SECTION 7
ENGINEERING COSTS

This section of the Industrial Waste Combustor (IWC) Industry Development Document presents the following information: sources of cost data along with a benchmark analysis of models; engineering costing methodology and description of each type of additional cost to comply with proposed options; individual treatment technology costs; and individual compliance costs for each facility in the database for each proposed option.

This chapter contains the following sections:

- Section 7.1 presents a discussion of the various costing options that were evaluated. The criteria used to evaluate these costing options are presented, as well as a benchmark analysis to compare the accuracy of each of these options. The selected costing option is also presented in this section.
- Section 7.2 presents a discussion of the costing methodology used to develop regulatory costs. This section discusses the methodology used to cost treatment systems and components, as well as to develop regulatory option costs.
- Section 7.3 presents the costing method used to cost for individual treatment technologies which comprise the regulatory options. Cost curves and equations developed for each treatment technology are presented in this section.
- Section 7.4 presents the approach to developing additional regulatory costs associated with the implementation of the IWC regulation. Additional costs which were developed include retrofit, monitoring, RCRA permit modification, and land costs.
- Section 7.5 presents the wastewater off-site disposal costs used for facilities with very low flow rates of IWC wastewater.
- Section 7.6 presents summary tables of the total compliance costs, by facility, for each of the IWC Industry regulatory options, including BPT/BAT and PSES. Also presented in this section are the compliance costs for NSPS and PSNS.

7.1 *COSTS DEVELOPMENT*

This section presents a discussion of the various costing options which were evaluated in order to calculate compliance costs for the IWC Industry. A discussion of the selection criteria used to evaluate these costing options are presented in this section, as well as a benchmark analysis to compare the accuracy of each of these options. The selected costing option is then presented.

7.1.1 *Sources of Cost Data*

The following sections present the various costing sources considered in developing regulatory costs for the IWC Industry, including computer models, vendor quotes, the Waste Treatment Industry Phase II: Incinerators 308 Questionnaire, and other effluent guidelines.

7.1.1.1 Cost Models

Cost estimates of wastewater treatment systems are required to be developed in order to evaluate the economic impact of the regulation. Mathematical cost models were used to assist in developing estimated costs. In a mathematical cost model, various design and vendor data are combined to develop cost equations which describe costs as a function of system parameters, such as flow. Using such models readily allows for iterative costing to be performed to assist in option selection.

For developing costs for the IWC Industry regulation, two commonly used cost models were evaluated:

- Computer-Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems (CAPDET), developed by the U.S. Army Corps of Engineers.
- W/W Costs Program (WWC), Version 2.0, developed by CWC Engineering Software.

CAPDET is intended to provide planning level cost estimates to analyze alternate design technologies for wastewater treatment systems. It was developed to estimate treatment system costs primarily for high flow, municipal wastewater applications. Modules are used which represent physical, chemical, and biological treatment unit processes. Equations in each of these modules are based upon engineering principles historically used for wastewater treatment plant design. Modules can be linked together to represent entire treatment trains. CAPDET designs and costs various treatment trains and ranks them with respect to present worth, capital, operating, or energy costs.

WWC is a cost model developed by Culp/Wesner/Culp from a variety of engineering sources, including vendor supplied data, actual plant construction data, unit takeoffs from actual and conceptual designs, and published data. The program allows for the costing of various unit processes. As with CAPDET, this program allows for these unit processes to be strung together to develop cost for treatment trains. WWC does not perform the design of the unit process, but rather prompts the user to provide design input parameters which form the basis for the costing. The WWC program is provided with a separate spreadsheet program entitled Design Criteria Guidelines to assist in developing the input parameters to the costing program. The Design Criteria Guidelines is a spreadsheet of treatment component design equations which is supplied using default parameters to assist in designing particular treatment units. Default parameters are based upon commonly accepted design criteria used in wastewater treatment. Flexibility is provided with this spreadsheet, in that particular design parameters can be modified to best satisfy given situations. Once design inputs are entered into the program, the WWC costing program yields both construction and operation and maintenance (O&M) costs for the system.

7.1.1.2 Vendor Data

For certain treatment processes, the cost models do not yield acceptable and valid treatment costs. In these instances, it was more reliable to obtain equipment and maintenance costs directly from treatment system or component manufacturers. Information on the wastewater characteristics was provided to the vendor in order to determine accurately the appropriate treatment unit and sizing. Vendor quotes were used to determine cost curves for multi-media filtration and for sludge dewatering using plate and frame technology. The cost curves used are based on the vendor quotes and information obtained as part of the CWT effluent guidelines effort.

7.1.1.3 Waste Treatment Industry Phase II: Incinerators 308 Questionnaire Costing Data

The Waste Treatment Industry Phase II: Incinerators 308 Questionnaire costing data was only utilized in the benchmark analysis to compare the accuracy of the costing models and is discussed further in Section 7.1.2.

7.1.1.4 Other EPA Effluent Guideline Studies

Other EPA effluent studies, such as the Organic Chemicals and Plastics and Synthetic Fibers (OCPSF) industry effluent guidelines, were reviewed in order to obtain additional costing background and supportive information. However, costs developed as part of other industrial effluent guidelines were not used in costing for this industry, with the exception of the CWT effluent guideline data referenced in Section 7.1.1.2 above.

7.1.2 *Benchmark Analysis and Evaluation Criteria*

A benchmark analysis was performed to gauge the accuracy of the costing models presented above. This benchmark analysis used actual costs provided in the Incinerator 308 questionnaires as compared to costs generated using various costing options. Two BPT/BAT facilities (Questionnaire ID#s 4646 and 4671) were selected to be used in the benchmark analysis. The BPT/BAT facilities had installed treatment systems similar to the proposed regulatory options. Treatment technologies which were used in the benchmark analysis include:

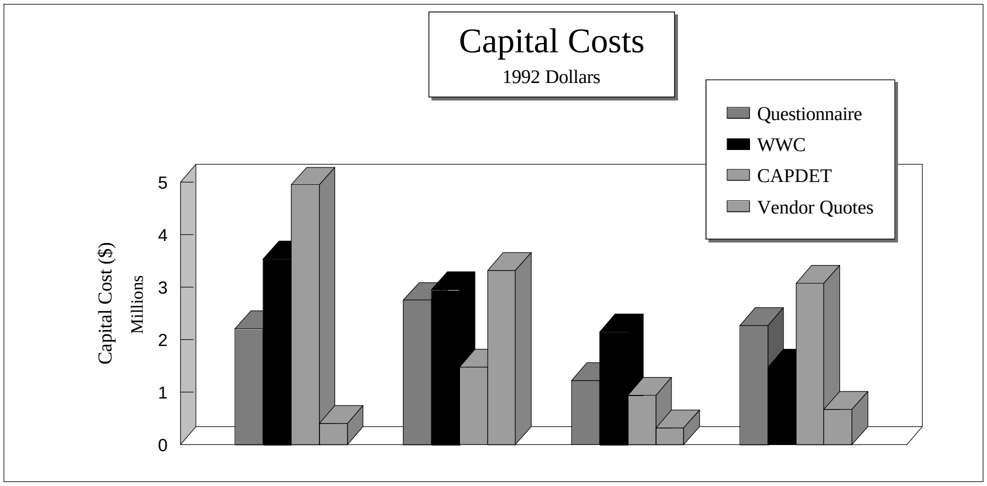
- equalization
- chemical precipitation
- sedimentation
- multimedia filtration

Table 7-1 presents a cost comparison of capital and O&M costs for the above technologies. Costs were developed using the average design flow of the selected BPT/BAT facilities and average pollutant loadings (see Section 4.0). This table presents costs developed using the WWC program, CAPDET, and vendor quotes, as compared to industry provided treatment system capital and O&M costs provided in the 308 Technical Questionnaires for the BPT/BAT facilities.

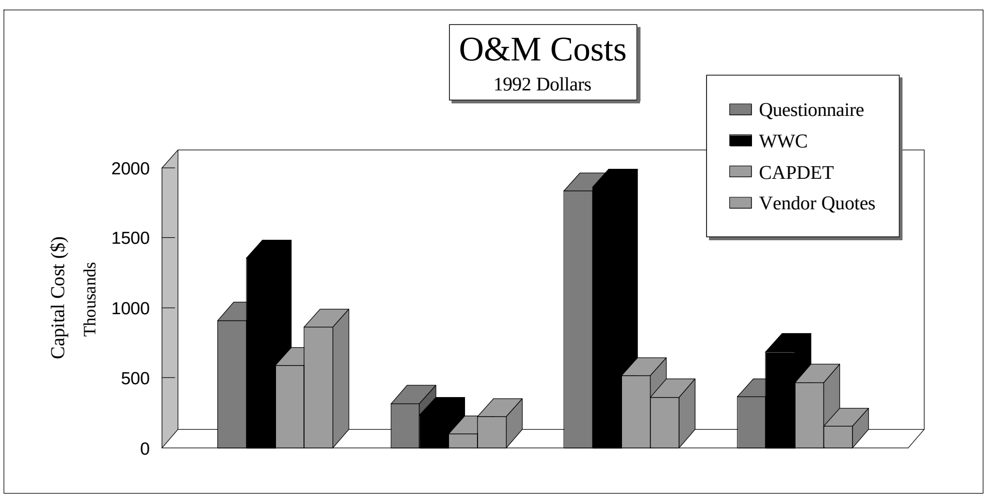
Capital costs provided in the 308 Technical Questionnaire for chemical precipitation systems installed at facility ID#s 4646 and 4671 were $2,207,000 and $1,215,000, respectively. Questionnaire capital cost for the second-stage chemical precipitation system and filtration process at facility ID # 4646 is $2,751,000, whereas, the capital cost for the second-stage chemical precipitation at facility ID # 4671 is $2,265,000. As demonstrated on Table 7-1, capital costs developed by the WWC program for the various treatment technologies were typically close to the actual costs as provided in the questionnaire. For the WWC program, the range of accuracy in predicting treatment component capital costs ranged from plus 76.6 percent for the chemical precipitation system for facility ID# 4671 to a minus 34.8 percent for the second-stage chemical precipitation system also for facility ID# 4671. The range of accuracy for the CAPDET program capital costs was greater than that of the WWC program and ranged from a positive 110.6 percent for the chemical precipitation system for facility ID# 4646 to a minus 46.6 percent for the second-stage chemical precipitation and filtration system at the same facility. Vendor quotes consistently had a large varaibility from actual questionnaire costs and were typically much lower.

O&M costs provided in the 308 Technical Questionnaire for chemical precipitation systems installed at facility ID#s 4646 and 4671 were $910,000 and $1,837,000, respectively. Questionnaire O&M cost for the second-stage chemical precipitation system and filtration process at facility ID # 4646 is $315,000, whereas, the O&M cost for the second-stage chemical precipitation at facility ID # 4671 is $363,000. As demonstrated on Table 7-1, O&M costs developed by the WWC program for the various treatment technologies were typically close to the actual costs as provided in the questionnaire. For the WWC program, the range of accuracy in predicting treatment component O&M costs ranged from plus 89.1 percent for the second-stage chemical precipitation system for facility ID# 4671 to a minus 26.4 percent for the second-stage chemical precipitation and filtration system for facility ID# 4646. The ranges of accuracy for the CAPDET program and vendor quotes in predicting O&M costs were typically greater than the WWC program costs or were significantly lower than questionnaire provided costs.

Table 7-1. Costing Source Comparison



	4646 Chem Precip	4646 2-stage Chem Precip and Sand Filtration	4671 Chem Precip	4671 2-stage Chem Precip
Questionnaire	2,206,980	2,751,204	1,214,563	2,265,009
WWC	3,543,264	2,950,035	2,144,446	1,476,821
CAPDET	4,948,779	1,475,480	942,216	3,072,253
Vendor Quotes	399,878	3,314,930	319,206	670,158



	4646 Chem Precip	4646 2-stage Chem Precip and Sand Filtration	4671 Chem Precip	4671 2-stage Chem Precip
Questionnaire	910,000	315,000	1,837,000	363,000
WWC	1,355,505	231,728	1,864,219	686,360
CAPDET	585,855	99,036	515,859	466,848
Vendor Quotes	860,867	222,135	361,623	151,889

Therefore, the benchmark analysis demonstrated that the WWC cost program consistently developed capital and O&M costs which are considered acceptable estimates of actual costs when compared to questionnaire responses. Whereas, both CAPDET and vendor quotes were determined not to be as accurate or consistent in estimating capital and O&M costs for these technologies.

The following criteria was used in order to evaluate the costing options and to select the appropriate option for developing the IWC Industry costing methodology:

- Does the model contain costing modules representative of the various wastewater technologies in use or planned for use in the IWC Industry?
- Can the program produce costs in the expected flow range experienced in this industry?
- Can the model be adapted to cost entire treatment trains used in the IWC Industry?
- Is sufficient documentation available regarding the assumptions and sources of data so that costs are credible and defensible?
- Is the model capable of providing detailed capital and operation and maintenance costs with unit costing breakdowns?
- Is the program capable of altering the default design criteria in order to accurately represent actual design criteria indicative of the IWC Industry?

7.1.3 *Selection of Final Cost Models*

Based upon the results of the benchmark analysis and an evaluation using the criteria above, the WWC costing program was selected for costing the majority of the treatment technologies. It was determined that the WWC produces reliable capital and O&M costs for a wide range of treatment technologies. As demonstrated on Table 7-1, WWC program costs were consistently accurate in predicating both capital and O&M costs for those wastewater treatment systems at the selected BPT/BAT facilities. Capital costs predicted by CAPDET for these various treatment systems were typically less consistent and were either much higher or lower than Questionnaire provided costs. O&M costs developed with CAPDET were typically low compared to Questionnaire costs. In addition, CAPDET could not cost all of the technologies needed for the IWC Industry and was determined not to be as accurate in predicting costs in the low flow range that characterize the IWC industry. Vendor quotes for both capital and O&M costs in general were much lower than Questionnaire costs. Therefore, CAPDET and vendor quotes (except as provided for below) were not used for costing.

The WWC computer-based costing program best satisfies the selection criteria presented above. The program can cost a wide range of typical and innovative treatment unit operations and can combine these unit operations to develop system costs. Since the WWC program is a computer based program, it readily allows for the repeated development of costs for a number of facilities. The program utilizes cost modules which can accommodate the range of flows and design input parameters needed to cost the IWC Industry. Costs developed by this program are based upon a number of sources, including actual construction and operation costs, as well as published data. Costs are presented in a breakdown summary table which contains unit costs and totals. Finally, the WWC program is adaptable to cost unit operations based upon specified design criteria, as well as flow rate. Certain unit operations are costed strictly based upon the input of flow rate, whereas other unit operations are costed based upon a combination of flow rate and design loadings or component size. The Design Criteria Guidelines spreadsheet is used in conjunction with the program to aid in determining particular treatment component design input parameters. This spreadsheet is based upon design default values, which can readily be modified in order to develop costs based upon particular design parameters common in the IWC Industry.

However, there were particular instances where the WWC program did not produce reliable cost information, such as for multi-media filtration and sludge dewatering facilities. WWC program costs for these technologies were excessively high as compared to industry provided costs in the 308 Questionnaire. For these technologies, vendor quotes were more accurate in predicating costs and, therefore, were used to provide costs.

7.2 *ENGINEERING COSTING METHODOLOGY*

This section presents the costing methodology used to develop treatment technology and BPT/BAT and PSES option costs for the IWC Industry. Additional costs to comply with this regulation, such as monitoring costs, are presented in a latter discussion in Section 7.4 of this chapter.

7.2.1 *Treatment Costing Methodology*

The following discussion presents a detailed summary of the technical approach used to estimate treatment technology costs for each in-scope facility in the IWC database. For each facility in the database and for each proposed option, EPA developed total capital and annual operation and maintenance treatment costs to upgrade existing wastewater treatment system, or to install new treatment technologies, in order to comply with the long term averages (LTAs). Facilities were costed primarily using the WWC costing program. Vendor cost curves, as developed in the CWT industry study, were used for multimedia filtration and sludge dewatering costing. Table 7-2 presents a breakdown of the costing method used for each treatment technology.

Table 7-2. Breakdown of Costing Method by Treatment Technology

Treatment Technology	Cost Using WWC Program	Cost Using Vendor Quotes[1]	Key Design Parameter(s)
Flocculation, Mixing & Pumping	X		Flow rate
Chemical Feed System	X		Flow rate & POI Metals
Primary & Secondary Clarification	X		Flow rate
Multimedia Filtration		X	Flow rate
Sludge Filter Press		X	Flow rate

(1) Cost curves developed using vendor quotes in the CWT guideline effort.

