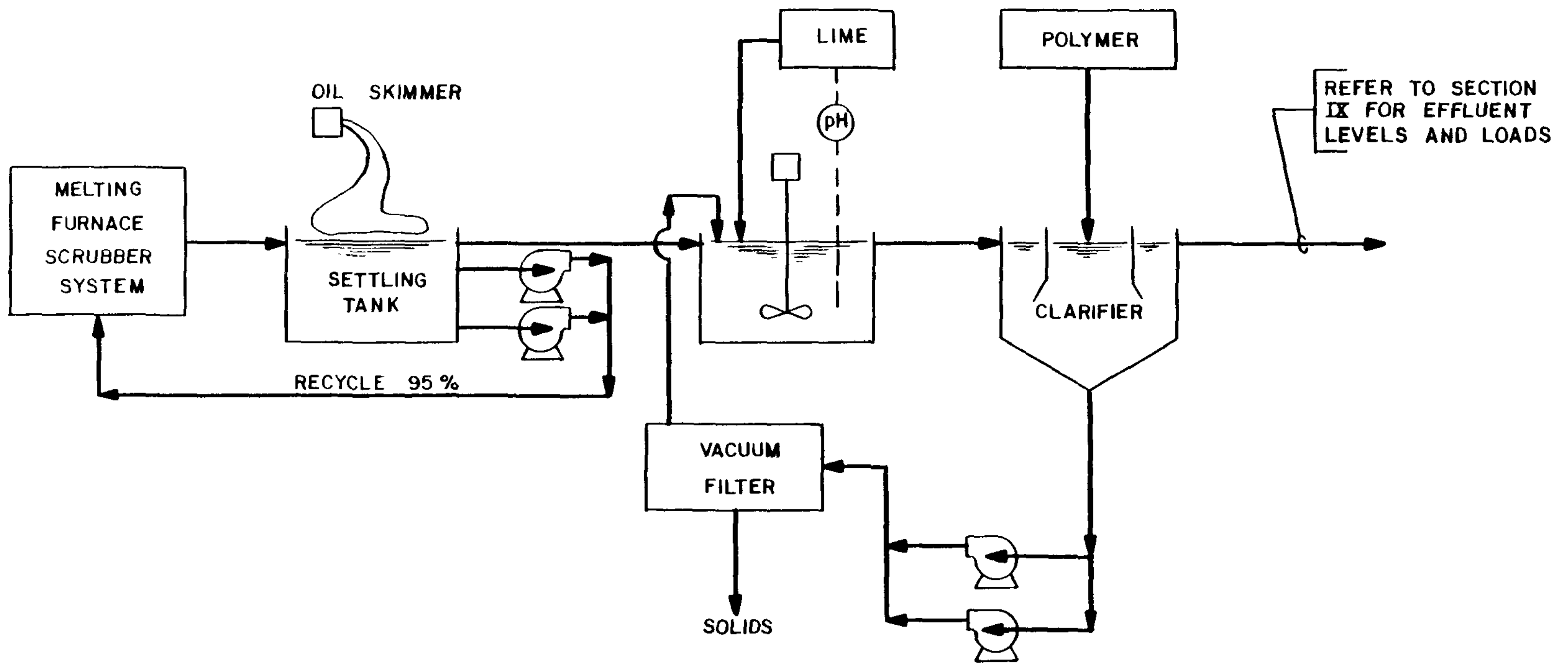
(a) Die Casting and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.00342	0.00167
Oil and Grease	0.00167	0.00100
Zinc	0.000111	0.0000467
pH	Within the range of 7.5 to 10	

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
TSS	0.0646	0.0315
Oil and Grease	0.0315	0.0189
Zinc	0.00209	0.000882
Phenols (4AAP)	0.0157	0.00787
pH	Within the range of 7.5 to 10	


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
BPT MODEL
Dwn 3/30/79
FIGURE IX-1
INVESTMENT CASTING OPERATION
POLYMER
FILTRATE
VACUUM FILTER
REFER TO SECTION IX FOR EFFLUENT LEVELS AND LOADS

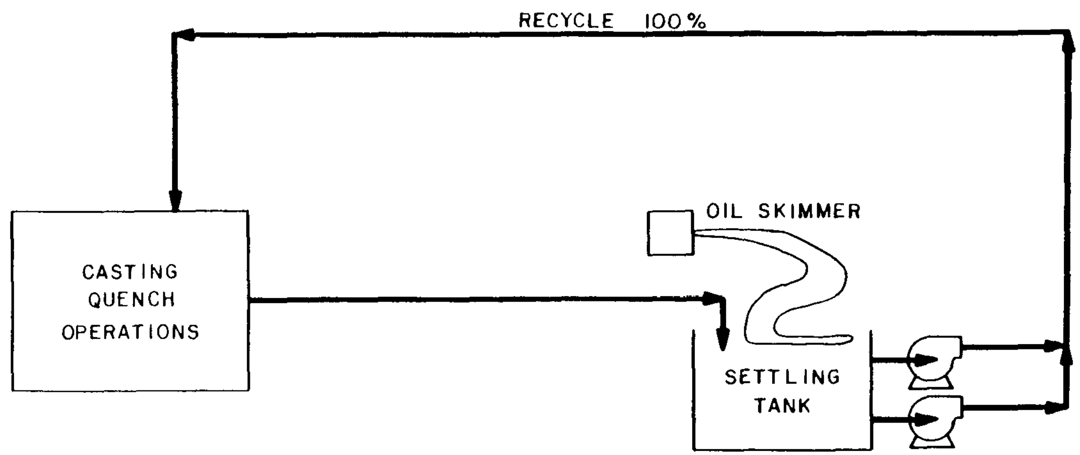


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BPT MODEL

Dwn. 3/3/81

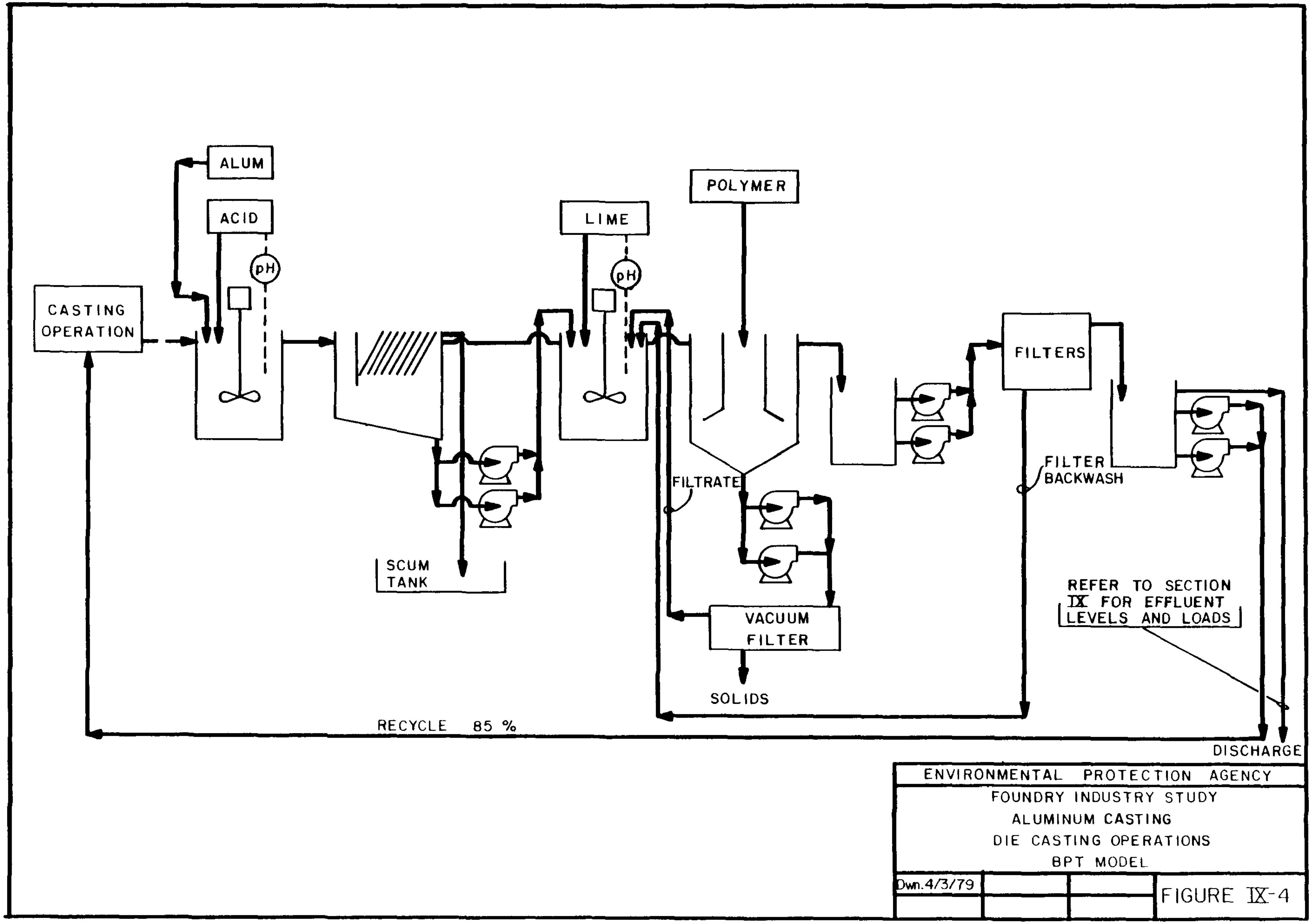
FIGURE IX-2

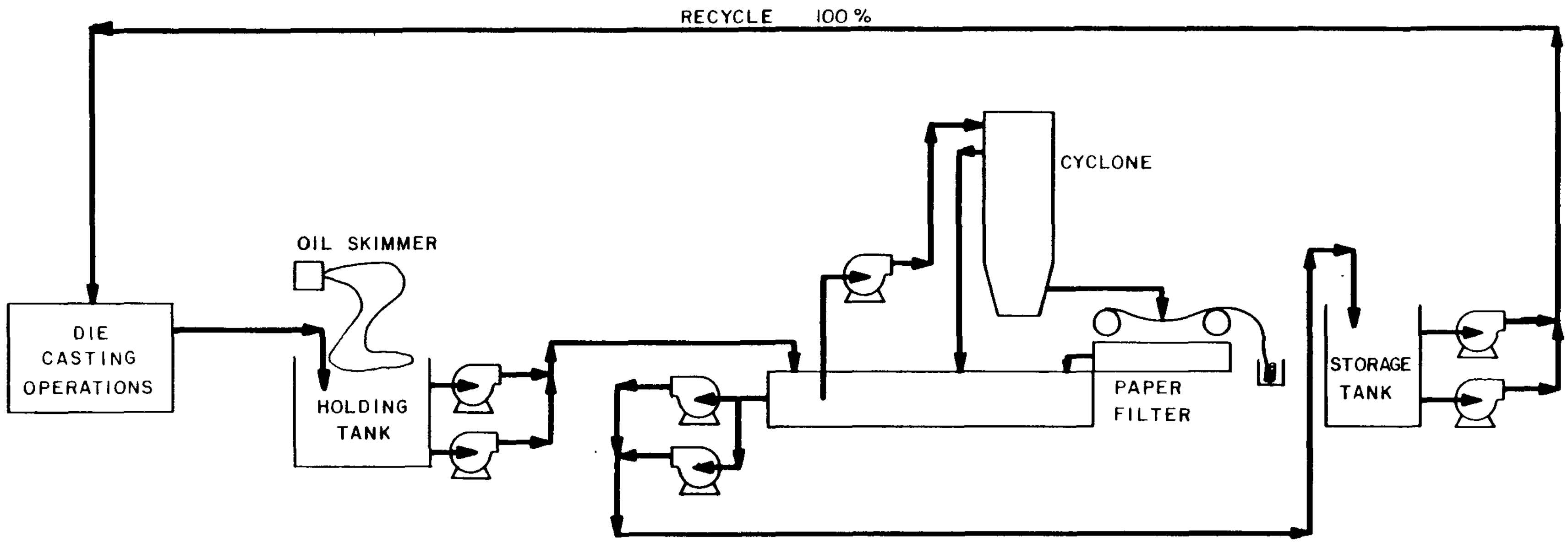


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
CASTING QUENCH OPERATIONS
BPT MODEL

Dwn. 3/30/79

FIGURE IX-3

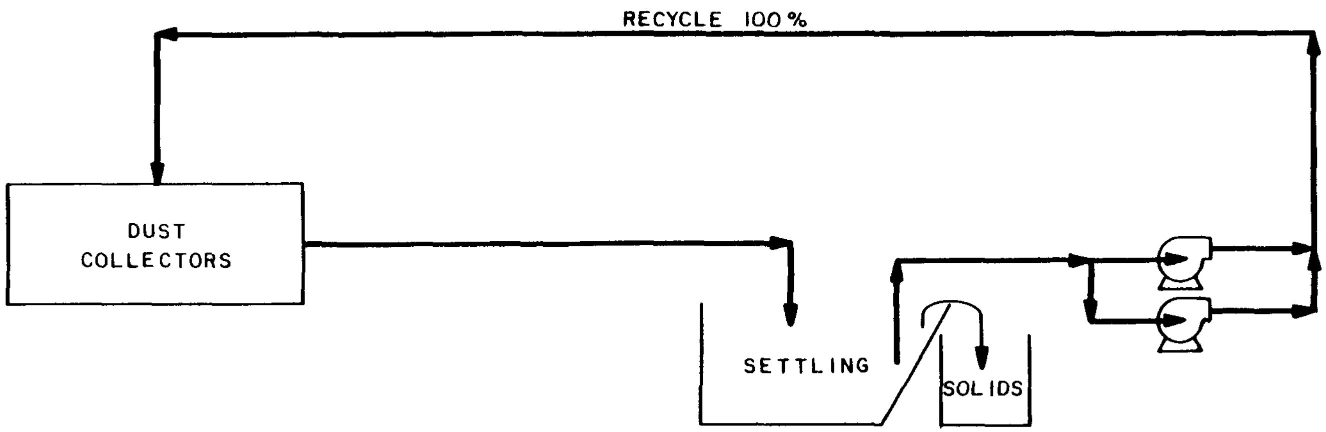

CASTING OPERATION
ALUM
ACID
pH
LIME
pH
POLYMER
SCUM TANK
FILTRATE
VACUUM FILTER
SOLIDS
FILTERS
FILTER BACKWASH
REFER TO SECTION IX FOR EFFLUENT LEVELS AND LOADS
RECYCLE 85 %
DISCHARGE
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
BPT MODEL
Dwn.4/3/79
FIGURE IX-4



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE LUBE OPERATIONS
BPT MODEL

Dwn.4/5/79

FIGURE IX-5



ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY

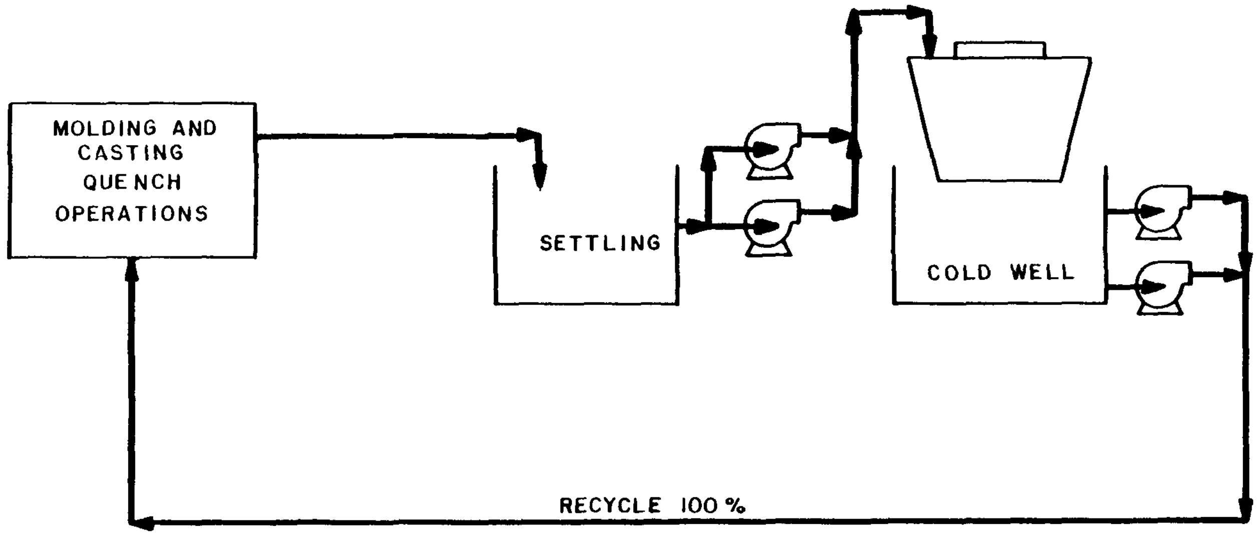
COPPER AND COPPER ALLOY CASTING

DUST COLLECTION OPERATIONS

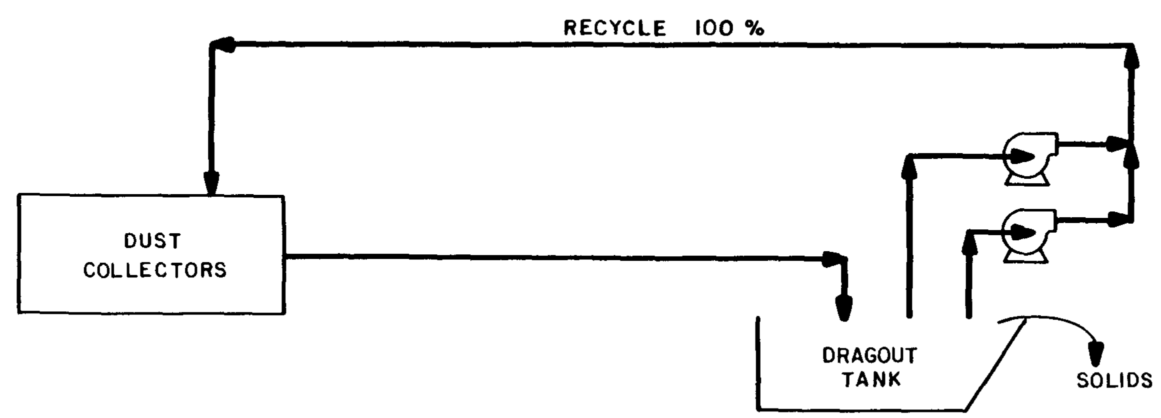
BPT MODEL

Dwn. 4/12/79

FIGURE IX-6



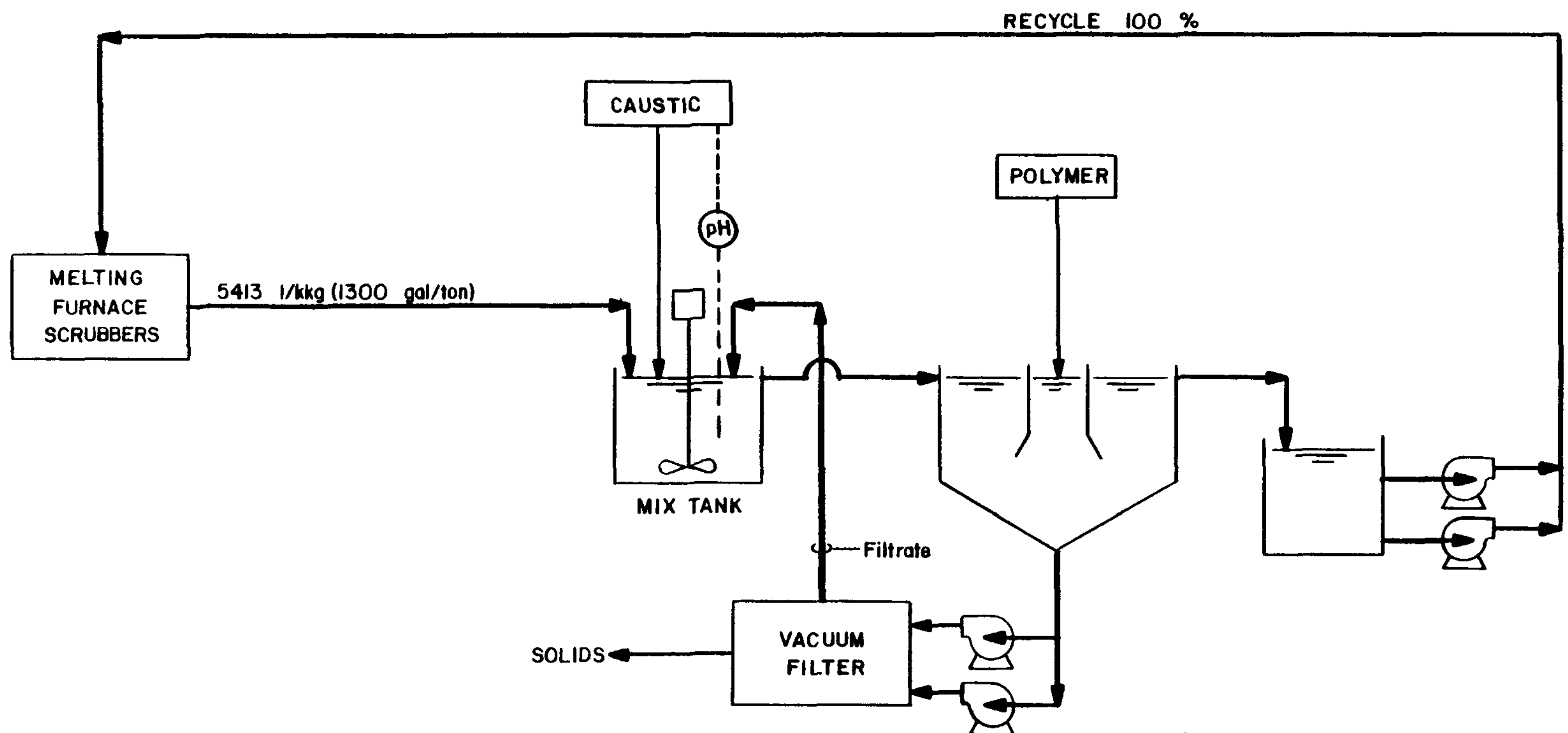
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
COPPER AND COPPER ALLOY CASTING
MOLD COOLING AND CASTING QUENCH
BPT MODEL
Dwn. 4/11/79
FIGURE IX-7



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
FERROUS CASTING
DUST COLLECTION OPERATIONS
BPT MODEL

Dwn. 4/19/79

FIGURE IX-8

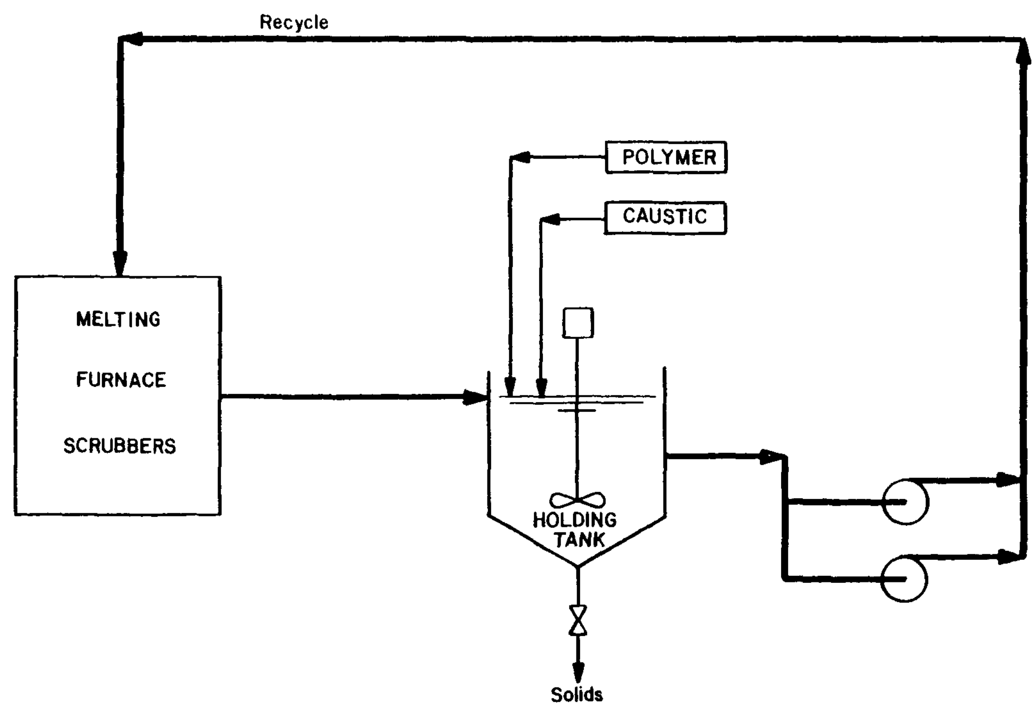


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
FERROUS CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BPT MODEL

Dwn. 3/3/81

FIGURE IX-9

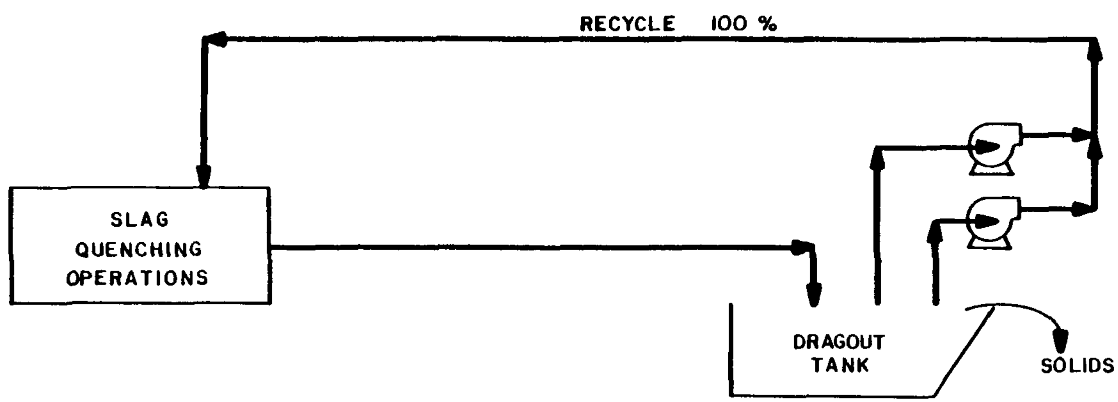


ENVIRONMENTAL PROTECTION AGENCY

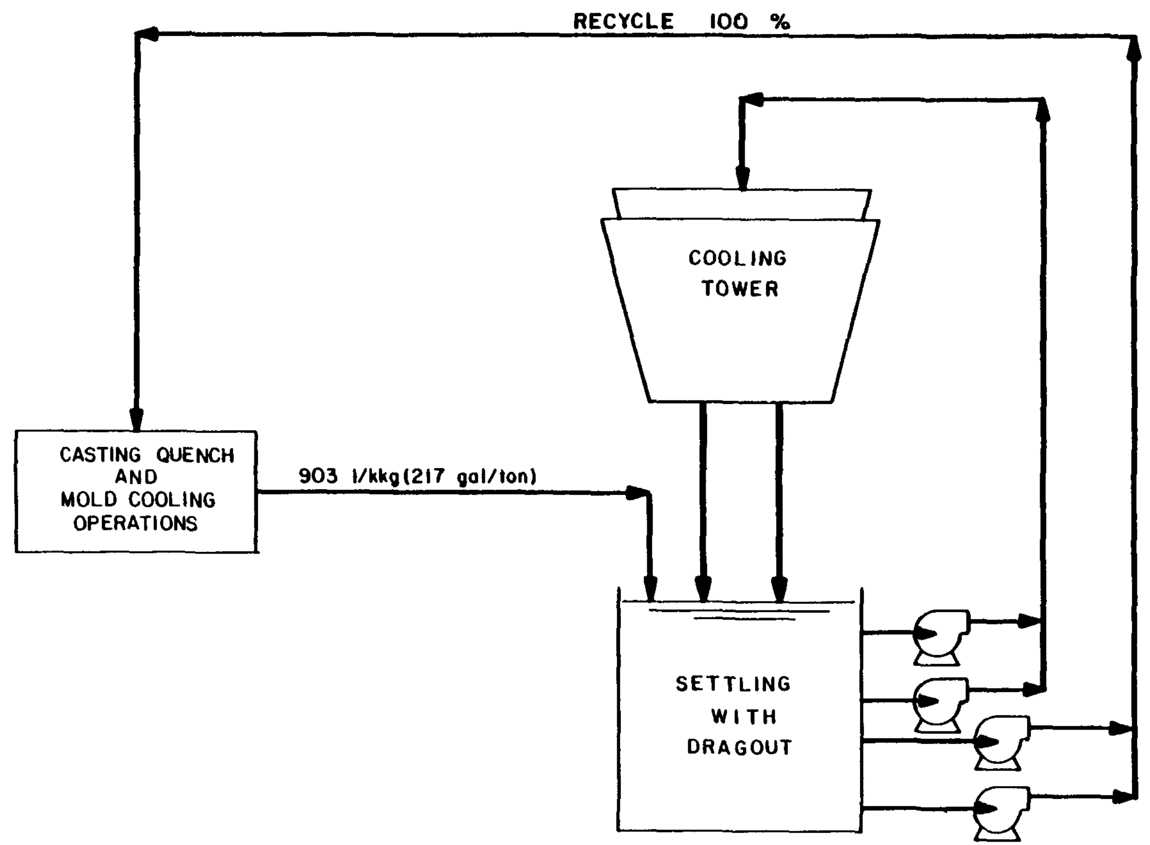
FOUNDRY INDUSTRY STUDY
FERROUS CASTING
SMALLER MELTING FURNACE SCRUBBER
OPERATIONS
BPT MODEL

Dwn 1/25/82

FIGURE IX-10



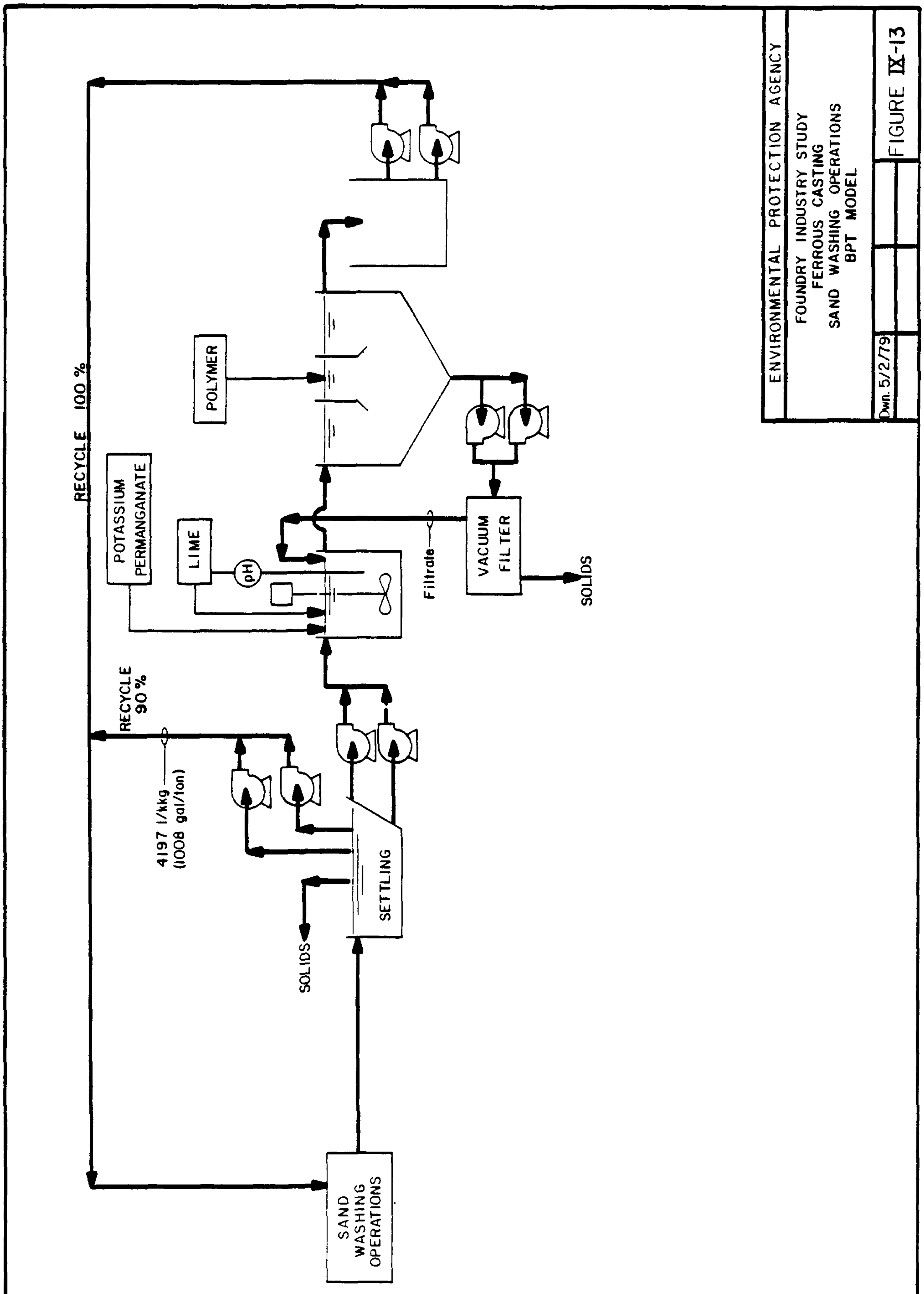
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
FERROUS CASTING
SLAG QUENCH OPERATIONS
BPT MODEL
Dwn. 4/19/79
FIGURE IX-11

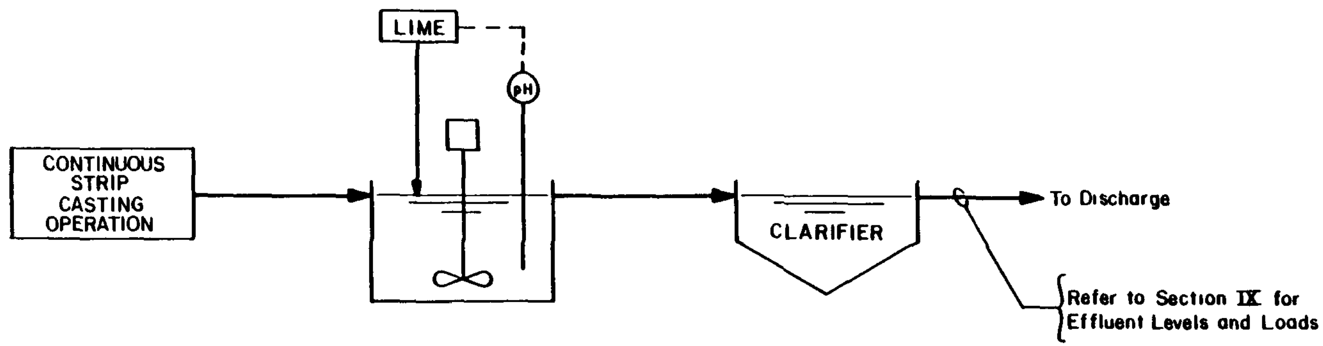


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
FERROUS CASTING
CASTING QUENCH AND MOLD COOLING
BPT MODEL

Dwn. 4/23/79

FIGURE IX-12


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
FERROUS CASTING
SAND WASHING OPERATIONS
BPT MODEL
FIGURE IX-13
Dwn. 5/2/79
RECYCLE 100 %
RECYCLE 90 %
4197 l/kkg (1008 gal/ton)
SAND WASHING OPERATIONS
SETTLING
SOLIDS
POTASSIUM PERMANGANATE
LIME
pH
POLYMER
Filtrate
VACUUM FILTER
SOLIDS

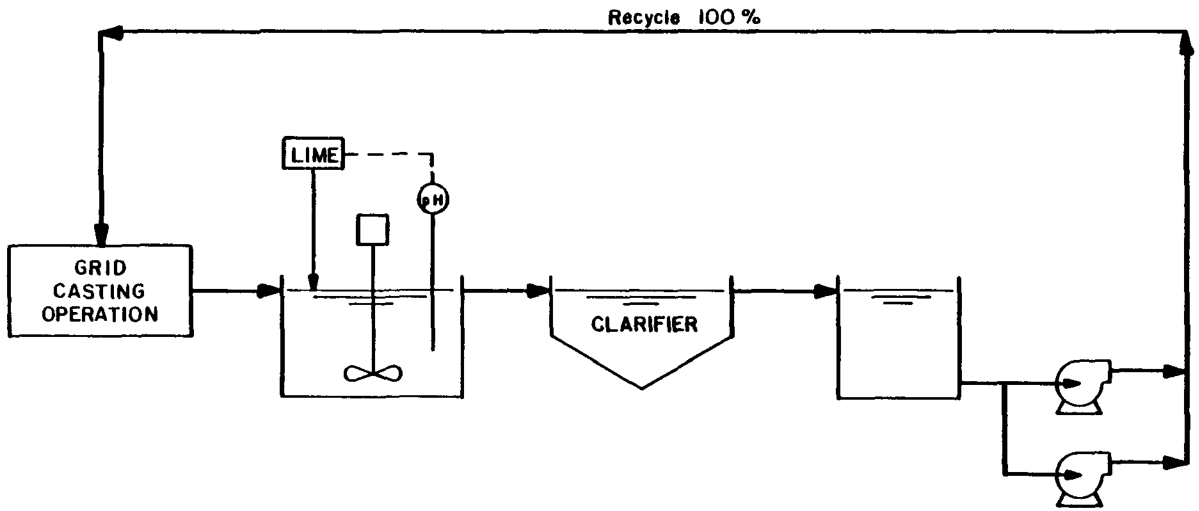


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
BPT MODEL

Dwn 3/5/81

FIGURE IX-14



ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
GRID CASTING OPERATIONS
BPT MODEL

Dwn 3/5/81

FIGURE IX-15

LEAD MELTING
FURNACE
SCRUBBERS
TIGHTEN INTERNAL
RECYCLE RATE TO 100%

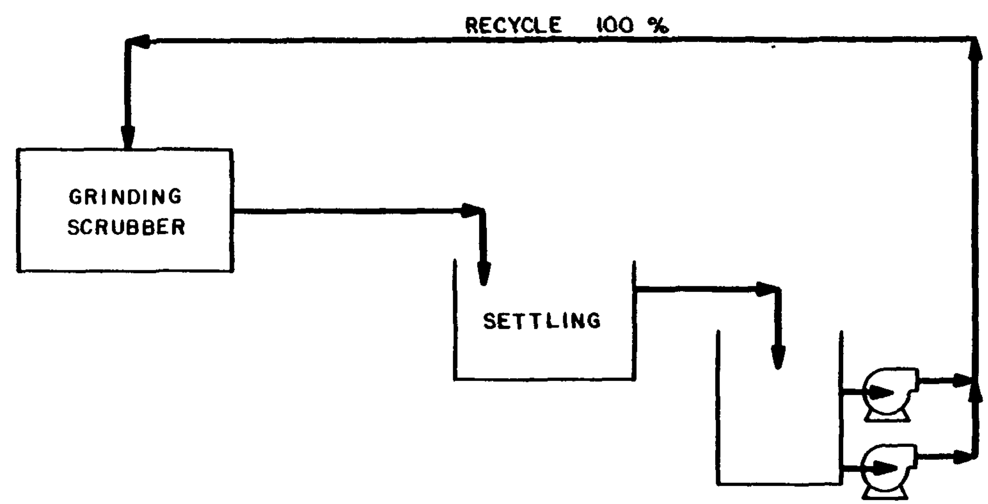
NOTE: NO EQUIPMENT NEEDED

ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BPT MODEL

Dwn. 3/22/79

FIGURE IX-16

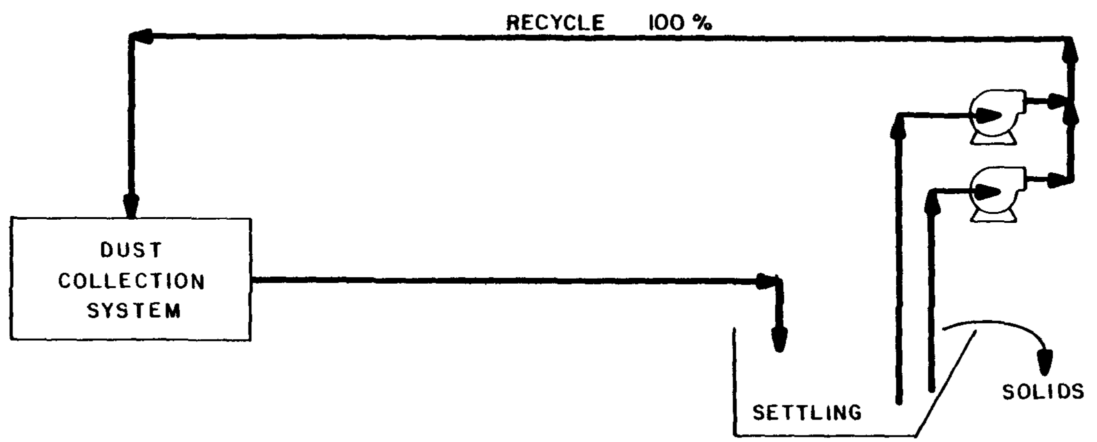


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
MAGNESIUM CASTING
GRINDING SCRUBBER OPERATIONS
BPT MODEL

Dwn. 4/5/79

FIGURE IX-17

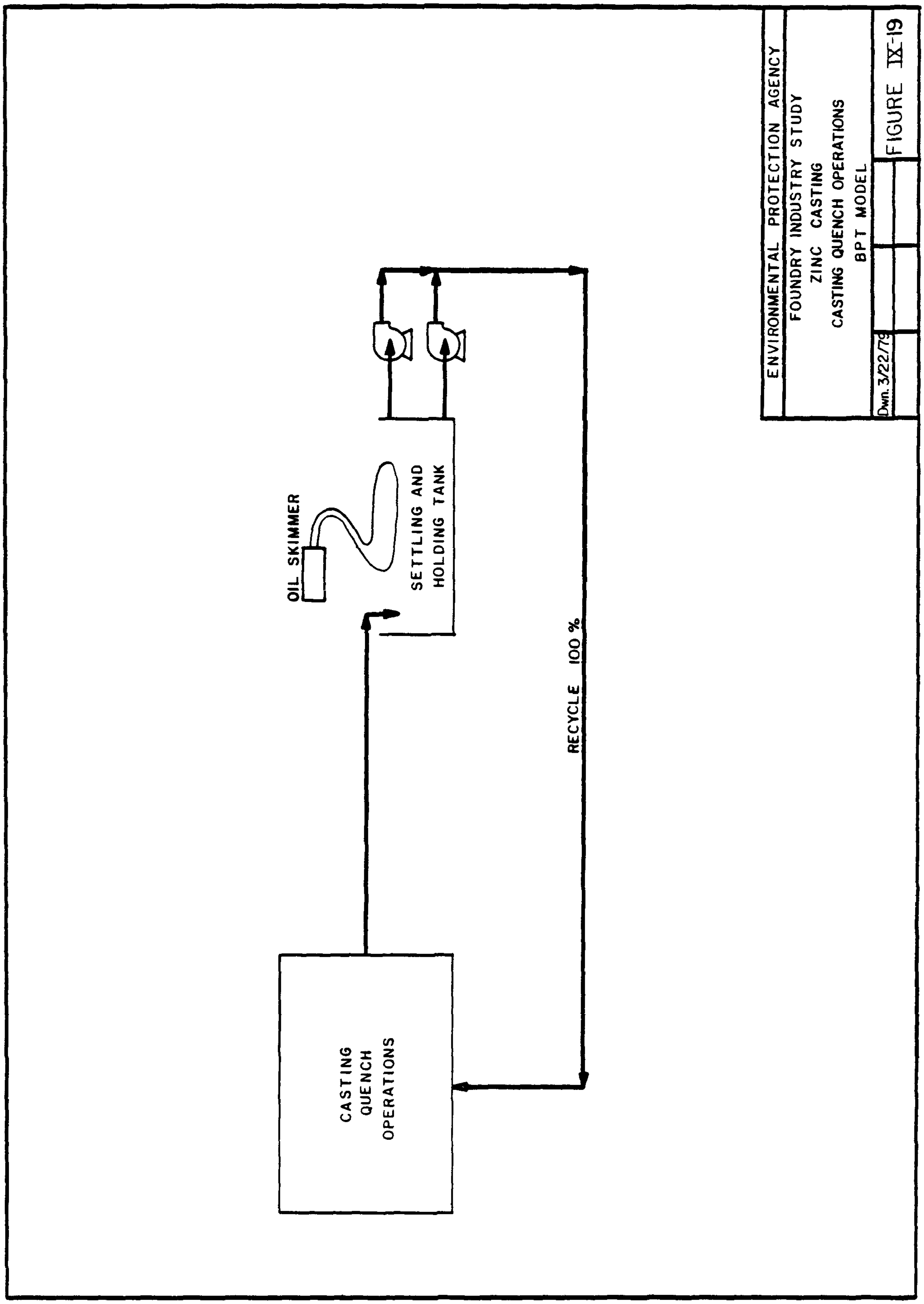


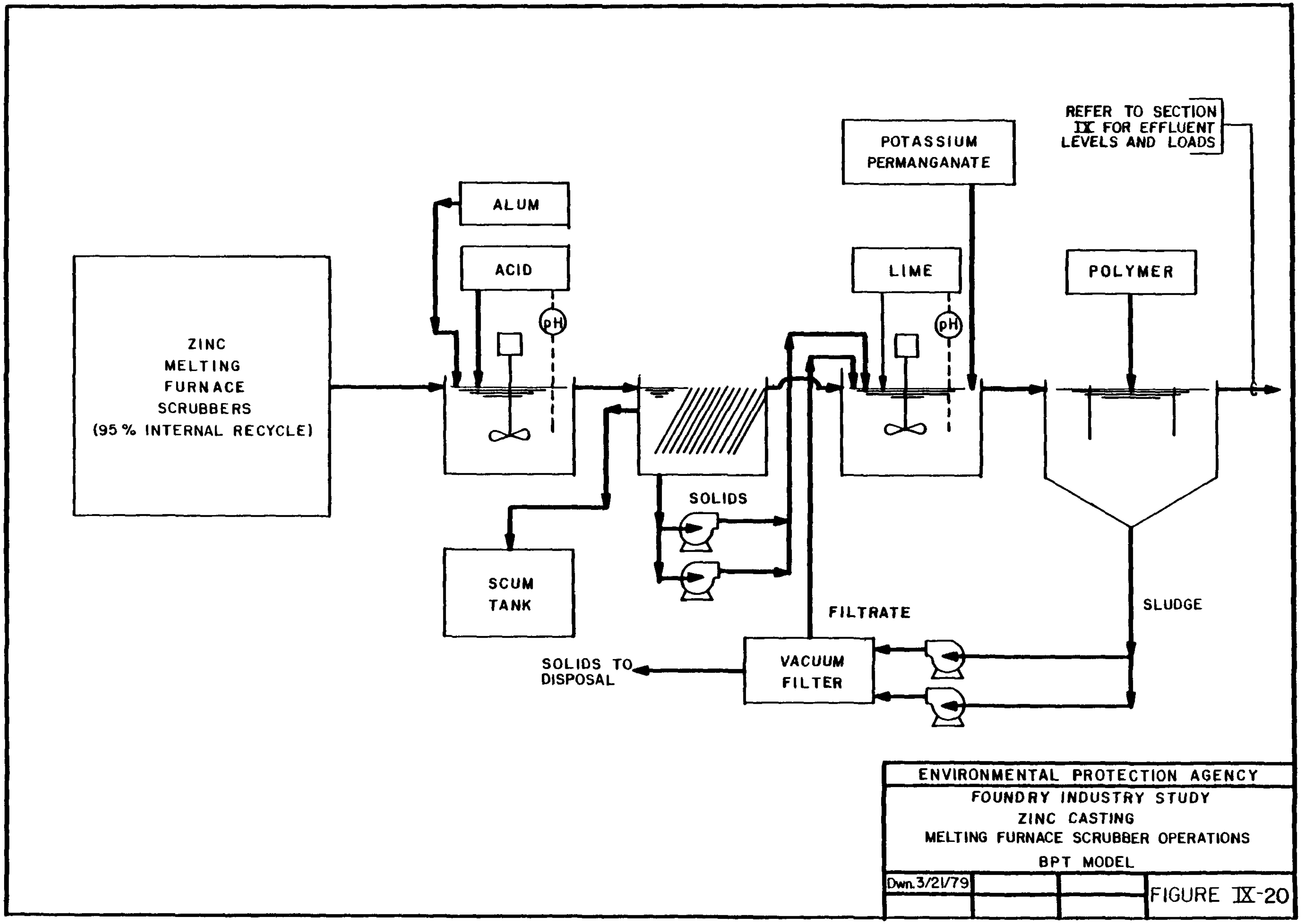
ENVIRONMENTAL PROTECTION AGENCY

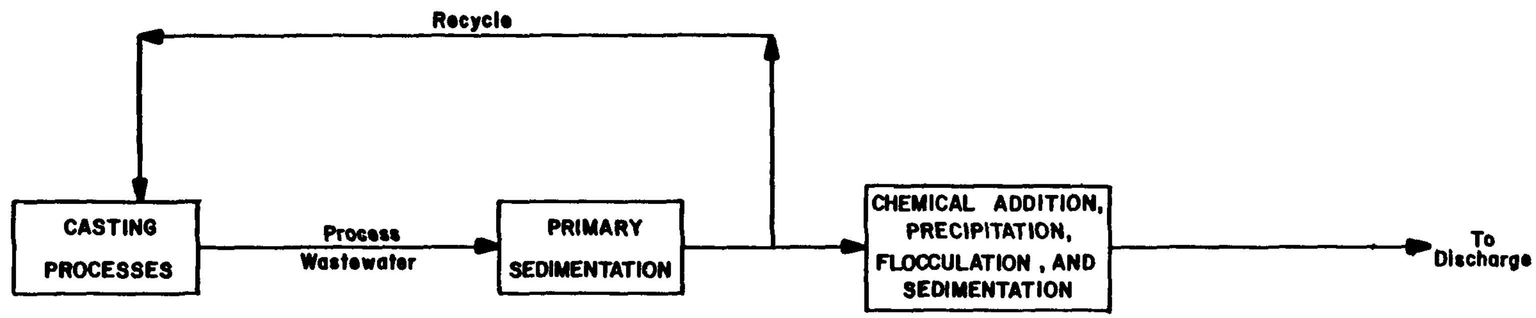
FOUNDRY INDUSTRY STUDY
MAGNESIUM CASTING
DUST COLLECTION OPERATIONS
BPT MODEL

Dwn. 5/3/79

FIGURE IX-18


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
CASTING QUENCH OPERATIONS
BPT MODEL
Dwn. 3/22/79
FIGURE IX-19
OIL SKIMMER
SETTLING AND HOLDING TANK
RECYCLE 100 %
CASTING QUENCH OPERATIONS


ZINC
MELTING
FURNACE
SCRUBBERS
(95 % INTERNAL RECYCLE)
ALUM
ACID
pH
SCUM
TANK
SOLIDS
SOLIDS TO
DISPOSAL
VACUUM
FILTER
FILTRATE
POTASSIUM
PERMANGANATE
LIME
pH
POLYMER
SLUDGE
REFER TO SECTION
IX FOR EFFLUENT
LEVELS AND LOADS
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BPT MODEL
Dwn. 3/21/79
FIGURE IX-20



NOTE: This Flow Diagram is Applicable to the Following Process Segments:

SUBCATEGORY	SEGMENTS
Aluminum	Casting Quench
Copper	Dust Collection Mold Cooling & Casting Quench
Ferrous	Dust Collection Slag Quench Mold Cooling & Casting Quench Sand Washing
Lead	Melting Furnace Scrubbers Grid Casting
Magnesium	Grinding Scrubbers Dust Collection
Zinc	Casting Quench

ENVIRONMENTAL PROTECTION AGENCY

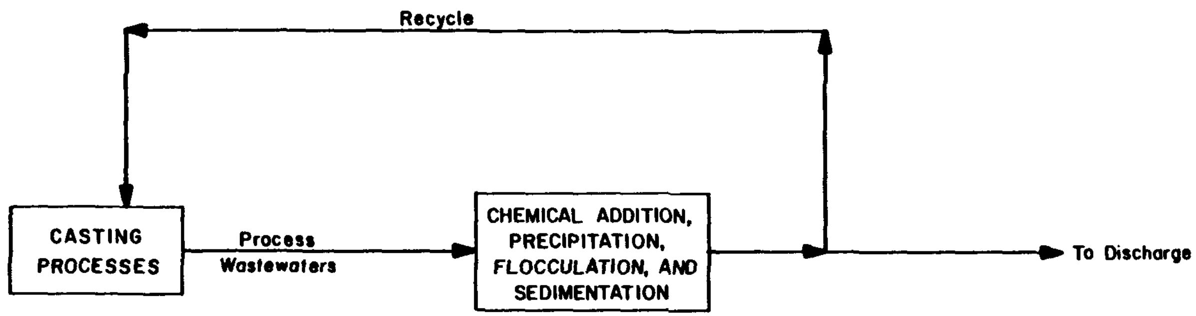
FOUNDRY INDUSTRY STUDY

DISCHARGE OPTIONS

WASTEWATER FLOW DIAGRAM

Dwn 10/14/82

FIGURE IX-21



NOTE: This flow diagram is applicable to the Aluminum Subcategory Die Lube and Ferrous Subcategory Melting Furnace Scrubber process segments.

ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
DISCHARGE OPTIONS
WASTEWATER FLOW DIAGRAM

Dwn. 10/14/82

FIGURE IX-22

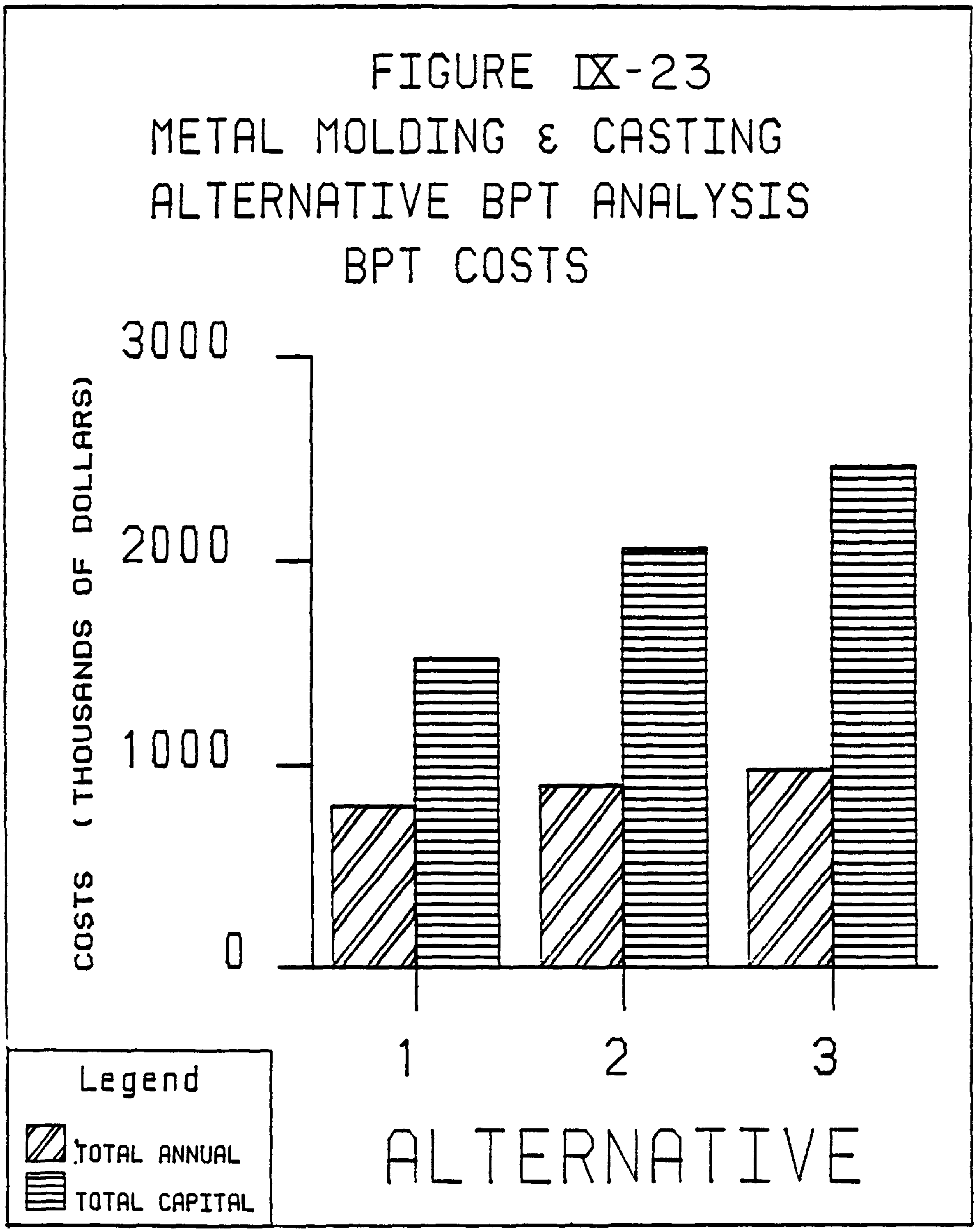
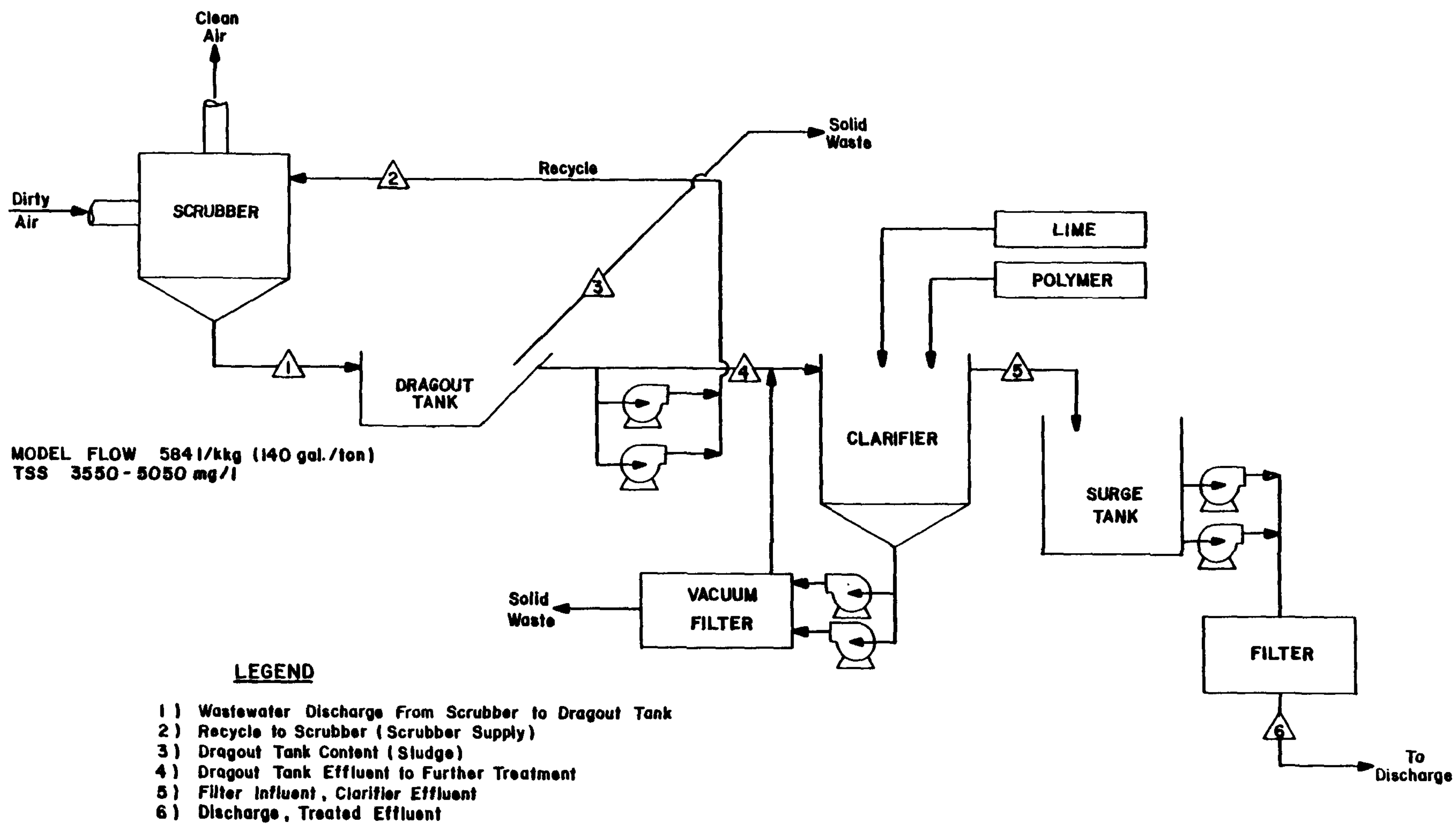


FIGURE IX-23
METAL MOLDING & CASTING
ALTERNATIVE BPT ANALYSIS
BPT COSTS
COSTS (THOUSANDS OF DOLLARS)
3000
2000
1000
0
1
2
3
ALTERNATIVE
Legend
TOTAL ANNUAL
TOTAL CAPITAL



ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
FERROUS SUBCATEGORY
DUST COLLECTION OPERATIONS
DISCHARGE ALTERNATIVE TREATMENT MODEL

Dwn 10/19/82

FIGURE IX-24

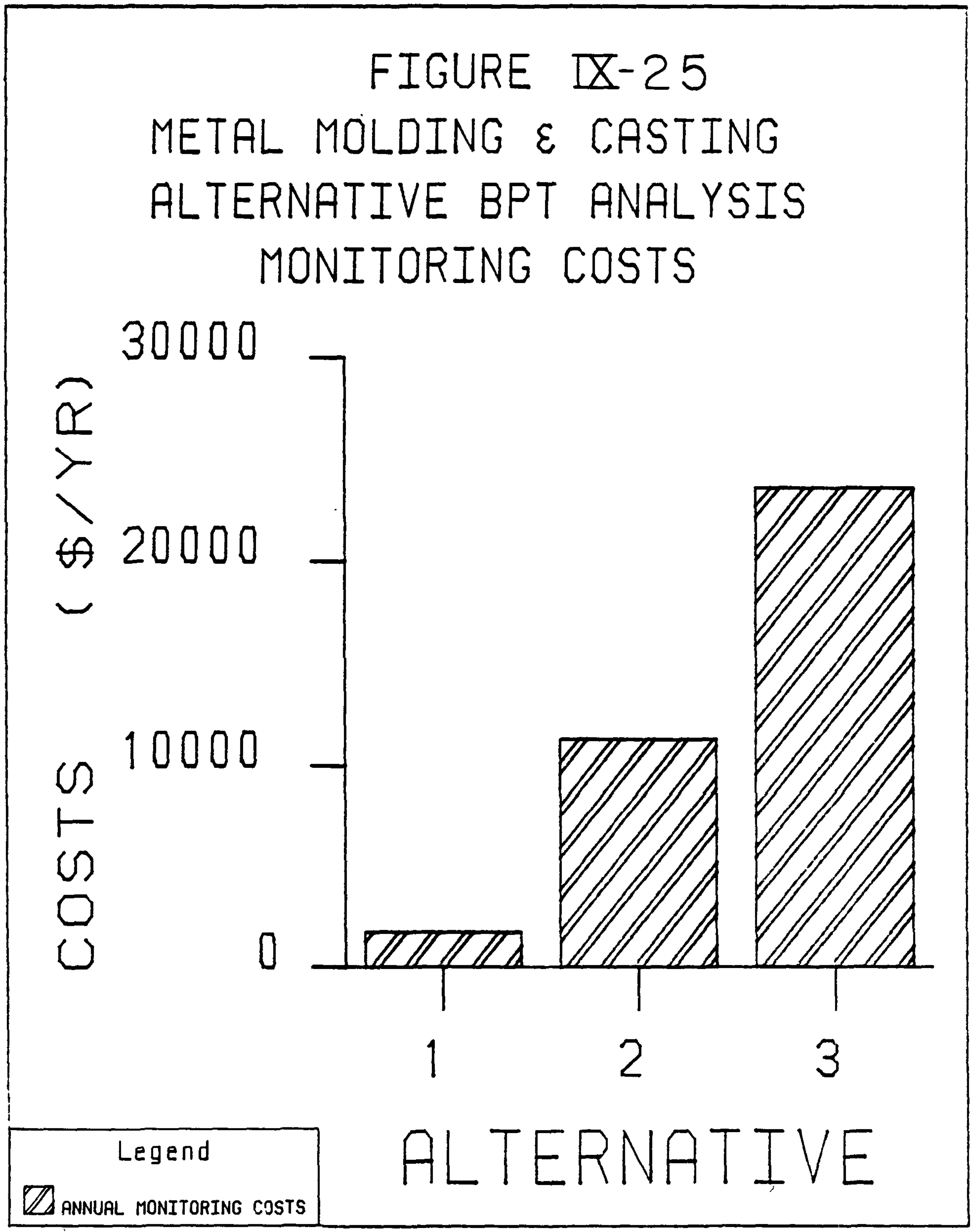


FIGURE IX-25
METAL MOLDING & CASTING
ALTERNATIVE BPT ANALYSIS
MONITORING COSTS
COSTS ($/YR)
30000
20000
10000
0
1
2
3
ALTERNATIVE
Legend
ANNUAL MONITORING COSTS

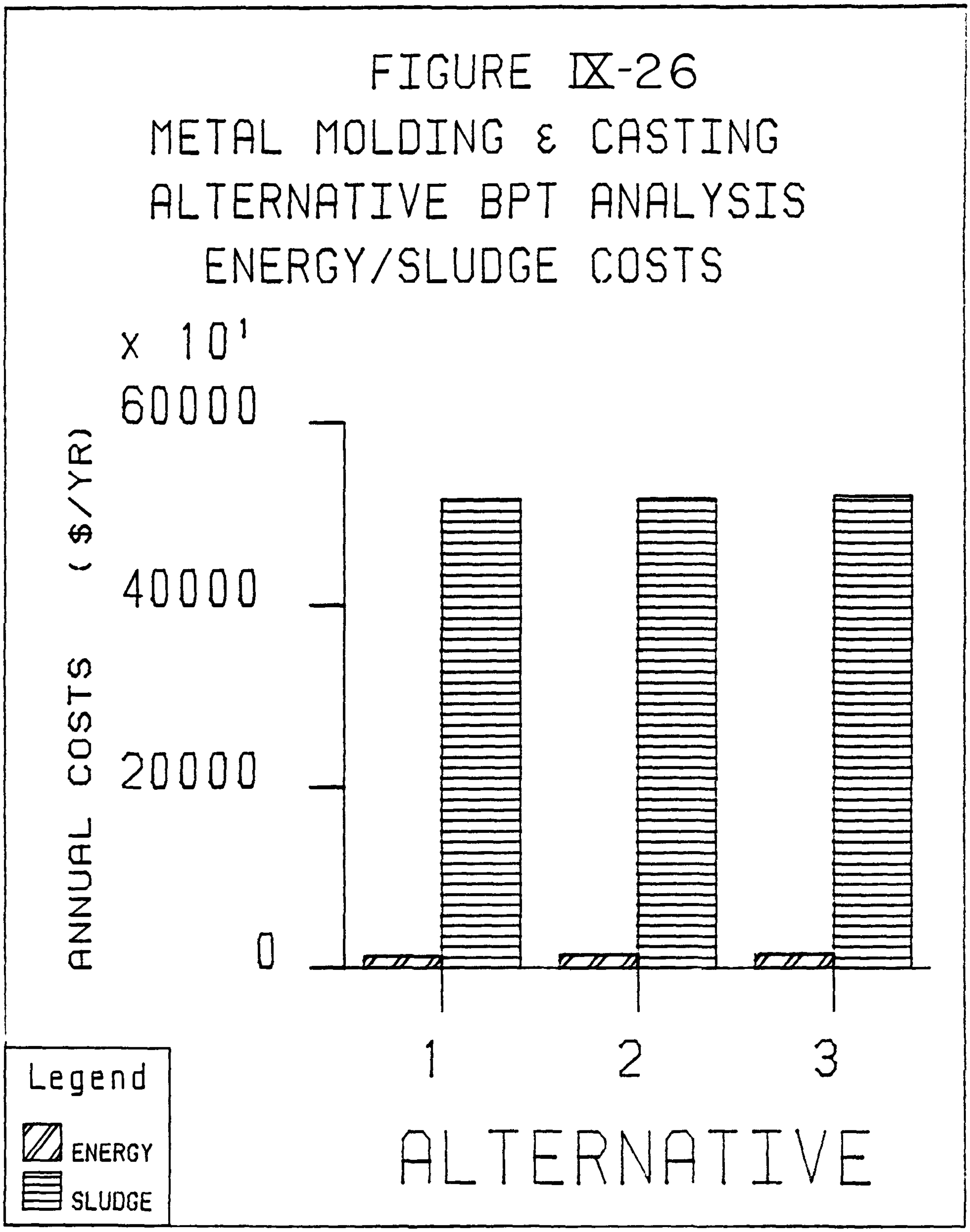


FIGURE IX-26
METAL MOLDING & CASTING
ALTERNATIVE BPT ANALYSIS
ENERGY/SLUDGE COSTS
x 10¹
60000
40000
20000
0
ANNUAL COSTS ($/YR)
1
2
3
ALTERNATIVE
Legend
ENERGY
SLUDGE

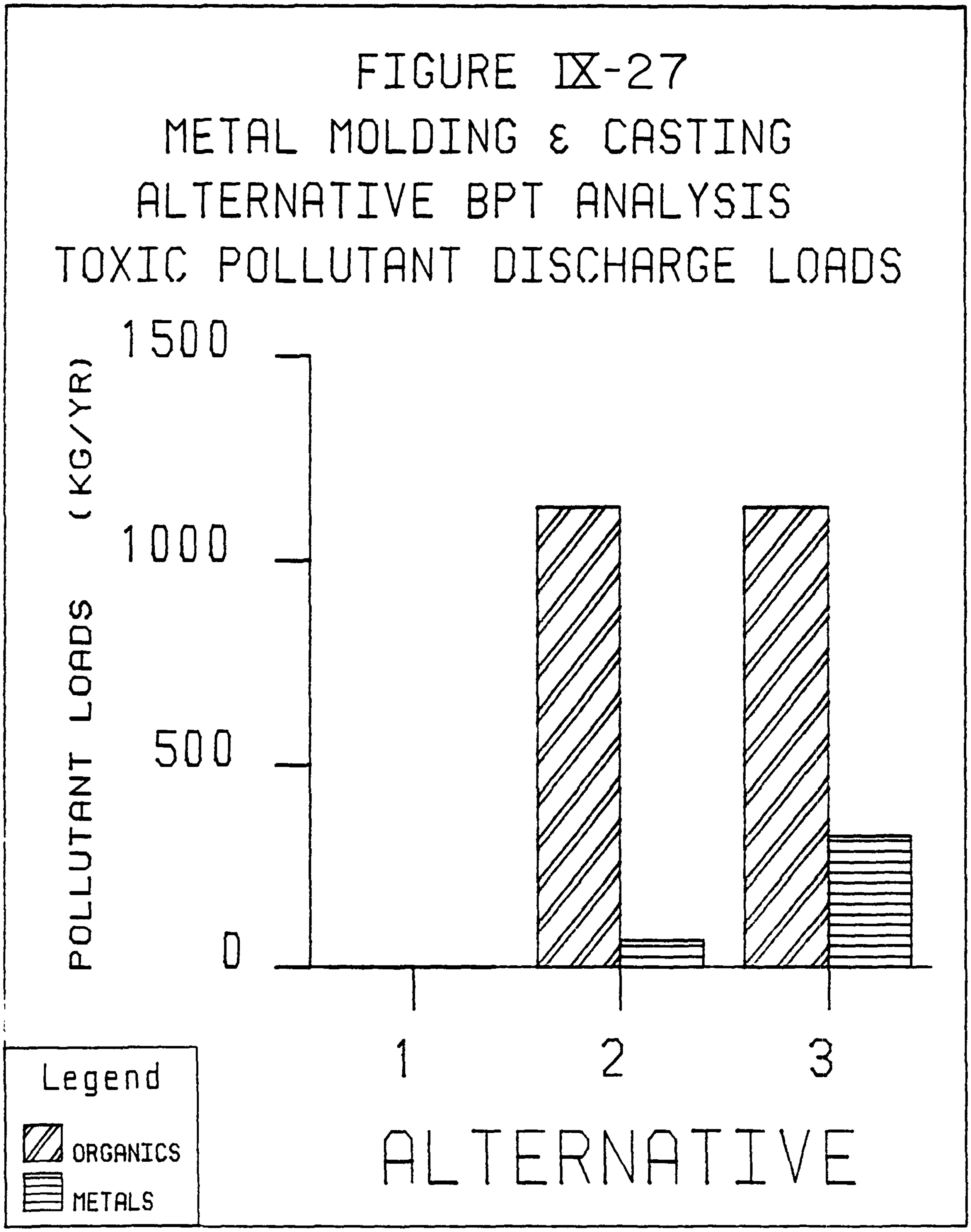


FIGURE IX-27
METAL MOLDING & CASTING
ALTERNATIVE BPT ANALYSIS
TOXIC POLLUTANT DISCHARGE LOADS
POLLUTANT LOADS (KG/YR)
1500
1000
500
0
1
2
3
ALTERNATIVE
Legend
ORGANICS
METALS

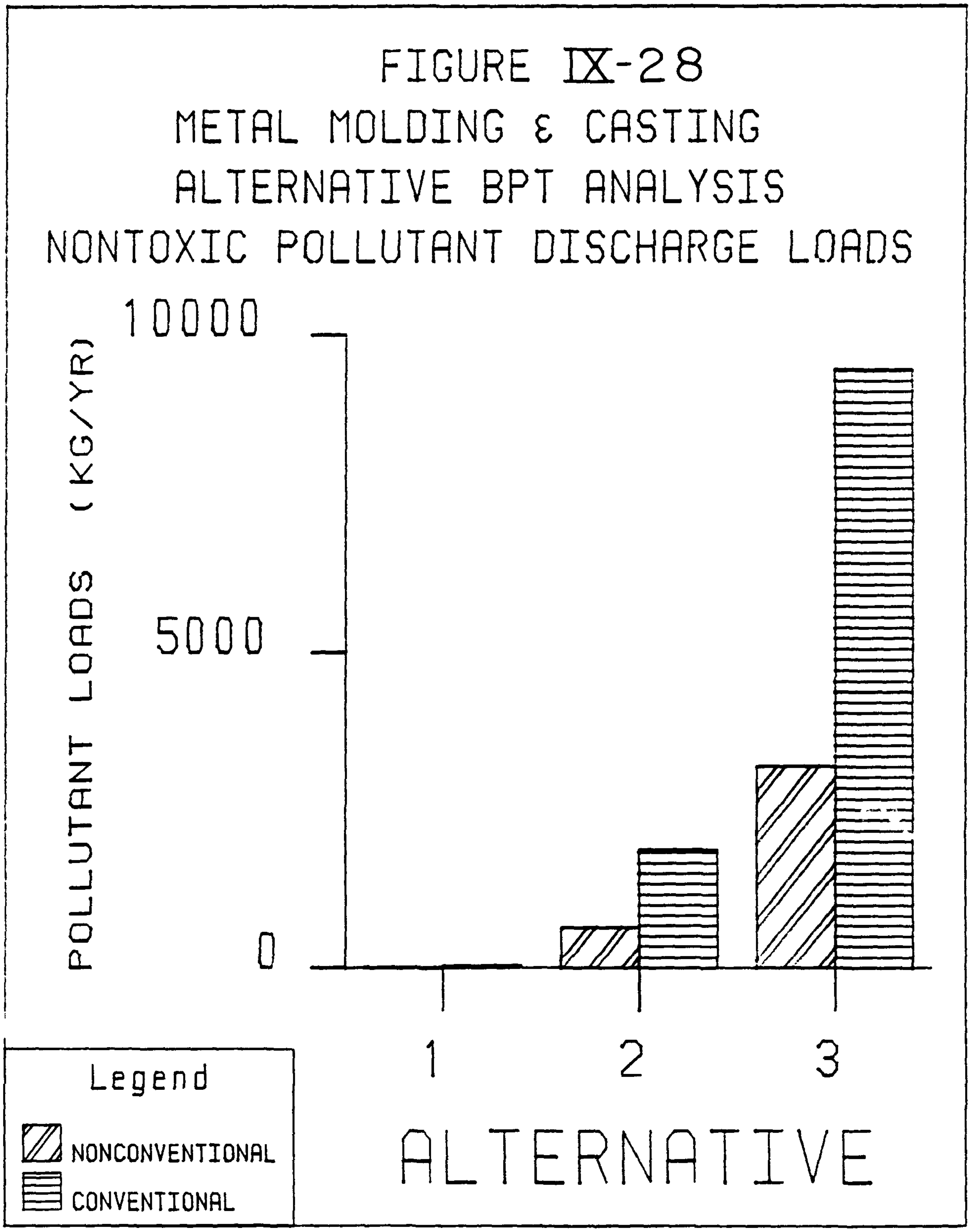


FIGURE IX-28
METAL MOLDING & CASTING
ALTERNATIVE BPT ANALYSIS
NONTOXIC POLLUTANT DISCHARGE LOADS
POLLUTANT LOADS (KG/YR)
10000
5000
0
1
2
3
ALTERNATIVE
Legend
NONCONVENTIONAL
CONVENTIONAL

SECTION X

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

INTRODUCTION

The effluent limitations which must be achieved by July 1, 1984 are to be based upon the best available control and treatment technology (BAT) employed by a point source within the industry category or subcategory, or by another industry from which technology is readily transferable. BAT may include process changes or internal controls, even when these modifications are not commonly practiced in the industry.