In using the WWC computer model to develop treatment technology costs, the first step was to use the Design Criteria Guidelines spreadsheet to develop input parameters for the computer costing program. Actual pollutant loadings from the facility were used whenever possible. If pollutant loadings were not available for a particular parameter, EPA used an estimated concentration developed based on combined waste stream loadings or loadings from similar facilities. The facility's baseline flow rate and the regulatory option LTAs were also used in the design of the unit operation. Certain key design parameters, such as total suspended solids, are used directly in the WWC program, and accompanying Design Criteria Guidelines spreadsheet, to design the various treatment unit operations, such as a clarifier. Selected pollutant of concern (POC) metals were used to assist in the design of BPT/BAT chemical precipitation systems. These metals typically impose a large requirement for the various precipitating agents, thereby governing the chemical feed system design. A more detailed discussion of individual treatment technology costing and their design parameters is presented in Section 7.3. The design parameters from the Design Criteria Guidelines spreadsheet were next used as input for the WWC costing program to develop the installed capital and O&M costs.

Individual treatment component costs were developed by the WWC program by using the corresponding module provided by the program for that particular technology. Technology-specific design parameters were input into the WWC program. The WWC program then calculated both installed capital costs and annual O&M costs. Treatment technology costs developed by the WWC costing program were corrected to 1992 costs using the Engineering News Record (ENR) published indexes. After the installed capital and annual O&M costs were developed for each facility, selected cost factors, as shown in Table 7-3, were applied to the results to develop total capital and O&M costs. Capital costs developed by the program include the cost of the treatment unit and some ancillary equipment associated with that technology (see Section 7.3 for further information on particular items costed for each technology). O&M costs for treatment chemicals, labor, materials, electricity, and fuel are included in the computer program O&M costs.

Table 7-3. Additional Cost Factors

Type	Factor	% of Capital Cost
Capital	Site Work & Interface Piping	18
	General Contractor Overhead	10
	Engineering	12
	Instrumentation & Controls	13
	Buildings	6
	Site Improvements	10
	Legal, Fiscal, & Administrative	2
	Interest During Construction	9
	Contingency	8
	Retrofit (if necessary)	20
O&M	Taxes & Insurance	2[1]

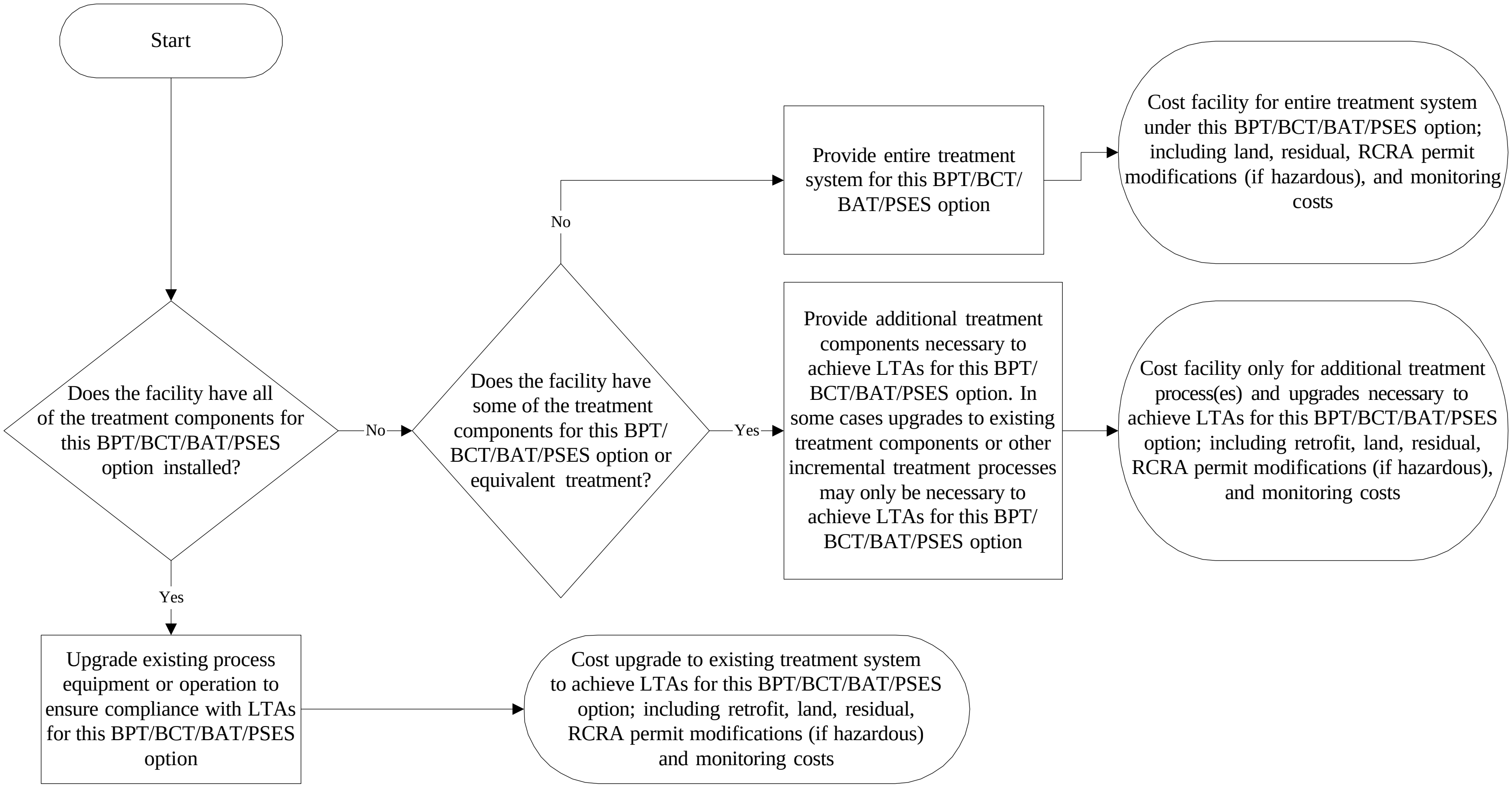
(1) 2 percent of total capital costs, which includes WWC computer costs and capital costs listed above.

7.2.2 *Option Costing Methodology*

The following discussion presents a detailed summary of the technical approach used to estimate the BPT/BAT and PSES option costs for each in-scope facility in the IWC database. Zero discharge facilities were not costed for any of the regulatory options. The costing methodology used to develop facility-specific BPT/BAT and PSES option compliance costs is presented graphically on the flow diagram in Figure 7-1.

For each proposed BPT/BAT and PSES regulatory option, it was first determined whether a facility was complying with the LTAs of each pollutant considered for regulation. None of the facilities were in compliance with the LTAs, and were therefore assigned additional equipment and/or upgrade costs to achieve compliance with that option. The next step was to determine whether a

Figure 7-1. Option-Specific Costing Logic Flow Diagram



facility had already installed treatment unit operations capable of complying with the LTAs. If a facility already had BPT/BAT, PSES or equivalent treatment installed, the facility was only assigned costs for treatment system upgrades.

For facilities that did not have BPT/BAT or PSES treatment systems or equivalent, costs were developed for the additional unit operations and/or system upgrades necessary to meet each LTA. Facilities which were already close to compliance with the LTAs were costed for upgrades in order to achieve BPT/BAT levels. Upgrade costs were developed using the WWC costing program whenever possible, and included either additional equipment to be installed on existing unit processes, expansion of existing equipment, or operational changes. Examples of upgrade costs include such items as a new or expanded chemical feed system, or improved or expanded sedimentation capabilities. If a facility had no treatment system, or one that could not achieve desired levels with upgrades or minor additions, an entire BPT/BAT treatment system was costed for that facility.

Once all of the individual treatment technology requirements for each facility were established, individual capital and O&M treatment technology costs were developed as previously described above in Section 7.2.1. In order to estimate the total compliance cost for a regulatory option it is necessary to sum all of the individual component treatment technology costs. Table 7-4 presents each of the proposed regulatory options in the IWC Industry and the corresponding treatment technologies costed for each.

7.3 *TREATMENT TECHNOLOGIES COSTING*

The following sections describe how costs were developed for the BPT/BAT/PSES treatment technologies. Specific assumptions are discussed for each treatment technology regarding the equipment used, flow ranges, input and design parameters, and design and cost calculations. Table 7-2, previously referenced, presented the selected costing method which was used to cost each of the treatment technologies used in the proposed BPT/BAT and PSES options. The following subsections present a detailed discussion on how each of the treatment technologies presented in Table 7-3 were costed. Costs are presented as physical/chemical wastewater treatment costs, and sludge treatment and disposal costs.

Table 7-4. Regulatory Option Wastewater Treatment Technology Breakdown

BPT/BCT /BAT/PSES OPTION	BPT/BCT/BAT/PSES OPTION DESCRIPTION	TREATMENT CODE COMPONENTS	WWC #
A	Two-stage Chemical Precipitation & SludgeDewatering	pumping	92
		rapid mix tank	104
		sodium bisulfite feed system	42
		flocculation	72
		sodium hydroxide feed system	45
		primary clarification	118
		pumping	92
		rapid mix tank	104
		hydrochloric acid feed system	46
		flocculation	72
		ferric chloride feed system	40
		polymer feed	43
		rapid mix tank	104
		sodium hydroxide feed system	45
		secondary clarification	118
		sludge dewatering	NA
B	Two-stage Chemical Precipitation, MMF & SludgeDewatering	pumping	92
		rapid mix tank	104
		sodium bisulfite feed system	42
		flocculation	72
		sodium hydroxide feed system	45
		primary clarification	118
		pumping	92
		rapid mix tank	104
		hydrochloric acid feed system	46
		flocculation	72
		ferric chloride feed system	40
		polymer feed	43
		rapid mix tank	104
		sodium hydroxide feed system	45
		secondary clarification	118
		multi-media filter	NA
		sludge dewatering	NA

NA = Technology costed using vendor cost curves from CWT study.

7.3.1 *Physical/Chemical Wastewater Treatment Technology Costs*

Table 7-4 presents a breakdown of the WWC treatment modules used in costing each treatment technology for each of the proposed regulatory options. The following sections present a description of costs for each physical/chemical wastewater treatment technology used in the proposed regulation. Capital and O&M cost curves were developed for specific technologies and system components. These curves, which represent cost as a function of flow rate or other system design parameter, were developed using a commercial statistical software package (SlideWrite Plus Version 2.1). First, costs were developed using the WWC program for each technology or component using as a design basis five different flow rates or other system design parameters (depending upon the governing design parameter). For instance, a technology costed on the basis of flow would have costs developed by the WWC program at 0.01 million gallons per day (MGD), 0.05 MGD, 0.1 MGD, 0.5 MGD, and 1.0 MGD. Ranges for the five selected points to cost were based upon a review of the flow or technology design parameters for all facilities in the database and were selected in order to bracket the range from low to high. Next, these five data points (flow/design parameter and associated cost) were entered into the commercial statistical software program . Cost curves to model the total capital and O&M costs were then developed by the program using curve fitting routines. A second order natural log equation format was used to develop all curves. All cost curves yielded total capital and O&M costs, unless otherwise noted.

7.3.1.1 Chemical Feed Systems

The following section presents the methodology used to calculate the chemical addition feed rates used with each applicable regulatory option. Table 7-5 presents a breakdown of the design process used for each type of chemical feed. Chemical costs presented in Table 7-6 were taken from the September 1992 Chemical Marketing Reporter.

For facilities with existing chemical precipitation systems, an evaluation was made as to whether the system was achieving the regulatory option LTAs. If the existing system was achieving LTAs, no additional chemical costs were necessary. However, if the facility was not achieving the

Table 7-5. Chemical Addition Design Method

Chemical	Basis for Design	
	Stoichiometry	Reference[1] (mg/L)
Hydrochloric Acid	X	
Sodium Hydroxide	X	
Polymer		2.0
Sodium Bisulfate	X	
Ferric Chloride		75

(1) Source: Industrial Water Pollution Control, 2nd Edition (Reference X).

Table 7-6. Treatment Chemical Costs

Treatment Chemical	Cost[1]
Ferric Chloride	$200/ton
Hydrochloric Acid	$72/ton
Polymer	$2.25/lb
Sodium Bisulfate	$230/ton
Sodium Hydroxide	$350/ton

(1) Source: 1992 Chemical Marketing Reporter

LTAs for an option, the facility was costed for an upgrade to the chemical precipitation system. First, the stoichiometric requirements were determined for each metal to be removed to the LTA level. If the current feed rates were within the calculated feed rates no additional costs were calculated. For facilities currently feeding less than the calculated amounts, the particular facility was costed for an upgrade to add additional precipitation chemicals, such as a coagulant, or expand their existing chemical feed system to accommodate larger dosage rates.

Facilities without an installed chemical precipitation system were costed for an entire metals precipitation system. The chemical feed rates used at a particular facility for either an upgrade or a new system were based upon stoichiometric requirements, pH adjustments, and buffering ability of the raw influent.

In developing the CWT proposed industry guideline, EPA's analysis led the agency to conclude that the stoichiometric requirements for chemical addition far outweighed the pH and buffer requirements. It was determined that 150 percent of the stoichiometric requirement would sufficiently accommodate for pH adjustment and buffering of the solution. An additional 50 percent of the stoichiometric requirement was included to react with metals not on the POC list. Finally, an additional 10 percent was added as excess. Therefore, a total of 210 percent of the stoichiometric requirement was used in developing costs.

Sodium Hydroxide Feed Systems

The stoichiometric requirement for sodium hydroxide to remove a particular metal is based upon the generic equation:

$$lb_{treatment\ chemical} = \left(\frac{lb_{M\ removed}}{year}\right)\left(\frac{valence_M}{MW_M}\right)\left(\frac{MW_{treatment\ chemical}}{valence_{Na/Ca}}\right)$$

where, M is the target metal and MW is the molecular weight.

The calculated amounts of sodium hydroxide to remove a pound of each of the selected metal pollutants of concern are presented in Table 7-7. For indirect dischargers, only those metals which were determined to pass through a POTW were used in determining the stoichiometric requirements. The other metals present in the wastewater will be accommodated for by the additional 110 percent of the stoichiometric requirement. Sodium hydroxide chemical feed system costs were developed for many facilities using the WWC costing program. Actual facility loadings were used to establish the sodium hydroxide dosage requirement. WWC unit process 45 was used to develop capital and O&M

Table 7-7. Sodium Hydroxide Requirements for Chemical Precipitation

Pollutant	Dosage Rate Sodium Hydroxide (lb/lb metal removed)
Aluminum	4.45
Antimony	1.64
Arsenic	2.67
Boron	11.10
Cadmium	0.71
Chromium	2.31
Copper	1.26
Iron	2.15
Lead	0.77
Manganese	2.91
Mercury	0.40
Molybdenum	2.50
Selenium	2.03
Silver	0.74
Tin	1.35
Titanium	3.34

costs for sodium hydroxide feed systems. The capital and O&M cost curves developed for sodium hydroxide feed systems, based upon the calculated dosages, are presented as Equations 7-1 and 7-2, respectively.

$$\ln(Y) = 10.653 - 0.184\ln(X) + 0.040\ln(X)^2 \quad (7\text{-}1)$$

$$\ln(Y) = 8.508 - 0.0464\ln(X) + 0.014\ln(X)^2 \quad (7\text{-}2)$$

where:

X = Dosage Rate (lb/day), and

Y = Cost (1992 $)

Figures 7-2 and 7-3 graphically present the sodium hydroxide feed system capital and O&M cost curves, respectively.

Cost for a sodium hydroxide feed system are estimated using the WWC unit process cost number 45. Costs are based on sodium hydroxide dosage rates between 10-10,000 lb/day, with dry sodium hydroxide used at rates less than 200 lb/day, and liquid sodium hydroxide used at higher feed rates. The costing program assumes that dry sodium hydroxide (98.9 percent pure) is delivered in drums and mixed to a 10 percent solution on-site. A volumetric feeder is used to feed sodium hydroxide to one of two tanks; one for mixing the 10 percent solution, and one for feeding. Two tanks are necessary for this process because of the slow rate of sodium hydroxide addition due to the high heat of solution. Each tank is equipped with a mixer and a dual-head metering pump, used to convey the 10 percent solution to the point of application. Pipe and valving is required to convey water to the dry sodium hydroxide mixing tanks and between the metering pumps and the point of application.