DEVELOPMENT OF BAT

For those fourteen process segments in which the proposed BPT limitations provide for complete recycle, the BAT model treatment systems and proposed BAT limitations are equivalent to the BPT treatment models and proposed limitations. The use of complete recycle in these process segments is discussed in detail in Section IX.

In the remaining process segments, the BPT model treatment systems did not incorporate complete recycle. In these process segments, the BPT level of treatment effluents may contain various toxic pollutants. The intent of the BAT model treatment system and the proposed BAT limitations is to provide for the control of these toxic pollutant discharges. Several BAT treatment alternatives were developed for each process segment. These alternatives provide options from which the Agency can make a selection to be used in developing the proposed BAT effluent limitations.

Given the prevalence of complete recycle at plants in this category, the Agency evaluated a BAT model treatment system incorporating complete recycle for each process segment. In developing such an alternative treatment system, consideration was given to the addition of model treatment components which would enable a plant to achieve complete recycle. Generally, the zero discharge alternatives are designed with only those treatment components necessary to treat process wastewater sufficiently to enable complete recycle. As can be seen in the cost estimates for each alternative (see Section VIII), the complete recycle alternative is generally the least expensive BAT treatment alternative.

In developing the BAT alternatives the Agency considered: the volume and quality of the BPT level of treatment effluents; the volume and quality of the BAT level of treatment effluents; the environmental impacts of the toxic pollutants found in the wastewaters; and, the cost of each alternative. Technologies considered for BAT were those which can be used in the foundry industry treatment systems and which are effective in reducing toxic pollutant levels. These technologies include systems which have demonstrated their performance capabilities and economic viability at the pilot plant, semi-works, or full-scale level.

The factors considered in evaluating and selecting the BAT alternatives proposed limitations included: the age of the equipment and facilities existing in the industry, the manufacturing process employed, the process changes required, the non-water quality environmental impacts (including energy requirements), and the costs of applying the technology to the industry.

The BAT level of treatment represents, at a minimum, the best economically achievable performance of plants of various ages, sizes, processes or other shared characteristics. As with BPT, where existing performance is uniformly inadequate, BAT model technologies may be transferred from another subcategory or category.

As with the BPT level of treatment, the Agency considered two discharge alternatives for the BAT level of treatment in all process segments. The development of the proposed BAT limitations is discussed first, followed by a brief discussion of the BAT discharge alternatives.

IDENTIFICATION OF BAT

Aluminum Casting

The proposed BPT limitations for two of the five aluminum casting subcategory process segments provide for no discharge of process wastewater pollutants to navigable waters. The effluents from the BPT model treatment systems for the remaining three process segments contain various toxic pollutants. Therefore, the control of these toxic pollutants is addressed by the BAT alternatives developed for each process segment. The BAT alternatives considered for the three remaining segments of the aluminum casting subcategory are discussed below.

Investment Casting Process

In developing the BAT alternatives for this process segment special consideration was given to the use of extensive recycle and the water quality requirements of the process, and to the capital and annual costs of the alternative technologies. Each alternative is an extension of the BPT model treatment system, (flocculation, sedimentation and solids dewatering), and provides for the extensive reycle of treated process wastewaters. A discussion of the two alternatives considered follows.

Alternative No. 1: Figure X-1

This alternative provides for the complete recycle of the BPT level of treatment effluent. An examination of the different uses of water in the investment casting process indicates that the BPT level of treatment effluent might be of suitable quality for complete recycle. Mold back up washdown, which is a house cleaning operation, does not require high quality water. Therefore, the effluent from the BPT model treatment system could be acceptable for use as washdown water.

Alternative No. 2: Figure X-2

This alternative incorporates filtration and complete recycle of the BPT level of treatment effluent. If low pressure sprays or small orifice spray nozzles are used in the investment casting wastewater recycle system, filtration of the wastewaters may be needed in order to minimize water supply system maintenance and cleaning requirements. As noted above, BAT No. 1 uses a high pressure spray system with larger orific spray nozzles as part of its complete recycle system.

Selection of a BAT Alternative

EPA has determined to exclude this process segment from further regulation at BAT because toxic organic pollutants were not detected or not present at treatable levels. Copper and zinc (the only toxic metals considered for regulation) are present in amounts too small to be effectively reduced by the technologies considered.

EPA is not requiring filtration following precipitation-sedimentation treatment because the levels of copper and zinc found in raw wastewaters are below the treatability levels achieved with filters. In addition, the technology to achieve

100 percent recycle is not demonstrated in and cannot readily be transferred to this process segment. After meeting the proposed BPT limitations, facilities in this process segment would discharge about 280 kg of conventional and nonconventional pollutants and 3.4 kg per year of toxic metal pollutants.

Melting Furnace Scrubber Process

The two BAT alternatives discussed below for melting furnace scrubber wastewaters build upon the treatment capabilities of the BPT model treatment system (sedimentation, skimming, 95% recycle, flocculation, precipitation, and vacuum filtration). Based upon the melting furnace scrubber complete recycle evaluation presented in Section IX, and recognizing the high recycle rates of some plants and the attainment of complete recycle in the zinc subcategory melting furance scrubber process segment, both of the BAT alternatives incorporate no discharge of process wastewater pollutants.

For those plants with extensive treatment facilities already in place, only recycle (and in some cases, filtration) equipment would be needed to achieve the performance levels incorporated in the BAT alternatives. However, those plants with only rudimentary treatment facilities in use will have a viable alternative to the installation of extensive BPT and BAT treatment systems. In these cases, the provision of only increased precipitation, sedimentation, and recycle capabilities beyond that provided by the scrubber equipment package would facilitate the attainment of complete recycle. The latter case can be likened to the use of complete recycle in the scrubber equipment and wastewater handling system provided by a manufacturer. This type of operation is termed complete internal recycle.

Alternative No. 1: Figure X-3

This alternative achieves no discharge of process wastewater pollutants to navigable waters by providing for the filtration and recycle of the BPT model treatment system effluent.

Alternative No. 2: Figure X-4

This alternative treatment system is based upon the design of internal recycle systems provided in the manufacturer's scrubber equipment packages, and the transfer of this technology from the zinc melting furnace scrubber process. Scrubbers are used on aluminum and zinc melting furnaces to control fumes generated when dirty, oily, or grease, scrap is remelted. When oil-free, grease-free scrap is remelted, scrubbers may not be required. Scrubber design is based primarily upon dust or fume loadings. These loadings are a function of scrap cleanliness and particulate distribution. Therefore, the function of the melting furnace scrubber is the same for both aluminum and zinc melting operations. The metallurgical differences between zinc and aluminum are only a minor design consideration in relation to the parameters mentioned above.

This BAT alternative was developed on the basis of the zinc melting furnace scrubber operation which achieves complete recycle (Plant 04622). Additional sedimentation and oil skimming capabilities are included in this alternative treatment system in order to ensure adequate solids and oil removal. These solids and oil and grease removal capabilities are more extensive than those commonly found in scrubber internal recycle systems.

Selection of a BAT Alternative

EPA proposes to exclude this process segment from the BAT limitations. The toxic pollutants present in the raw wastewaters of aluminum melting furnace scrubbers are below the treatability limits of well operated precipitation and sedimentation treatment systems or other technologies considered. The toxic metal pollutants and toxic organic pollutants are present in amounts too small to be effectively reduced by any of the technologies considered. Complete recycle is not a viable BAT option because the technology to achieve complete recycle has not been demonstrated by aluminum plants with melting furnace scrubber processes and cannot be readily transferred. EPA did not consider filtration following precipitation and sedimentation treatment with a discharge because the toxic metal pollutants found in raw wastewaters are below the treatability levels achieved with filters. EPA estimates the discharge of pollutants not controlled will be 61.0 kilograms per year of toxic pollutants and 1100 kilograms per year of conventional and nonconventional pollutants.

Die Casting Process

In this process segment, as in the previous process segments, the BAT treatment alternatives are extensions of the BPT level of treatment. However, the presence of significant levels (refer to Tables V-18 and V-32) of several toxic organic and metallic pollutants (particularly the phenolic compounds, lead, and zinc) warrants the incorporation of the best available technology prior to discharge. Various technologies were examined for their toxic pollutant removal capabilities.

In-process controls were examined to identify those changes which could be made to reduce water usage, and those measures which could be taken to reduce or eliminate the contamination of process wastewaters with toxic pollutants. Procedures used to reduce the amount of hydraulic oil leakage and die lubricant waste at the process will lower the demands placed on the treatment equipment for the removal of the toxic pollutants. These procedures will also facilitate the attainment of a high rate of recycle.

In the development of the three BAT alternatives, the engineering aspects of extensive recycle, and the water quality requirements of the die casting process were considered. In addition, any cost savings, which would be realized as a result of using a particular BAT alternative were identified. Consideration of the water quality requirements of the process indicate that process wastewaters would be suitable for extensive recycle provided that certain in-process changes were instituted, or extensive treatment was installed.

Alternative No. 1: Figure X-5

BAT alternative No. 1 is based on the increased recycle of the BPT effluent to attain an overall recycle rate of 95%. This alternative, provides the maximum effluent reduction benefits for the least incremental cost over BPT. The prudent use of die casting process liquids (die lubricants, etc.) or the segregated collection of die lubes (as discussed in Section IX for the the die lube process segment) would improve the overall operation of this alternative treatment model.

Toxic organic pollutants are contained in the die casting process wastewaters. These organics originate in the process liquids liberally sprayed on the exterior of the die to cool it. These liquids drip to the floor and run into floor drains unless specific measures are taken to collect these wastes. This excess of die casting process liquids significantly increases the concentrations of toxic organic pollutants in die casting process wastewaters.

However, even after taking proper precautions, significant levels of toxic pollutants can be generated in the process. To reduce the levels of toxics, the BPT model treatment system (and in turn the BAT No. 1 system) includes an emulsion breaking system. Studies conducted by the Agency, and analytical data collected at two sampled plants (17089 and 12040), indicate that emulsion breaking is capable of reducing toxic organic pollutant concentrations. The two plants noted above practice emulsion breaking as provided in the BPT model treatment system. In conjunction with the in-process controls, emulsion breaking should provide sufficient organic pollutant control to facilitate a high degree of recycle.

The toxic organic pollutant treated effluent analytical data from plants 17089 and 12040 provided the basis for the effluent loadings which would be achieved by this alternative. As noted above, the treatment practices employed at these plants are similar those incorporated in the model treatment system. Follow are the toxic organic pollutant analytical data for the noted plants. The list of selected pollutants will indicate treatment of those organic pollutants considered for regulation. This list also presents the predominant, as reflected in the analytical data, pollutants in that group of pollutants considered for regulation.

Pollutant		No. of Observations	Effluent Concentrations (mg/l) Average	Median
001	Acenaphthene	6	0.019	0
021	2,4,6-trichlorophenol	6	0.063	0.006
022	Parachlorometacresol	6	0.058	0.020
023	Chloroform	6	0.138	0.086
065	Phenol	6	0.013	0.012
067	Butyl benzyl phthalate	6	0.214	0
076	Chrysene	6	0.004	0
085	Tetrachloroethylene	6	0.054	0.052
	Phenols (4AAP)	6	0.222	0.181

The increase in recycle from 85% (at BPT) to 95% (at BAT-1) is based upon sampling data, and survey data for Plant 20223. In addition to the data from plant 20223, high rate recycle is demonstrated at the BPT level of treatment in the aluminum subcategory casting quench and die lube process segments and in the zinc subcategory die casting and casting quench process segment. Refer to Section IX. The practices in these segments, particularly the die lube process segment, demonstrate the relationship between in-process controls (of casting sprays, lubricants, etc.) and the ability to attain a high degree of recycle. In these segments, controls to prevent or minimize process solution contamination are a prime factor in attaining complete recycle. This relationship applies to this process segment as well.

Following are the effluent loadings for this BAT alternative. The average concentration values of the organic pollutants presented above were used as the basis for the monthly average loadings. The treatment performance data presented in Section IX provided the basis for the toxic metals effluent loadings which would be achieved by this alternative. The Agency's selection of pollutants for which BAT limitations are being proposed is based upon the following considerations: the ability of the BAT technologies to control a pollutant; the relative level, discharge load, and impact of each pollutant; the need to establish practical monitoring requirements; and the ability of one pollutant to indicate the control of other pollutant/s considered for regulation.

BAT ALTERNATIVE No. 1
EFFLUENT LOADINGS

ALUMINUM DIE CASTING PROCESS

Pollutant or Pollutant Property		Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
001	Acenaphthene	0.0000092	0.0000046
021	2,4,6-trichlorophenol	0.0000305	0.0000152
022	Parachlorometa cresol	0.0000281	0.0000140
023	Chloroform	0.0000668	0.0000334
065	Phenol	0.0000063	0.0000031
067	Butyl benzyl phthalate	0.000104	0.0000518
076	Chrysene	0.0000019	0.0000010
085	Tetrachloroethylene	0.0000261	0.0000131
122	Lead	0.0000242	0.0000218
128	Zinc	0.000247	0.000102
	Phenols(4AAP)	0.000107	0.0000537

Alternative No. 2: Figure X-6

BAT No. 2 adds granular activated carbon adsorption to the BPT recycle system. This alternative incorporates the extensive treatment that may be required when in-process changes (to limit the introduction of toxic organic pollutants at the source) are not adopted. Instead, toxic organic pollutant control is provided as a final treatment step. This alternative is the most expensive of the three alternatives.

The use of activated carbon adsorption for the removal of toxic organic pollutants serves two purposes: to remove toxic organics and to prevent the buildup of organic materials, particularly phenols, in the recycle system. One of the plants (Plant 17089) visited during the sampling survey has installed an activated carbon system since the sampling visit was conducted. The following table presents a summary of the effluent loadings which would be achieved with the technology incorporated in this treatment alternative. These loadings are based upon concentrations demonstrated in Agency studies ("Treatability of Organic Priority Pollutants", May 1979) of activated carbon adsorption system performance.

BAT ALTERNATIVE NO. 2
EFFLUENT LOADINGS

ALUMINUM DIE CASTING PROCESS

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
001 Acenaphthene	0.0000048	0.0000024
021 2,4,6-trichlorophenol	0.0000121	0.0000060
022 Parachlorometacresol	0.0000242	0.0000121
023 Chloroform	0.0000668	0.0000334
065 Phenol	0.0000063	0.0000031
067 Butyl benzyl phthalate	0.0000048	0.0000024
076 Chrysene	0.0000019	0.0000010
085 Tetrachloroethylene	0.0000242	0.0000121
122 Lead	0.0000242	0.0000218
128 Zinc	0.000247	0.000102
Phenols(4AAP)	0.0000242	0.0000121

Alternative No. 3: Figure X-7

The third BAT alternative provides for the 95% recycle of the BAT No. 2 effluent. The justifications provided for BAT Nos. 1 and 2 apply to this treatment alternative as well.

Selection of a BAT Alternative

Based upon its applicability to and attainability by the plants within this process segment, the proposed BAT limitations are based upon the performance of BAT Alternative No. 1. This alternative also exhibits the lowest cost of implementation. On a model basis, the investment and annual costs of BAT Alternative No. 2 are 14 and 66 times greater, respectively, than the investment and annual costs of BAT Alternative No. 1. Refer to Table VIII-31.

The proposed BAT limitations would result in the removal of 55 kg per year of toxic organics and toxic metal pollutants from the BPT effluent.

Lead Casting

The proposed BPT effluent limitations for two of the three lead casting subcategory process segments (grid casting and melting furnace scrubber) provide for no discharge of process wastewater pollutants to navigable waters. As the BPT level of treatment effluent from the other process segment may contain high concentrations of lead, the control of this toxic pollutant is addressed by the alternatives developed for this process segment.

Continuous Strip Casting Process

The following two BAT alternatives are incremental to the BPT model treatment system. The treatment technologies incorporated in the BAT alternative treatment systems reflect the current practices of plants in this process segment.

Alternative No. 1: Figure X-8

This treatment alternative incorporates filtration of the effluent from the BPT model treatment system. Four of the five plants in this segment provide filtration of their process wastewaters prior to discharge. This treatment component is capable of achieving additional reductions in toxic metals levels as a result of removing additional particulate matter as lead may be present in the particulate or precipitate forms. The following table presents a summary of the effluent loadings which would be achieved with the technology incorporated in this treatment alternative. These effluent loadings are based upon the performance data of the combined metals data base (refer to Sections VII and IX) for precipitation, sedimentation, and filtration technologies. These technologies are demonstrated in this process segment. Sections VII and IX provide discussions of the concentration data upon which these effluent loadings are based. The selection of lead for regulation is based upon the pollutant selection procedures noted previously in this section.

BAT ALTERNATIVE NO. 1
EFFLUENT LOADINGS
LEAD CONTINUOUS STRIP CASTING PROCESS

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
122 Lead	0.0000227	0.0000204

Alternative No. 2: Figure X-9

This treatment alternative incorporates the filtration component of BAT No. 1 and adds complete recycle of the filter effluent. One of the five plants (Plant 10169) in this process segment currently achieves complete recycle using the treatment technologies provided in the model treatment system. This alternative achieves no discharge of process wastewater pollutants to navigable waters.

Selection of a BAT Alternative

These are presently no direct discharges in this segment, therefore, BAT limitations are not appropriate. No BAT alternative has been selected, and no BAT limitations are being proposed for the lead subcategory continuous strip casting segment.

Zinc Casting

The proposed BPT limitations for the die casting and casting quench process segment provides for no discharge of process wastewater pollutants to navigable waters. The BPT level of treatment for the melting furnace scrubber process segment provides for a blowdown which contains a number of toxic pollutant. Therefore, three BAT alternatives have been developed for the control of these pollutants.

Melting Furnace Scrubber Process

Alternative No. 1: Figure X-10

This BAT treatment alternative is based on complete recycle of the BPT model treatment system effluent. This level of treatment is demonstrated at plant 04622. As little additional equipment would be needed to close the recycle loop, implementation costs for this alternative are minimal. In addition, effluent monitoring costs are eliminated and the purchases of makeup water are reduced.

Alternative No. 2: Figure X-11

This alternative incorporates sulfide precipitation, filtration and activated carbon treatment of the BPT system effluent. The application of the filtration and activated carbon adsorption technologies is based upon a transfer of technologies from the aluminum subcategory melting furnace scrubber process segment. Plant 17089 uses these treatment technologies in this process segment. Refer to the previous discussions in this section for details regarding the applicability and transfer of treatment technologies between the aluminum and zinc casting subcategories.

Sulfide precipitation is incorporated for the purpose of providing optimum toxic metal pollutant removal. The potassium permanganate phenols destruction component of the BPT model system is not required when activated carbon adsorption is used. This is the most expensive of the BAT alternatives in this process segment as it reflects the costs associated with the installation of the extensive treatment (i.e., activated carbon) necessary to reduce toxic organic pollutant concentrations to the fullest extent. The effluent concentrations used as the bases for these loadings are based upon data presented in Sections VII and IX and upon upon studies ("Treatability of Organic Priority Pollutants", May 1979) conducted by the Agency to determine activated carbon adsorption capabilities. Following is a summary of the effluent loadings which would be attained with the technologies incorporated in this treatment alternative. The selection of pollutants for regulation follows the procedures noted previously in this section.

BAT ALTERNATIVE NO. 2
EFFLUENT LOADINGS
ZINC MELTING FURNACE SCRUBBER PROCESS

Pollutant or Pollutant Property		Maximum for Any One Day (kg/kkg)	Maximum for Monthly Averages (kg/kkg)
021	2,4,6-trichlorophenol	0.000157	0.0000787
022	Parachlorometacresol	0.000315	0.000157
031	2,4-dichlorophenol	0.000315	0.000157
034	2,4-dimethylphenol	0.000315	0.000157
055	Naphthalene	0.000315	0.000157
065	Phenol	0.000315	0.000157
067	Butyl benzyl phthalate	0.0000630	0.0000315
128	Zinc	0.000117	0.0000600
	Phenols (4AAP)	0.000315	0.000157

Alternative No. 3: Figure X-12

BAT No. 3 provides for closing the recycle loop in the scrubber equipment package provided by the manufacturer. This mode of operation is termed complete internal recycle. The mode of treatment most prevalent among plants operating zinc melting furnace scrubbers consists of extensive internal recycle, generally greater than 90 percent, followed by treatment of the recycle system effluent. However, some plants extensively recycle within the scrubber equipment package and then discharge a process effluent without further treatment.

The ability of scrubbers to tolerate high recycle rates without detrimental effects on performance prompted the development of this BAT alternative. Refer to Section IX for a review of the viability of high recycle rate and complete recycle in melting furnace scrubber systems.

This alternative is the least costly of the three BAT alternatives. The ability of the scrubber equipment to provide sufficient treatment for the attainment of complete recycle is demonstrated by plant 04622.

Selection of a BAT Alternative

The proposed BAT effluent limitations in this process segment are based upon the first alternative, i.e., no discharge of process wastewater pollutants to navigable waters. Complete recycle systems are demonstrated in this process segment and are economically achievable.

Several toxic organic pollutants may remain in the BPT level of treatment effluent. To remove these toxic organic pollutants the Agency considered activated carbon adsorption technology as the only technology capable of removing these pollutants. On a model basis, the investment and annual costs of activated carbon adsorption and filtration (needed to ensure proper carbon adsorption system operation) are 11 and 32 times greater, respectively, than the costs of BAT Alternative No. 1. Refer to Table VIII-94.

The proposed BAT limitations would result in the removal of 665 kg per year of toxic pollutants.

Effluent Pollutant Load Summary

Table X-1 presents a summary of the pollutant load reductions achieved in each subcategory and process segment as a result of implementing the various BAT levels of treatment. These data pertain to complete recycle and direct discharge operations. Complete recycle operations only contribute to the raw waste pollutant loads. Section XIII presents pertinent details on the pretreatment standards. Refer to Section VIII for summaries of the industry-wide costs of treatment for the various subcategories.

ANALYSIS OF BAT DISCHARGE OPTIONS

As with the BPT level of treatment, discharge alternatives were also considered for the BAT level of treatment. These discharge alternatives, incorporating 90% and 50% recycle, are similar to those addressed in the BPT discussion (see Section IX). The assumptions made and the evaluation processes followed are similar to the assumptions and review processes of the BPT discharge alternative analysis.

The 90% and 50% recycle options considered as possible bases for BPT were rejected for the reasons set forth in Section IX. Complete recycle is economically achievable and will remove substantial quantities of toxic pollutants. A number of process segments would discharge toxic organic pollutants (principally phenolic compounds) if complete recycle were not the basis for BAT. These pollutants would appear in the range of 0.5 mg/l to 30.7 mg/l in the discharges. Neither the 90% nor the 50% recycle option was based upon technologies that would treat these toxic organic pollutants. If a discharge option were selected for BAT and these pollutants required treatment, the total cost of these options would far exceed the cost of complete recycle.

As with the BPT discharge alternatives, alternative effluent limitations were developed for the 90% and 50% recycle alternatives. These alternative limitations are presented in Tables X-2 (for the 90% recycle alternative) and X-3 (for the 50% recycle alternative).

TABLE X-1

RAW WASTEWATER AND TREATED EFFLUENT POLLUTANT LOADS
DIRECT AND ZERO DISCHARGE OPERATIONS

Subcategory	Process Segment	Treatment Level (2)	Pollutant Loads (kg/year x 10^{-3}) Toxic Organics (3)	Toxic Metals	Non Conventional	Conventional
Aluminum	Investment Casting	Raw	0.002	0.003	0	9.01
		BPT	0.002	0.002	0	0.28
		BAT	0.002	0.002	0	0.28
	Melting Furnace	Raw	0.139	0.263	0.25	42.00
		BPT	0.056	0.005	0.01	1.08
		BAT	0.056	0.005	0.01	1.08
	Casting Quench	Raw	0.006	0.033	0.01	16.08
		BPT	0	0	0	0
		BAT	0	0	0	0
	Die Casting	Raw	0.541	3.656	0	1,919.03
		BPT	0.044	0.039	0	1.40
		BAT	0.015	0.013	0	0.47
	Die Lube	Raw	1.491	0.049	0.23	178.99
		BPT	0	0	0	0
		BAT	0	0	0	0
Copper	Dust Collection	Raw	1.824	152.79	0.68	399.10
		BPT	0	0	0	0
		BAT	0	0	0	0
	Mold Cooling and Casting Quench	Raw	0	11.41	0	347.91
		BPT	0	0	0	0
		BAT	0	0	0	0

TABLE X-1
RAW WASTEWATER AND TREATED EFFLUENT POLLUTANT LOADS
DIRECT AND ZERO DISCHARGE OPERATIONS
PAGE 2

			Pollutant Loads (kg/year x 10^{-3})			
Subcategory	Process Segment	Treatment Level[2]	Toxic Organics[3]	Toxic Metals	Non Conventional	Conventional
Ferrous	Dust Collection	Raw	283.9	218.4	22,566	695,797
		BPT	0	0	0	0
		BAT	0	0	0	0
	Melting Furnace Scrubber	Raw	105.7	27,301.9	21,142	63,777
		BPT	0	0	0	0
		BAT	0	0	0	0
	Slag Quench	Raw	0.621	58.6	1,462	2,709
		BPT	0	0	0	0
		BAT	0	0	0	0
	Mold Cooling and Casting Quench	Raw	0	0	107	2,171
		BPT	0	0	0	0
		BAT	0	0	0	0
	Sand Washing	Raw	0.332	9.9	232	9,786
		BPT	0	0	0	0
		BAT	0	0	0	0
Lead	Continuous Strip Casting	Raw	0	0.001	0	0.01
		BPT	0	0	0	0
		BAT	0	0	0	0

TABLE X-1
RAW WASTEWATER AND TREATED EFFLUENT POLLUTANT LOADS
DIRECT AND ZERO DISCHARGE OPERATIONS
PAGE 3

Subcategory	Process Segment	Treatment Level[2]	Pollutant Loads (kg/year x 10^{-3}) Toxic Organics[3]	Toxic Metals	Non Conventional	Conventional
Magnesium	Grinding Scrubbers	Raw	0	0.003	0	0.07
		BPT	0	0	0	0
		BAT	0	0	0	0
	Dust Collection	Raw	0	0.001	0.03	0.10
		BPT	0	0	0	0
		BAT	0	0	0	0
Zinc	Die Casting and Casting Quench	Raw	0.032	1.036	0.02	221.56
		BPT	0	0	0	0
		BAT	0	0	0	0
	Melting Furnace Scrubber	Raw	679.1	155.6	0	7,490
		BPT	0.038	0.006	0	0.42
		BAT	0	0	0	0
TOTAL		Raw	1,073.7	27,914	45,510	784,864
		BPT	0.140	0.052	0.01	3.18
		BAT	0.073	0.020	0.01	1.83

(1): Based upon the pollutants considered for regulation.
(2): The BAT loads are based upon the selected BAT alternative.
(3): Includes phenols (4AAP) but not the individual phenolic compounds (e.g., 2,4,6-trichlorophenol, pentachlorophenol).

TABLE X-2

ALTERNATIVE EFFLUENT LIMITATIONS

90% RECYCLE DISCHARGE ALTERNATIVE

Subpart A - Aluminum Casting Subcategory

(a) Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.000124	0.0000512

(b) Die Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Acenaphthene	0.0000184	0.0000092
2,4,6-trichlorophenol	0.0000610	0.0000305
Parachlorometacresol	0.0000561	0.0000281
Chloroform	0.000134	0.0000668
Phenol	0.0000126	0.0000063
Butyl benzyl phthalate	0.000207	0.000104
Chrysene	0.0000039	0.0000019
Tetrachloroethylene	0.0000523	0.0000261
Lead	0.0000484	0.0000436
Zinc	0.000494	0.000203
Phenols (4AAP)	0.000215	0.000107

(c) Die Lube Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
2,4,6-trichlorophenol	0.0000012	0.0000006
Chlorofoorm	0.0000026	0.0000013
Phenol	0.0000002	0.0000001
Butyl benzyl phthalate	0.0000041	0.0000021
Tetrachloroethylene	0.0000010	0.0000005
Copper	0.0000123	0.0000059
Lead	0.0000010	0.0000009
Zinc	0.0000098	0.0000040
Phenols (4AAP)	0.0000043	0.0000021

Subpart B - Copper Casting Subcategory

(a) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Copper	0.000110	0.0000524
Lead	0.0000086	0.0000077
Zinc	0.0000877	0.0000361

(b) Mold Cooling and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper	0.000603	0.000288
Zinc	0.000481	0.000198

Subpart C - Ferrous Casting Subcategory

(a) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Copper	0.0000748	0.0000356
Lead	0.0000058	0.0000053
Zinc	0.0000596	0.0000245

(b) Melting Furnace Scrubber

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper	0.000694	0.000331
Lead	0.0000542	0.0000488
Zinc	0.000553	0.000228

(c) Slag Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper	0.000192	0.0000916
Lead	0.0000150	0.0000135
Zinc	0.000153	0.0000631

(d) Casting Quench and Mold Cooling Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper[1]	0.000117	0.0000560
Lead[1]	0.0000092	0.0000083
Zinc[1]	0.0000936	0.0000385

[1] These limitations would be applicable only when casting quench and mold cooling wastewaters are treated with other ferrous subcategory process wastewaters.

(e) Sand Washing Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Copper	0.000598	0.000285
Lead	0.0000467	0.0000421
Zinc	0.000477	0.000196

Subpart D - Lead Casting Subcategory

(a) Grid Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Lead	0.0000023	0.0000020

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/100 lb) of Metal Poured	
Lead	0.0000308	0.0000277

Subpart E - Magnesium Casting Subcategory

(a) Grinding Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.000681	0.000280

(b) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Zinc	0.0000094	0.0000039

Subpart F - Zinc Casting Subcategory

(a) Die Casting and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.0000170	0.0000070

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.000321	0.000132
Phenols (4AAP)	0.00315	0.00157

TABLE X-3

ALTERNATIVE EFFLUENT LIMITATIONS

50% RECYCLE DISCHARGE ALTERNATIVE

Subpart A - Aluminum Casting Subcategory

(a) Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.000621	0.000256

(b) Die Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Acenaphthene	0.0000920	0.0000460
2,4,6-trichlorophenol	0.000305	0.000152
Parachlorometacresol	0.000281	0.000140
Chloroform	0.000668	0.000334
Phenol	0.0000629	0.0000315
Butyl benzyl phthalate	0.00104	0.000518
Chrysene	0.0000194	0.0000097
Tetrachloroethylene	0.000261	0.000131
Lead	0.000242	0.000218
Zinc	0.00247	0.00102
Phenols (4AAP)	0.00107	0.000537

(c) Die Lube Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
2,4,6-trichlorophenol	0.0000060	0.0000030
Chloroform	0.0000132	0.0000066
Phenol	0.0000012	0.0000006
Butyl benzyl phthalate	0.0000205	0.0000103
Tetrachloroethylene	0.0000052	0.0000026
Copper	0.0000614	0.0000293
Lead	0.0000048	0.0000043
Zinc	0.0000489	0.0000202
Phenols (4AAP)	0.0000213	0.0000107

Subpart B - Copper Casting Subcategory

(a) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Copper	0.000550	0.000262
Lead	0.0000430	0.0000388
Zinc	0.000438	0.000180

(b) Mold Cooling and Casting Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper	0.00302	0.00144
Zinc	0.00240	0.000990

Subpart C - Ferrous Casting Subcategory

(a) Dust Collection

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Copper	0.000374	0.000178
Lead	0.0000292	0.0000263
Zinc	0.000298	0.000123

(b) Melting Furnace Scrubber

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper	0.00347	0.00165
Lead	0.000271	0.000244
Zinc	0.00277	0.00114

(c) Slag Quench Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper	0.000961	0.000458
Lead	0.0000751	0.0000676
Zinc	0.000766	0.000315

(d) Casting Quench and Mold Cooling Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Copper[1]	0.000587	0.000280
Lead[1]	0.0000459	0.0000413
Zinc[1]	0.000468	0.000193

[1] These limitations would be applicable only when casting quench and mold cooling wastewaters are treated with other ferrous subcategory process wastewaters.