A 50 percent sodium hydroxide solution is purchased, premixed and delivered by bulk transport for feed rates greater than 200 lb/day. The 50 percent solution contains 6.38 pounds of sodium hydroxide per gallon, which is stored in fiberglass reinforced polyester tanks designed to a hold 15 day capacity. Dual-head metering pumps are used to convey the liquid solution to the point of application, and a standby metering pump is provided in all systems. The storage tanks are located indoors, since 50 percent sodium hydroxide begins to crystallize at temperatures less than 54°F.

<u>Ferric Chloride Feed Systems</u>

Ferric chloride feed systems were costed using the WWC unit process 40. Costs were based upon a dosage rate of 75 mg/l of ferric chloride. The capital and O&M cost curves developed for

Figure 7-2
Sodium Hydroxide Capital Cost Curve

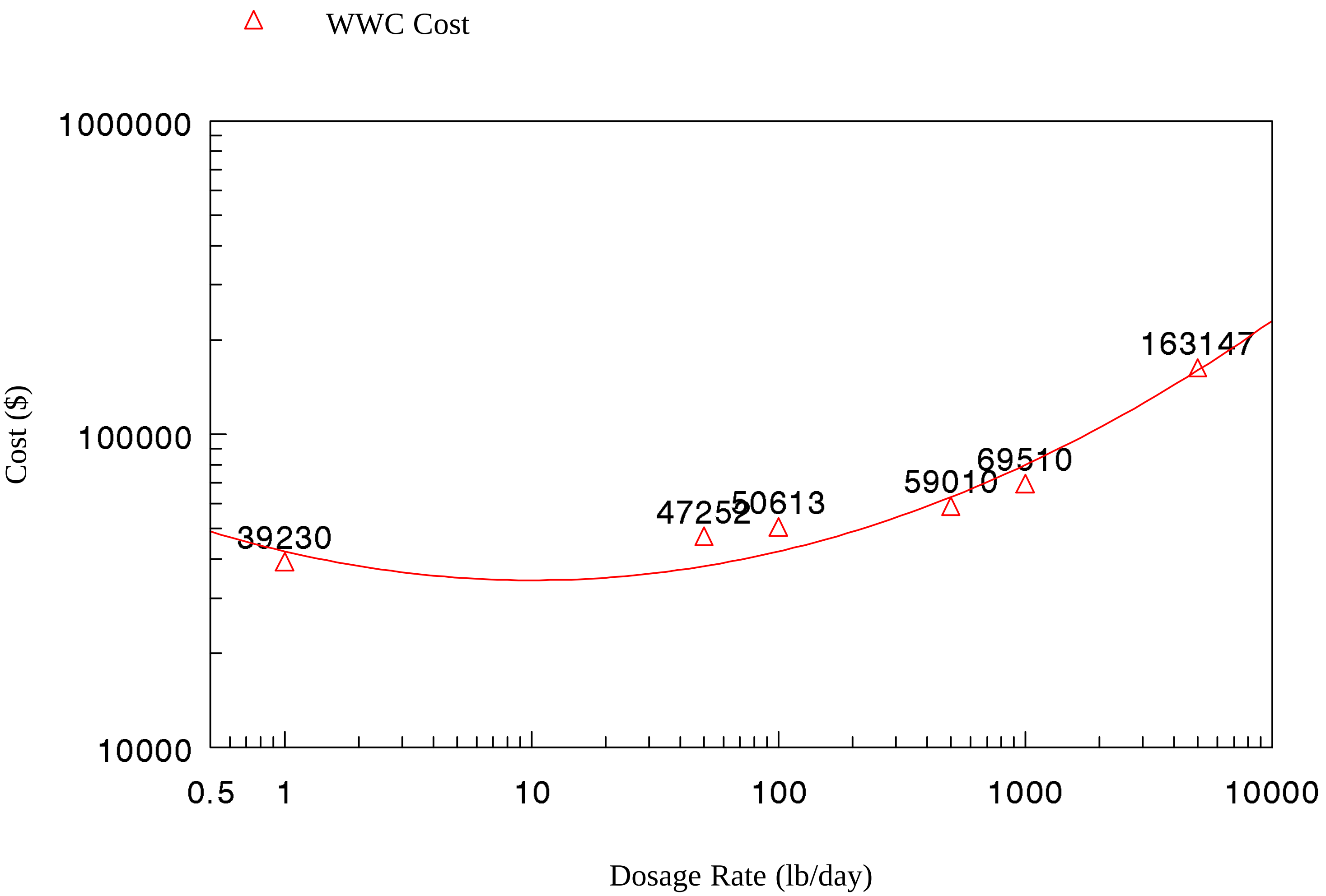
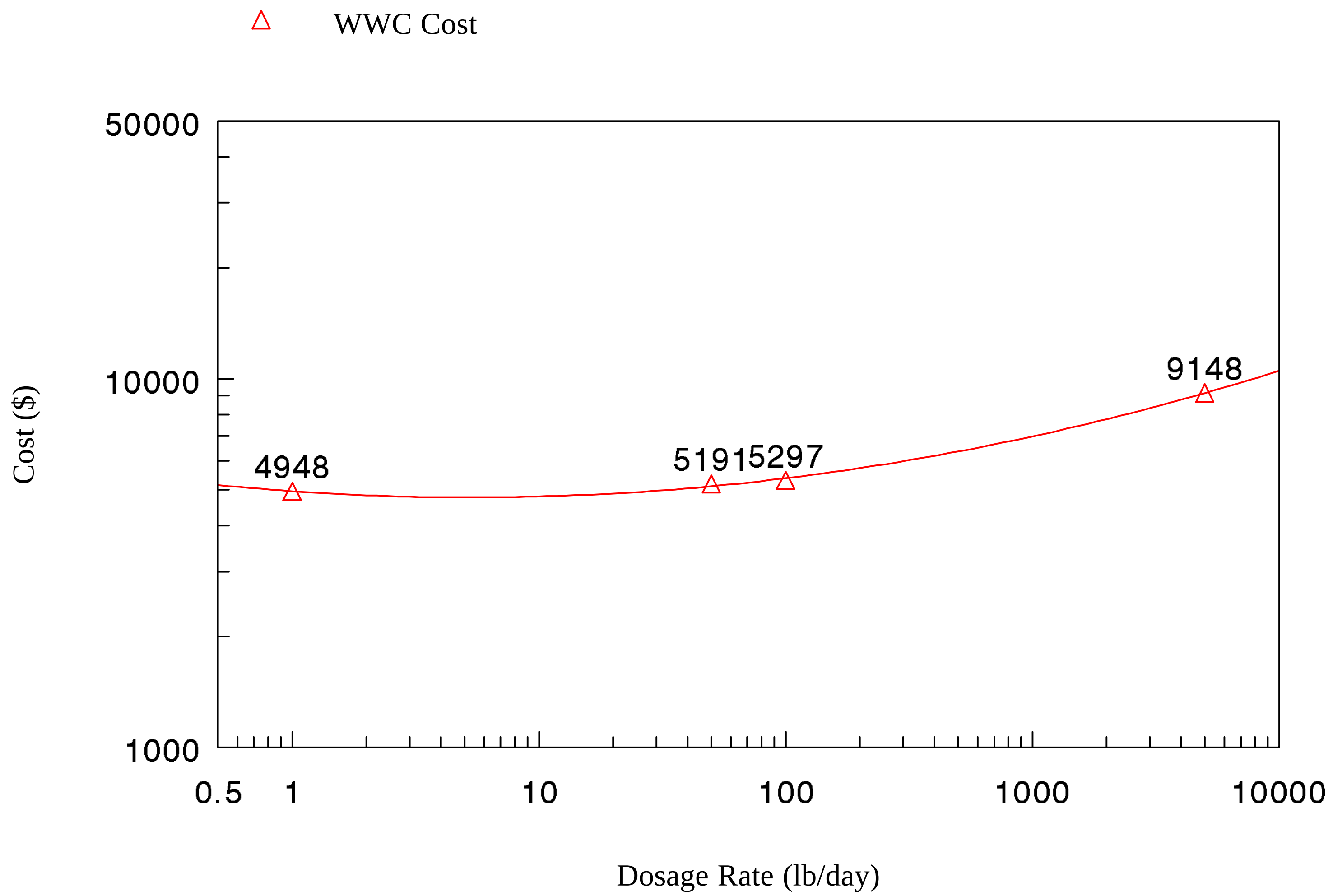


Figure 7-3
Sodium Hydroxide O&M Cost Curve



ferric chloride feed systems are based upon the calculated dosage and are presented as Equations 7-3 and 7-4, respectively.

$$\ln(Y) = 11.199 - 0.136\ln(X) + 0.054\ln(X)^2 \quad (7\text{-}3)$$

$$\ln(Y) = 8.808 - 0.408\ln(X) + 0.074\ln(X)^2 \quad (7\text{-}4)$$

where:

X = Dosage Rate (lb/hr), and

Y = Cost (1992 $)

Figures 7-4 and 7-5 graphically present the ferric chloride feed system capital and O&M cost curves, respectively. Costs for ferric chloride feed facilities are based on storage and feeding a 43 percent solution of ferric chloride with a weight of 12 pounds per gallon (5.2 lbs dry ferric chloride/gallon). The solution is stored in covered fiberglass reinforced polyester tanks designed to hold a 15 day supply. Cost estimates include dual-head metering pumps (one standby) with materials suitable for ferric chloride and 150 feet of stainless steel pipe and associated valves. Automatic or feed back controls are excluded.

Sodium Bisulfite Feed Systems

Sodium bisulfite feed systems were costed using the WWC unit process 42. Costs were based upon a stoichiometric requirement of 2.81 mg/l of sodium bisulfite per 1 mg/l of total chromium. The capital and O&M cost curves developed for sodium bisulfite feed systems are based upon the calculated dosage and are presented as Equations 7-7 and 7-8, respectively.

$$\ln(Y) = 10.822452 - 0.010997\ln(X) + 0.038691\ln(X)^2 \quad (7\text{-}7)$$

$$\ln(Y) = 8.418772 + 0.51824\ln(X) + 0.039838\ln(X)^2 \quad (7\text{-}8)$$

where:

X = Dosage Rate (lb/hr), and

Y = Cost (1992 $)

Figure 7-4

Ferric Chloride Capital Cost Curve

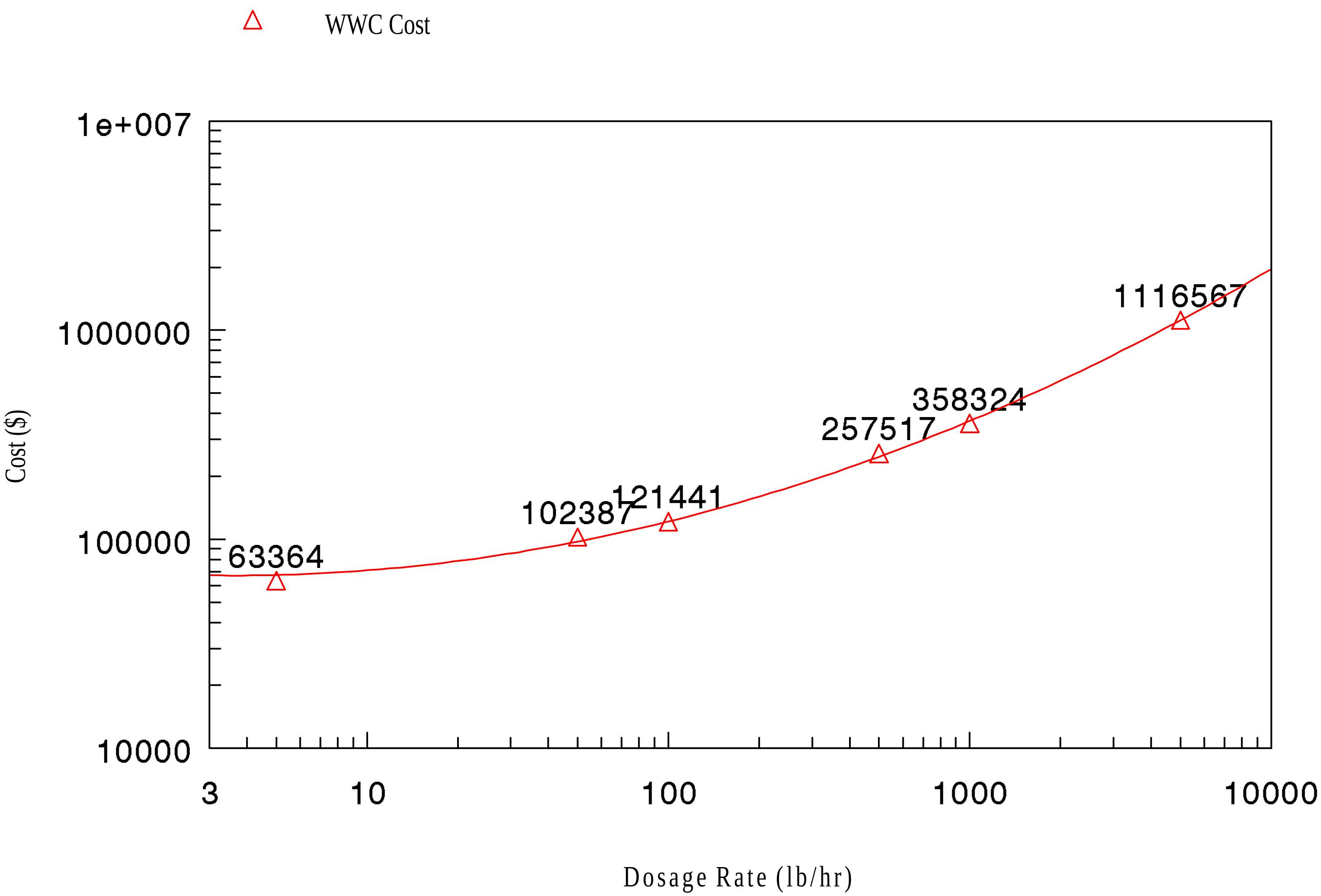
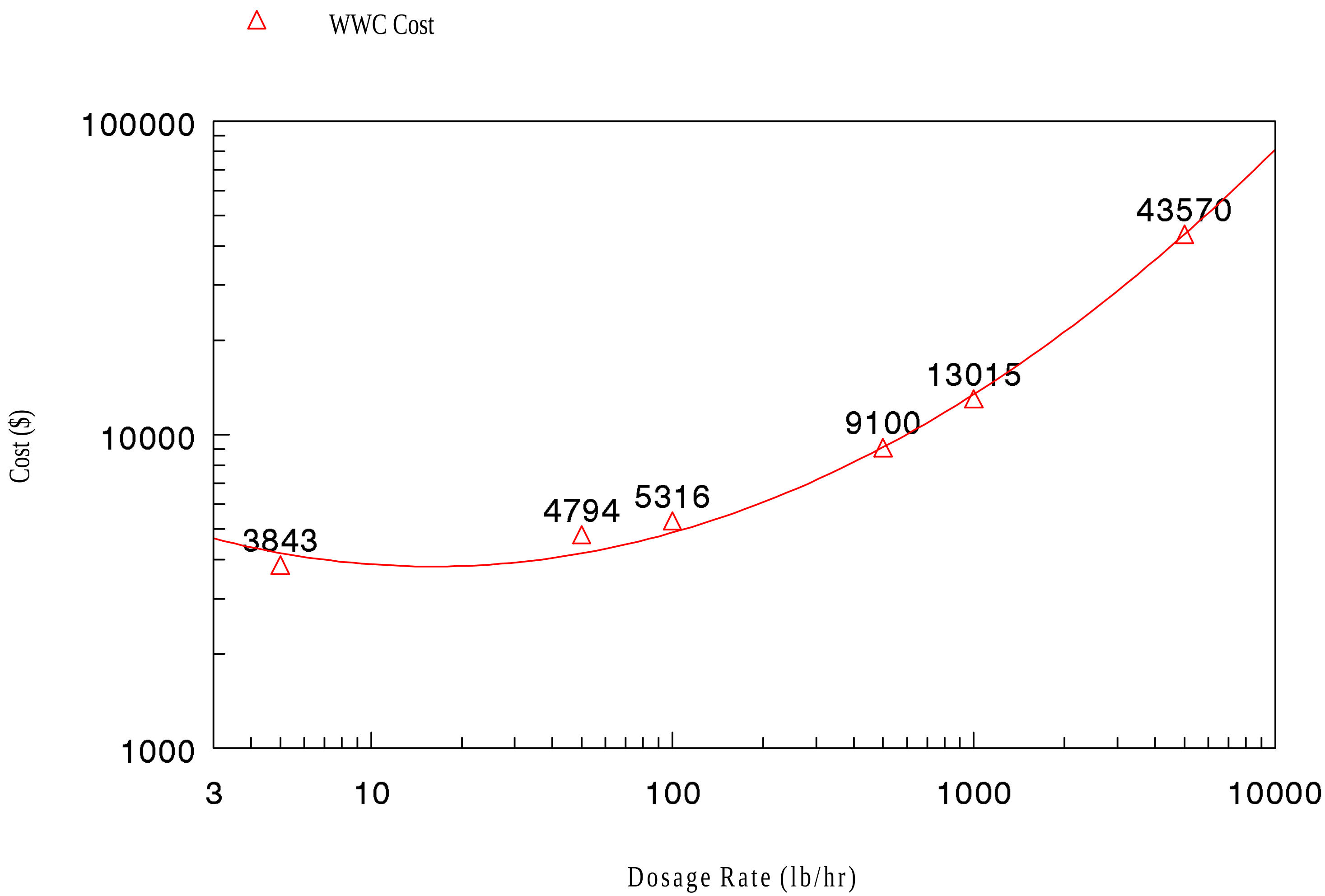


Figure 7-5

Ferric Chloride O&M Cost Curve



Figures 7-6 and 7-7 graphically present the sodium bisulfite feed system capital and O&M cost curves, respectively.

A 5 minute detention period is provided in the dissolving tank. Fifteen days of storage is included using mild steel storage hoppers which are located indoors. Sodium bisulfite is conveyed pneumatically from bulk delivery trucks to the hoppers, with the blower located on the delivery truck. Hopper costs include dust collectors. Bag loaders are used on the feeder in systems too small for bulk systems. Volumetric feeders are used for all installations. Solution tanks are located directly beneath the storage hoppers. Conveyance from the solution tanks to the point of application is by dual-head diaphragm metering pumps.

Hydrochloric Acid Feed Systems

Hydrochloric acid is necessary to neutralize the waste stream or adjust the waste stream for chemical treatment. The amount necessary was calculated using the following equation.

$$mg/L\ H_2SO_4 = (10^{-initial\ pOH} - 10^{-final\ pOH})(\frac{mol\ OH^-}{1L})(\frac{1\ mol\ H_2SO_4}{2\ mol\ H^+})(\frac{98{,}000\ mg}{1\ mol\ H_2SO_4})$$

To allow for solution buffering, 10 percent excess acid was added.

Hydrochloric acid feed systems were costed using the WWC unit process 46. The capital and O&M cost curves developed for hydrochloric acid feed systems, based upon the calculated feed rate, are presented as Equations 7-9 and 7-10, respectively.

$$\ln(Y) = 10.431273 - 0.196812\ln(X) + 0.044247\ln(X)^2 \qquad (7\text{-}9)$$

$$\ln(Y) = 7.630396 + 0.312305\ln(X) - 0.002419\ln(X)^2 \qquad (7\text{-}10)$$

where:

X = Feed Rate (gpd), and

Y = Cost (1992 $)

Figures 7-8 and 7-9 graphically present the hydrochloric acid feed system capital and O&M cost curves, respectively.

Figure 7-6

Sodium Bisulfite Capital Cost Curve

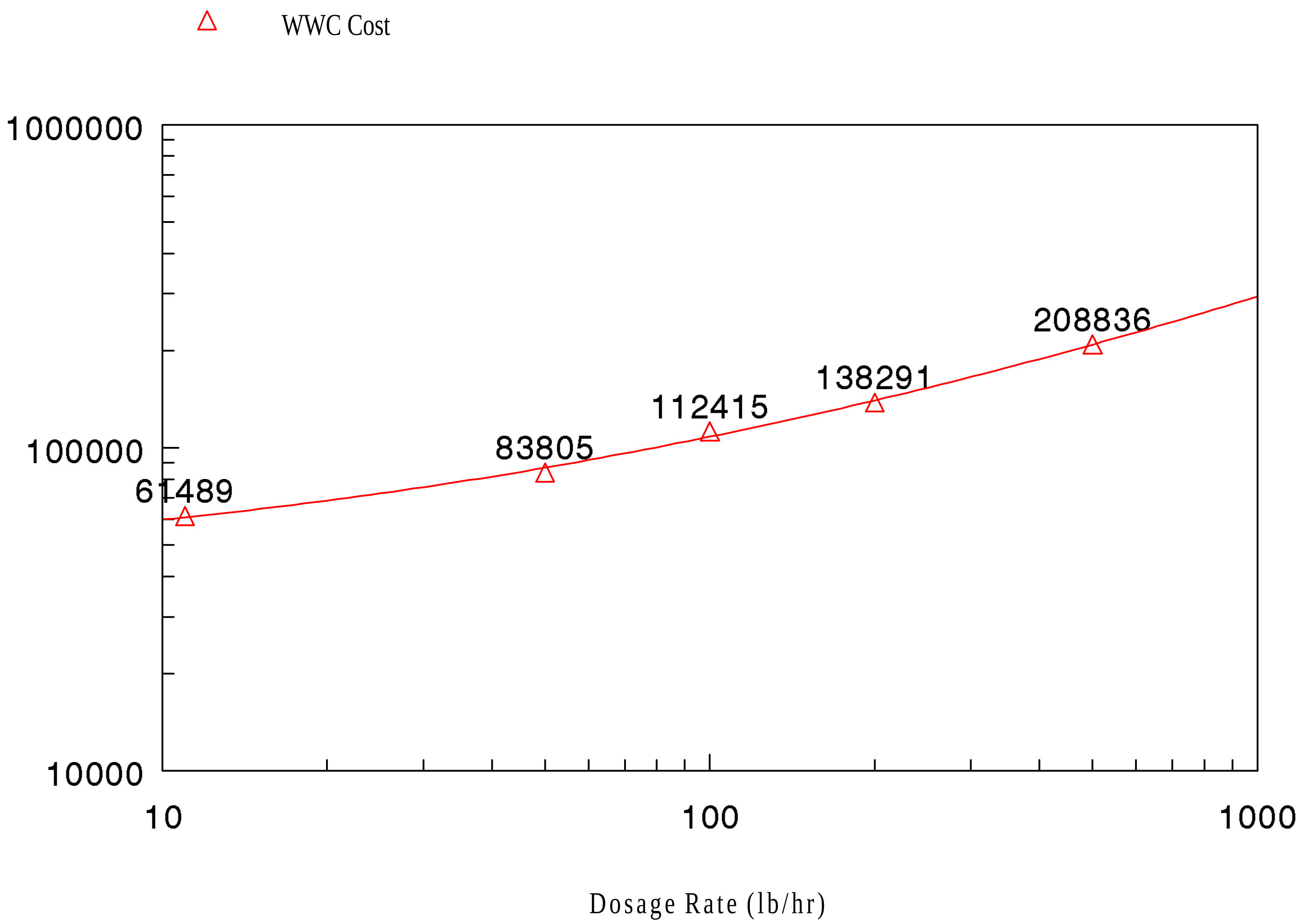


Figure 7-7

Sodium Bisulfite O&M Cost Curve

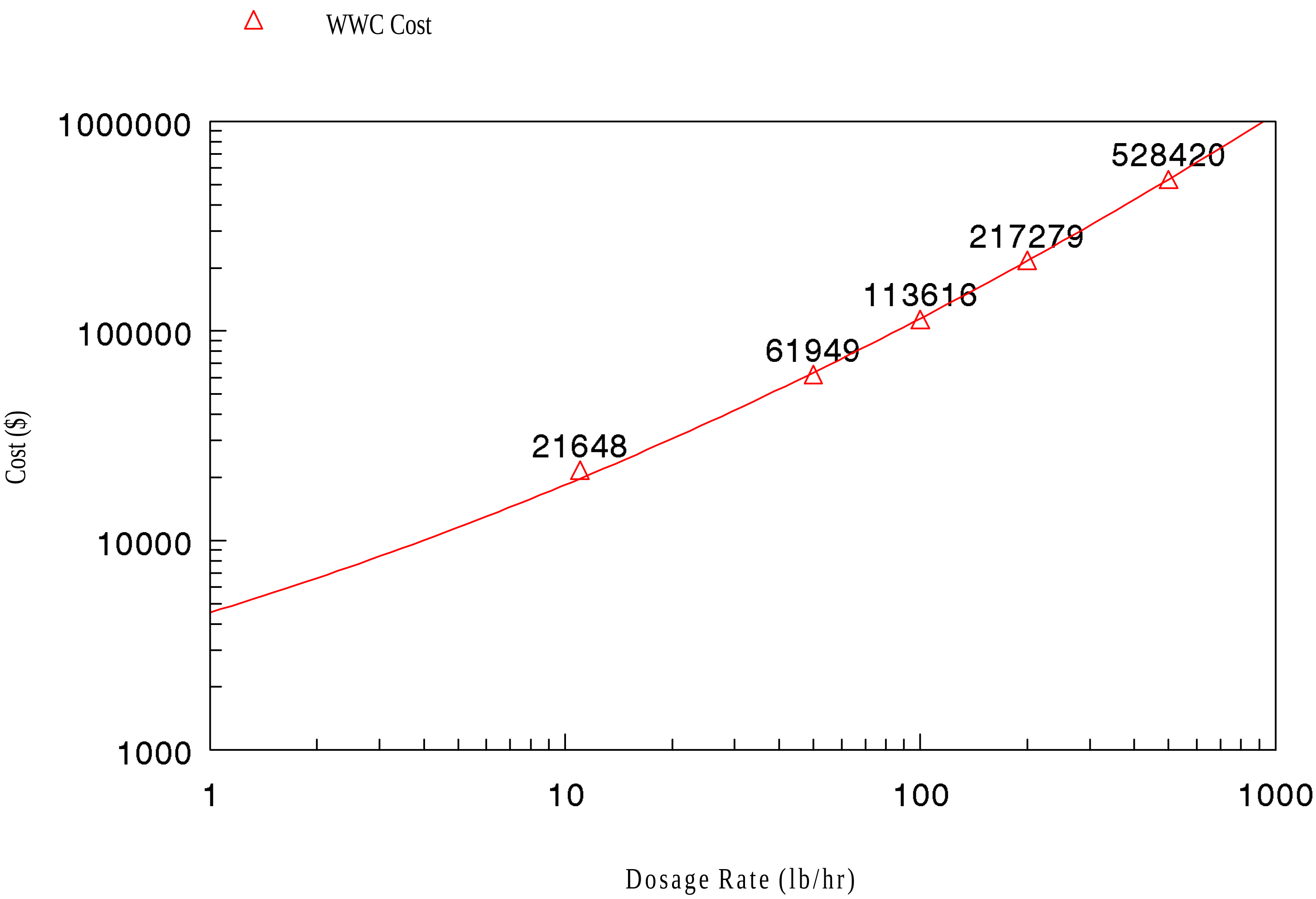


Figure 7-8
Hydrochloric Acid Capital Cost Curve

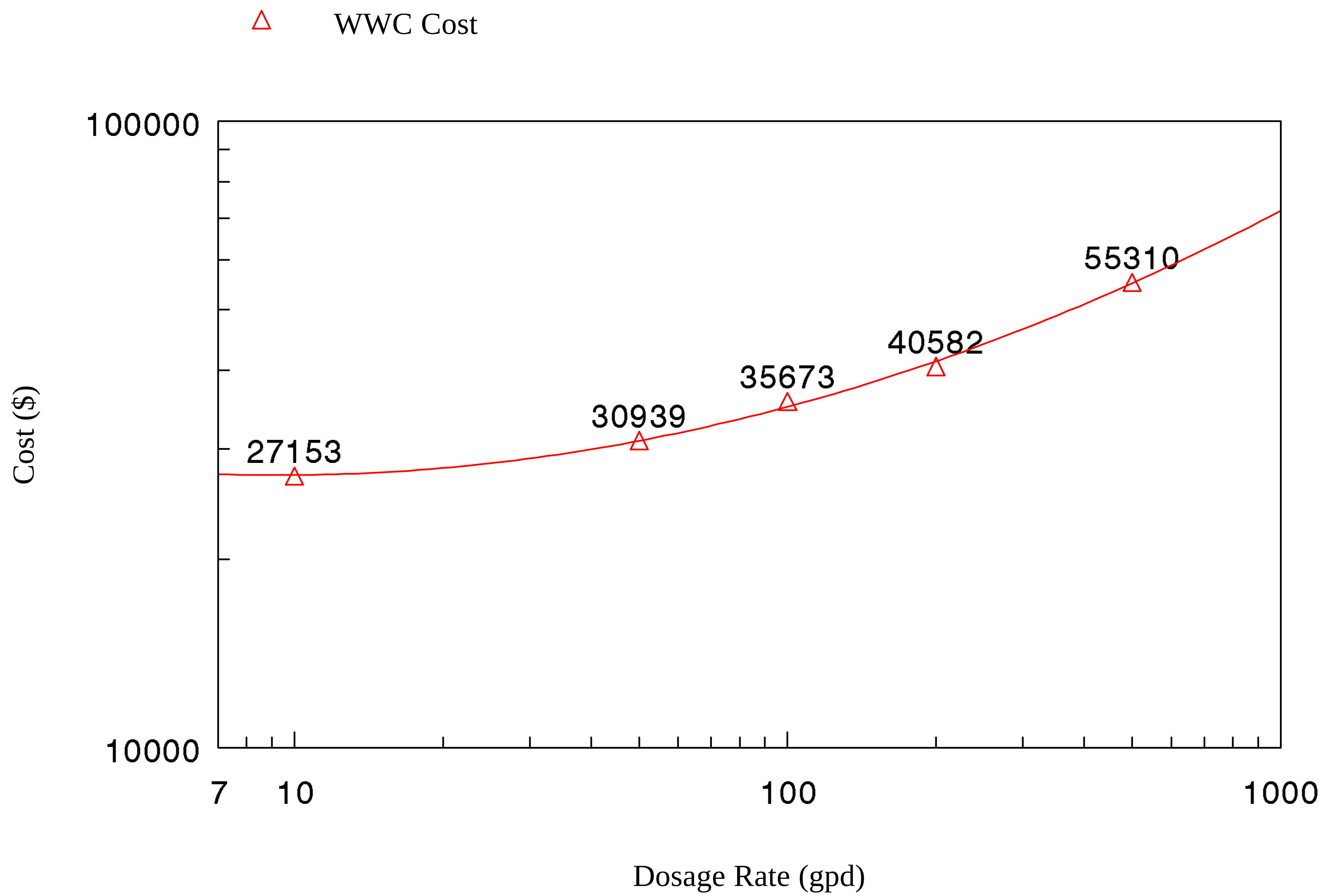
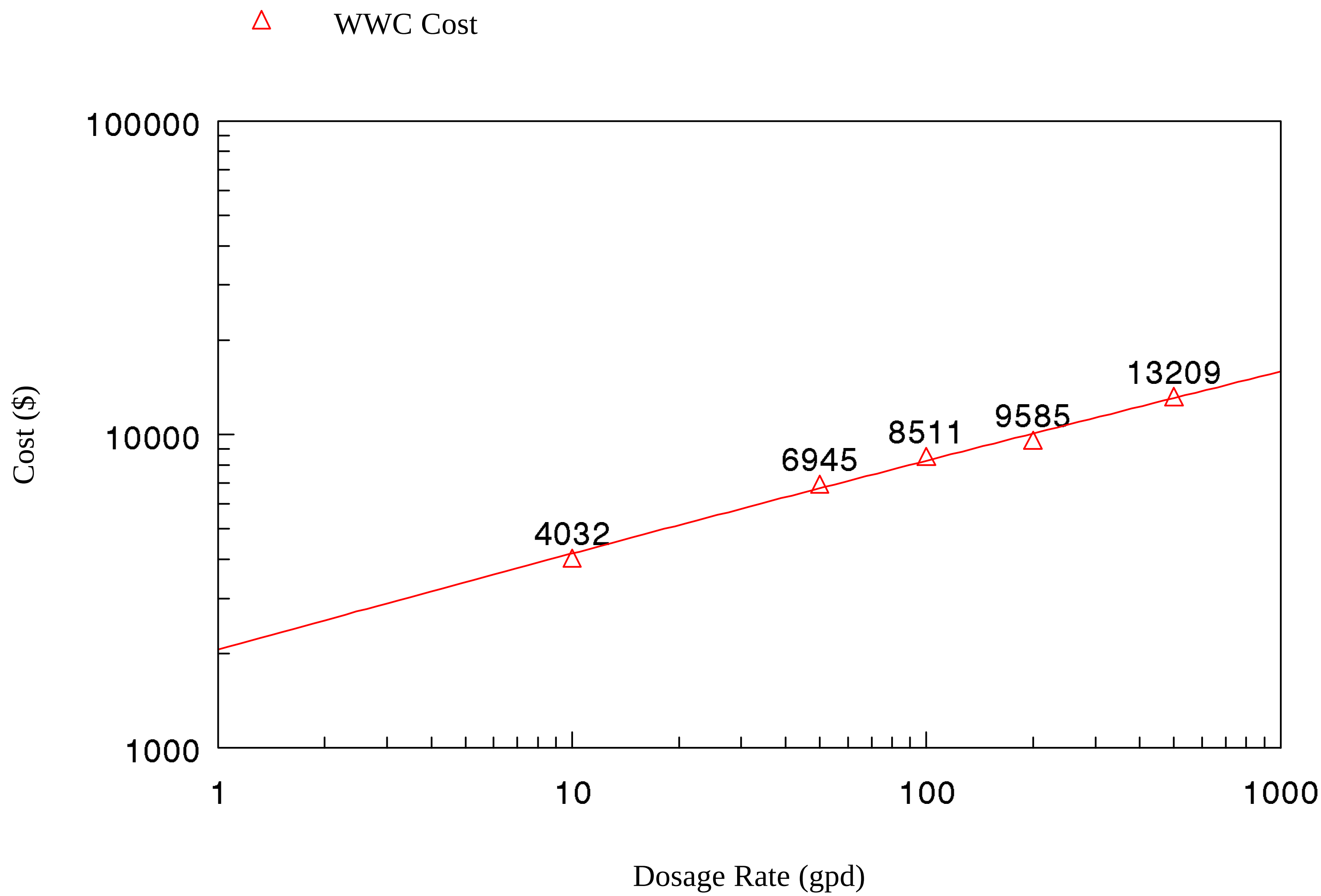