(e) Sand Washing Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Copper	0.00299	0.00143
Lead	0.00234	0.000210
Zinc	0.00238	0.000981

Subpart D - Lead Casting Subcategory

(a) Grid Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximun for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Lead	0.0000113	0.0000102

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Lead	0.000154	0.000139

Subpart E - Magnesium Casting Subcategory

(a) Grinding Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.00340	0.00140

(b) Dust Collection Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Sand Handled	
Zinc	0.0000468	0.0000193

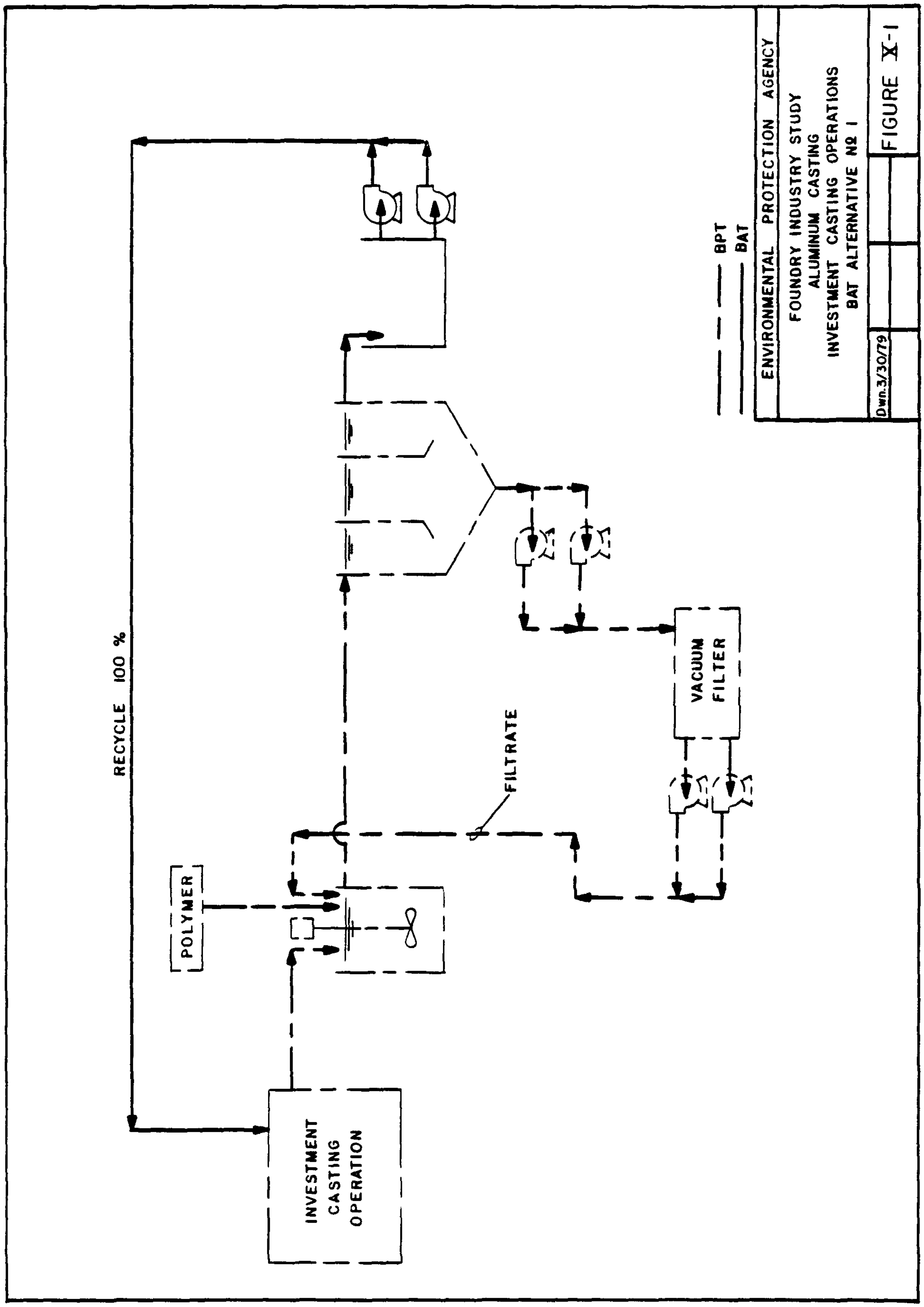
Subpart F - Zinc Casting Subcategory

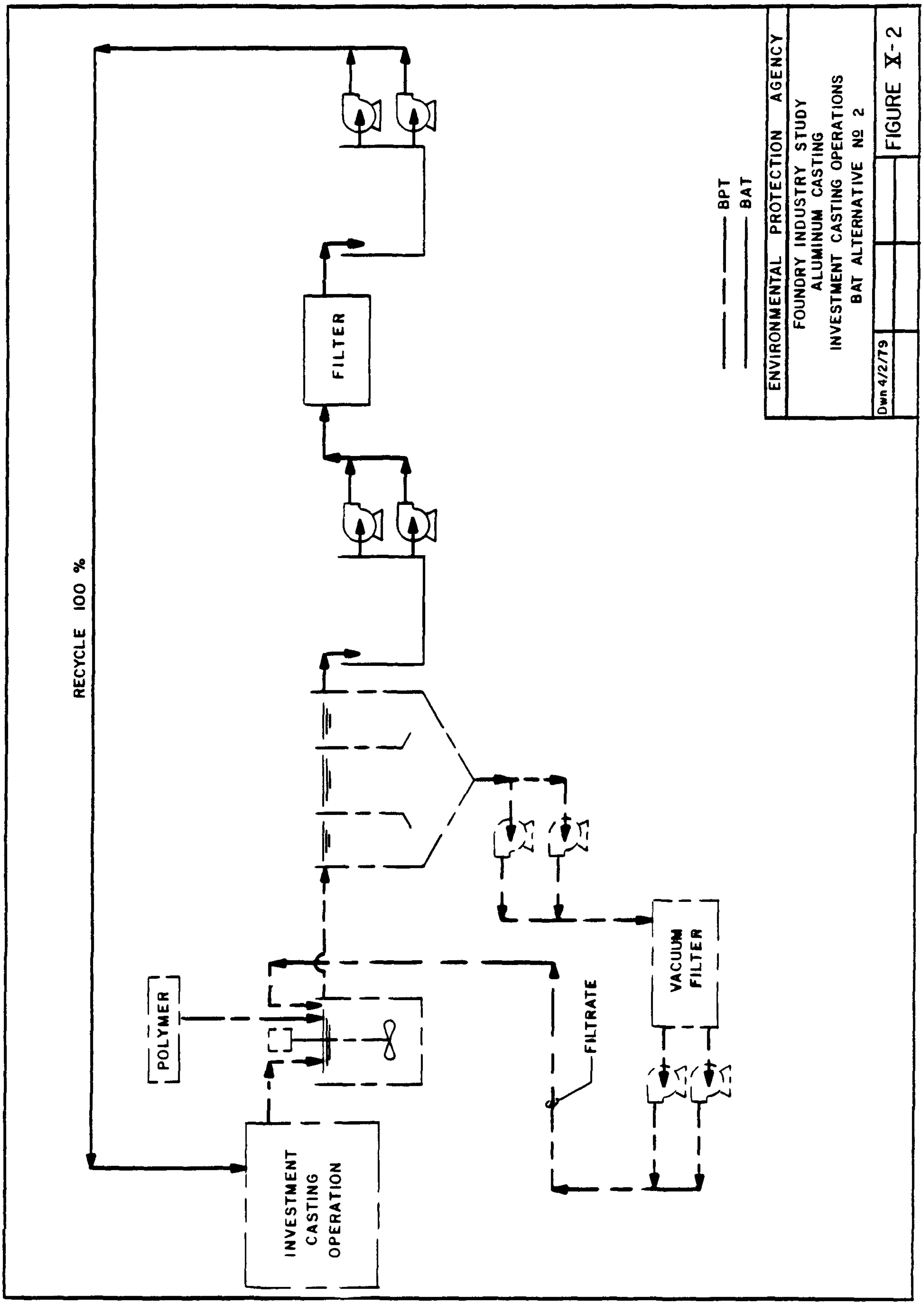
(a) Die Casting and Casting Quench Operations

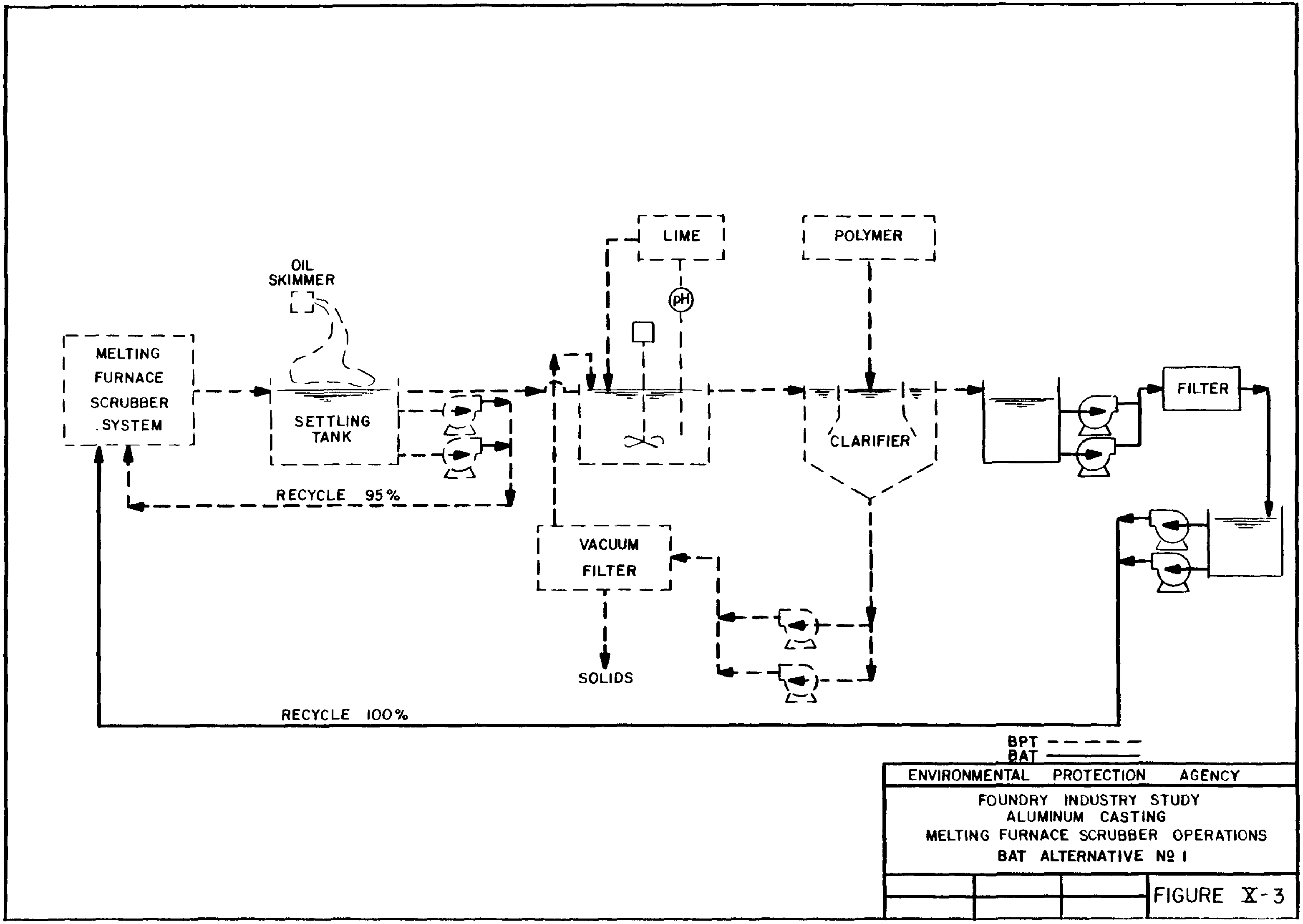
Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.0000851	0.0000350

(b) Melting Furnace Scrubber Operations

Pollutant or Pollutant Property	Maximum for Any One Day	Maximum for Monthly Average
	kg/kkg (lb/1000 lb) of Metal Poured	
Zinc	0.00161	0.000661
Phenols (4AAP)	0.0157	0.00787


RECYCLE 100 %
POLYMER
FILTRATE
VACUUM FILTER
INVESTMENT CASTING OPERATION
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
BAT ALTERNATIVE Nº 1
Dwn.3/30/79
FIGURE X-1


RECYCLE 100 %
FILTER
POLYMER
INVESTMENT CASTING OPERATION
FILTRATE
VACUUM FILTER
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
BAT ALTERNATIVE № 2
Dwn 4/2/79
FIGURE X-2


MELTING FURNACE SCRUBBER SYSTEM
OIL SKIMMER
SETTLING TANK
RECYCLE 95%
LIME
pH
POLYMER
CLARIFIER
FILTER
VACUUM FILTER
SOLIDS
RECYCLE 100%
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BAT ALTERNATIVE Nº I
FIGURE X-3

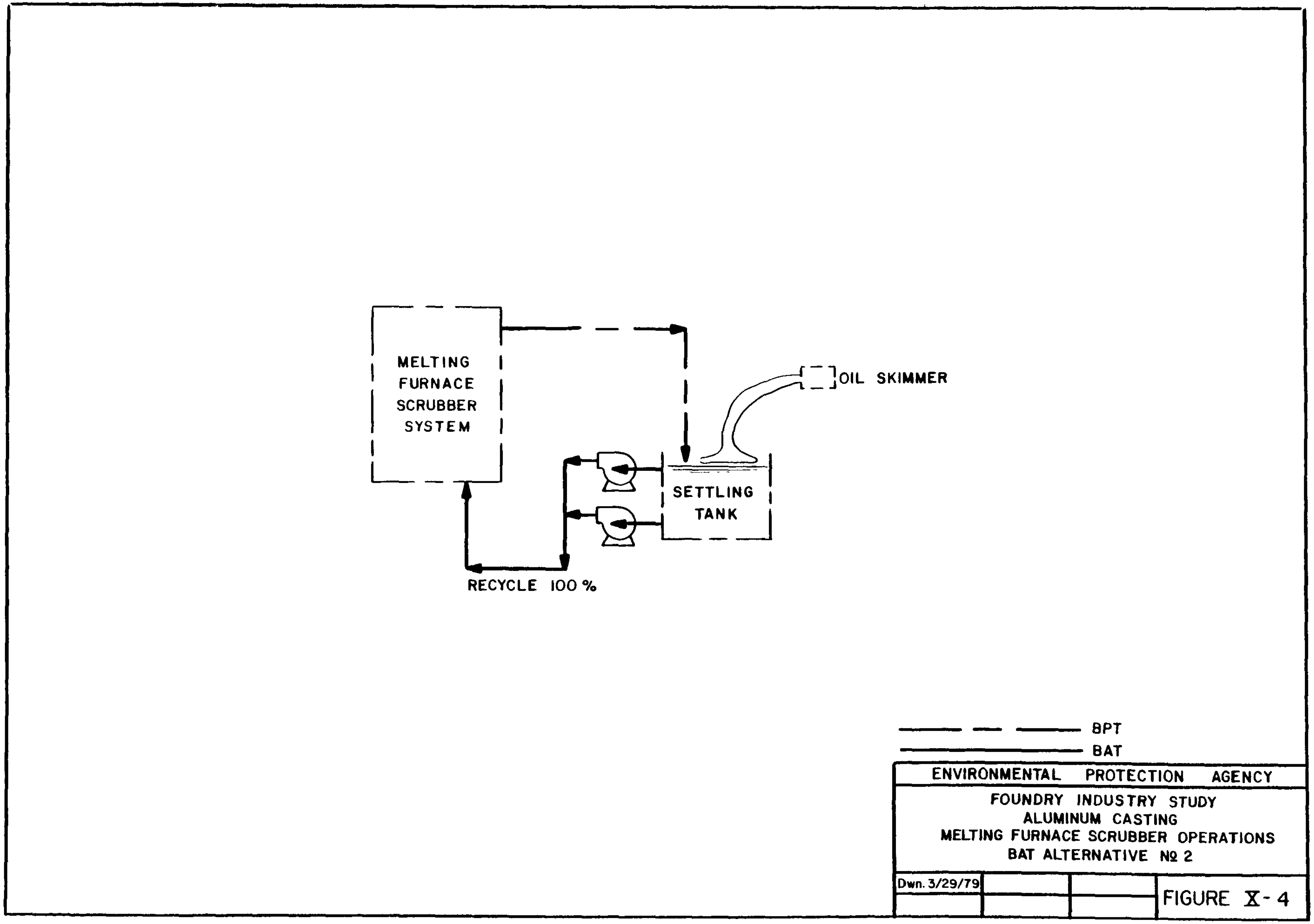
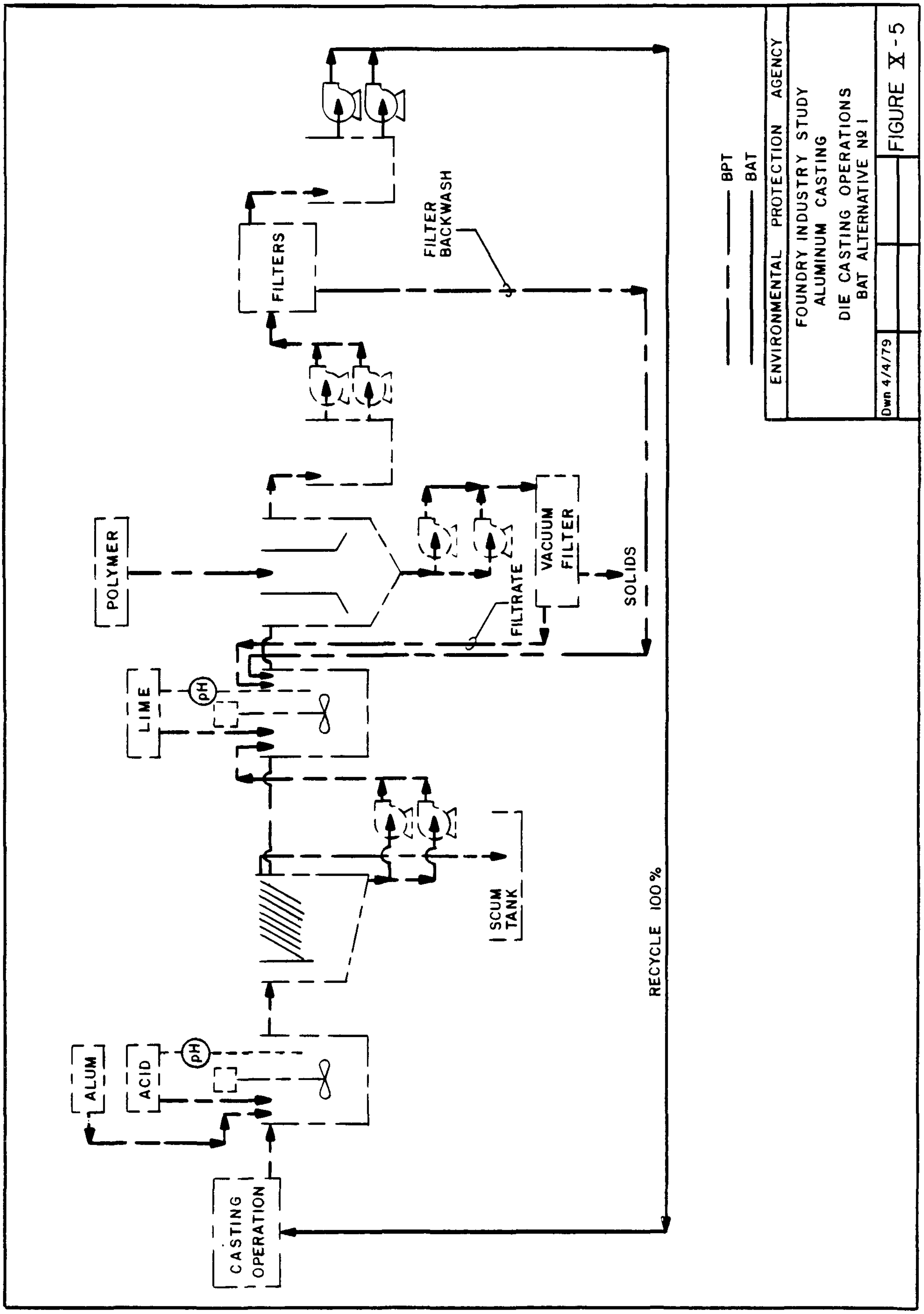
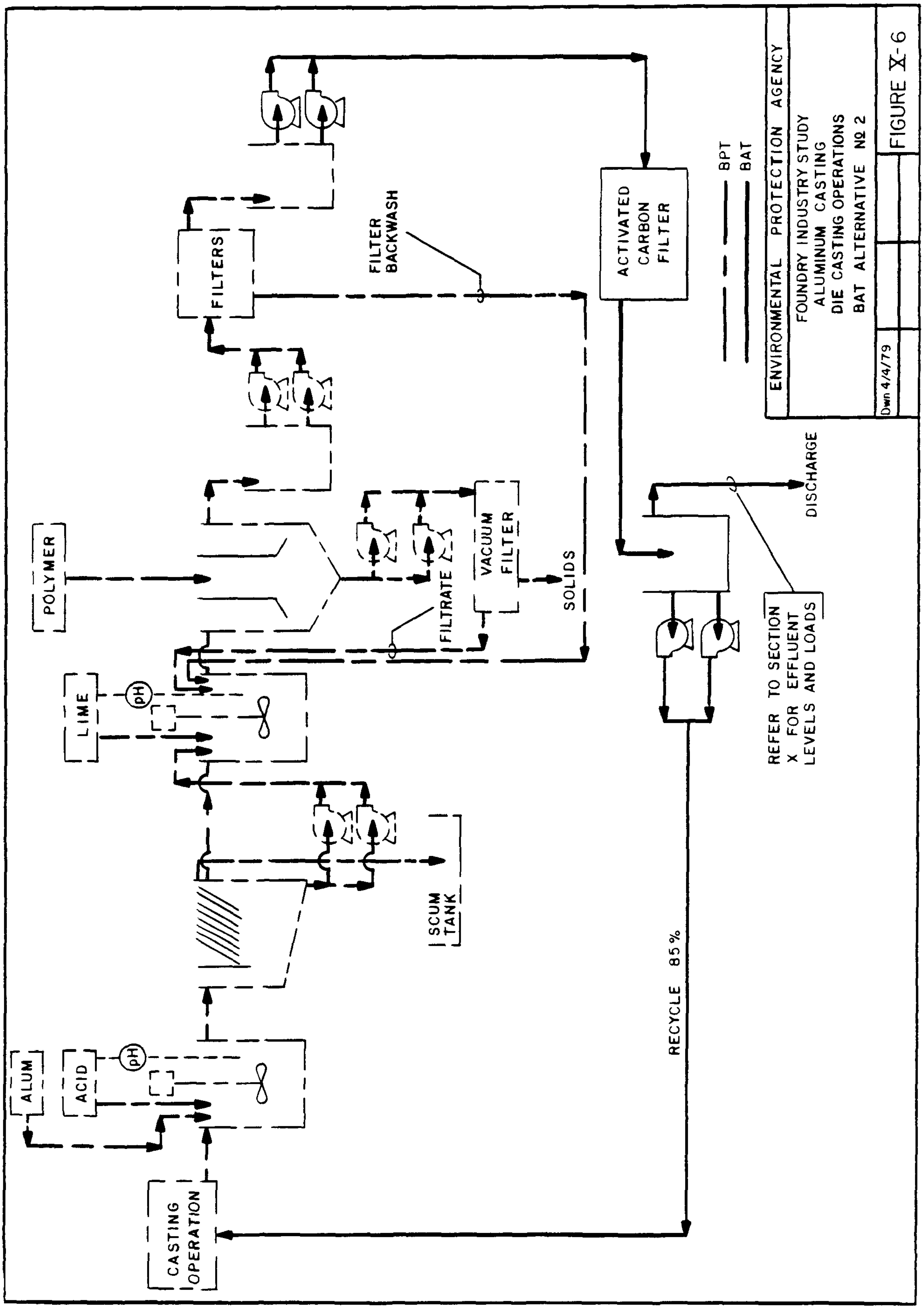
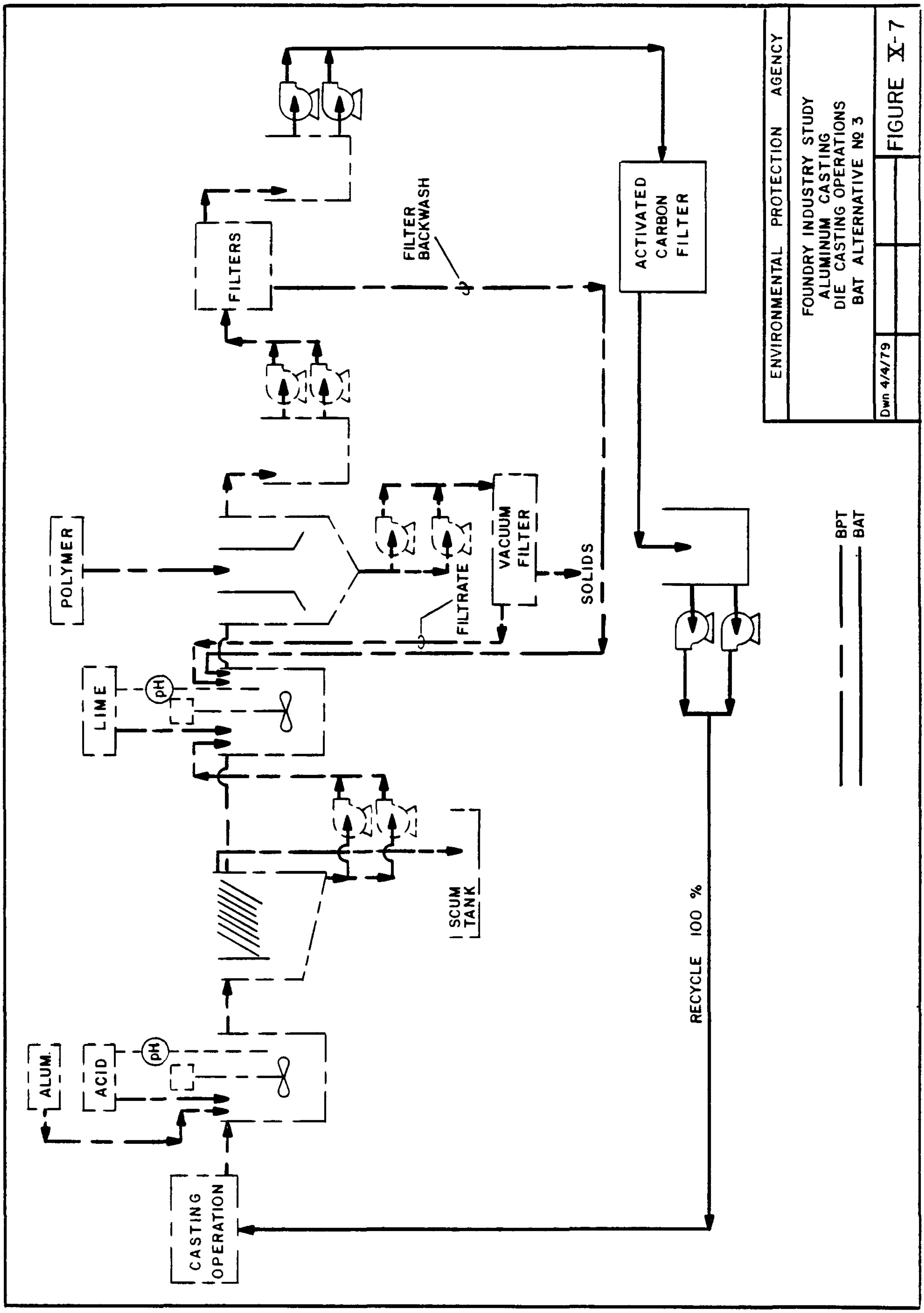
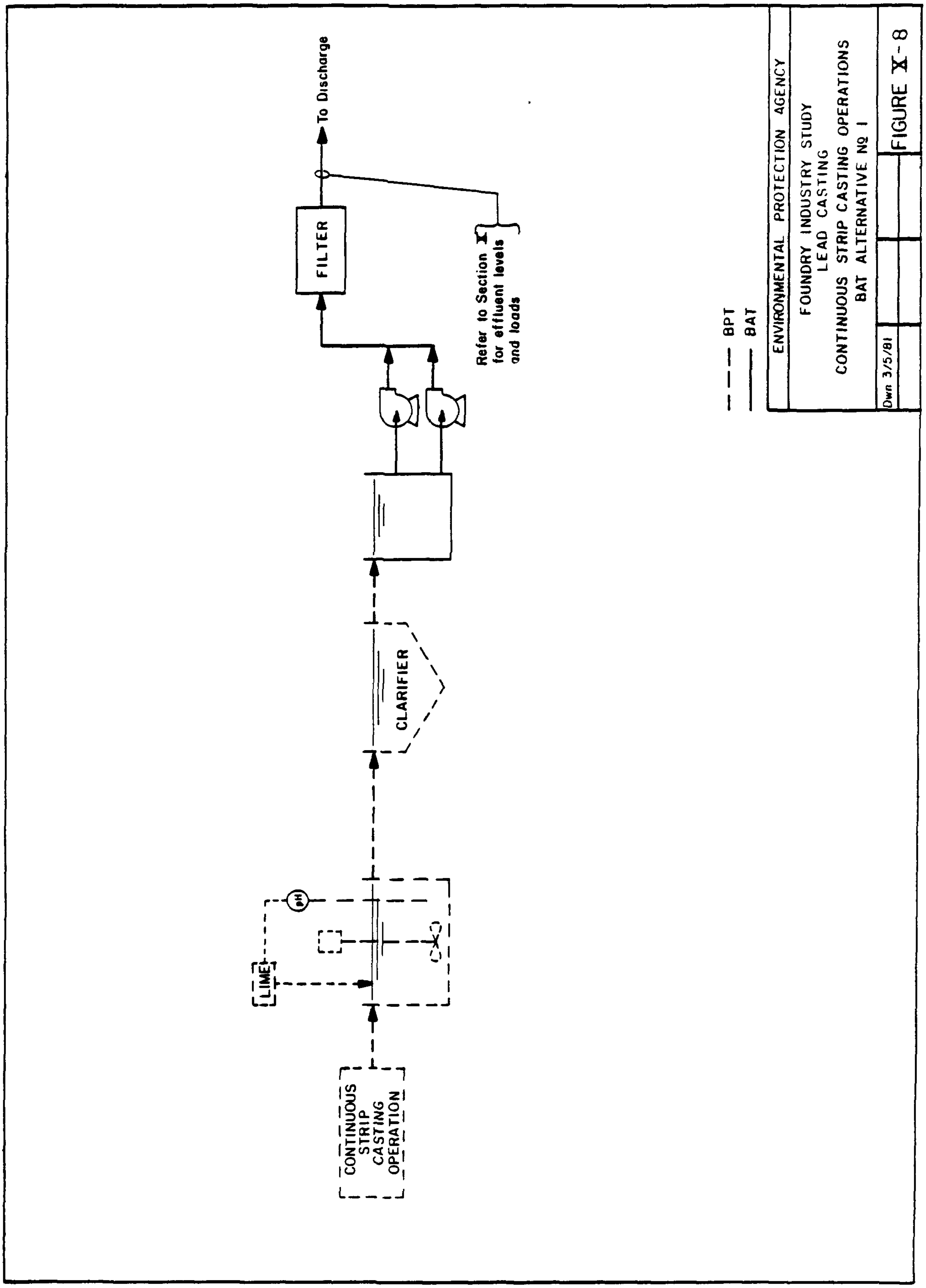

MELTING
FURNACE
SCRUBBER
SYSTEM
OIL SKIMMER
SETTLING
TANK
RECYCLE 100 %
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BAT ALTERNATIVE № 2
Dwn. 3/29/79

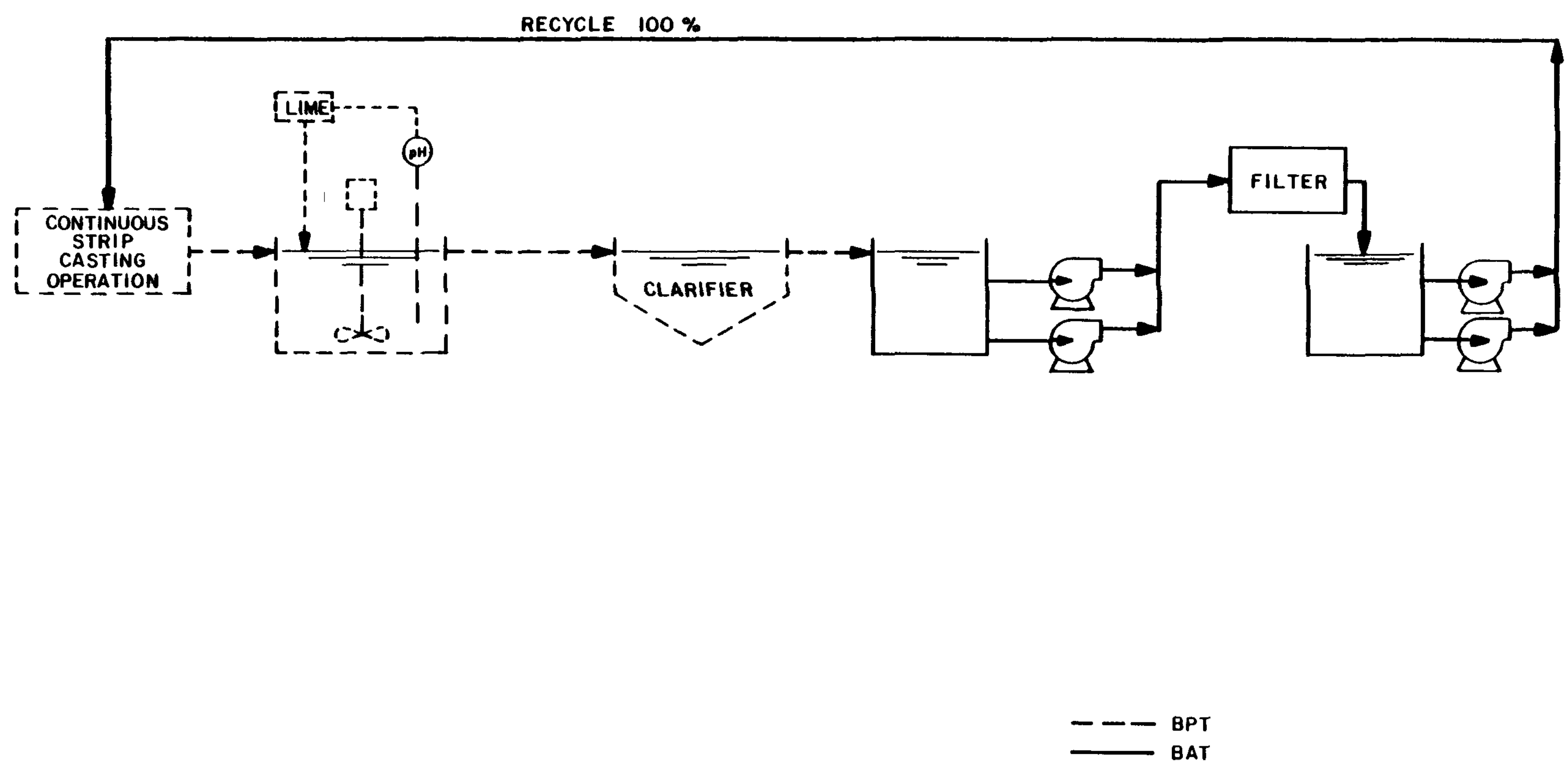
FIGURE X-4


CASTING OPERATION
ALUM
ACID
pH
SCUM TANK
RECYCLE 100%
LIME
pH
POLYMER
FILTRATE
VACUUM FILTER
SOLIDS
FILTERS
FILTER BACKWASH
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
BAT ALTERNATIVE Nº 1
Dwn 4/4/79
FIGURE X-5


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
BAT ALTERNATIVE № 2
FIGURE X-6
Dwn 4/4/79
BPT
BAT
CASTING OPERATION
ALUM
ACID
pH
LIME
POLYMER
SCUM TANK
FILTRATE
VACUUM FILTER
SOLIDS
FILTERS
FILTER BACKWASH
ACTIVATED CARBON FILTER
DISCHARGE
RECYCLE 85%
REFER TO SECTION X FOR EFFLUENT LEVELS AND LOADS


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
BAT ALTERNATIVE № 3
Dwn 4/4/79
FIGURE X-7
CASTING OPERATION
ALUM.
ACID
pH
LIME
pH
POLYMER
SCUM TANK
VACUUM FILTER
FILTRATE
SOLIDS
FILTERS
FILTER BACKWASH
ACTIVATED CARBON FILTER
RECYCLE 100 %
BPT
BAT


CONTINUOUS STRIP CASTING OPERATION
LIME
pH
CLARIFIER
FILTER
To Discharge
Refer to Section X for effluent levels and loads
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
BAT ALTERNATIVE No 1
Dwn 3/5/81
FIGURE X-8

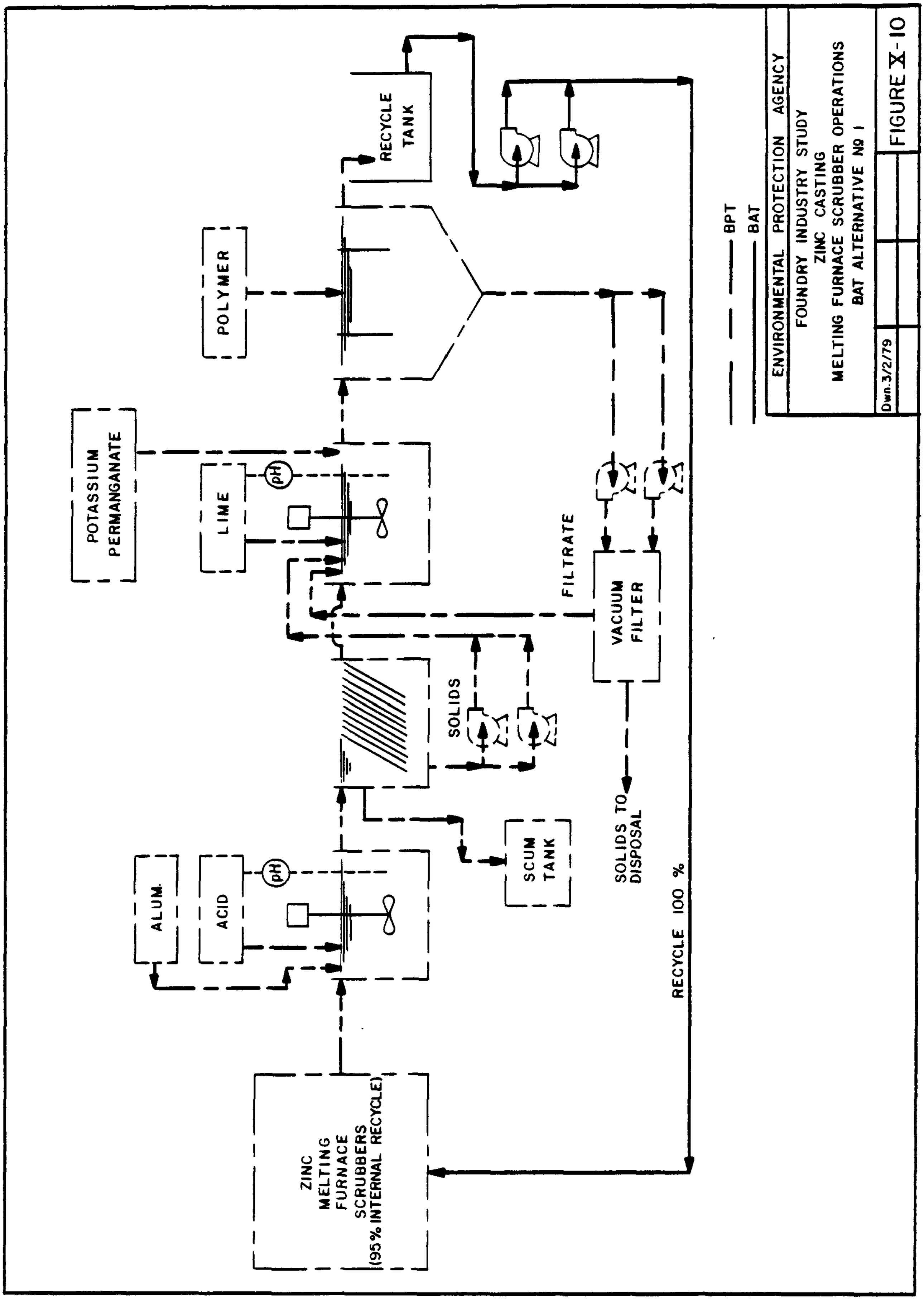


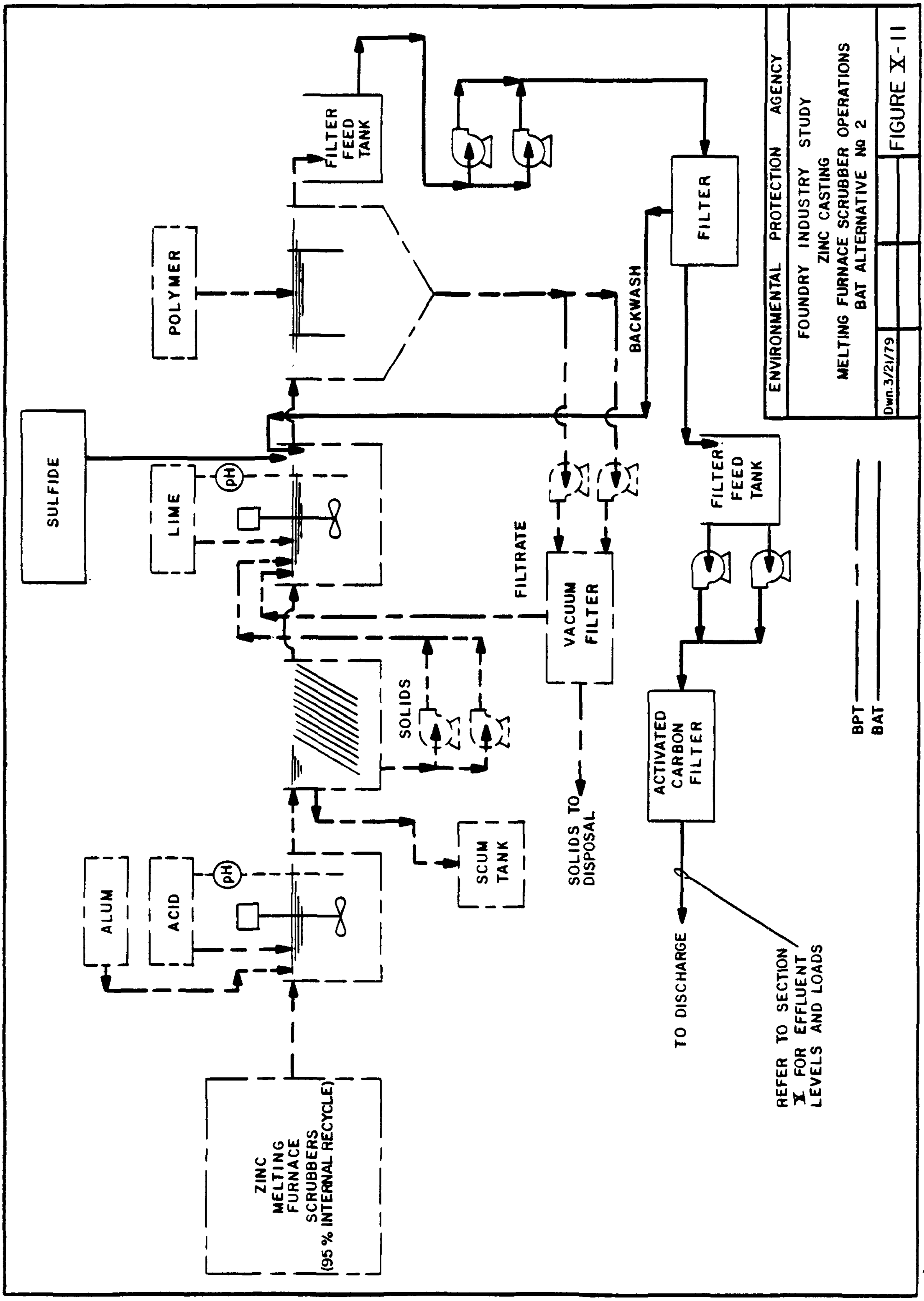
ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
BAT ALTERNATIVE Nº 2

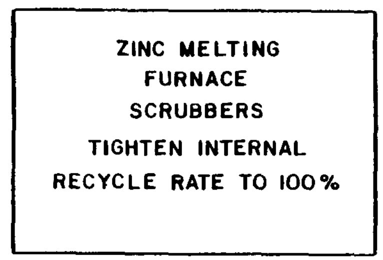
Dwn. 3/5/81

FIGURE X-9


ZINC
MELTING
FURNACE
SCRUBBERS
(95% INTERNAL RECYCLE)
ALUM.
ACID
pH
SCUM
TANK
SOLIDS
SOLIDS TO
DISPOSAL
POTASSIUM
PERMANGANATE
LIME
pH
FILTRATE
VACUUM
FILTER
POLYMER
RECYCLE
TANK
RECYCLE 100 %
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BAT ALTERNATIVE Nº I
Dwn.3/2/79
FIGURE X-10



ZINC MELTING FURNACE SCRUBBERS (95% INTERNAL RECYCLE)
ALUM
ACID
pH
SCUM TANK
SOLIDS
SULFIDE
LIME
pH
POLYMER
FILTRATE
VACUUM FILTER
SOLIDS TO DISPOSAL
BACKWASH
FILTER FEED TANK
FILTER
FILTER FEED TANK
ACTIVATED CARBON FILTER
TO DISCHARGE
REFER TO SECTION X FOR EFFLUENT LEVELS AND LOADS
BPT
BAT
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BAT ALTERNATIVE № 2
Dwn. 3/21/79
FIGURE X-11



NOTE: NO EQUIPMENT NEEDED

ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
BAT ALTERNATIVE Nº 3

Dwn 3/22/79

FIGURE X-12

SECTION XI

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY

The 1977 Amendments added Section 301(b)(2)(E) to the Act establishing the "best conventional pollutant control technology" (BCT) for discharges of conventional pollutants from existing industrial point sources. Conventional pollutants are those defined 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" (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 F.R. 50732). 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 has argued that a second cost test was not required).

EPA has determined that the BAT alternatives considered in this category are capable of removing significant amounts of conventional pollutants. On October 29, 1982, the Agency proposed a revised BCT methodology. EPA is deferring proposing BCT limitations for this category until the revised methodology can be applied to the technologies available for the control of conventional pollutants in this category.

SECTION XII

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF NEW SOURCE PERFORMANCE STANDARDS

INTRODUCTION

A new source is defined as any source the construction of which is commenced after the publication of proposed regulations prescribing new source performance standards. The basis for New Source Performance Standards (NSPS) under Section 306 of the Act is to be the best available demonstrated technology. New plants have the opportunity to design the best and most efficient manufacturing processes and wastewater treatment technologies. Congress, therefore, directed EPA to consider the best demonstrated processes and operating methods, in-plant control measures, end-of-pipe treatment technologies, and other alternatives that reduce pollution to the maximum extent feasible, including, where practicable, no discharge of pollutants to navigable waters.

Identification of NSPS

For the 14 process segments in which "no discharge of process wastewater pollutants" is proposed at BPT, EPA did not develop alternative treatment models for NSPS. BAT is equivalent to BPT for these process segments and represents current, state-of-the-art treatment facilities and practices. Therefore, no additional treatment alternatives or practices have been considered by the Agency for NSPS. For these 14 process segments the proposed NSPS are equivalent to the proposed BAT limitations.

For the remaining 5 process segments EPA considered alternative NSPS treatment models that are equivalent to the BPT and the BAT treatment alternatives.

Following is a summary of the NSPS model treatment alternatives with references to the equivalent BPT and BAT alternatives:

Process	NSPS Alternative	Equivalent Reference Models
Aluminum-Investment Casting	NSPS No. 1	BPT
	NSPS No. 2	BPT and BAT No. 1
	NSPS No. 3	BPT and BAT No. 2
Aluminum-Melting Furnace Scrubber	NSPS No. 1	BPT
	NSPS No. 2	BPT and BAT No. 1

	NSPS No. 3	BPT and BAT No. 2
Aluminum-Die Casting	NSPS NO. 1	BPT
	NSPS No. 2	BPT and BAT No. 1
	NSPS No. 3	BPT and BAT No. 2
	NSPS No. 4	BPT and BAT No. 3
Lead-Continuous Strip Casting	NSPS No. 1	BPT
	NSPS No. 2	BPT and BAT No. 1
	NSPS No. 3	BPT and BAT No. 2
Zinc-Melting Furnace Scrubber	NSPS No. 1	BPT
	NSPS No. 2	BPT and BAT No. 1
	NSPS No. 3	BPT and BAT No. 2
	NSPS No. 4	BPT and BAT No. 3

Figures XII-1 through XII-17 depict the above NSPS alternative treatment systems. Refer to Section IX for illustrations of the model treatment systems for the remaining process segments.

Rationale for NSPS

In those process segments in which the proposed BPT effluent limitations require no discharge of process wastewater pollutants, complete recycle clearly represents the best demonstrated technology.

NSPS Effluent Levels

For those five process segments for which BPT and BAT treatment models and alternatives were developed, the effluent levels attainable by the NSPS treatment alternatives are identical to those presented for the corresponding treatment models and alternatives in Sections IX and X. As noted above, the NSPS model treatment systems for the remaining process segments provide a treatment approach similar to that of the BPT and BAT model treatment systems, i.e., no discharge of process wastewater pollutants to navigable waters.

Selection of an NSPS Alternative

In the 15 process segments in which the proposed BAT levels of treatment achieve no discharge of process wastewater pollutants to navigable waters, the proposed NSPS are equal to the proposed BAT limitations.

In two process segments (aluminum investment casting and aluminum melting furnace scrubber), the selected NSPS alternatives are identical to the BPT model treatment systems, i.e., NSPS No. 1. In the investment casting process segment complete recycle is neither demonstrated nor readily transferred. Likewise, complete recycle is not demonstrated in the aluminum melting furnace scrubber process segment.

In the aluminum die casting segment and the lead continuous strip casting process segments, the proposed NSPS are based upon the demonstrated treatment technologies of the NSPS Alternative No. 2 treatment systems. While the Agency considered treatment alternatives beyond the NSPS Alternative No. 2 level of treatment, the Agency concluded that the other alternatives are not demonstrated. The selected alternatives are equivalent to the selected or preferred BAT model treatment systems. Details pertaining to these treatment systems, and the resulting limits and standards, were previously reviewed in Sections IX and X.

Following are the proposed NSPS for the three process segments with discharge standards other than zero discharge:

PROPOSED NSPS

Aluminum-Investment Casting Process

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
TSS	1.103	0.538
Oil and Grease	0.538	0.323
pH	Within the range of 7.5 to 10	

PROPOSED NSPS

Aluminum Melting Furnace Scrubber Process

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
TSS	0.0166	0.00809
Oil and Grease	0.00809	0.00486
pH	Within the range of 7.5 to 10	

PROPOSED NSPS

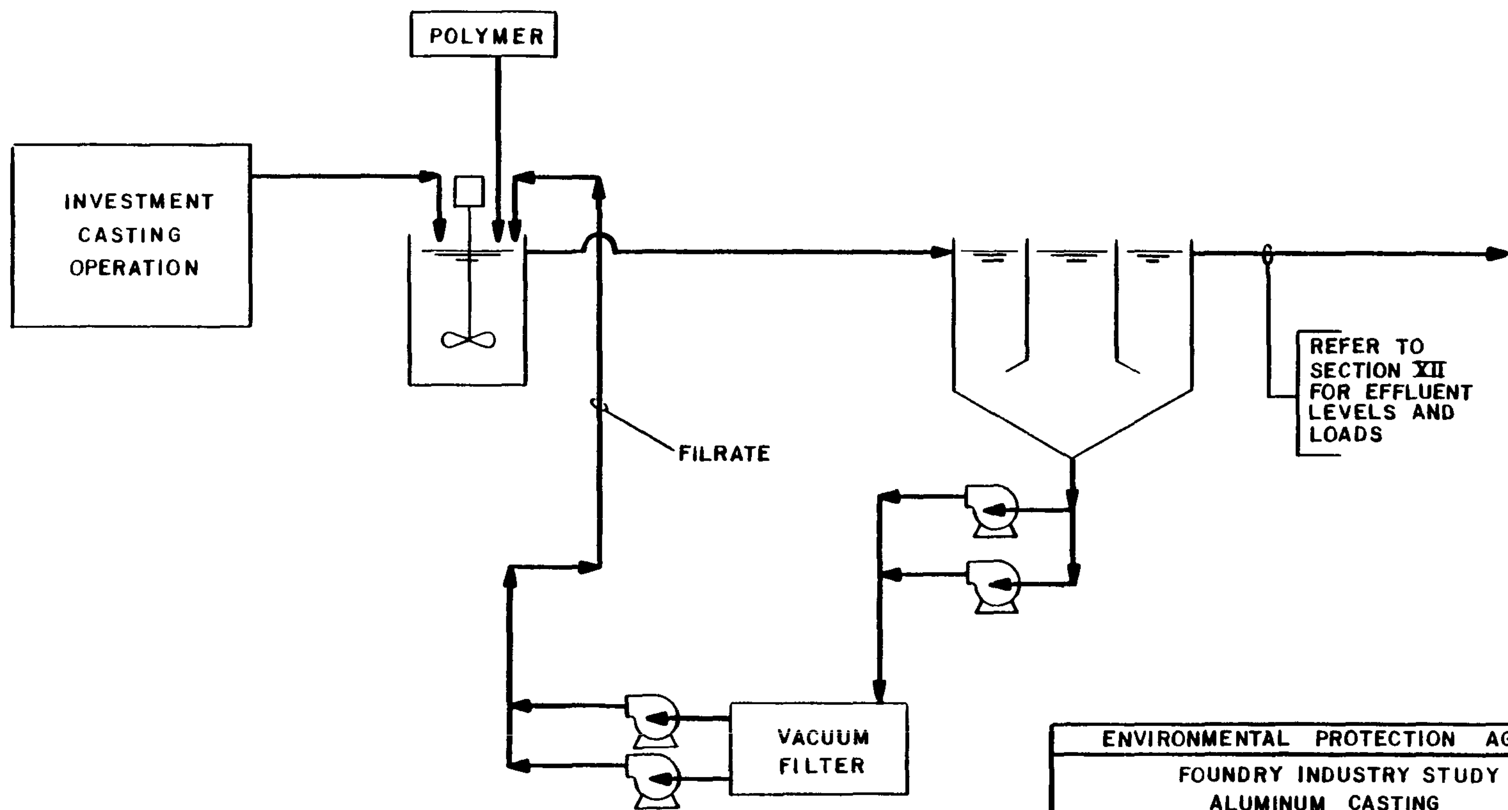
Aluminum-Die Casting Process

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
Acenaphthene	0.0000092	0.0000046
2,4,6-trichlorophenol	0.0000305	0.0000152
Parachlorometacresol	0.0000281	0.0000140
Chloroform	0.0000668	0.0000334
Phenol	0.0000063	0.0000031
Butyl benzyl phthalate	0.000104	0.0000518
Chrysene	0.0000019	0.0000010
Tetrachloroethylene	0.0000261	0.0000131
Lead	0.0000242	0.0000218
Zinc	0.000247	0.000102
Phenols (4AAP)	0.000107	0.0000537
TSS	0.00363	0.00266
Oil and Grease	0.00242	0.00242
pH	Within the range of 7.5 to 10	

PROPOSED NSPS

Lead-Continuous Strip Casting Process

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
Lead	0.0000227	0.0000204
TSS	0.00340	0.00250
Oil and Grease	0.00227	0.00227
pH	Within the range of 7.5 to 10	

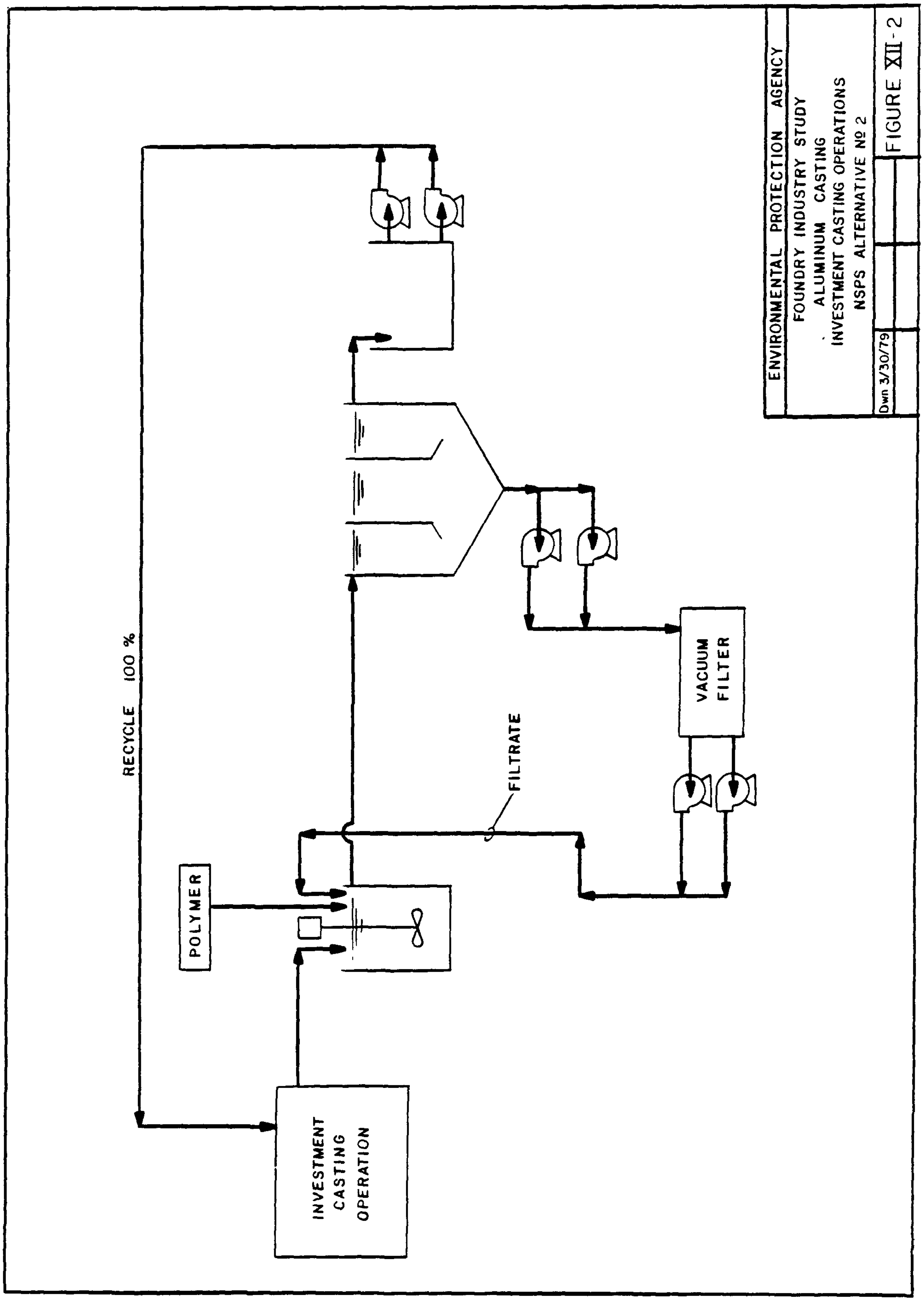


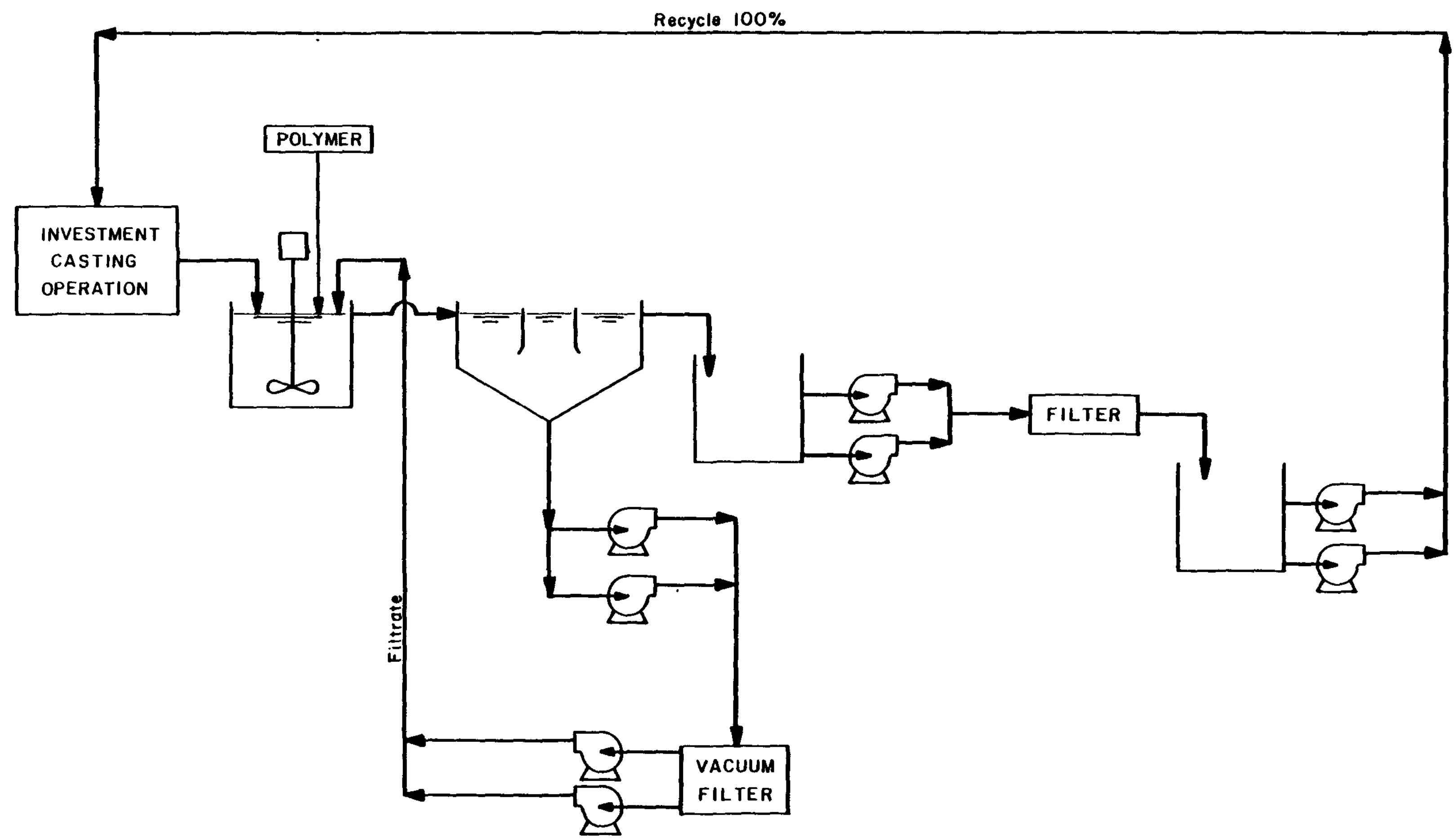
ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
NSPS ALTERNATIVE № 1

Dwn. 3/30/79

FIGURE XII-1


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
NSPS ALTERNATIVE № 2
Dwn 3/30/79
FIGURE XII-2
RECYCLE 100 %
POLYMER
FILTRATE
VACUUM FILTER
INVESTMENT CASTING OPERATION