Figure 7-9
Hydrochloric Acid O&M Cost Curve



Costs are based on systems capable of metering concentrated acid from a storage tank directly to the point of application. For feed rates up to up to 200 gpd, the concentrated acid is delivered in drums and stored indoors. At higher flow rates, the acid is delivered in bulk and stored outdoors in fiberglass reinforced polyester tanks. Acid is stored for 15 days, and a standby metering pump is included for all installations.

Polymer Feed Systems

WWC unit process 34 was used to cost for polymer feed systems. Polymer dosage rate in lb/hr was calculated based upon a target concentration of 2 mg/l using the facility's flow rate. Although this module is designed to cost for a liquid alum feed system, costs generated by this module were determined to be more reasonable and accurate in developing polymer system costs than the WWC unit process 43 for polymer feed systems. The capital and O&M unloaded cost curves developed for polymer feed systems are presented as Equations 7-11 and 7-12, respectively.

$$\ln(Y) = 10.539595 - 0.13771\ln(X) + 0.052403\ln(X)^2 \qquad (7\text{-}11)$$

$$\ln(Y) = 9.900596 + 0.99703\ln(X) + 0.00019\ln(X)^2 \qquad (7\text{-}12)$$

where:

X = Dosage Rate (lb/hr), and

Y = Cost (1992 $)

Figures 7-10 and 7-11 graphically present the polymer feed system capital and O&M cost curves, respectively.

Polymer is stored for 15 days in fiberglass reinforced polyester tanks. For smaller installations, the tanks are located indoors and left uncovered, and for larger installations the tanks are covered and vented, with insulation and heating provided. Dual-head metering pumps deliver the polymer from the storage tank and meter the flow to the point of application. Feed costs include 150 feet of 316 stainless steel pipe, along with fittings and valves, for each metering pump. A standby metering pump is included for each installation.

Figure 7-10
Polymer Feed Capital Cost Curve

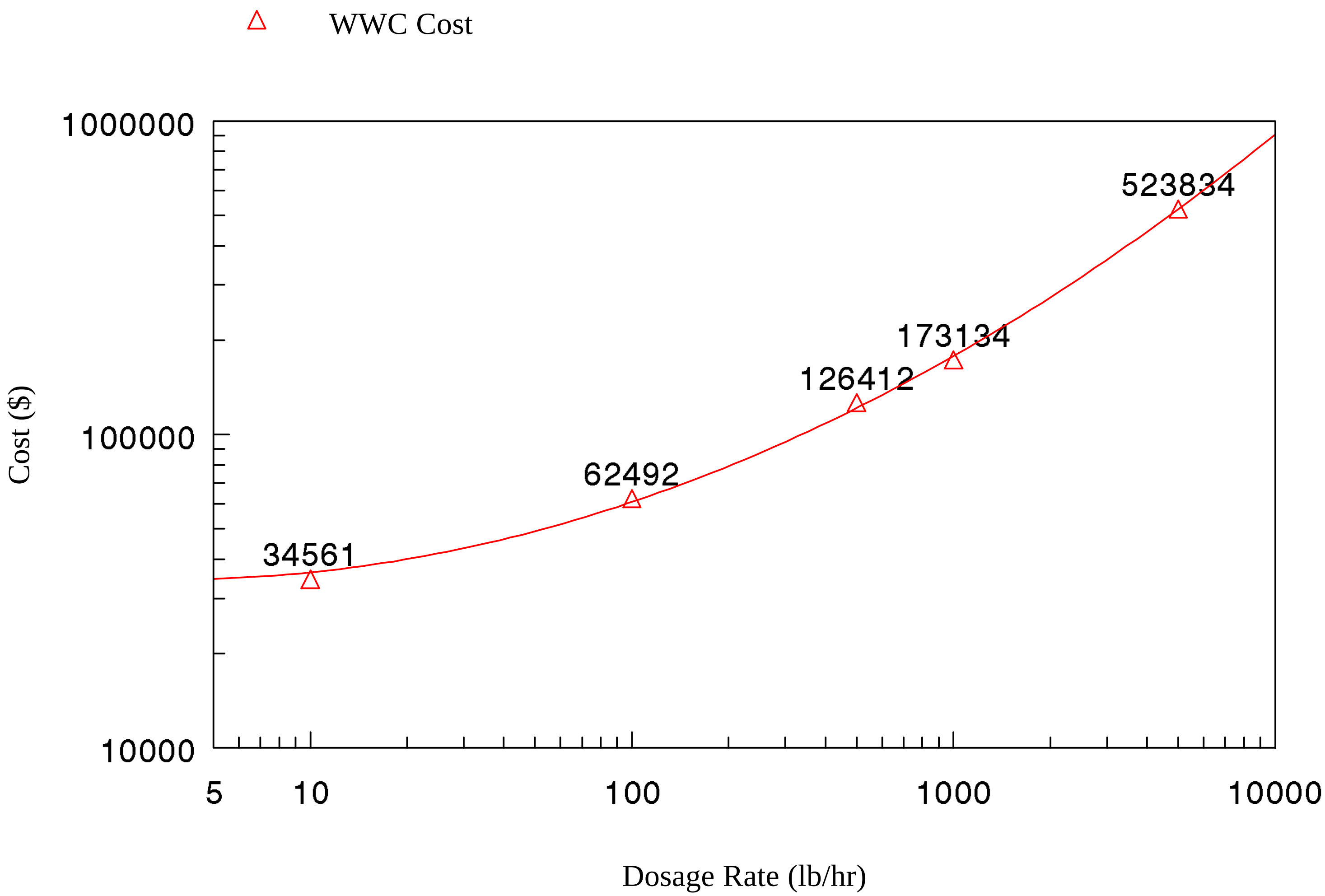
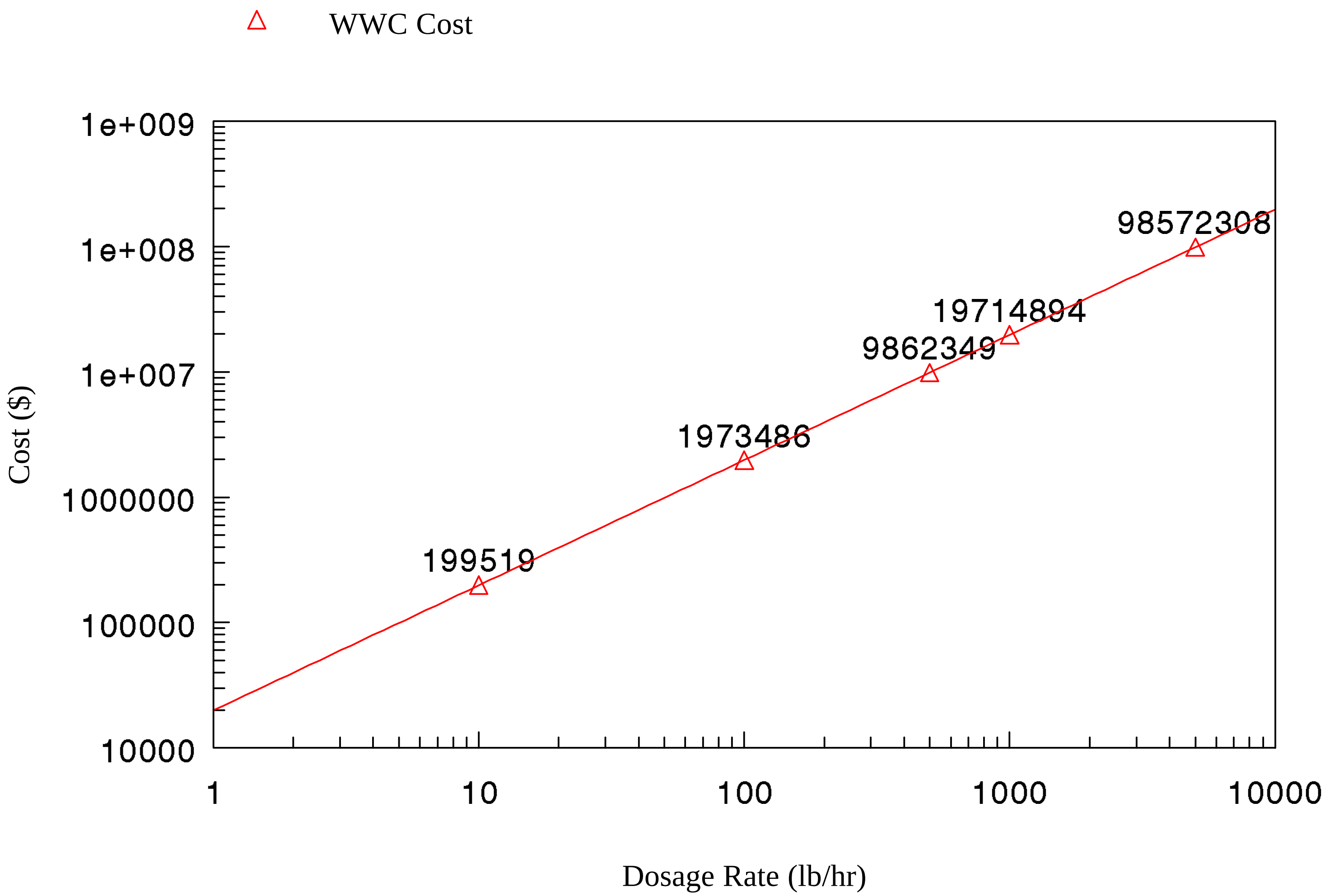


Figure 7-11
Polymer Feed O&M Cost Curve



7.3.1.2 Pumping

Wastewater pumping costs were estimated using WWC unit process 92, and are based on flow rate. The capital and O&M cost curves developed for pumping are presented as Equations 7-13 and 7-14, respectively.

$$\ln(Y) = 10.048 + 0.167\ln(X) - 0.001\ln(X)^2 \quad (7\text{-}13)$$

$$\ln(Y) = 7.499 + 0.024\ln(X) + 0.0429\ln(X)^2 \quad (7\text{-}14)$$

where:

X = Flow Rate (gpm), and

Y = Cost (1992 $)

Figures 7-12 and 7-13 graphically present the pumping capital and O&M cost curves, respectively.

7.3.1.3 Rapid Mix Tanks

Capital and O&M costs for rapid mix tanks were estimated using the WWC unit process 104 and are based on reinforced concrete basins. The capital and O&M cost curves developed for rapid mix tanks based upon flow rate are presented as Equations 7-15 and 7-16, respectively.

$$\ln(Y) = 12.234467 - 0.677898\ln(X) + 0.078143\ln(X)^2 \quad (7\text{-}15)$$

$$\ln(Y) = 10.730231 + 0.614141\ln(X) + 0.083221\ln(X)^2 \quad (7\text{-}16)$$

where:

X = Flow Rate (MGD), and

Y = Cost (1992 $)

Figures 7-14 and 7-15 graphically present the rapid mix tank capital and O&M cost curves, respectively.

Common wall construction is assumed for multiple basins. Costs include vertical shaft, variable speed turbine mixers with 304 stainless steel shafts, paddles, and motors. Costs are based