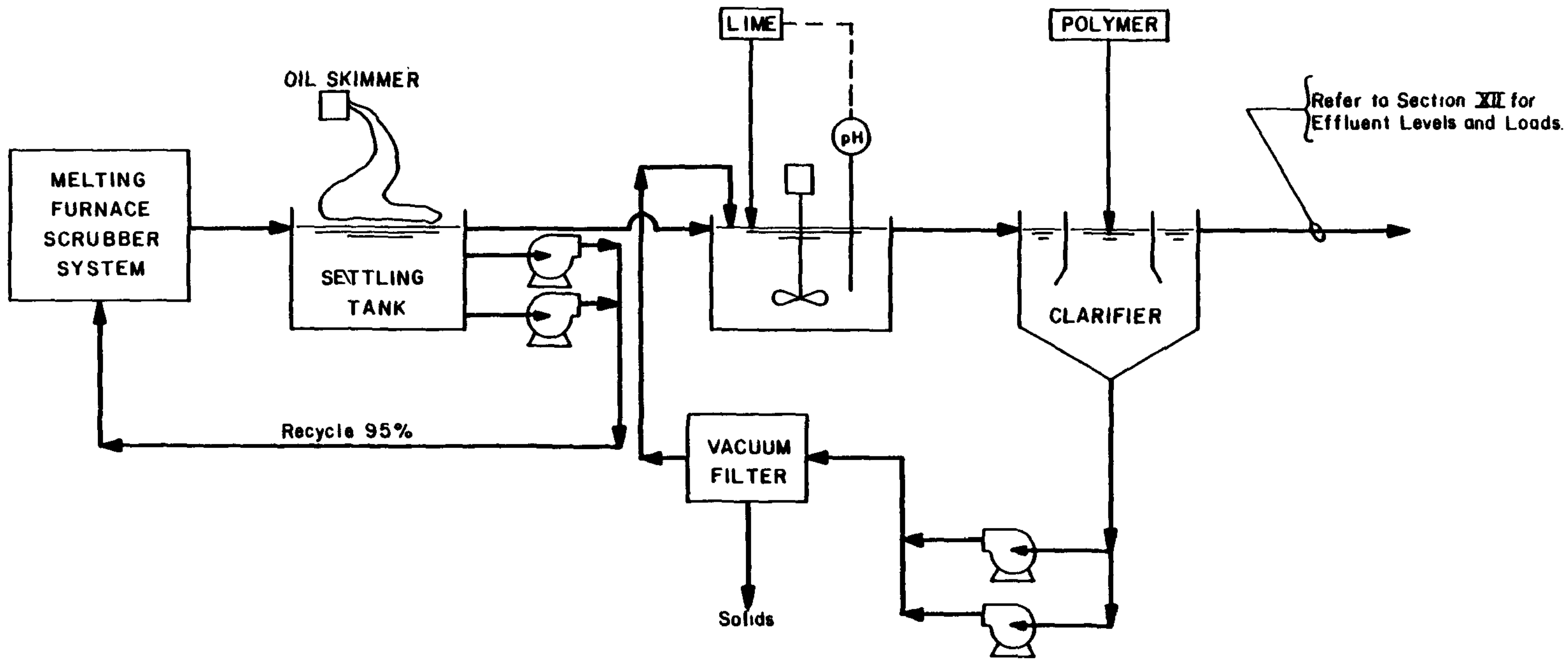


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
NSPS ALTERNATIVE № 3

Dwn. 4/2/79

FIGURE XII-3

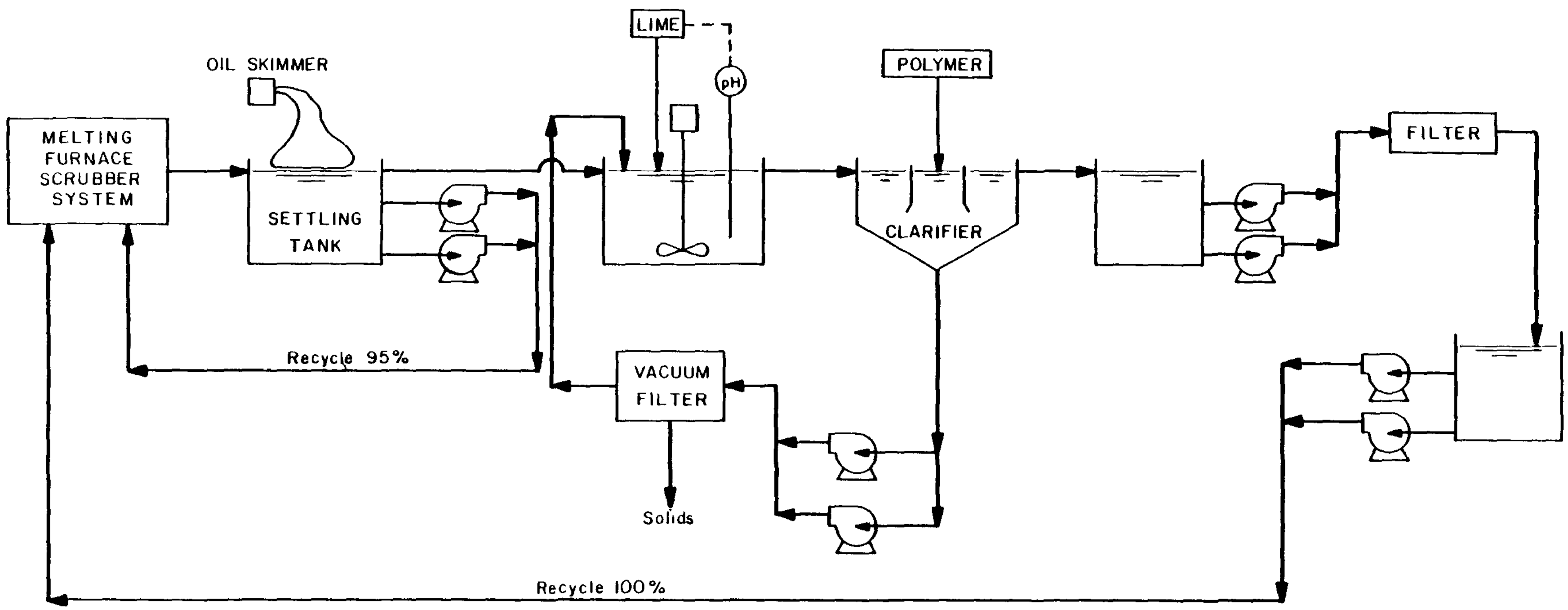


ENVIRONMENTAL PROTECTION AGENGY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
NSPS ALTERNATIVE № 1

Dwn. 3/28/79

FIGURE XII-4

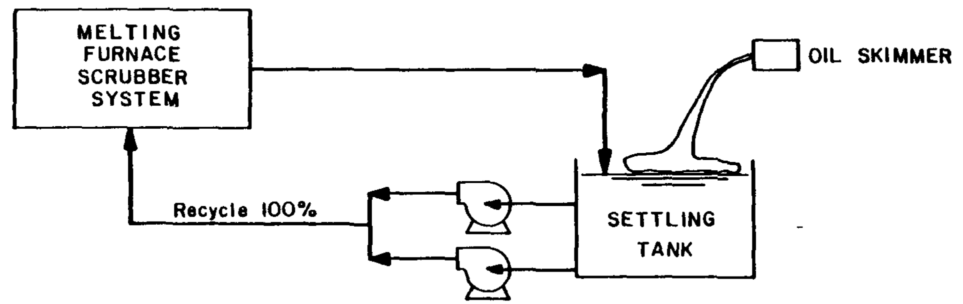


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
NSPS ALTERNATIVE № 2

Dwn 3/30/79

FIGURE XII-5

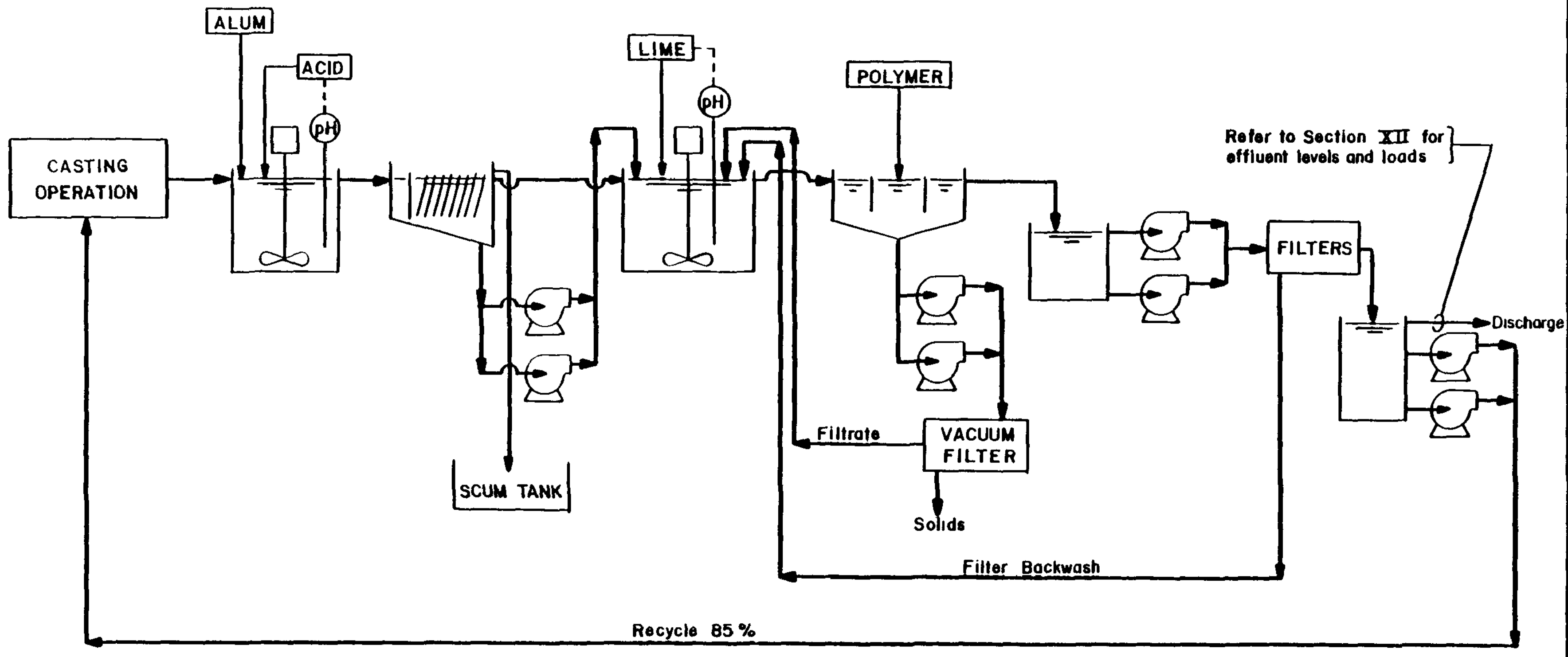


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
NSPS ALTERNATIVE No 3

Dwn 3/29/79

FIGURE XII-6

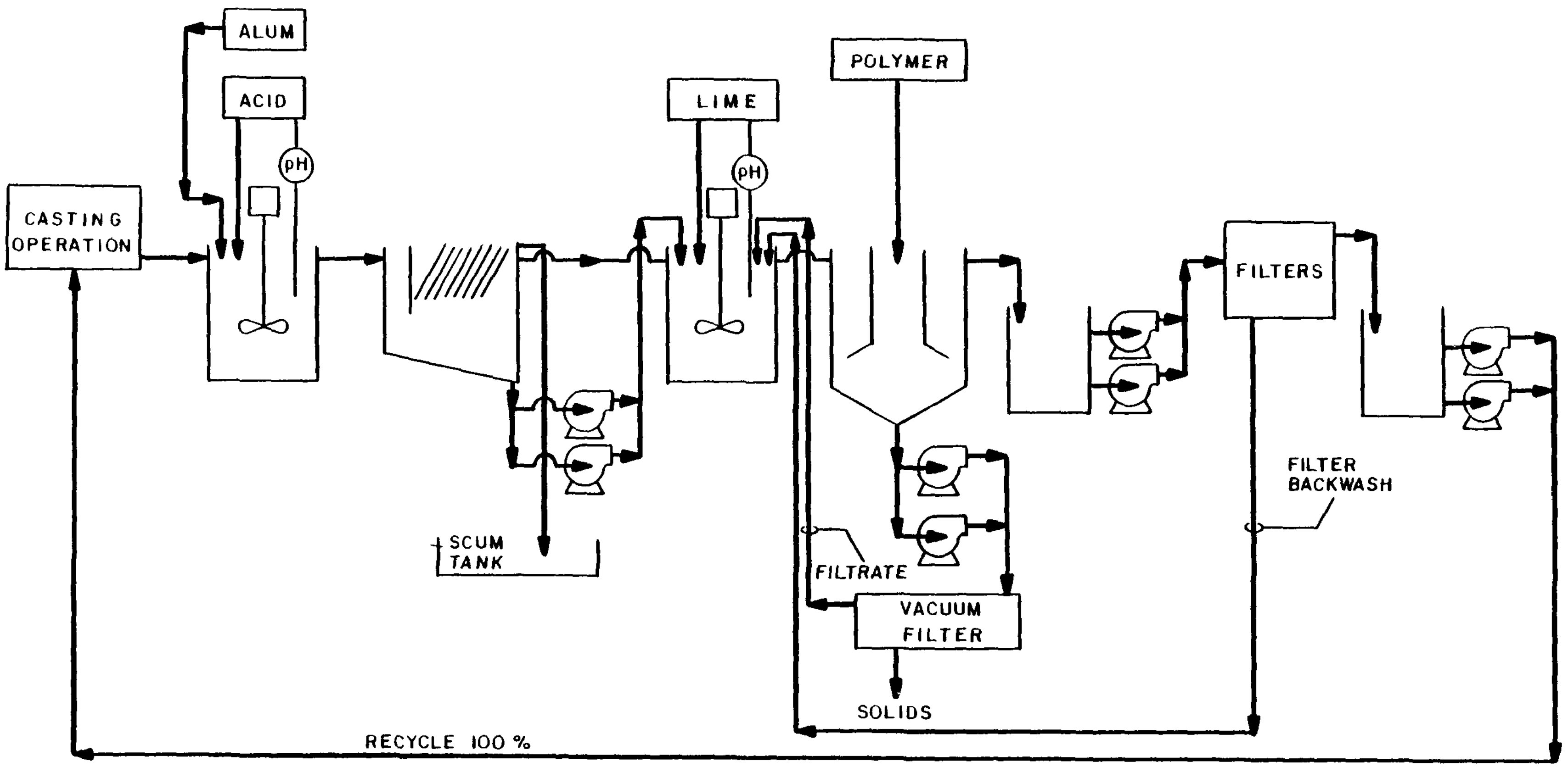


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
NSPS ALTERNATIVE Nº I

Dwn. 4/3/79

FIGURE XII-7

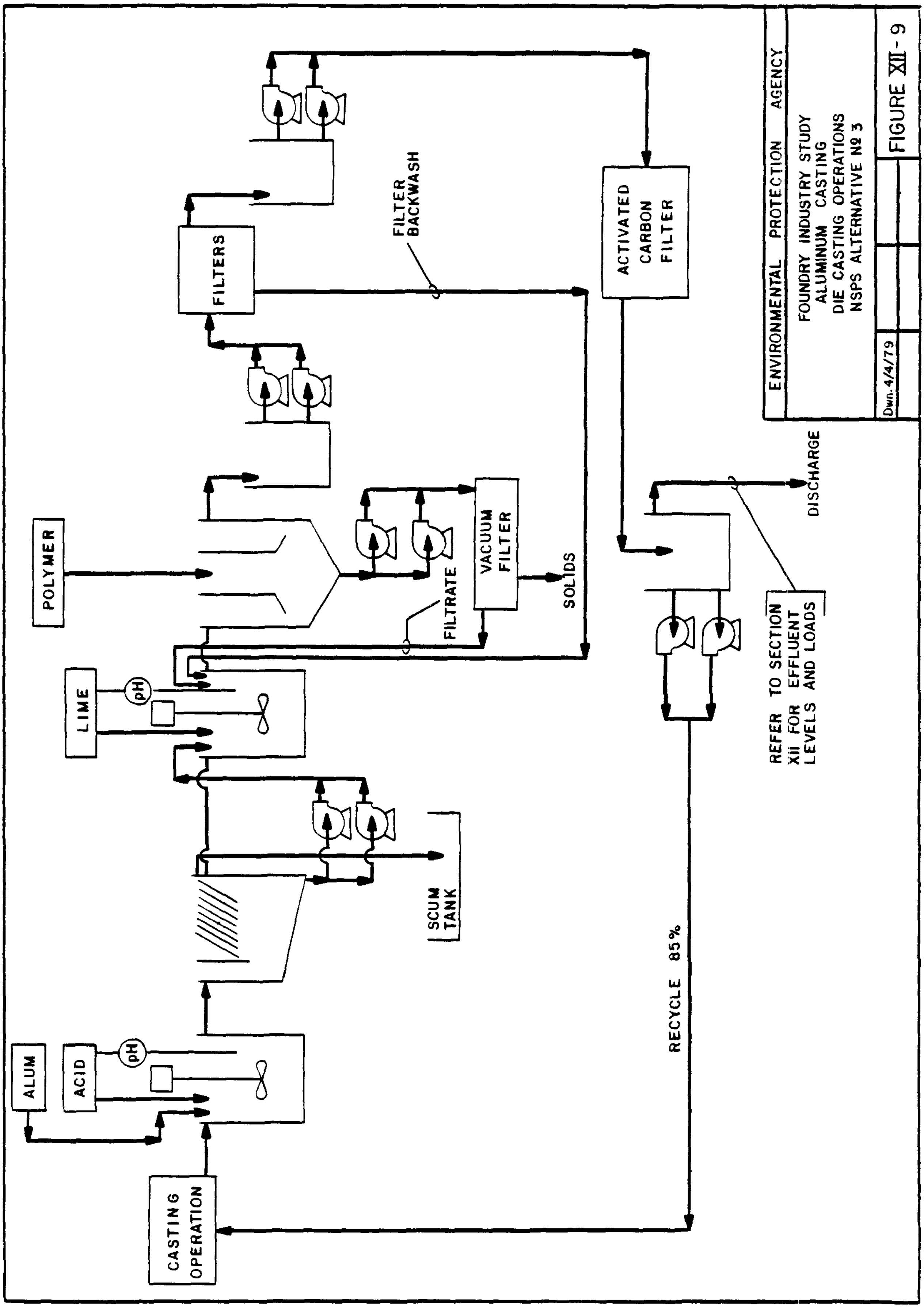


ENVIRONMENTAL PROTECTION AGENCY

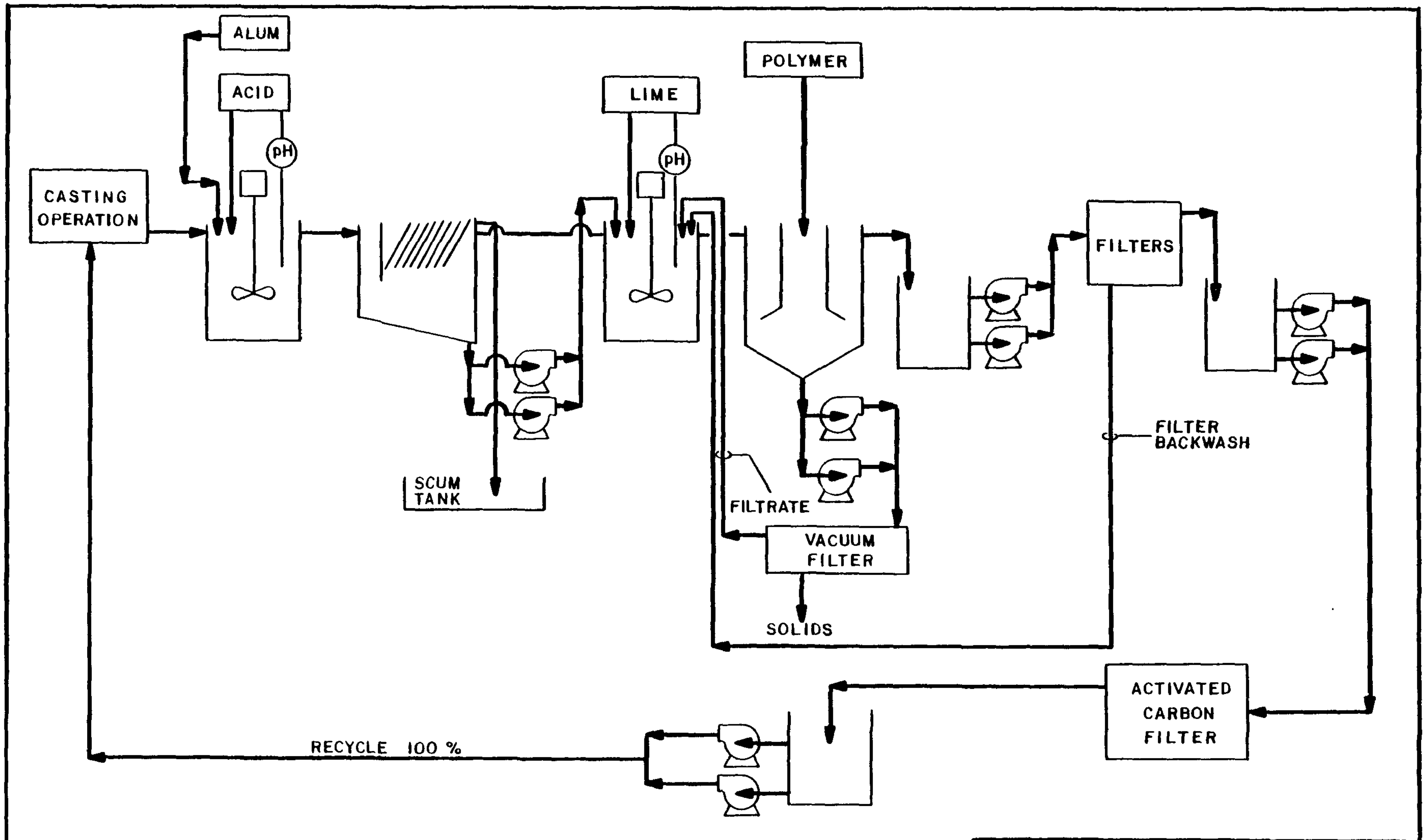
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
NSPS ALTERNATIVE № 2

Dwn 4/4/79

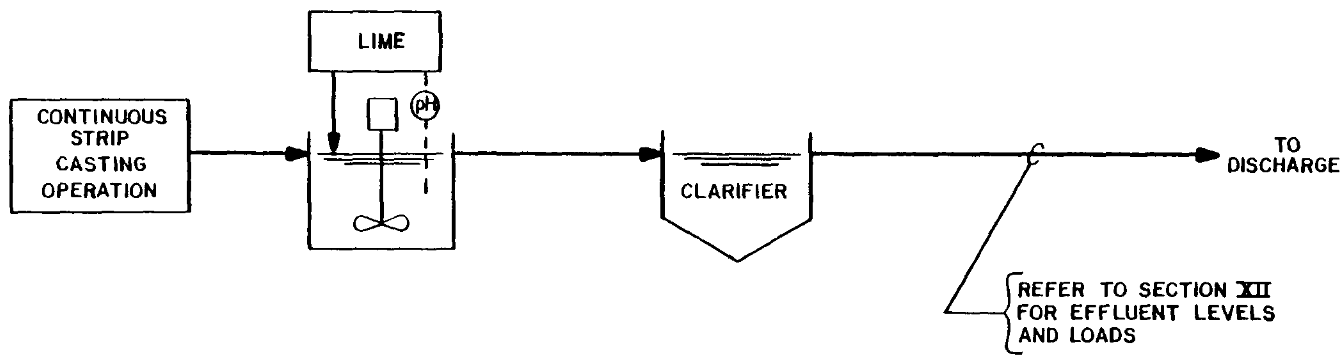
FIGURE XII - 8



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
NSPS ALTERNATIVE Nº 3
Dwn. 4/4/79
FIGURE XII-9
CASTING OPERATION
ALUM
ACID
pH
SCUM TANK
LIME
pH
POLYMER
VACUUM FILTER
FILTRATE
SOLIDS
FILTERS
FILTER BACKWASH
ACTIVATED CARBON FILTER
DISCHARGE
REFER TO SECTION XII FOR EFFLUENT LEVELS AND LOADS
RECYCLE 85%



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
NSPS ALTERNATIVE № 4
Dwn. 4/4/79
FIGURE XII-10

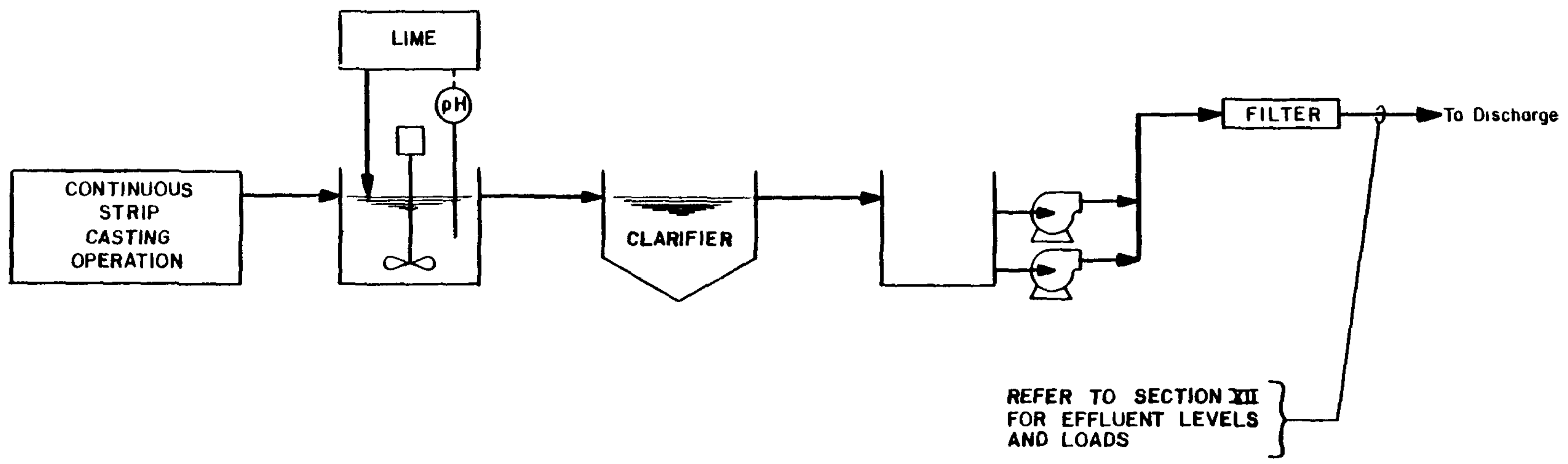


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
NSPS ALTERNATIVE Nº 1

Dwn. 3/5/81

FIGURE XII-11

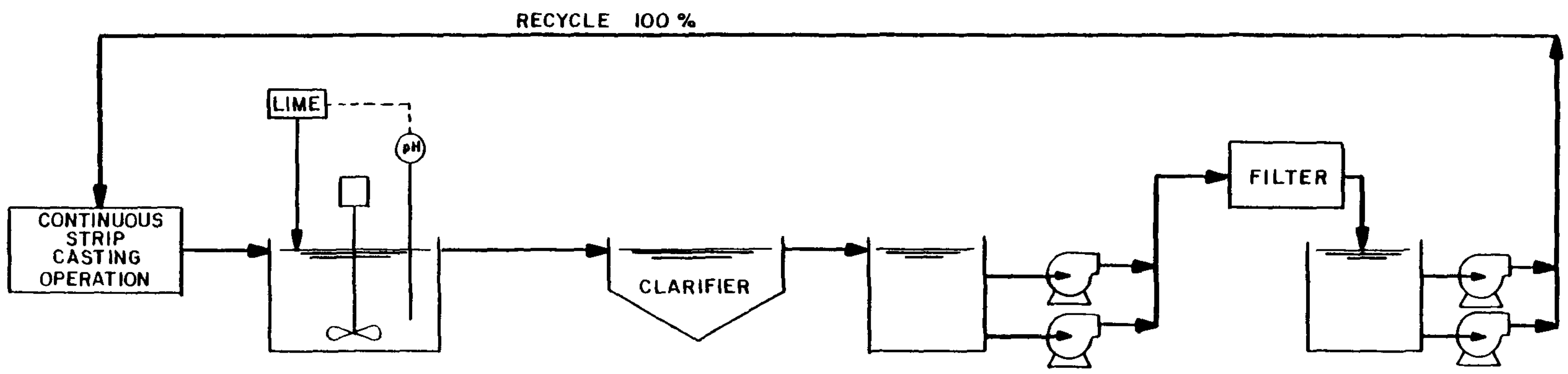


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
NSPS ALTERNATIVE Nº 2

Dwn.3/5/81

FIGURE XII-12

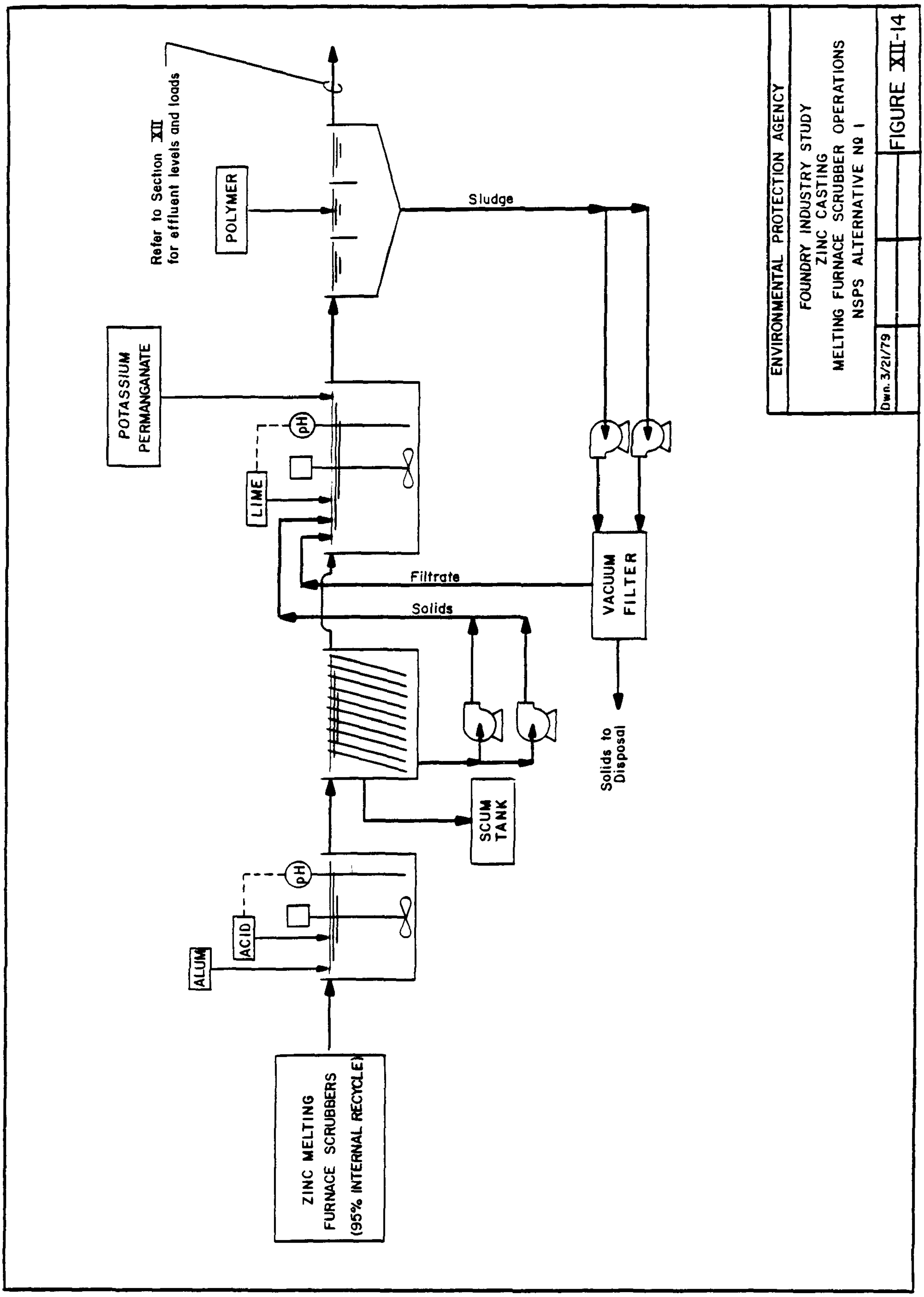


ENVIRONMENTAL PROTECTION AGENCY

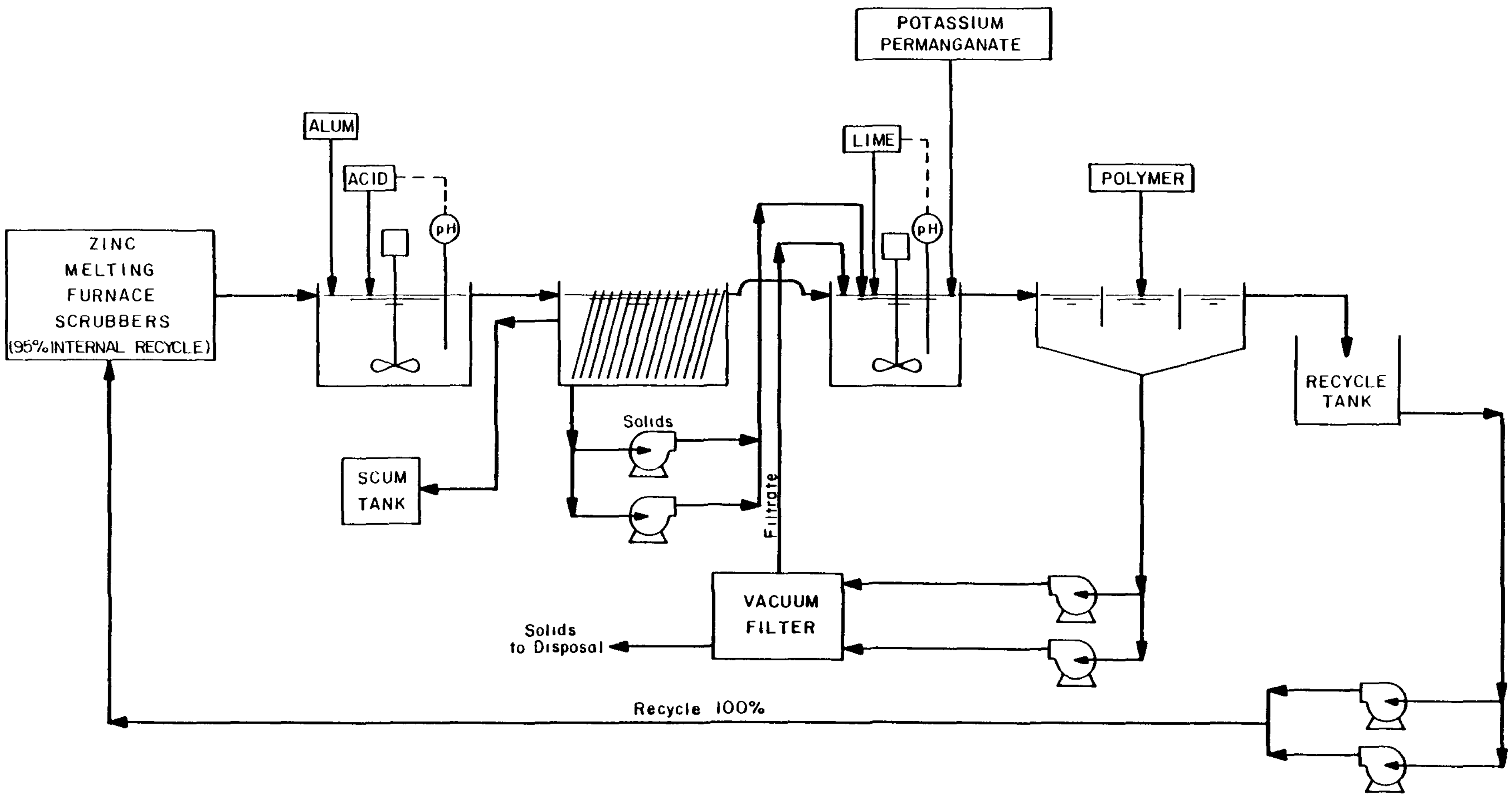
FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
NSPS ALTERNATIVE № 3

Dwn 3/5/81

FIGURE XII-13



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
NSPS ALTERNATIVE № 1
Dwn. 3/21/79
FIGURE XII-14
ZINC MELTING FURNACE SCRUBBERS (95% INTERNAL RECYCLE)
ALUM
ACID
pH
SCUM TANK
Solids
Filtrate
LIME
POTASSIUM PERMANGANATE
POLYMER
Sludge
VACUUM FILTER
Solids to Disposal
Refer to Section XII for effluent levels and loads

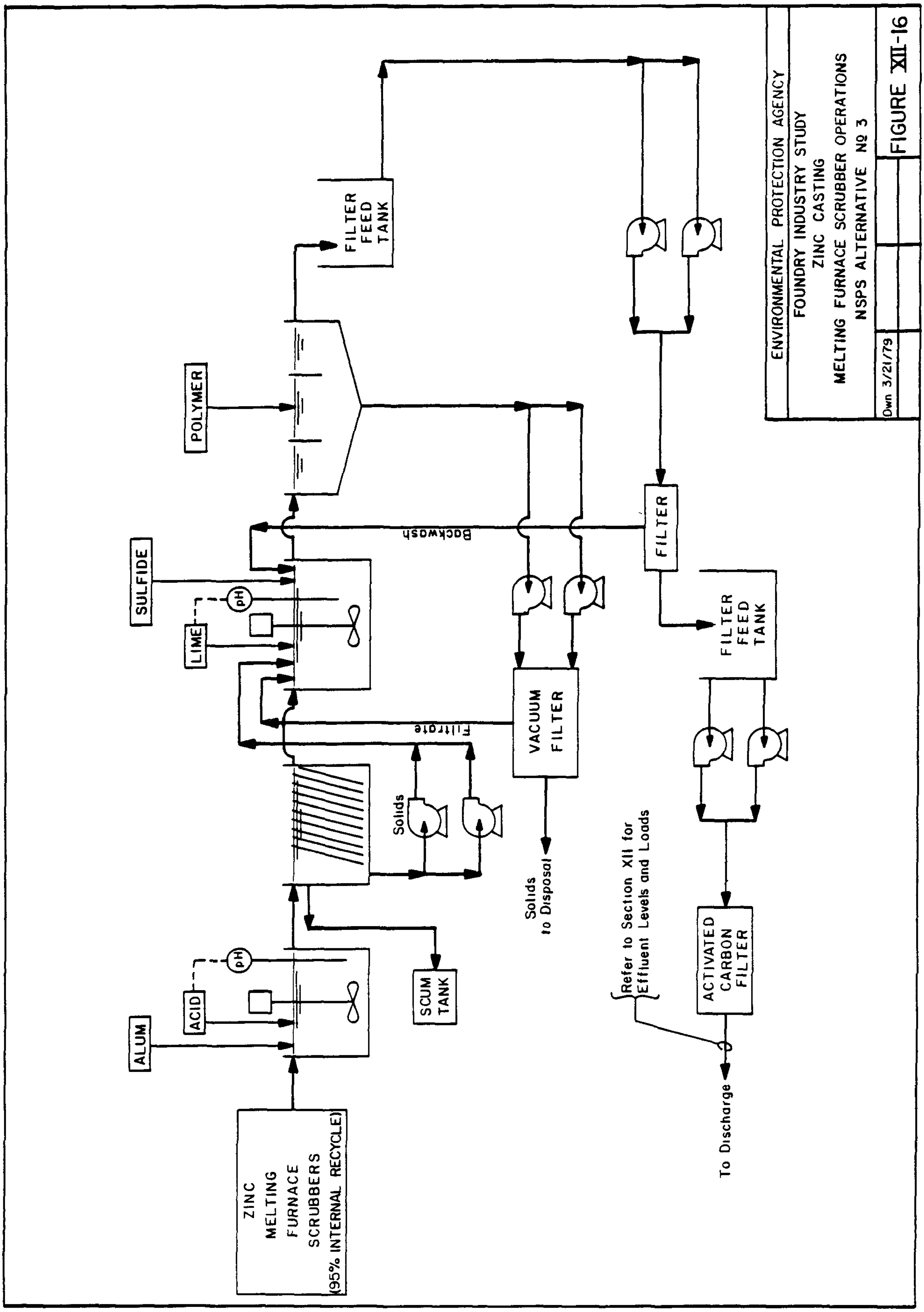


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
NSPS ALTERNATIVE № 2

Dwn 3/21/79

FIGURE XII-15



ZINC MELTING FURNACE SCRUBBERS (95% INTERNAL RECYCLE)
ALUM
ACID
pH
SCUM TANK
Solids
Filtrate
LIME
pH
SULFIDE
Backwash
POLYMER
FILTER FEED TANK
VACUUM FILTER
Solids to Disposal
FILTER
FILTER FEED TANK
ACTIVATED CARBON FILTER
Refer to Section XII for Effluent Levels and Loads
To Discharge
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
NSPS ALTERNATIVE № 3
Dwn 3/21/79
FIGURE XII-16

ZINC MELTING
FURNACE
SCRUBBERS
TIGHTEN INTERNAL
RECYCLE RATE TO 100%

NOTE: NO EQUIPMENT NEEDED

ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBERS OPERATIONS
NSPS ALTERNATIVE № 4

Dwn 3/22/79

FIGURE XII-17

SECTION XIII

PRETREATMENT STANDARDS FOR DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS

Introduction

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for existing sources (PSES) which must be achieved within three years of promulgation. PSES are designed to prevent the pass through of toxic pollutants at POTW systems. The legislative history of the 1977 Clean Water Act indicates that pretreatment standards are to be technology-based, i.e., analogous to the best available technology for the 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 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 facilitate the installation of adequate treatment capabilities.

General Pretreatment Standards

For detailed information on Pretreatment Standards refer to 46 FR 9404 et seq, "General Pretreatment Regulations for Existing and New Sources of Pollution," (January 28, 1981). See also 47 FR 4518 (February 1, 1982). In particular, 40 CFR Part 403 describes national standards (prohibited and categorical standards), revision of categorical standards through removal allowances, and POTW pretreatment programs.

In developing the proposed pretreatment standards for foundry operations, the Agency gave primary consideration to the objectives and requirements of the General Pretreatment Regulations. The Agency determined that uncontrolled discharges of certain metal molding and casting operations' wastewaters to POTWs would result in the pass through of toxic pollutants.

Categorical Pretreatment Standards

POTWs are usually not designed to treat the toxic pollutants (primarily the toxic metals) present in foundry process wastewaters. Instead, POTWs are typically designed to treat biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform bacteria, and pH.

Before proposing pretreatment standards, the Agency examined whether the pollutants discharged by the industry pass through the POTW or interfere with the POTW operation or sludge disposal practices. In determining whether pollutants pass through a POTW, the Agency compares the percentage of a pollutant removed by a POTW with the percentage removed by direct dischargers applying BAT. A pollutant is deemed to pass through the POTW when the average percentage removed nationwide by a well-operated POTW meeting secondary treatment requirements is less then the percentage removed by direct dischargers complying with BAT effluent limitations for that pollutant.

This approach to the definition of pass through satisfies two competing objectives set by Congress: that standards for indirect dischargers be equivalent to standards for direct dischargers, while, the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers. Rather than comparing the mass or concentration of pollutants discharged by the POTW with the mass or concentration discharged by a direct discharger, the Agency compared the percentage of the pollutants removed in treatment. The Agency takes this approach because a comparison of the mass or concentration of pollutants in a POTW effluent with the mass or concentration in a direct discharger's effluent would not take into account the mass of pollutants discharged to the POTW from non-industrial sources nor the dilution resulting from the addition of large amounts of non-industrial wastewater.

In the foundry category the Agency has concluded that the toxic metals and toxic organics that would be regulated under these proposed standards would pass through the POTW.

The average percentage of toxic metals removed by POTWs nationwide ranges from 19 to 65 percent (as seen below).

National Removal Credit Efficiencies

Cadmium	38%
Chromium	65%
Copper	58%
Lead	48%
Nickel	19%
Silver	66%
Zinc	65%

Total Regulated Metals	62%
Cyanide	52%

EPA developed the "national removal credits" on the basis of its "Fate of Priority Pollutants in POTWs" report (EPA 440/1-82/303).

The Agency estimates that the percentage of toxic metals that can be removed by a direct discharger applying BAT is expected to be above 70 percent. Accordingly, these pollutants pass through POTW's. In addition, since toxic metals are not degraded in the POTW (they either pass through or are removed in the sludge), their presence in the POTW sludge may limit a POTW's chosen sludge disposal method.

In addition to toxic metals, the POTW study collected limited data on toxic organic pollutants. Removals of these pollutants, some of which are also discharged by foundries, are in the range of 60 to 95 percent. Complete recycle of process wastewater removes all toxic organic pollutants from discharge. For the one process segment, aluminum die casting, with a PSES discharge allowance for toxic organic pollutants, the toxic organic pollutant removals are estimated to be 95 percent. The Agency has concluded that the toxic organic pollutants regulated under these proposed standards would pass through a POTW.

The toxic pollutant removal provided by POTWs is incidental to the POTW's main function of conventional pollutant treatment. POTWs have, historically, accepted quantities of many pollutants which are well above levels which POTWs have the capacity to treat adequately.

Due to the presence of toxic pollutants in wastewaters from foundry operations, pretreatment must be provided to ensure that these pollutants do not pass through the POTW.

Pretreatment standards for total suspended solids, oil and grease, and pH are not proposed because these pollutants can be effectively treated at POTWs.

The following discussions identify the rationale for the model treatment technologies, the expected levels of pollutant removal, and, finally, the selection of pretreatment models upon which the categorical proposed PSES and PSNS are based.

Identification of Pretreatment

For the 14 process segments in which "no discharge of process wastewater pollutants" is proposed at BPT, EPA did not develop alternative treatment models for PSES and PSNS. BAT is equivalent to BPT for these process segments. The proposed PSES are technology-based and analogous to the proposed BAT limitations for toxic pollutants in these 14 process segments. For the same 14 process segments, the proposed NSPS are "no discharge of process wastewater pollutants." In these segments the Agency is proposing PSNS equivalent to NSPS.

By eliminating the discharge to a POTW, complete recycle provides the maximum level of toxic pollutant control. In addition, expenditures for effluent monitoring and for POTW user fees are reduced or eliminated. The model treatment systems for these process segments are illustrated in Sections IX and X. For the remaining 5 process segments EPA considered alternative PSES and PSNS treatment models that are equivalent to the BAT and NSPS treatment alternatives.

Following is a summary of the treatment model bases for the remaining five process segments.

Process	PSES/PSNS Alternative	Reference Models
Aluminum Investment Casting	No. 1	BPT
	No. 2	BPT and BAT No. 1
	No. 3	BPT and BAT No. 2
Aluminum Melting Furnace Scrubber	No. 1	BPT
	No. 2	BPT and BAT No. 1
	No. 3	BPT AND BAT No. 2
Aluminum Die Casting	No. 1	BPT
	No. 2	BPT and BAT No. 1
	No. 3	BPT and BAT No. 2
	No. 4	BPT and BAT No. 3
Lead Continuous Strip Casting	No. 1	BPT
	No. 2	BPT and BAT No. 1
	No. 3	BPT and BAT No. 2
Zinc Melting Furnace Scrubber	No. 1	BPT
	No. 2	BPT and BAT No. 1
	No. 3	BPT and BAT No. 2
	No. 4	BPT and BAT No. 3

Figures XIII-1 through XIII-17 illustrate the above PSES and PSNS treatment models.

Selection of PSES and PSNS

The Agency found no POTW dischargers in either segment of the magnesium casting subcategory. Therefore, the Agency is not proposing PSES for the magnesium subcategory grinding scrubber or dust collection process segments. The proposed PSNS in these two segments are equivalent to the proposed NSPS.

The following discussions address each of the process segments for which pretreatment alternatives were developed.

Aluminum-Investment Casting

The Agency is not proposing PSES or PSNS because at the levels of total suspended solids and oil and grease discharged from this process these pollutants are considered compatible with treatment by POTWs. Furthermore, the toxic metals present in the raw wastewaters of this process segment are below the treatability levels of precipitation and sedimentation technologies.

Aluminum - Melting Furnace Scrubber

The Agency is not proposing PSES or PSNS because at the levels of total suspended solids and oil and grease discharged from this process these pollutants are considered compatible with treatment by POTWs. Furthermore, the toxic metals present in the raw wastewaters of this process segment are below the treatability levels of precipitation and sedimentation technologies.

Aluminum - Die Casting

In this process segment the Agency is proposing PSES equivalent to the proposed BAT limitations and PSNS equivalent to the proposed NSPS. The technologies used as the bases for the proposed PSES and PSNS are identical and represent the best demonstrated technology in this segment. Refer to Sections X and XII for details on the selection of the treatment alternative, the selection of pollutants to be regulated, and the development of effluent limitations and standards. The proposed PSES would result in the removal of 59.4 kg per year of toxic pollutants.

Following are the proposed PSES and PSNS for the aluminum die casting process segment.

PROPOSED PSES AND PSNS

Aluminum-Die Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
Acenaphthene	0.0000092	0.0000046
2,4,6-trichlorophenol	0.0000305	0.0000152
Parachlorometacresol	0.0000281	0.0000140
Chloroform	0.0000668	0.0000334
Phenol	0.0000063	0.0000031
Butyl benzyl phthalate	0.000104	0.0000518
Chrysene	0.0000019	0.0000010
Tetrachloroethylene	0.0000261	0.0000131
Lead	0.0000242	0.0000218
Zinc	0.000247	0.000102
Phenols (4AAP)	0.000107	0.0000537

Lead - Continuous Strip Casting

In the lead continuous strip casting process segment the Agency is proposing PSES based upon sedimentation, precipitation, and filtration technologies (BAT Alternative 1). These technologies are demonstrated by four of the five continuous strip casting plants. The proposed PSES would result in the removal of 6.9 kg per year of toxic metals. The Agency is proposing PSNS equivalent to PSES. Refer to Sections X and XII for additional details on the selection of the treatment alternative, the selection of a regulated pollutant, and the development of effluent standards.

PROPOSED PSES AND PSNS

Lead Continuous Strip Casting Operations

Pollutant or Pollutant Property	Maximum for Any One Day (kg/kkg)	Maximum for Monthly Average (kg/kkg)
Lead	0.0000227	0.0000204

Zinc - Melting Furnace Scrubber

In this process segment the Agency is proposing PSES equivalent to the proposed BAT limitations and PSNS equivalent to the proposed NSPS. The technologies used as the bases for the proposed PSES and PSNS are identical and represent the best demonstrated technology in this segment. Refer to Sections X and XII for details on the selection of the treatment alternative. The proposed PSES and PSNS are no discharge of process wastewater pollutants to a POTW.