Figure 7-12

Wastewater Pumping Capital Cost Curve

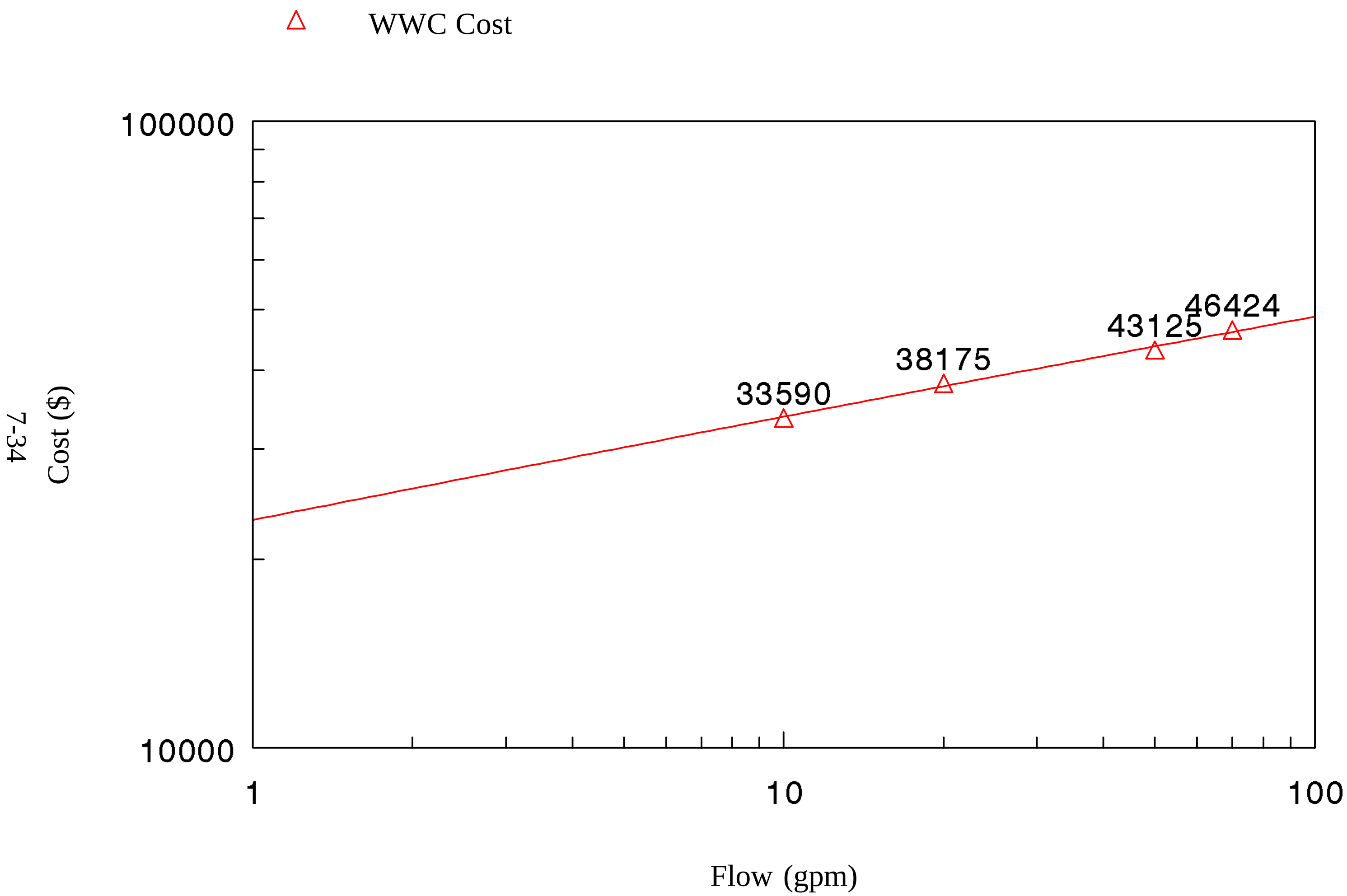


Figure 7-13
Wastewater Pumping O&M Cost Curve

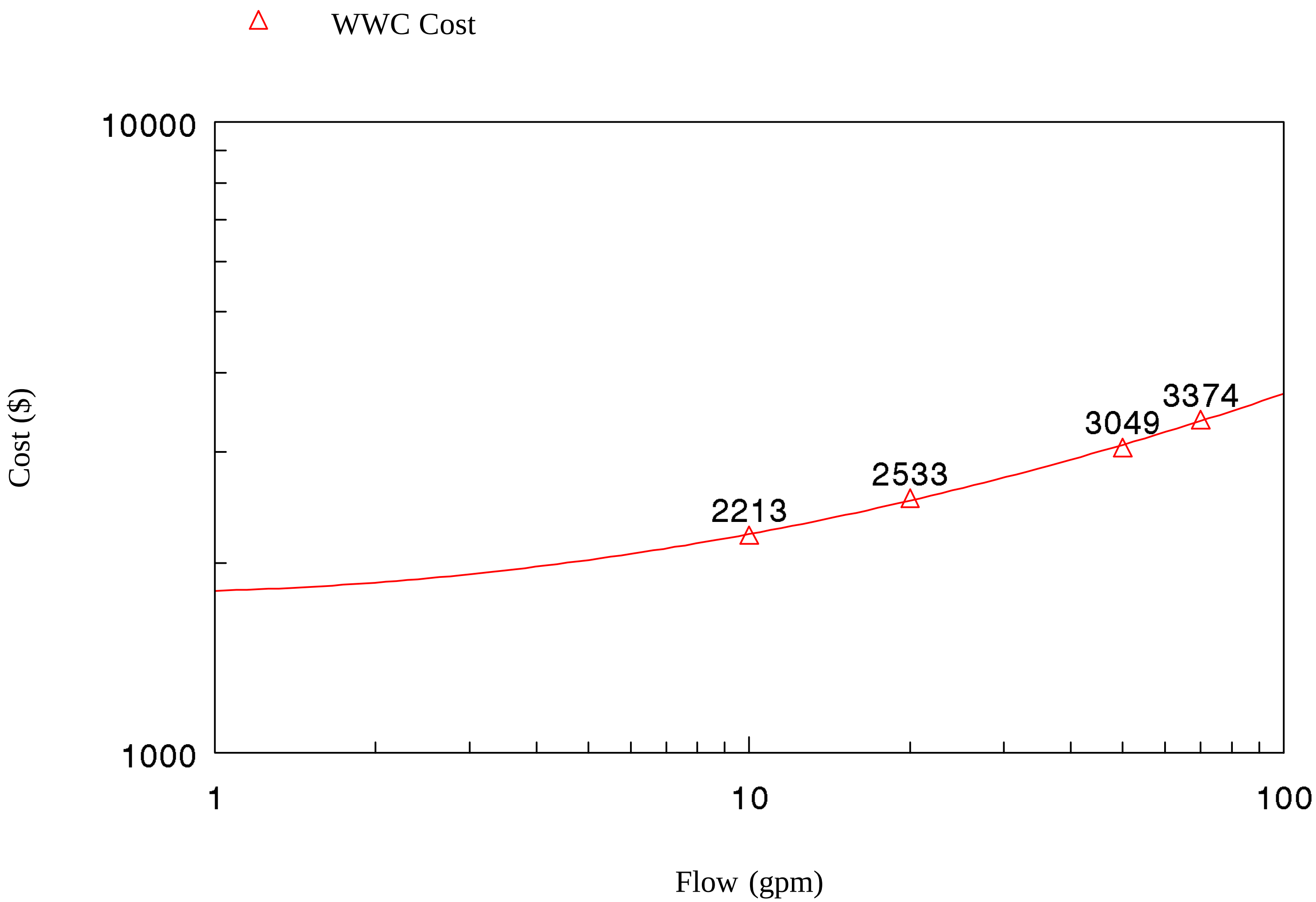


Figure 7-14

Mix Tank Capital Cost Curve

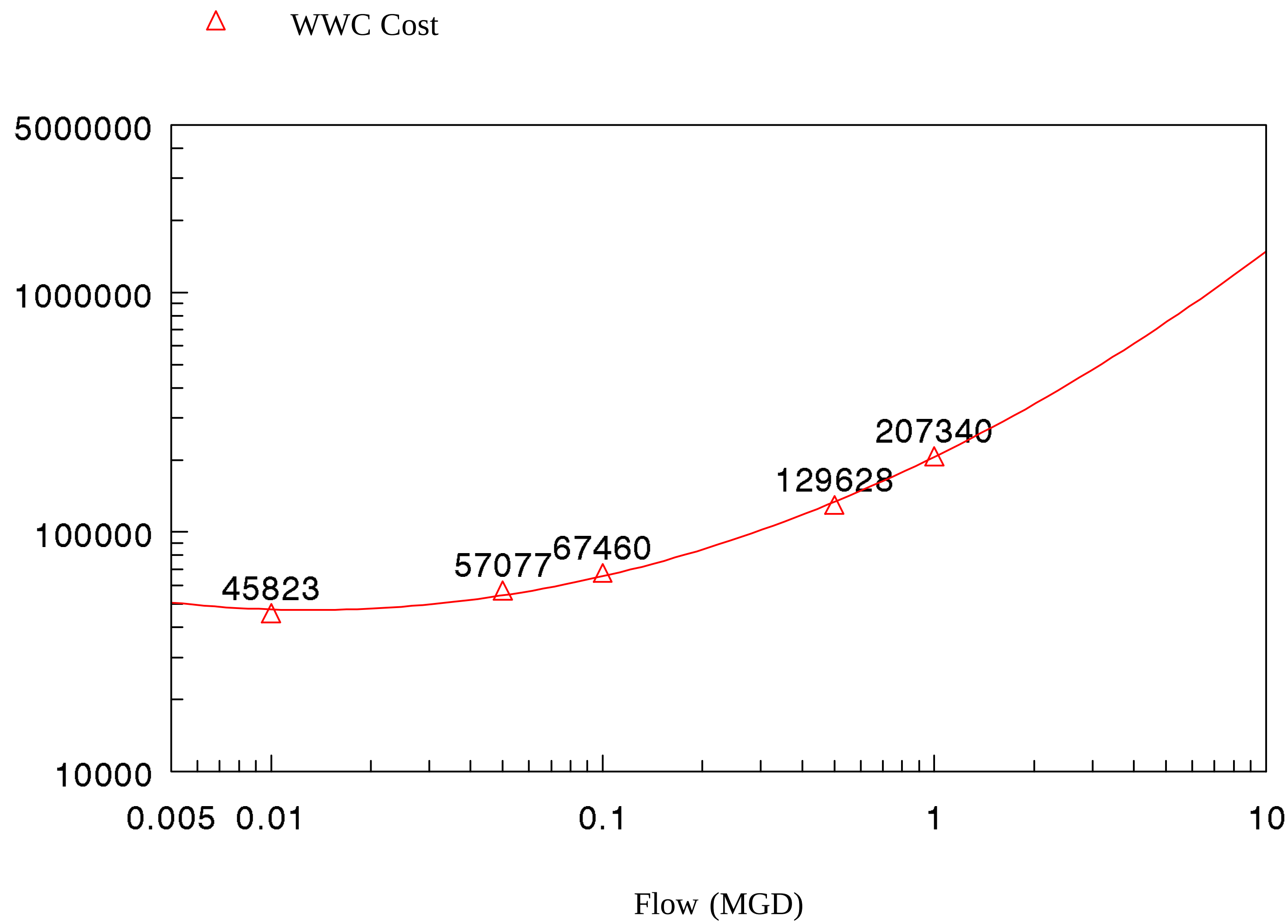
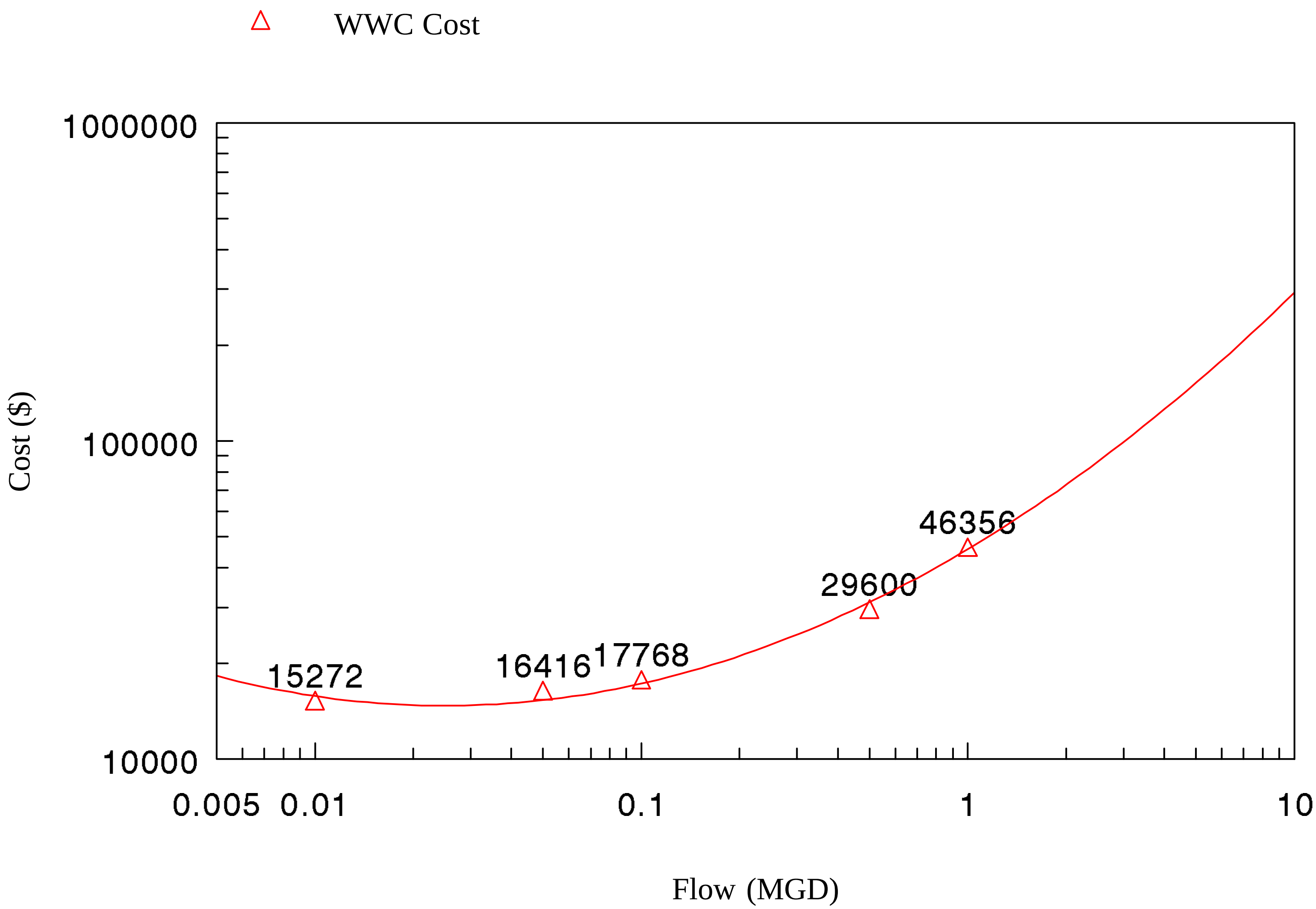


Figure 7-15
Mix Tank O&M Cost Curve



on a G value (G is the mean temporal velocity gradient which describes the degree of mixing; i.e., the greater the value of G the greater the degree of mixing) of 300 (3 ft-lbs/sec/cu. ft.) and a water temperature of 15°C. The energy requirements are a function of G value, water temperature, and an overall mechanism efficiency of 70 percent.

7.3.1.4 Flocculation

A cost curve was developed for flocculation using the WWC cost program. WWC unit process 72 was used. Costs for flocculation were based upon a function of flow at a hydraulic detention time of 20 minutes. The capital and O&M cost curves developed for flocculation are presented as Equations 7-17 and 7-18, respectively.

$$\ln(Y) = 11.744579 + 0.633178\ln(X) - 0.015585\ln(X)^2 \qquad (7\text{-}17)$$

$$\ln(Y) = 8.817304 + 0.533382\ln(X) + 0.002427\ln(X)^2 \qquad (7\text{-}18)$$

where:

X = Flow Rate (MGD), and

Y = Cost (1992 $)

Figures 7-16 and 7-17 graphically present the flocculation capital and O&M cost curves, respectively. Cost estimates for flocculation basins are based on rectangular-shaped, reinforced concrete structures with a depth of 12 feet and length-to-width ratio of 4:1. Horizontal paddle flocculators were used in costing because they are less expensive and more efficient. Manufactured equipment costs are based on a G value (G is the mean temporal velocity gradient which describes the degree of mixing; i.e., the greater the value of G the greater the degree of mixing) of 80. Cost estimates for drive units are based on variable speed drives for maximum flexibility, and although common drives for two or more parallel basins are often utilized, the costs are based on individual drives for each basin.

Energy requirements are based on a G value 80 and an overall motor/mechanism efficiency of 60 percent. Labor requirements are based on routine operation and maintenance of 15 min/day/basin and a 4 hour oil change every 6 months.