<u>POTW Removal Rate Comparison</u>

The toxic metal pollutant removal rates of the selected pretreatment alternatives for the two process segments which incorporate a discharge are compared to the POTW removal rates for these pollutants:

	Lead	Zinc
Actual POTW	48%	65%
Aluminum Subcategory- Die Casting Process	99%	>99%
Lead Subcategory - Continuous Strip Casting Process	89%	-

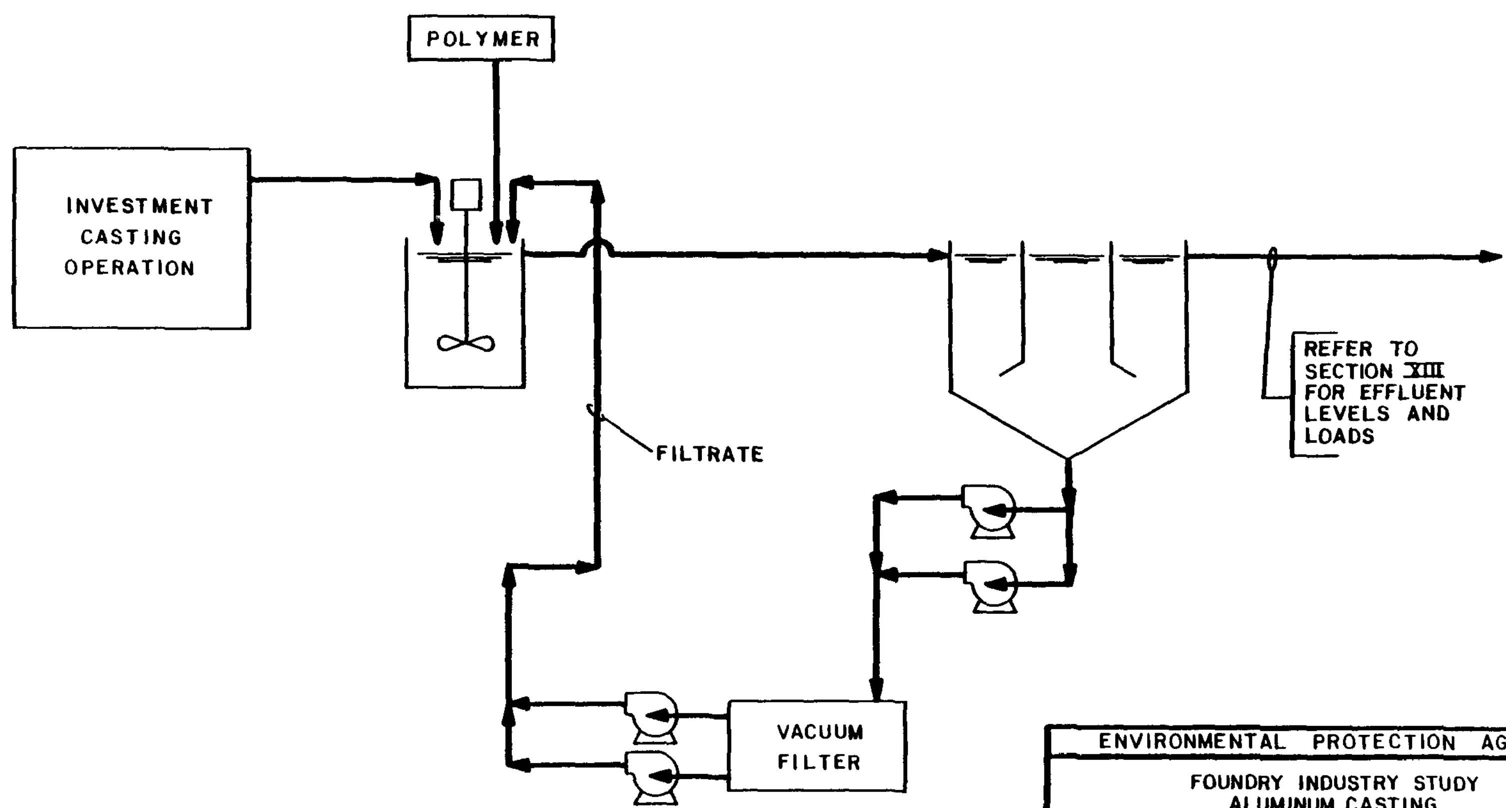
As shown above the selected alternatives will remove these toxic metals (i.e., prevent the pass through of toxic metals at POTWs) to a significantly greater degree than would occur if these wastewaters were discharged untreated to POTWs. The achievability of the proposed standards is reviewed in Sections IX, X, and XII.

ANALYSIS OF PSES DISCHARGE OPTIONS

As with the BPT level of treatment, discharge alternatives were also considered for the PSES level of treatment. These discharge alternatives, incorporating 90% and 50% recycle, are similar to those addressed in the BPT discussion (see Section IX) . The assumptions made and the evaluation processes followed are similar to the assumptions and review processes of the BPT discharge alternative analysis.

The 90% and 50% recycle options considered as possible bases for PSES were rejected for the reasons set forth in Section IX. Complete recycle is economically achievable and will remove substantial quantities of toxic pollutants. A number of process segments would discharge toxic organic pollutants (principally phenolic compounds) if complete recycle were not the basis for PSES. These pollutants would appear in the range of 0.5 mg/l to 30.7 mg/l in the discharges. Neither the 90% nor the 50% recycle option was based upon technologies that would treat toxic organic pollutants. If a discharge option were selected for PSES and these pollutants required treatment, the total cost of these options would far exceed the cost of complete recycle.

The alternative PSES and PSNS which would be established if either discharge alternative were selected are equivalent to the alternative BAT limitations presented in Tables X-2 and X-3.

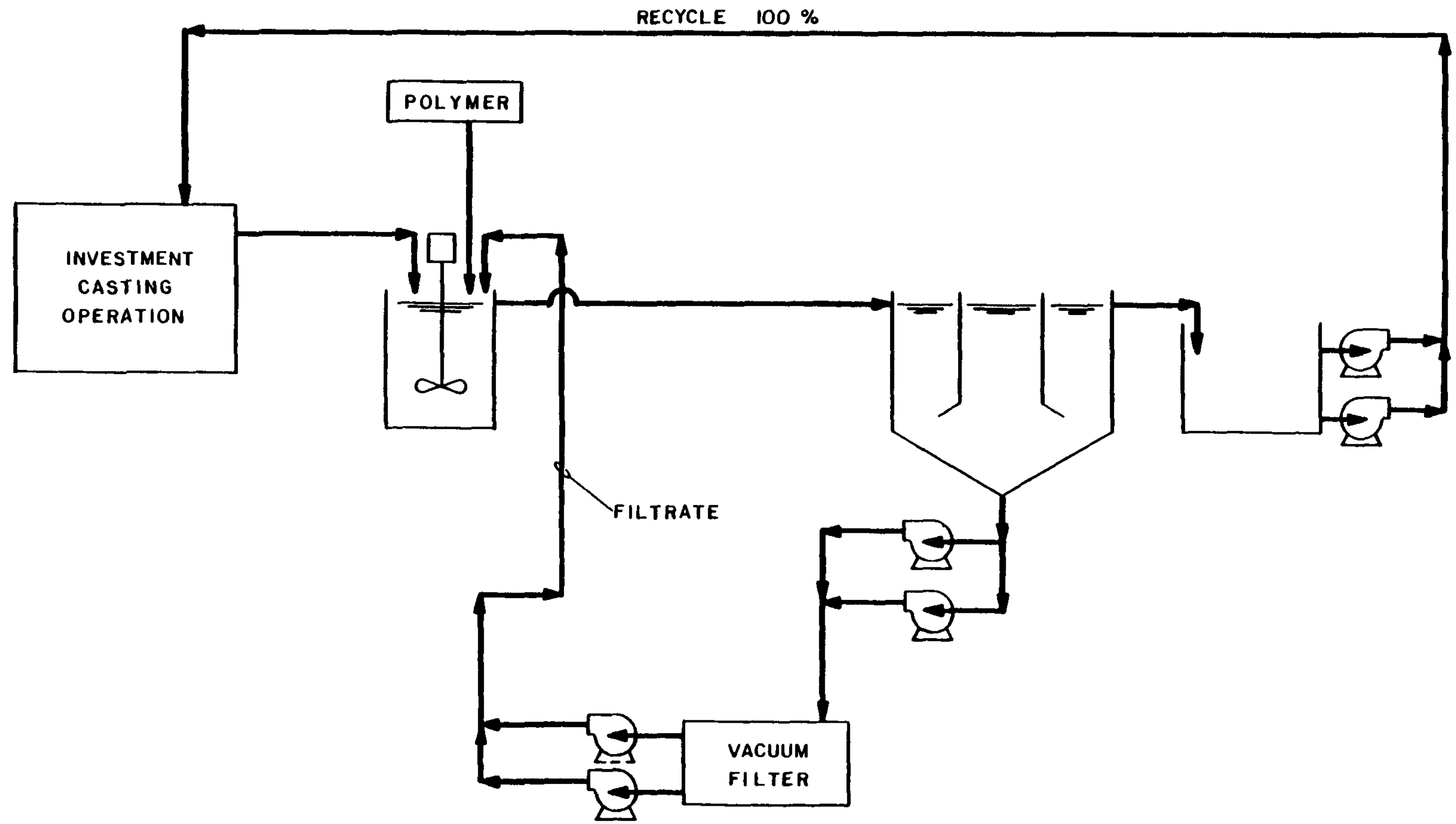


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 1

Dwn. 3/30/79

FIGURE XIII - 1

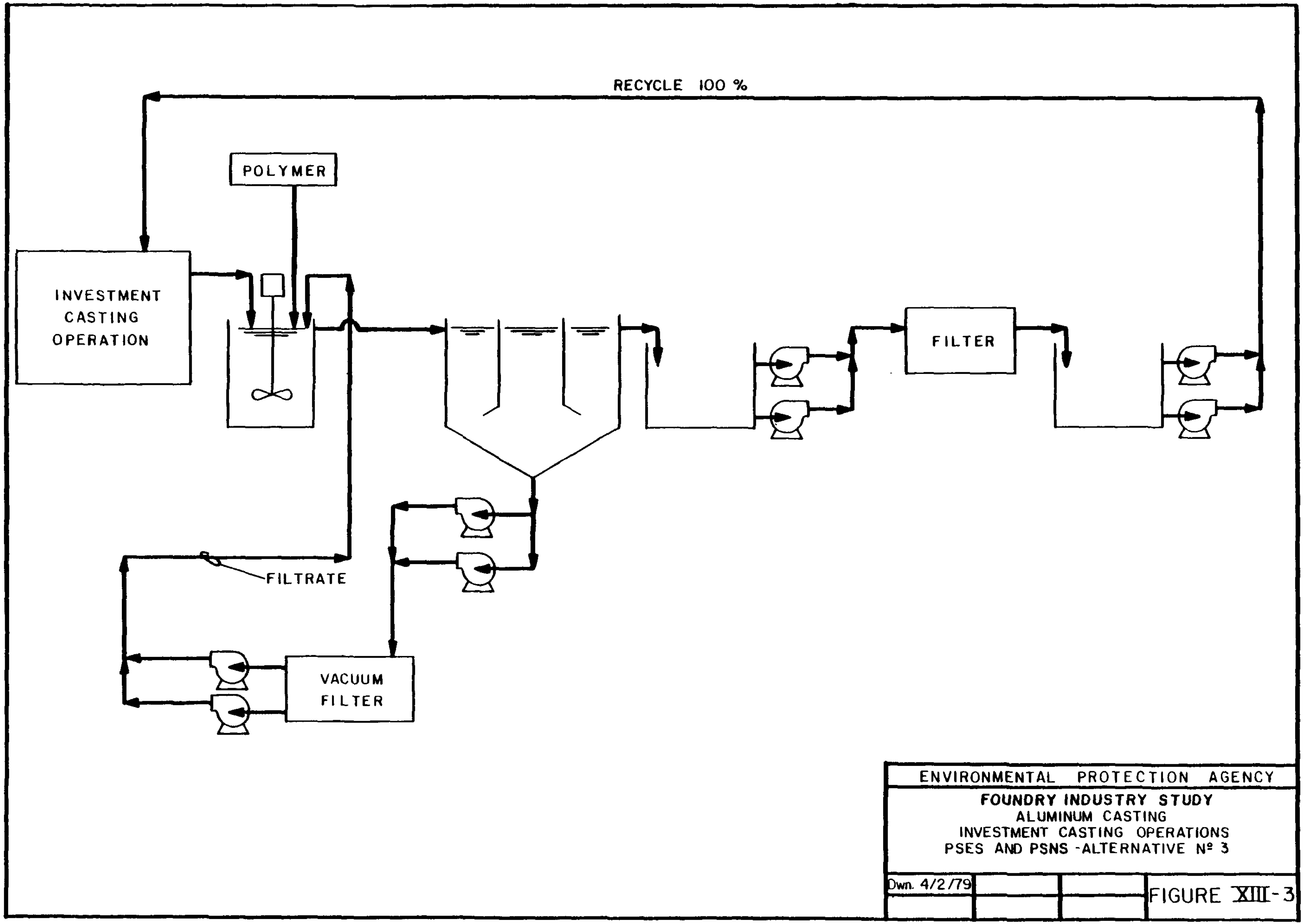


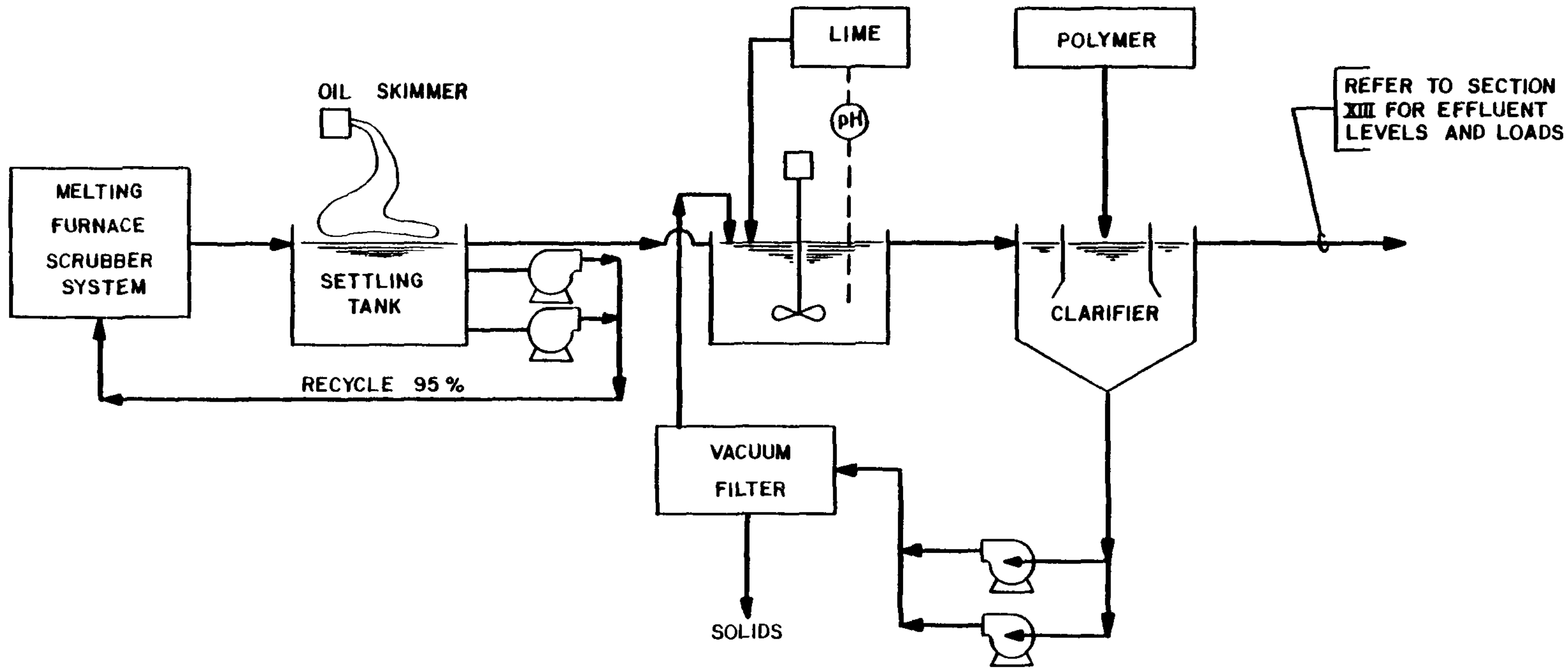
ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 2

Dwn. 3/30/79

FIGURE XIII-2

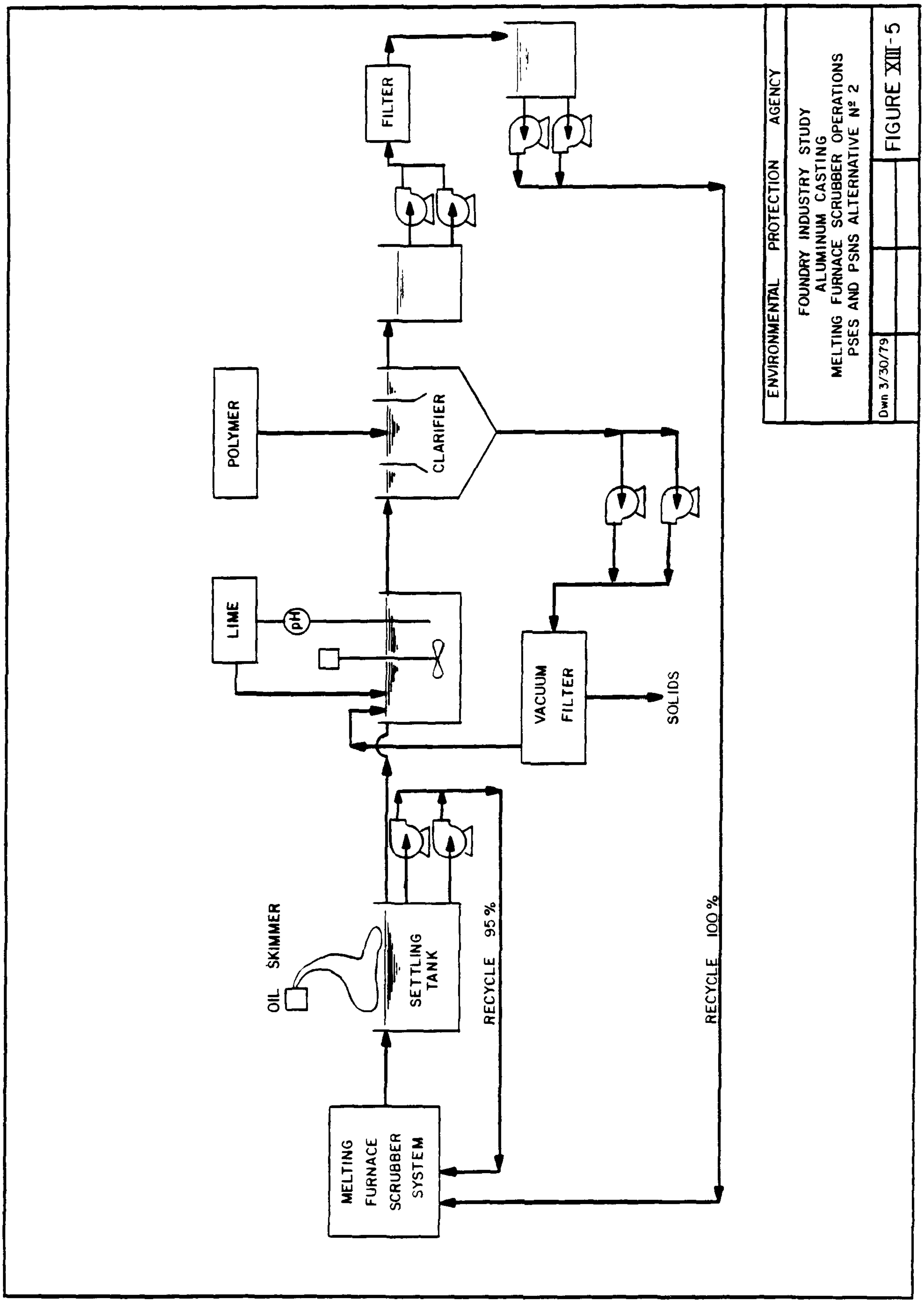

RECYCLE 100 %
POLYMER
INVESTMENT CASTING OPERATION
FILTER
FILTRATE
VACUUM FILTER
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
INVESTMENT CASTING OPERATIONS
PSES AND PSNS -ALTERNATIVE Nº 3
Dwn. 4/2/79
FIGURE XIII-3



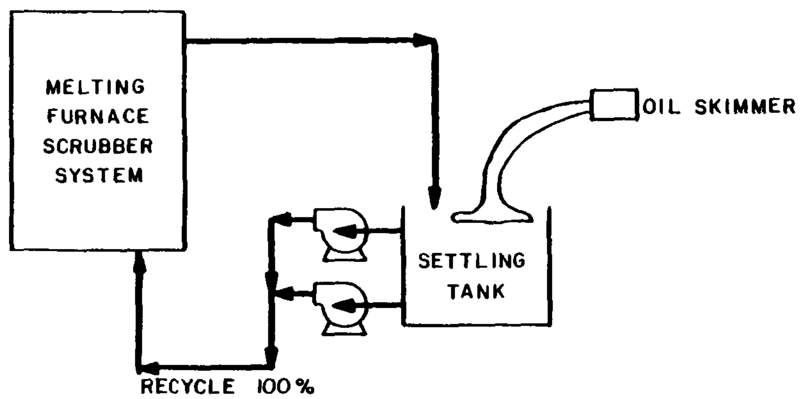
ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
PSES AND PSNS ALTERNATIVE Nº I

FIGURE XIII-4



MELTING FURNACE SCRUBBER SYSTEM
OIL SKIMMER
SETTLING TANK
RECYCLE 95 %
RECYCLE 100 %
LIME
pH
POLYMER
CLARIFIER
VACUUM FILTER
SOLIDS
FILTER
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 2
Dwn 3/30/79
FIGURE XIII-5

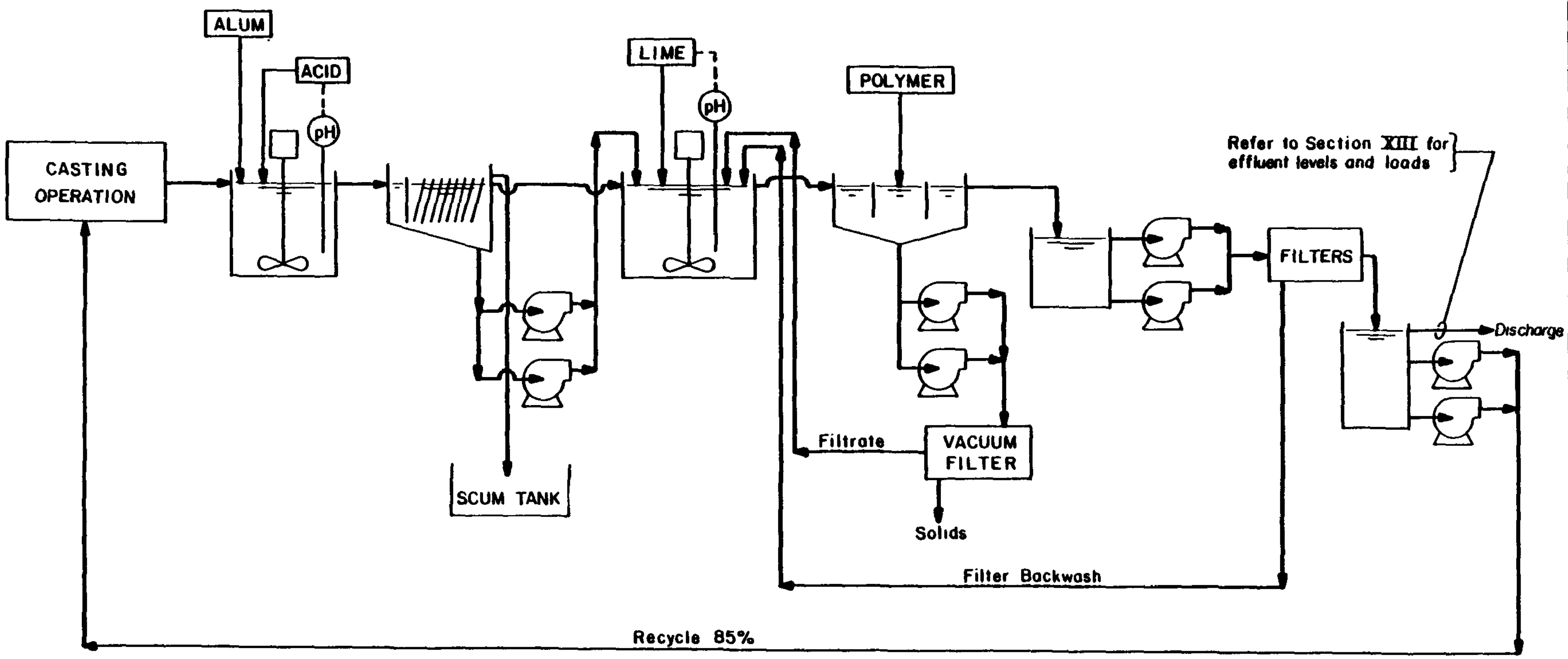


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
MELTING FURNACE SCRUBBER OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 3

Dwn. 3/29/79

FIGURE XIII-6

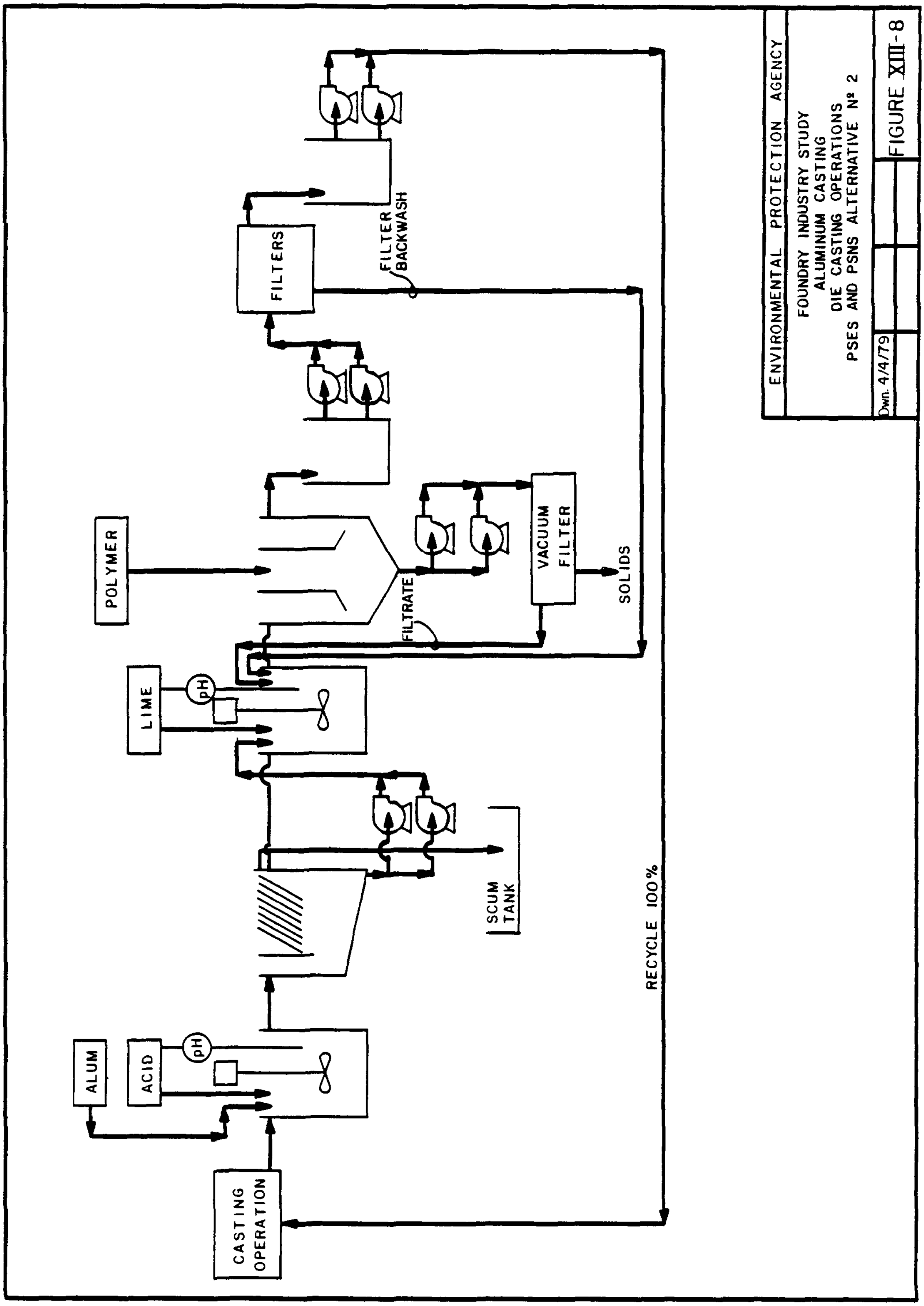


ENVIRONMENTAL PROTECTION AGENCY

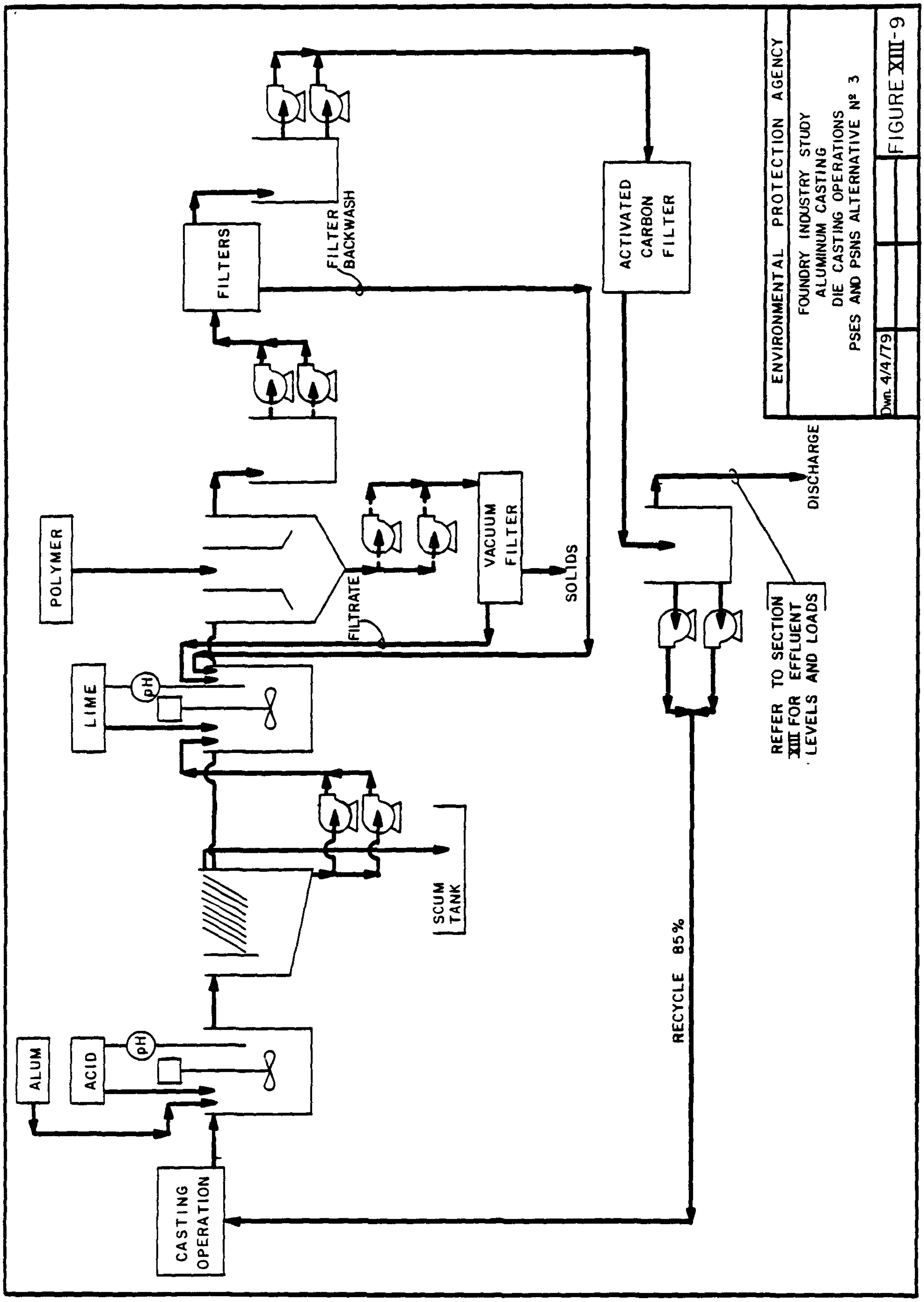
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 1

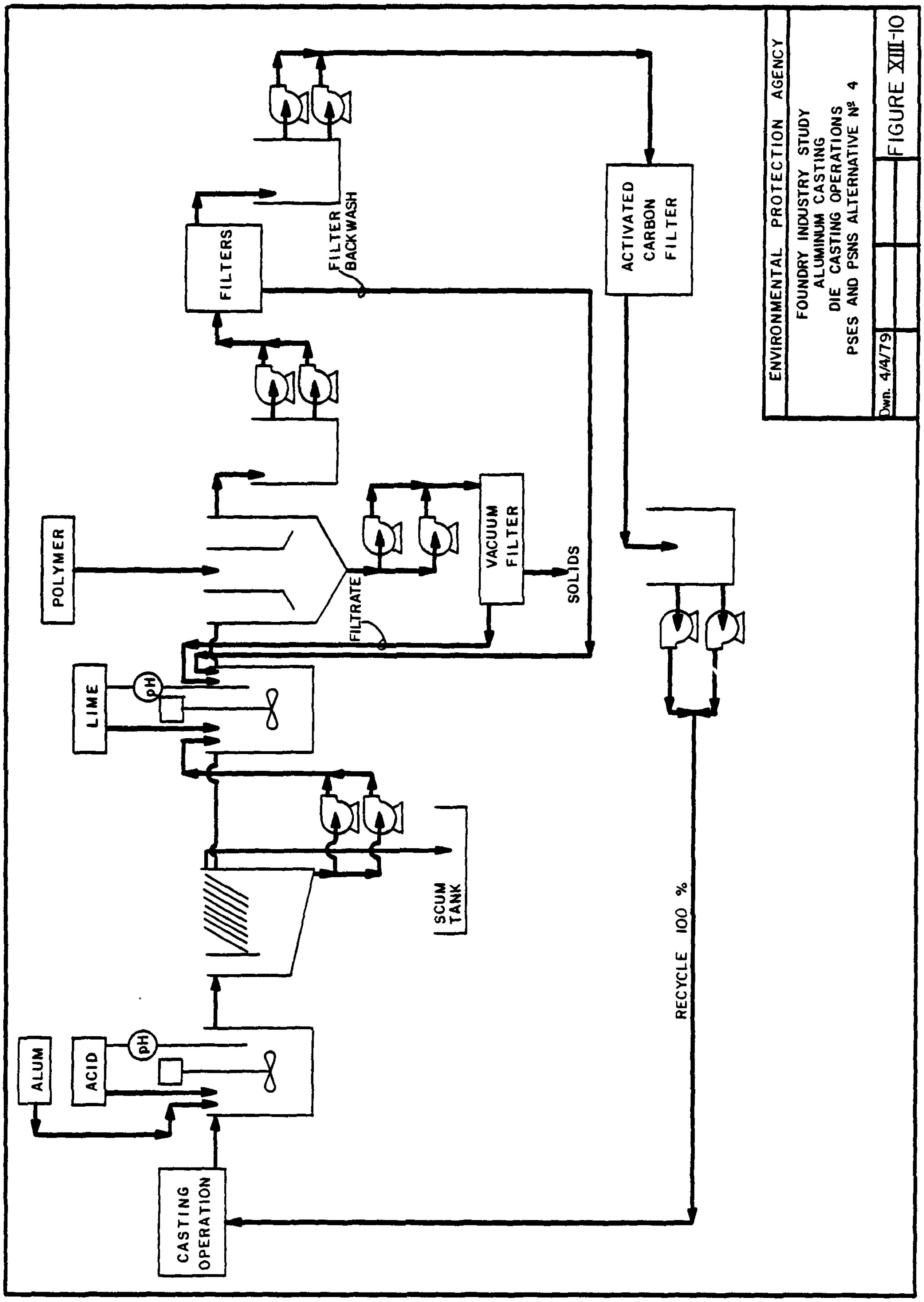
Dwn. 4/3/79

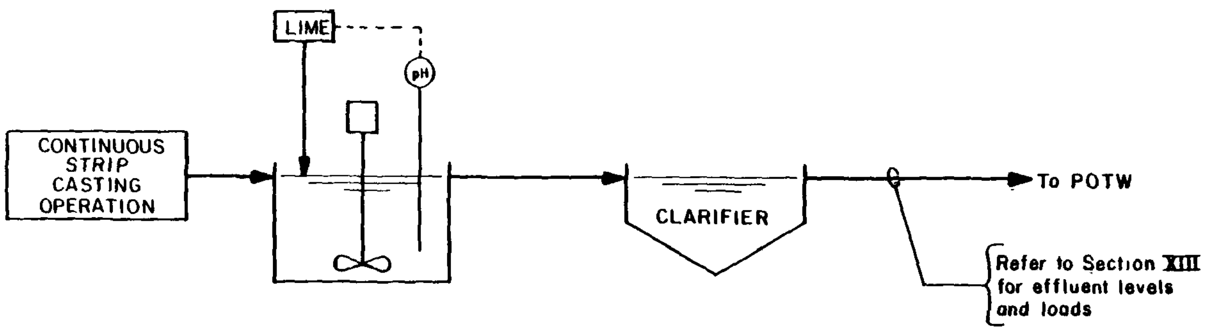
FIGURE XIII-7



ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 2
Dwn. 4/4/79
FIGURE XIII-8
CASTING OPERATION
ALUM
ACID
pH
SCUM TANK
LIME
pH
POLYMER
FILTRATE
VACUUM FILTER
SOLIDS
FILTERS
FILTER BACKWASH
RECYCLE 100%