Figure 7-16
Flocculation Capital Cost Curve

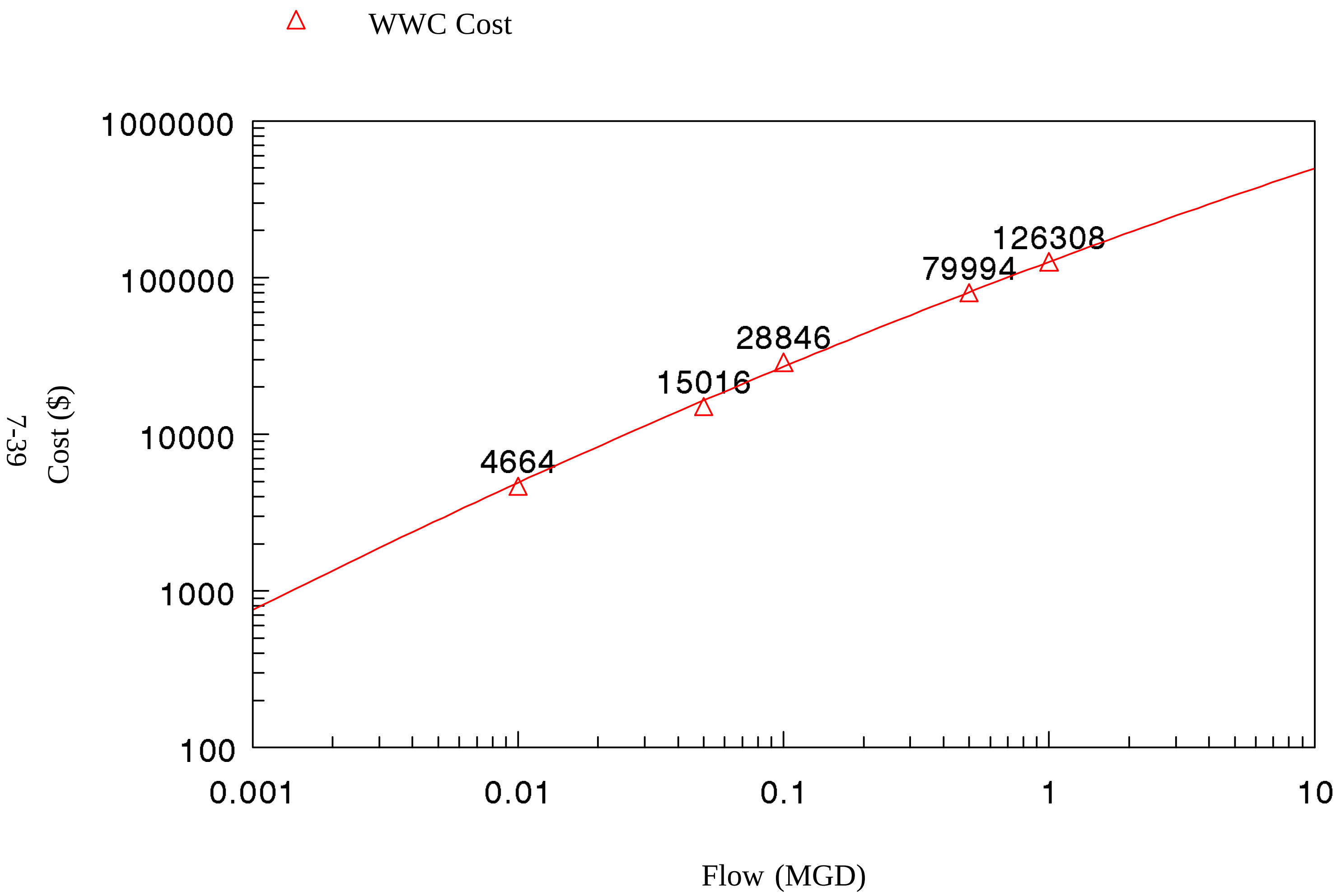
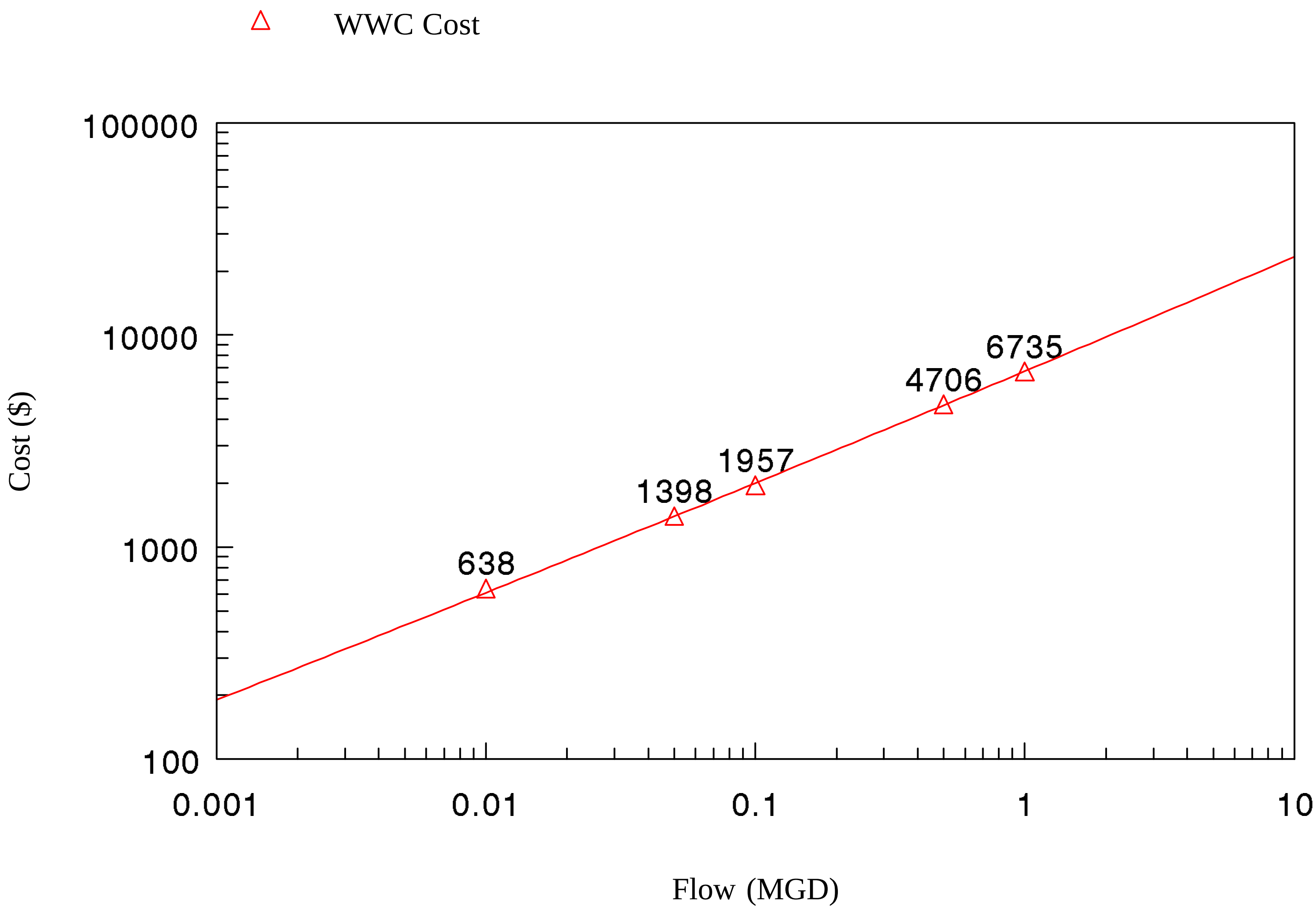


Figure 7-17
Flocculation O&M Cost Curve



7.3.1.5 Primary Clarification

Cost curves were developed for primary clarification using the WWC cost program. WWC unit process 118 for a rectangular basin with a 12 foot side wall depth was used . Costs for primary clarification were based upon a function of flow rate, using an overflow rate of 900 gallons per day per square feet in calculating tank size. The capital and O&M cost curves developed for primary clarification are presented as Equations 7-19 and 7-20, respectively.

$$\ln(Y) = 12.517967 + 0.575652\ln(X) + 0.009396\ln(X)^2 \quad (7\text{-}19)$$

$$\ln(Y) = 10.011664 + 0.268272\ln(X) + 0.00241\ln(X)^2 \quad (7\text{-}20)$$

where:

X = Flow Rate (MGD), and

Y = Cost (1992 $)

Figures 7-18 and 7-19 graphically present the primary clarification capital and O&M cost curves, respectively.

Estimated costs are based on rectangular basins with a 12 foot side water depth (SWD), and chain and flight sludge collectors. Costs for the structure assumed common wall construction, and include the chain and flight collector, collector drive mechanism, weirs, the reinforced concrete structure complete with inlet and outlet troughs, a sludge sump, and sludge withdrawal piping.

7.3.1.6 Secondary Clarification

Cost curves were developed for secondary clarification using the WWC cost program. WWC unit process 118 for a rectangular basin with a 12 foot side wall depth, and chain and flight collectors was used. Costs for secondary clarification were based upon a function of flow rate, using an overflow rate of 600 gallons per day per square feet in calculating tank size. The capital and O&M cost curves developed for secondary clarification are presented as Equations 7-21 and 7-22, respectively.

Figure 7-18

Primary Clarifier Capital Cost Curve

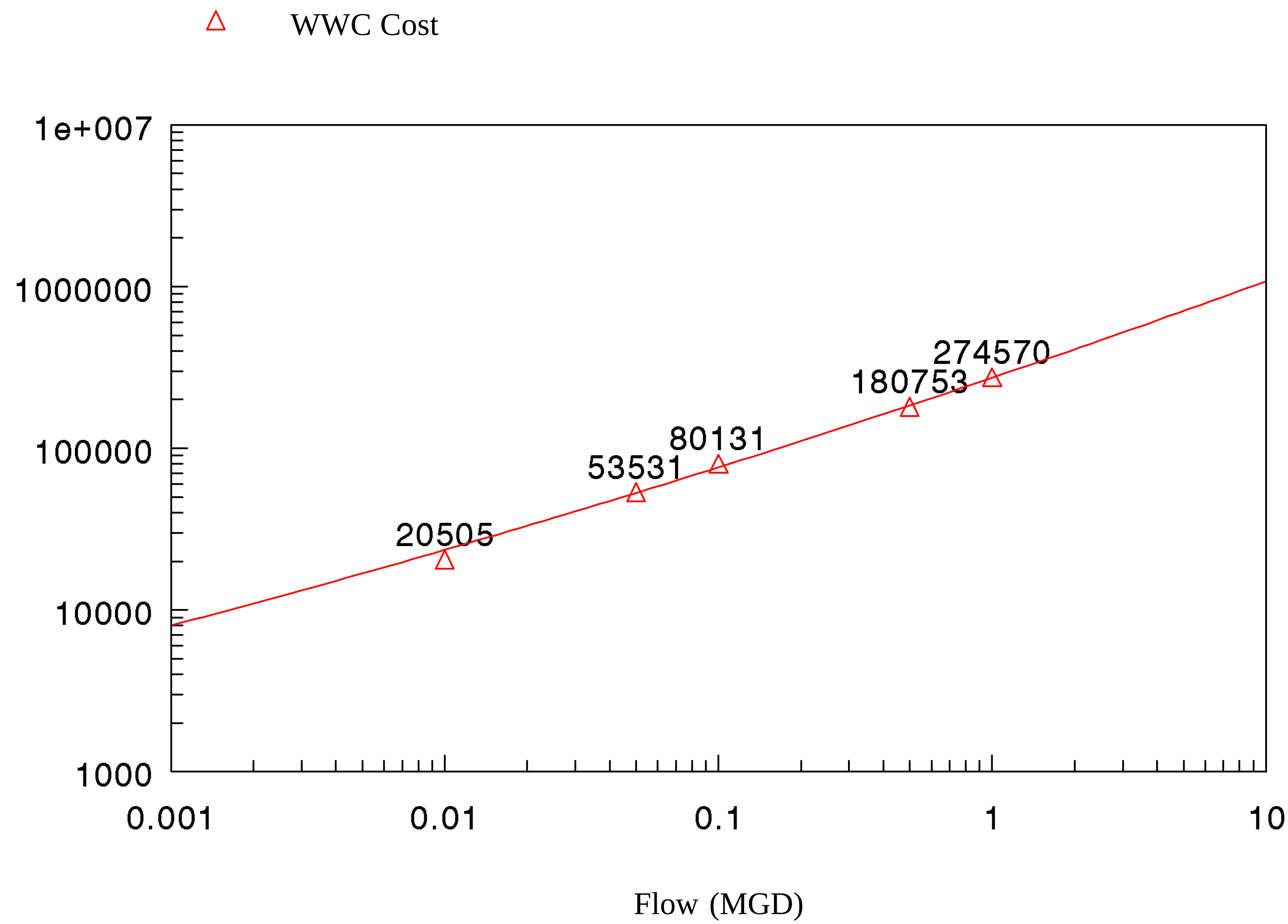
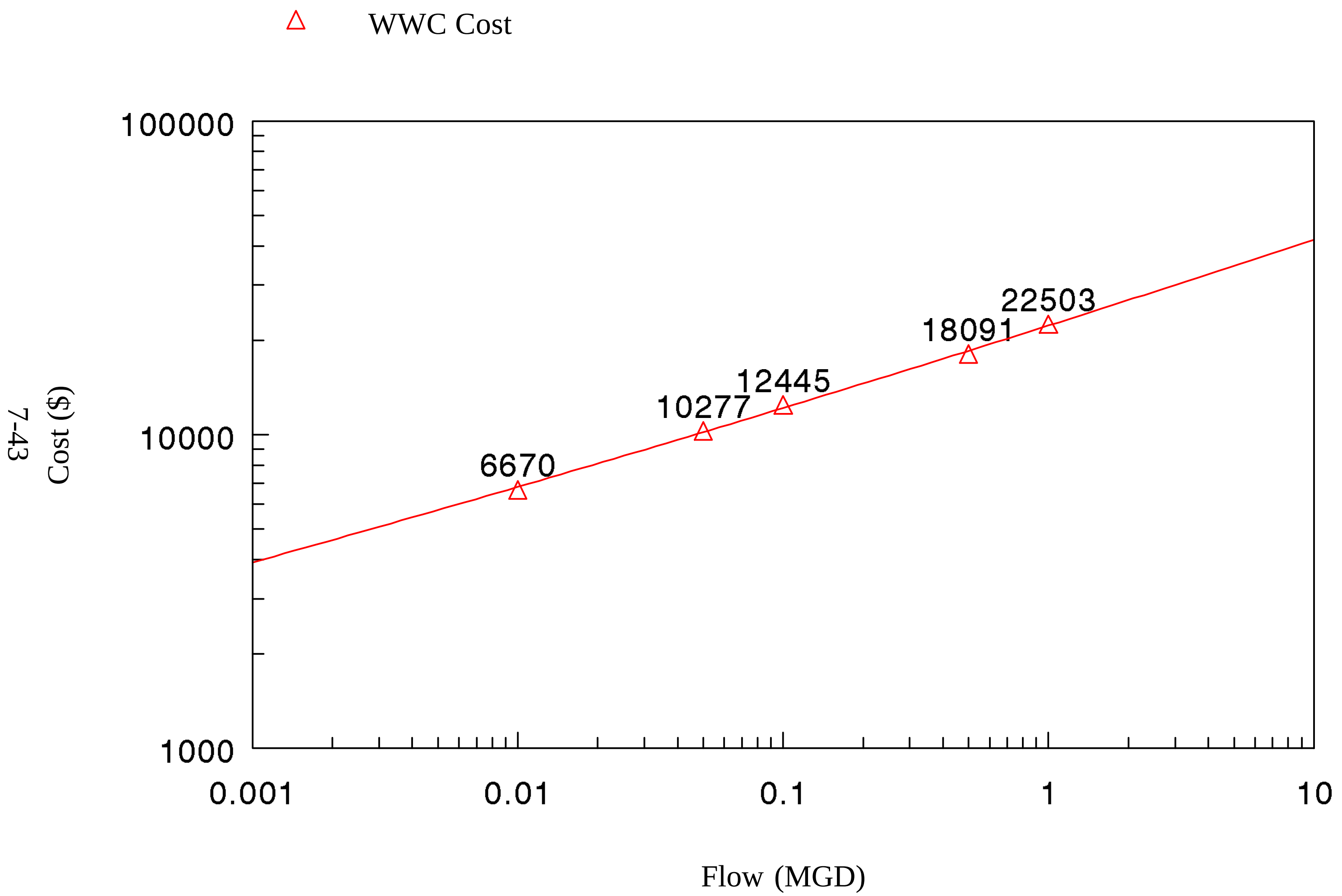


Figure 7-19

Primary Clarifier O&M Cost Curve



$$\ln(Y) = 12.834601 + 0.688675\ln(X) + 0.035432\ln(X)^2 \quad (7\text{-}21)$$

$$\ln(Y) = 10.197762 + 0.339952\ln(X) + 0.015822\ln(X)^2 \quad (7\text{-}22)$$

where:

X = Flow Rate (MGD), and

Y = Cost (1992 $)

Figures 7-20 and 7-21 graphically present the secondary clarification capital and O&M cost curves, respectively. Costs for the structure assumed common wall construction, and include the chain and flight collector, collector drive mechanism, weirs, the reinforced concrete structure complete with inlet and outlet troughs, a sludge sump, and sludge withdrawal piping. Yard piping to and from the clarifier is not included in the above costs, but accounted for by the engineering cost factors.

7.3.1.7 Multimedia Filtration

A capital cost curve, as a function of flow rate, was developed for a multimedia filtration system using vendor supplied quotes. The cost curve used in this study was developed as part of the CWT effluent guidelines effort. The capital cost curve developed for multimedia filtration is presented as Equation 7-23.

$$\ln(Y) = 12.265 + 0.658\ln(X) + 0.036\ln(X)^2 \quad (7\text{-}23)$$

where:

X = Flow Rate (MGD), and

Y = Capital Cost (1992 $)

O&M costs for filter operation were estimated as 50 percent of the capital cost. Figure 7-22 graphically presents the multimedia filtration capital cost curve.