CASTING OPERATION
ALUM
ACID
pH
SCUM TANK
LIME
pH
POLYMER
FILTRATE
VACUUM FILTER
SOLIDS
FILTERS
FILTER BACKWASH
ACTIVATED CARBON FILTER
RECYCLE 85%
DISCHARGE
REFER TO SECTION XIII FOR EFFLUENT LEVELS AND LOADS
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 3
Dwn. 4/4/79
FIGURE XIII-9


CASTING OPERATION
ALUM
ACID
pH
SCUM TANK
LIME
pH
POLYMER
FILTRATE
VACUUM FILTER
SOLIDS
FILTERS
FILTER BACKWASH
ACTIVATED CARBON FILTER
RECYCLE 100 %
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ALUMINUM CASTING
DIE CASTING OPERATIONS
PSES AND PSNS ALTERNATIVE Nº 4
Dwn. 4/4/79
FIGURE XIII-10

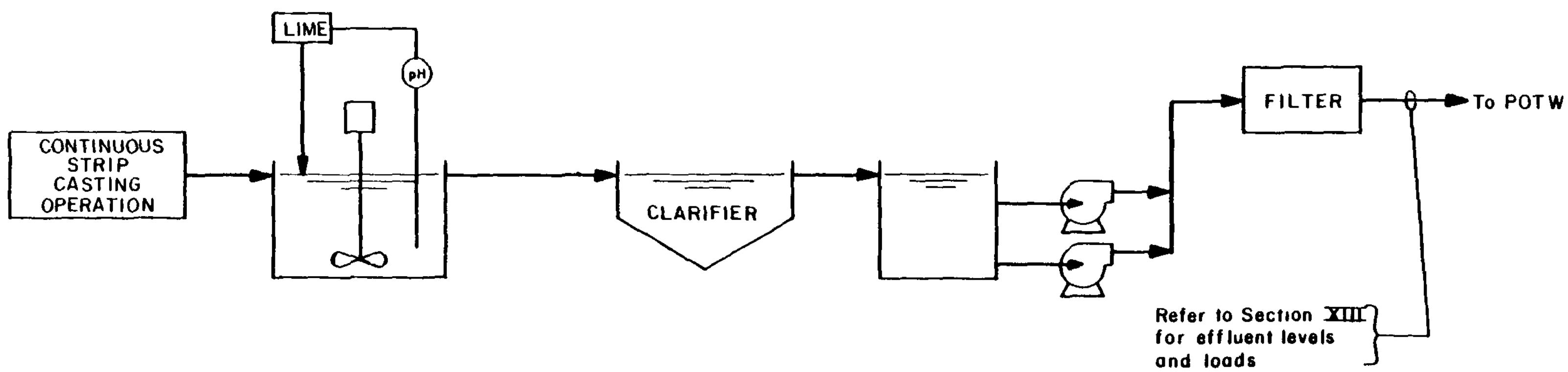


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
PSES & PSNS-ALTERNATIVE Nº 1

Dwn 3/5/81

FIGURE XIII-11

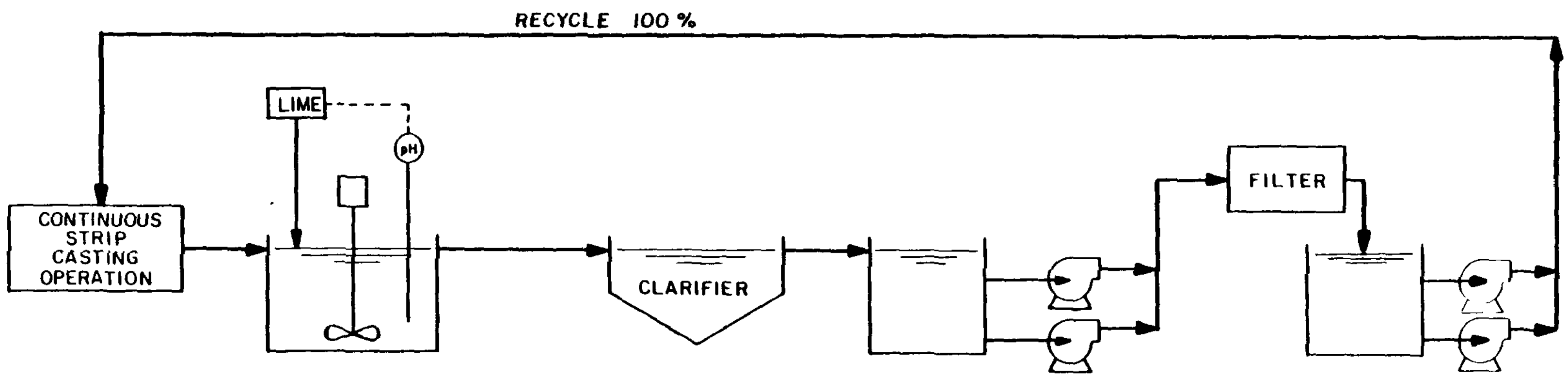


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
PSES AND PSNS-ALTERNATIVE Nº 2

Dwn 3/5/81

FIGURE XIII-12

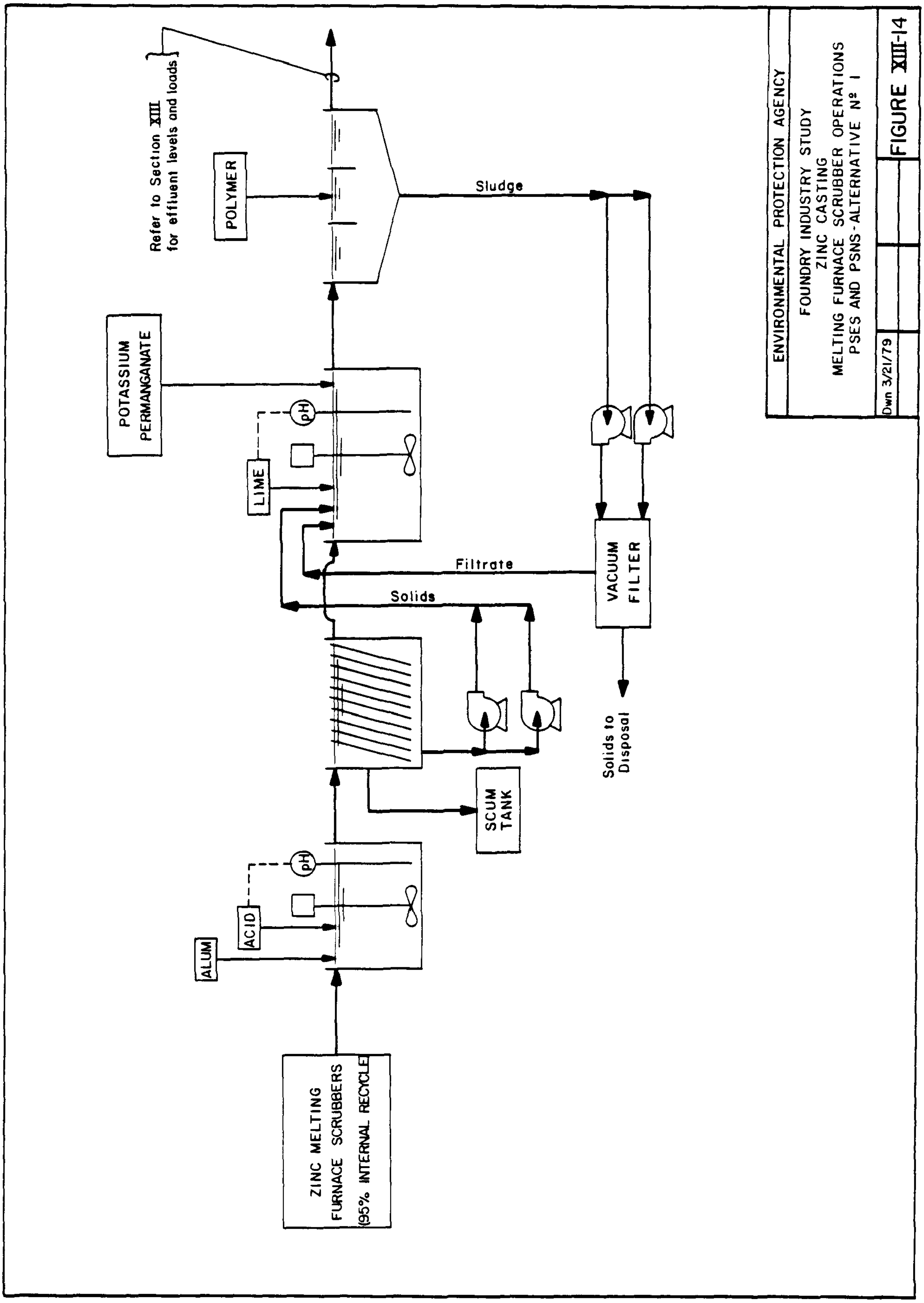


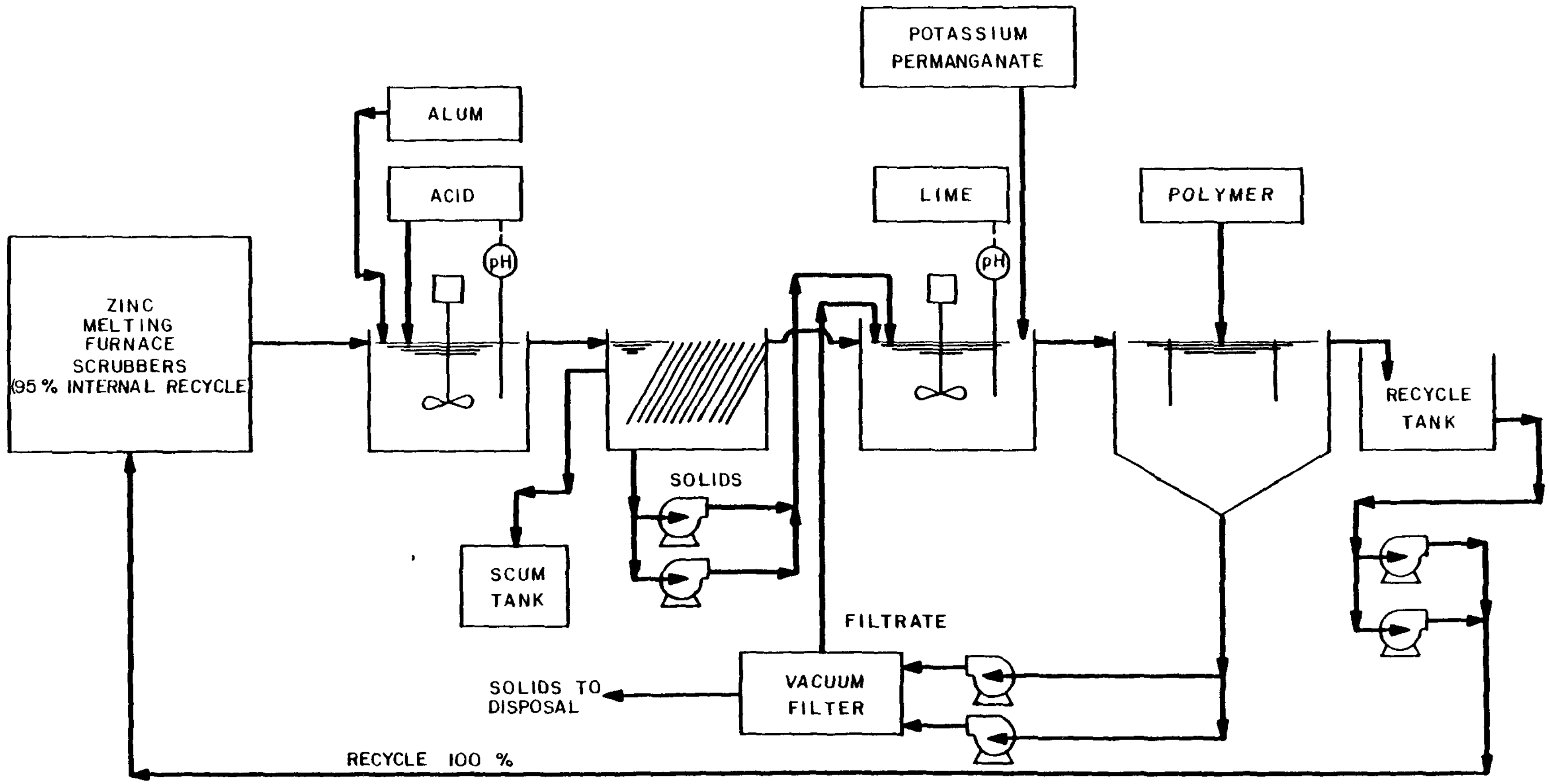
ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
LEAD CASTING
CONTINUOUS STRIP CASTING OPERATIONS
PSES & PSNS-ALTERNATIVE Nº 3

Dwn 3/5/81

FIGURE XIII-13


ZINC MELTING
FURNACE SCRUBBERS
(95% INTERNAL RECYCLE)
ALUM
ACID
pH
SCUM TANK
Solids
Filtrate
LIME
POTASSIUM PERMANGANATE
POLYMER
Sludge
VACUUM FILTER
Solids to Disposal
Refer to Section XIII for effluent levels and loads
ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
PSES AND PSNS-ALTERNATIVE Nº 1
Dwn 3/21/79
FIGURE XIII-14

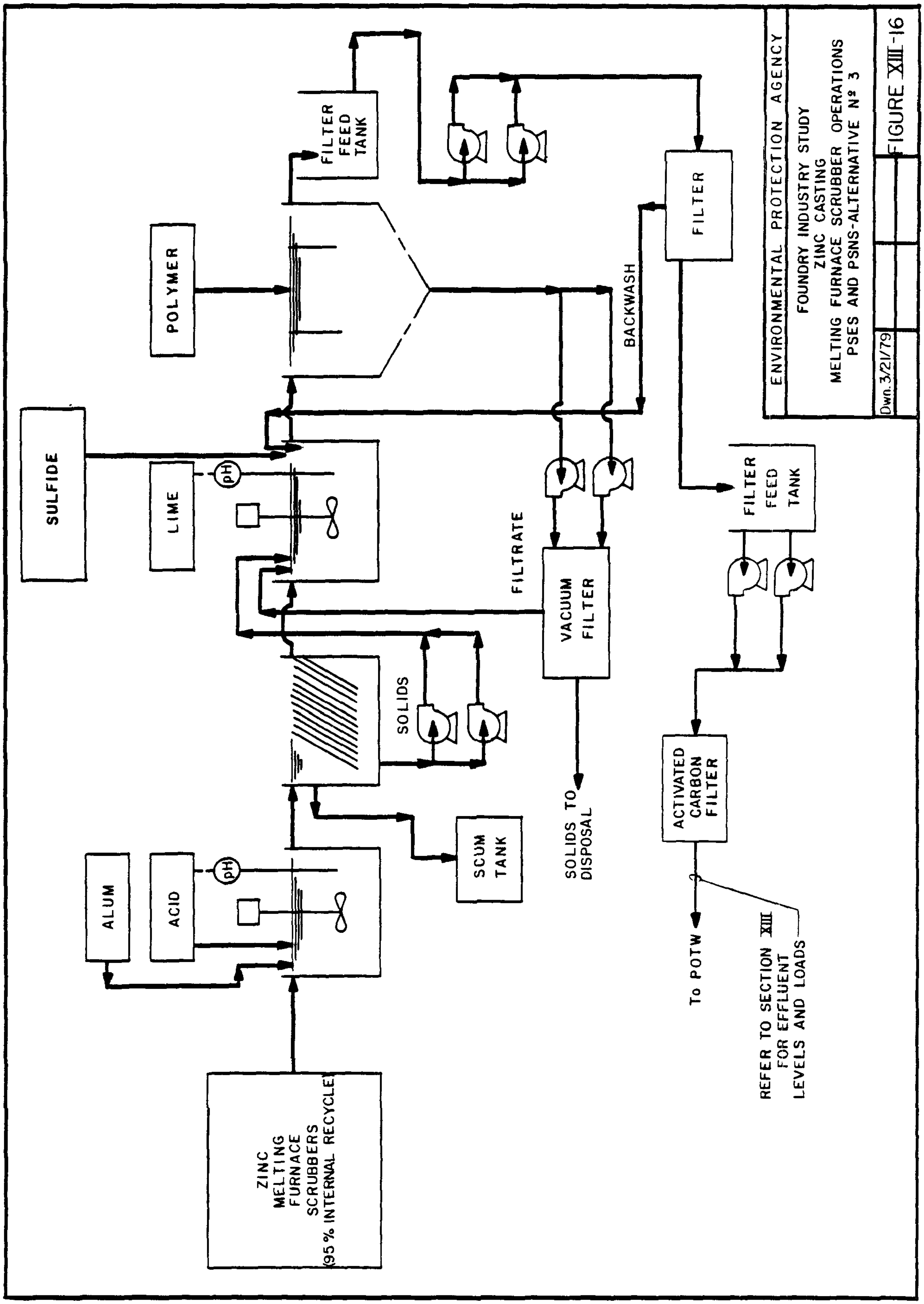


ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
PSES AND PSNS-ALTERNATIVE Nº 2

Dwn. 3/21/79

FIGURE XIII-15


ENVIRONMENTAL PROTECTION AGENCY
FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
PSES AND PSNS-ALTERNATIVE Nº 3
Dwn. 3/21/79
FIGURE XIII-16
ZINC MELTING FURNACE SCRUBBERS (95% INTERNAL RECYCLE)
ALUM
ACID
pH
SCUM TANK
SOLIDS
SULFIDE
LIME
pH
POLYMER
FILTER FEED TANK
FILTRATE
BACKWASH
VACUUM FILTER
SOLIDS TO DISPOSAL
FILTER
FILTER FEED TANK
ACTIVATED CARBON FILTER
To POTW
REFER TO SECTION XIII FOR EFFLUENT LEVELS AND LOADS

ZINC MELTING
FURNACE
SCRUBBERS
TIGHTEN INTERNAL
RECYCLE RATE TO 100%

NOTE: NO EQUIPMENT NEEDED

ENVIRONMENTAL PROTECTION AGENCY

FOUNDRY INDUSTRY STUDY
ZINC CASTING
MELTING FURNACE SCRUBBER OPERATIONS
PSES AND PSNS-ALTERNATIVE Nº 4

Dwn 3/22/79

FIGURE XIII-17

SECTION XIV

ACKNOWLEDGEMENTS

The Environmental Protection Agency was aided in the preparation of this Development Document by the Cyrus Wm. Rice Group of NUS Corporation. Rice's effort was managed by Mr. Thomas J. Centi. Mr. David E. Soltis and Mr. Samuel A. Young directed the engineering activities and were assisted by Ms. Debra M. Wroblewski, Ms. Joan O. Knapp, Mr. Joseph J. Tarantino, and Mr. J. Steven Paquette. Field and sampling programs were conducted under the leadership of Mr. David E. Soltis and Mr. Samuel A. Young. Laboratory and analytical services were conducted under the guidance of Miss C. Ellen Gonter and Mrs. Linda Dean. The drawings contained within were prepared by the RICE drafting personnel Mr. William B. Johnson, Mr. Keith Christner, and Mr. Richard J. Deluca, under the supervision of Mr. Albert M. Finke. The work associated with calculations of raw waste loads and effluent loads is attributed to Mr. David E. Soltis, Ms. Debra M. Wroblewski, Ms. Joan Knapp, and Mr. Joseph J. Tarantino. The cost estimates for treatment models were prepared by Mr. Albert M. Finke. Computer services were provided by Mr. J. Steven Paguette, Mr. Joseph J. Tarantino, Ms. Joan O. Knapp, and Mr. Henry K. Hess.

Acknowledgement and appreciation are given to Ms. Kaye Storey, Ms. Carol Swann, Ms. Pearl Smith and Ms. Glenda Nesby of the Agency's word processing staff for their tireless and dedicated effort in this document. Acknowledgement and appreciation are also given to Ms. Ellen Siegler of the Agency's Office of General Counsel, Mr. John Kukulka of the Agency's Economic Analysis Branch, and Mr. Mahesh Podar of the Agency's Office of Policy and Resource Management. The administrative assistance provided by Mrs. Irena Wagner of the C.W. Rice Group of NUS Corporation is also greatly appreciated.

Finally, the excellent cooperation of the many companies who participated in the survey and contributed pertinent data is gratefully appreciated. Special thanks is also given to the Cast Metals Federation and the American Foundrymen's Society.

SECTION XV

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SECTION XVI

GLOSSARY

Acrylic Resins - Synthetic resins used as sand binders for coremaking. These resins are formed by the polymerization of acrylic acid or one of its derivatives with benzoyl peroxide or a similar catalyst. The most frequently used starting materials for these resins include acrylic acid, methacrylic acid, or acrylonitrile. Since exposure of these binder materials to hot metal temperatures could cause breakdown of these binders, cyanide might be generated.

Agglomerate. The collecting of small particles together into a larger mass.

Air Setting Binders - Sand binders which harden by exposure to air. Sodium silicate, Portland cement, and oxychloride are the primary constituents of such binders.

Magnesia used in the blending of oxychloride can contain small amounts of impurities such as calcium oxide, calcium hydroxide or calcium silicate which increase the volume change during the setting process, thus decreasing mold strength and durability. To eliminate this lime effect, 10 percent of finely divided metallic copper is added to the mixture.

Alkyd Resin Binders - Cold set resins used in the forming of cores. This type of binder is referred to as a three component system using alkyd-isocyanate, cobalt naphthenate, and diphenyl methane di-isocyanate. Cobalt naphthenate is the drier and diphenyl methane di-isocyanate is the catalyst. Exposure of these binders to hot metal temperatures can cause the breakdown of these binder materials, and the resulting degradation products might include naphthalenes, phenols, and cyanides, in some separate or combined form.

Alloying Materials and Additives - The following is a list of materials known to be used in foundry operations.

Aluminum	Chromium	Manganese	Sulfur
Beryllium	Cobalt	Molybdenum	Tantalum
Bismuth	Columbium	Nickel	Tin
Boron	Copper	Nitrogen	Titanium
Cadmium	Hydrogen	Oxygen	Tungsten
Calcium	Iron	Phosphorus	Vanadium
Carbon	Lead	Potassium	Zinc
Cerium	Lithium	Selenium	Zirconium
Chloride	Magnesium	Silicon	

Baghouse. An independent structure or building that contains fabric bags to collect dusts. Usually incorporates fans and dust conveying equipment.

Binder. Any material used to help sand grains to stick together.

Borides - A class of boron containing compounds, primarily calcium boride, used as a constituent in refractory materials. Metallic impurities that often accompany the use of these materials include titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, thorium, and uranium.

Bulk Bed Washer. A wet type dust collector consisting of a bed of lightweight spheres through which the dust laden air must pass while being sprayed by water or liquor.

Catalysts - Materials used to set binder materials used in core and mold formation. Primary set catalysts used are phosphoric acid and toluenesulfonic acid. Exposure of residual catalyst materials in the mold to hot metal temperatures could cause chemical breakdown of these materials with the possible generation of free toluene.

Charcoal - A product of the destructive distillation of wood. Used for heat and as a source of carbon in the foundry industry. Because of the nature of the destructive distillation process, charcoal may contain residuals of toxic pollutants such as phenol, benzene, toluene, naphthalene, and nitrosamines.

Charge. A minimum combination of the various materials required to produce a hot metal of proper specifications.

Chrome Sand - (Chrome-Iron Ore) - A dark material containing dark brown streaks with submetallic to metallic luster. Usually found as grains disseminated in perioditite rocks. Used in the preparation of molds.

Chromite Flour - (See Chrome Sand above) - Chrome sand ground to 200 mesh or finer, can be used as a filler material for mold coatings for steel castings.

Clarification. The process of removing undissolved materials from a liquid, specifically by sedimentation.

Classifier. A device that separates particles from a fluid stream by size. Stream velocity is gradually reduced, and the larger sized particles drop out when the stream velocity can no longer carry them.

Cleaning Agents and Degreasers - Ethylene dichloride, polychloroethylene, trichloroethylene.

Coagulant. A compound which, when added to a wastewater stream, enhances wastewater settleability. The coagulant aids in the binding and agglomeration of the particles suspended in the wastewater.

Coatings - Corrosion Resistant - Generally alkyd or epoxy resins. See Alkyd Resin Binders and Epoxy Resins. Applied to metal molds to prevent surface corrosion.

Coke-Foundry - The residue from the destructive distillation of coal. A primary ingredient in the making of cast iron in the cupola. Because of the nature of the destructive distillation process and impurities in the coal, the coke may contain residuals of toxic pollutants such as phenol, benzene, toluene, naphthalene and nitrosamines.

Coke-Petroleum - Formed by the destructive distillation of petroleum. Like foundry coke, petroleum coke can also be used for making cast iron in the cupola.

Coke-Pitch - Formed by the destructive distillation of petroleum pitch. Used as a binder in the sand molding process.

Coolants - Water, oil and air. Their use is determined by the extent and rate of cooling desired.

Cope. The top half of a two-piece sand mold.

Core. An extra-firm shape of sand used to obtain a hollow section in a casting by placing it in a mold cavity to give interior shape to a casting.

Core Binders - Bonding and holding materials used in the formation of sand cores. The three general types consist of those that harden at room temperature, those that require baking, and the natural clays. Binders that harden at room temperature include sodium silicate, Portland cement, and chemical cements such as oxychloride. Binders that require baking include the resins, resin oils, pitch, molasses, cereals, sulfite liquor, and proteins. Fireclay and bentonite are the clay binders.

Core Binder Acceleratros - Used in conjunction with Furan resins to cause hardening of the resin-sand mixture at room temperature. The most commonly used accelerator is phosphoric acid.

Core and Mold Washes - A mixture of various materials, primarily graphite, used to obtain a better finish on castings, including smoother surfaces, less scabbing and buckling, and less metal penetration. The filler material for washes should be refractory type composed of silica flour, zircon flour or chromite flour.

Core Oils - Used in oil-sand cores as a parting agent to prevent the core material from sticking to the cast metal. Core oils are generally classified as mineral oils (refined petroleum oils) and are available as proprietary mixtures or can be ordered to specification. Typical core oils have specific gravities of 0.93 to 0.965 and contain a minimum of 70 percent nonvolatiles at 177°C (350°F).

Crucible. A highly refractory vessel used to melt metals.

Cupola. A verticle shaft furnace consisting of a cylindrical steel shell lined with refractories and equipped with air inlets at the base and an opening for charging with fuel and melting stock near the top. Molten metal runs to the bottom.

Die Coatings - Oil containing lubricants or parting compounds such as carbon tetrachloride, cyclohexane, methylene chloride, xylene and hexamethylenetetramine. The coatings used to prevent castings from adhering to the die and to provide a casting with a better finish. A correctly chosen lubricant will allow metal to flow into cavities that otherwise cannot be filled.

Drag. The lower half of a two-piece sand mold.

Electrode. Long cylindrical rods made of carbon or graphite and used to conduct electricity into a charge of metal.

Epoxy Resins - Two component resins used to provide corrosion resistant coatings for metallic molds or castings. These materials are synthetic resins obtained by the condensation or polymerization of phenol, acetone, and epichlorohydrin (chloropropylene oxide). Alkyds, acrylates, methacrylates and allyls, hydrocarbon polymers such as indene, coumarone and styrene, silicon resins, and natural and synthetic rubbers all can be applied as additives or bases. Polyamine and amine based compounds are normally used as curing agents. Because of the temperatures to which these materials are exposed, and because of the types of materials that are used to produce many of the components of these materials, toxic pollutants such as zinc, nickel, phenol, benzene, toluene, naphthalene, and possibly nitrosamines could be generated.

Filter Cake. That layer of dewatered sludge removed from the surface of a filter. This filter is used to reduce the volume of sludge generated as a result of the waste treatment process.

Flask. A rectangular frame open at top and bottom used to retain molding sand around a pattern.

Flocculation. The process in which particles agglomerate, resulting in an increase in particle size and settleability.

Flux. A substance used to promote the melting or purification of a metal in a furnace.

Furan Resins - A heterocyclic ring compound formed from diene and cyclic vinyl ether. Its main use is as a cold set resin in conjunction with acid accelerators such as phosphoric or toluene sulfonic acid for making core sand mixtures that harden at room temperature. Toluene could be formed during thermal degradation of the resins during metal pouring.

Furfuryl Alcohol - A synthetic resin used to formulate core binders. The amount of furfuryl alcohol used depends on the desired core strength. One method of formulating furfuryl alcohol is by batch hydrogenation of furfuryl at elevated temperature and pressure with a copper chromite catalyst.

Furnace Charge - Scrap - Various toxic pollutant metals may be present in the raw materials charged in the melting furnace. These pollutants originate from various sources - iron ore, pigs, steel or case scrap, automotive scrap, and ferroalloys. These pollutants may be antimony, arsenic, chromium, copper, lead, titanium, and zinc.

Gate. An entry passage for molten metal into a mold.

Gilsonite - A material used primarily for sand binders. It is one of the purest natural bitumens (99.9 percent) and is found in lead mines. Lead may be present as an impurity in Gilsonite.

Gypsum Cement - A group of cements consisting primarily of calcium sulfate and produced by the complete dehydration of gypsum. It usually contains additives such as aluminum sulfate or potassium carbonate. It is used in sand binder formulation.

Head. A large reservoir of molten metal incorporated into a mold to supply hot metal to a shrinking portion of a casting during its cooling stage.

Heat Treat. To adjust or alter a metal property through heat.

Hydraulic Cyclone. A fluid classifying device that separated heavier particles from a slurry.

Impingement. The striking of air or gasborne particles on a wall or baffle.

Impregnating Compounds - Materials of low viscosity and surface tension used primarily for the sealing of castings. Polyester resins and sodium silicate are the two types of materials used. Phthalic anhydride and diallyl phthalate are used in the formulation of the polyester resins.

Induction Furnace. A crucible surrounded by coils carrying alternating electric current. The current induces magnetic forces into the metal charged into the crucible. These forces cause the metal to heat.

Investment Mold Materials - A broad range of waxes and resins including vegetable wax, mineral wax, synthetic wax, petroleum wax, insect wax, rosin, terpene resins, coal tar resins, chlorinated elastomer resins, and polyethylene resins used in the manufacture and use of investment molds. The presence of coal tar resins in investment mold materials might indicate the possible presence of toxic pollutants such as phenol, benzene, toluene, naphthalene, and nitrosamines as residues in the resins or as possible products of degradation of these resins when subjected to heat.

Ladle. A vessel used to hold or pour molten metal.

Lignin Binders - Additives incorporated into resin-sand mixtures to improve surface finish and to eliminate thermal cracking during pouring. Lignin is a major polymeric component of woody tissue composed of repeating phenyl propane units. It generally amounts to 20-30 percent of the dry weight of wood. Phenol might be generated during thermal degradation of lignin binders during metal pouring.

Lubricants - Calcium stearate, zinc stearate and carnauba wax are lubricating agents added to resin sand mixtures to permit the easy release of molds from patterns.

Mica - A class of silicates with widely varying composition used in the refractory making process. They are essentially silicates of aluminum but are sometimes partially replaced by iron, chromium and an alkali such as potassium, sodium or lithium.

Mold. A form made of sand, metal, or refractory material, which contains the cavity into which molten metal is poured to produce a casting.

MOLDING

CO_2 Molding. The CO_2 (carbon dioxide) molding processes uses sodium silicate binders to replace the clay binders used in sand molds and cores. In the CO_2 process, a low strength mold or core is made with a mixture of sodium silicate (3-4%) and sand. Carbon dioxide gas is passed through the sand, causing the sodium silicate to develop a dry compressive strength greater than 200 psi. Ready-to-use cores and complete molds can be made quickly, with no baking or drying needed. The high strength developed by the CO_2 process enables molds to be made and poured without back-up flasks or jackets.

No-Bake Molds. The process is of fairly recent (15 years) origin. The sand coating consists of a binder and catalyst, their interaction results in a molded sand with high green strength (over 200 psi). The name of the process derives from the fact that the mold requires no baking. The amount of sand used, and the general form of the molds are similar to green sand operations; however, the high strength permits flask removal and mold pouring without a jacket. The castings poured using this process have good dimensional accuracy and excellent finish.

Permanent Mold Casting. A metal mold consisting of two or more metal parts is used repeatedly for the production of many castings of the same form. The molten metal enters the mold by gravity. Permanent mold casting is particularly suitable for high-volume production of small, simple castings that have a uniform wall thickness and no undercuts or intricate internal coring.

Plaster Mold Casting. Plaster mold casting is a specialized casting process used to produce nonferrous castings that have greater dimensional accuracy, smoother surfaces and more-finely reproduced details than can be obtained with sand molds or permanent molds.

Shell Molding. Shell molding is a process in which a mold is formed from a mixture of sand and a heat-setting resin binder. The sand resin mixture is placed in a heated metal pattern in which the heat causes the binder to set. As the sand grains adhere to each other, a sturdy shell, which becomes one half of the mold, is formed. The halves are placed together with cores located properly, clamped and adequately backed up, and then the mold is poured. This process produces castings with good surface finish and good dimensional accuracy while using smaller amounts of molding sand.

No Bake Binders - Furan resins and alkyd-isocyanate compounds are the two predominant no bake binders. Furan resins, as previously mentioned, are cyclic compounds which use phosphoric acid or toluenesulfonic acid as the setting agents. Alkyd-isocyanate binders have fewer limitations in use than furan resins, but the handling of cobalt naphthenate does present problems.

Pattern. A form of wood, metal, or other material around which molding material is placed to make a mold for casting metals.

Phenolic Resins - Phenol formaldehyde resins - A group of varied and versatile synthetic resins. They are made by reacting almost any phenolic and an aldehyde. In some cases, hexamethylene-tetramine is added to increase the aldehyde content. The resins formed are classified as one and two step resins depending on how they are formed in the reaction kettle. Both types of materials are used separately or in combination in the blending of commercial molding materials. Due to the thermal degradation of phenolic resins that may occur during metal pouring, phenol and formaldehyde may be generated.

Pitch Binders - Thermosetting binders used in coremaking. Baking of the sand-binder mixture is required for evaporation-oxidation and polymerization to take place.

Polymeric Flocculant (Polyelectrolyte). High molecular weight compounds which, due to their charges, aid in particle binding and agglomeration.

Quenching. A process of inducing rapid cooling from an elevated temperature.

Quenching Oil - Medium to heavy grade mineral oils used in the cooling of metal. Standard weight or grade of oil would be similar to standard SAE 60.

Recycle - The practice of returning, in whole or in part, treated or untreated process wastewaters to the process.

Recuperator. A steel or refractory chamber used to reclaim heat from waste gases.

Riser Compounds - Extra strength binders used to reduce the extent of riser erosion. Such materials generally contain lignin, furfuryl alcohol and phosphoric acid.

Rosins, Natural - (Gum rosin, colophony, pine resin, common rosin) - A resin obtained as a residue after the distillation of turpentine oil from crude turpentine. Rosin is primarily an isomeric form of the anhydride of abietic acid. It is one of the more common binders in the foundry industry.

Sand Flowability Additives - A mixture of sand, dicalcium silicate, water and wetting agents. This combination is based on a process of Russian origin which achieves a higher degree of flowability than either the conventional sand mix or those with organic additives.

Scrap. Usually refers to miscellaneous metal used in a charge to make new metal.

Sand Binders - Binder materials are the same as those used in core making. The percentage of binder may vary in core and molds depending on sand strength required, extent of mold distortion from hot metal and the metal surface finish required.

Seacoal - Ground bituminous coal used to help control the thermal expansion of the mold and to control the composition of the mold cavity gas during pouring.

Shot Blast. A casting cleaning process employing a metal abrasive (grit or shot)propelled by centrifugal or air force.

Shakeout. The operation of removing castings from the mold. A mechanical unit for separating the mold material from the solidified casting.

Slag. A product resulting from the action of a flux on the oxidized non-metallic constituents of molten metals.

Slag Quench. A process of rapidly cooling molten slag to a solid material. Usually performed in a water trough or sump.

Snorkel. A pipe through the furnace roof, or an opening in a furnace roof, used to withdraw the furnace atmosphere.

Spray Chamber. A large volume chamber in a flowing stream where water or liquor sprays are inserted to wet the flowing gas.

Sprue. A vertical channel from the top of the mold used to conduct the molten metal to the mold cavity.

Tapping. The process of removing molten metal from a furnace.

Tuyere. An opening in a cupola for introduction of air for combustion.

Urea Formaldehyde Resins - An important class of thermosetting resins identified as aminoplastics. The parent raw materials (urea and formaldehyde) are united under controlled temperature and pH to form intermediates that are mixed with fillers (cellulose) to produce molding powders for patterns.

Venturi Scrubber. A wet type of dust collector that uses the turbulence developed in a narrowed section of the conduit to promote intermixing of the dust laden gas with water sprayed into the conduit.

Washing Cooler. A large vessel where a flowing gas stream is subjected to sprays of water or liquor to remove gasborne dusts and to cool the gas stream by evaporation.

Wet Cap. A mechanical device placed on the top of a stack that forms a curtain from a water stream through which the stack gases must pass.

Wetting Compounds - Materials which reduce the surface tension of solutions thus allowing uniform contact of solution with the material in question. Sodium alkylbenzene sulfonates comprise the principal type of surface-active compounds, but there are a vast number of other compounds used.

*U.S. GOVERNMENT PRINTING OFFICE : 1982 0-381-085/44f7