The total capital costs for the multimedia filtration systems represent equipment and installation costs. The total construction cost includes the costs of the filter, instrumentation and

Figure 7-20

Secondary Clarifier Capital Cost Curve

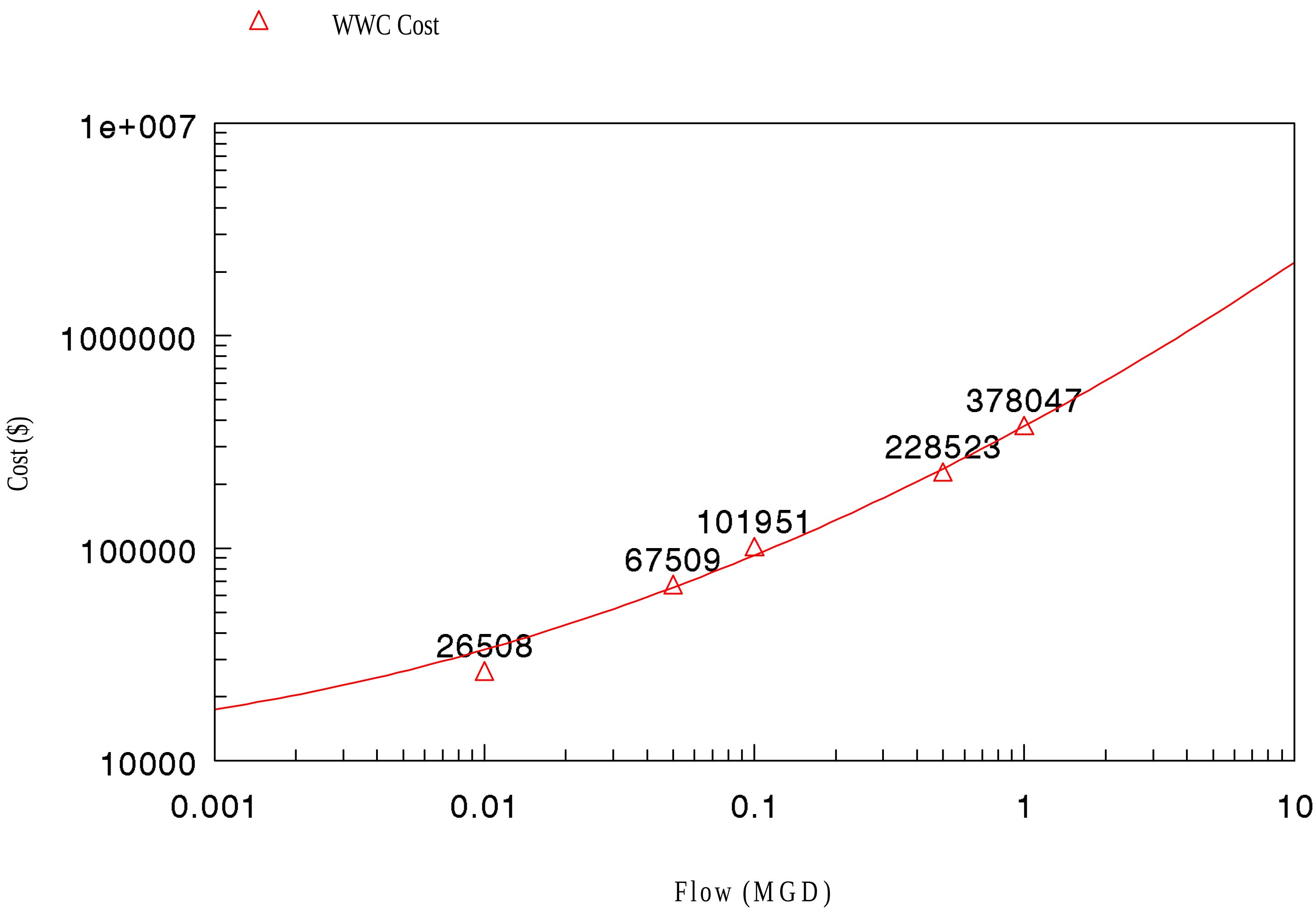


Figure 7-21

Secondary Clarifier O&M Cost Curve

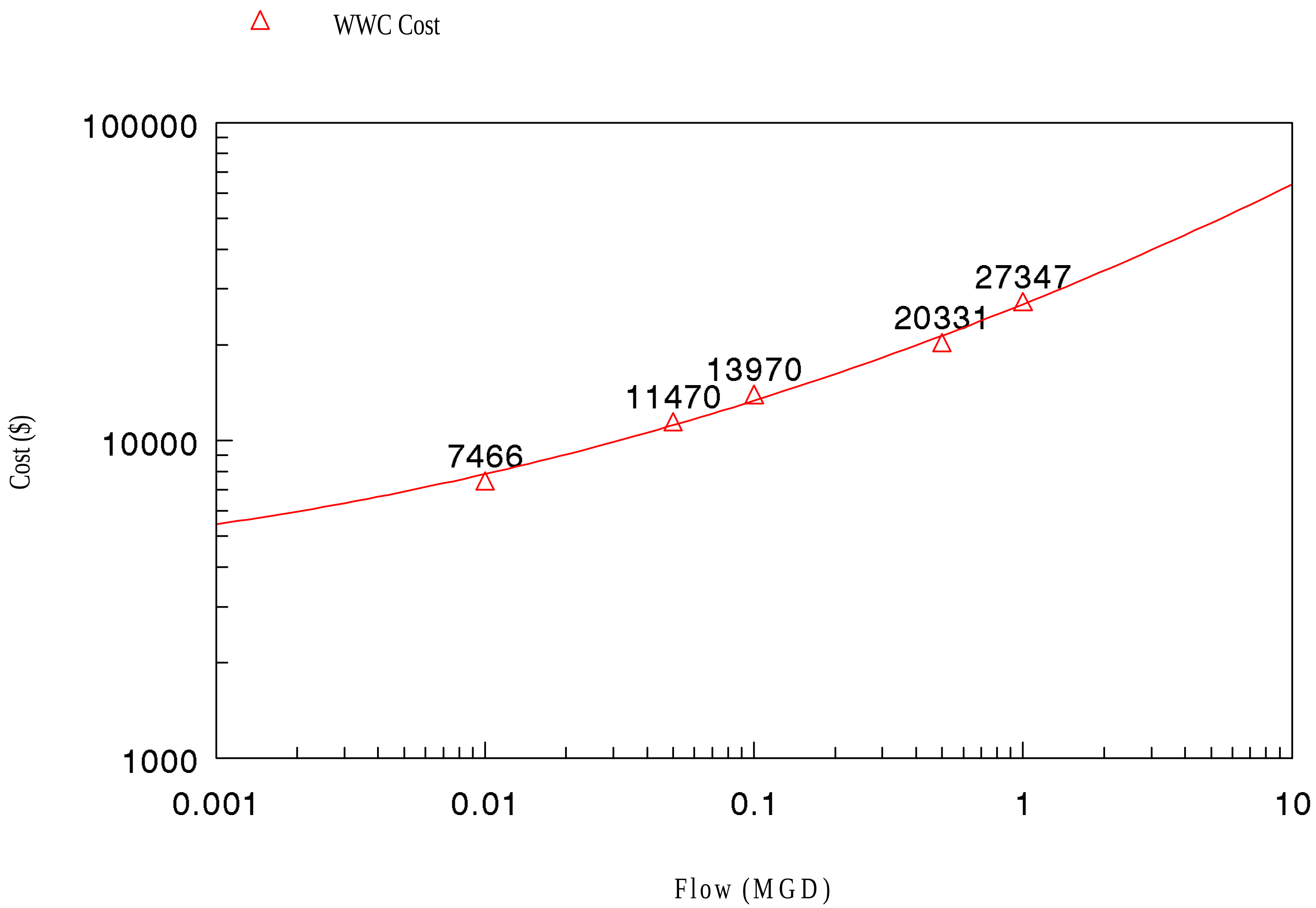
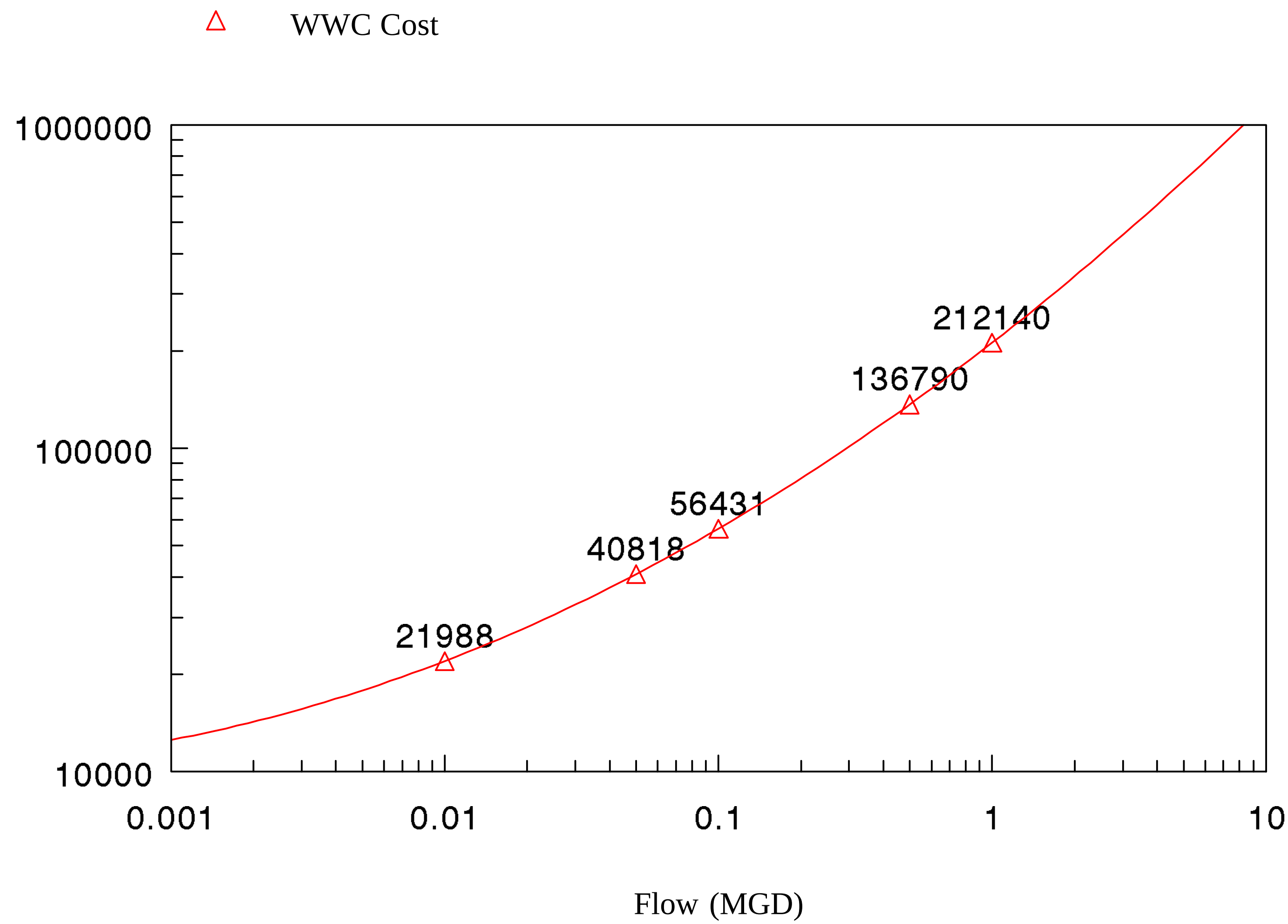


Figure 7-22

Multimedia Filtration Capital Cost Curve



controls, pumps, piping, and installation. The operation and maintenance costs include energy usage, maintenance, labor, taxes, and insurance.

7.3.2 *Sludge Treatment and Disposal*

The method of developing sludge treatment and disposal costs are presented in the following sections.

7.3.2.1 Plate and Frame Pressure Filtration

Regulatory costs for sludge dewatering were developed using cost curves from the CWT effluent guideline effort. Costs are for a sludge dewatering system using a plate and frame pressure filter, and are based upon flow rate. Only facilities without installed sludge treatment were costed.

The capital and O&M cost curves developed for a plate and frame filter press sludge dewatering are presented as Equations 7-24 and 7-25, respectively.

$$\ln(Y) = 15.022877 + 1.1199216\ln(X) + 0.063001\ln(X)^2 \quad (7\text{-}24)$$

$$\ln(Y) = 12.52046 + 0.713233\ln(X) + 0.066701\ln(X)^2 \quad (7\text{-}25)$$

where:

X = Flow (MGD), and

Y = Cost (1992 $)

Figures 7-23 and 7-24 graphically present the plate and frame sludge dewatering capital and O&M cost curves, respectively. For facilities with a flow rate of less than 1,500 gallons per day, the O&M costs were estimated as 50 percent of the capital cost.

The components of the plate and frame pressure filtration system include: filter plates, filter cloth, hydraulic pumps, pneumatic booster pumps, control panel, connector pipes, and support platform. Equipment and operational costs were obtained from manufacturers' recommendations. The capital cost equation was developed by adding installation, engineering, and contingency costs to the vendors' equipment costs. The O&M costs were based on estimated electricity usage,

Figure 7-23

Sludge Dewatering Capital Cost Curve

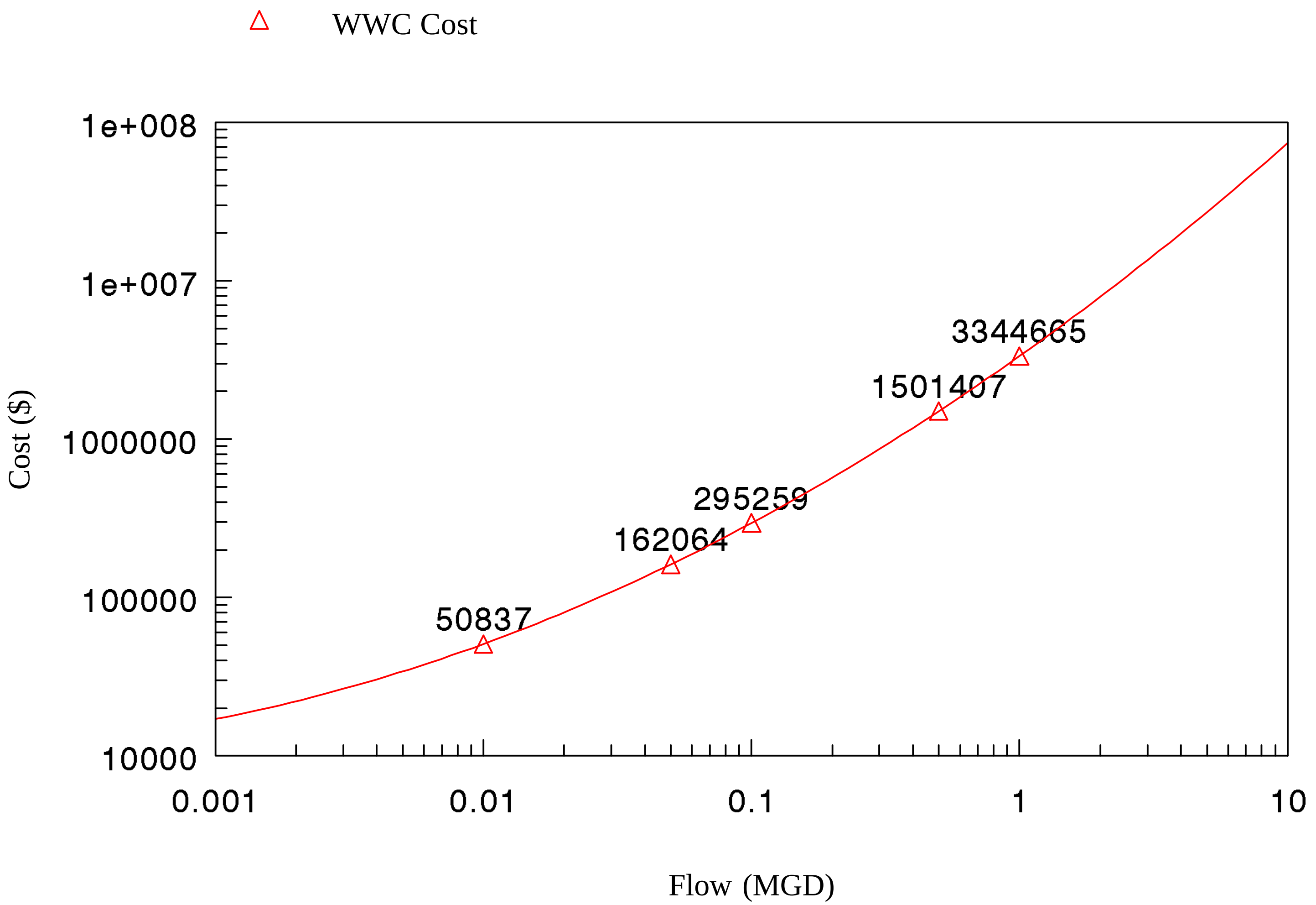
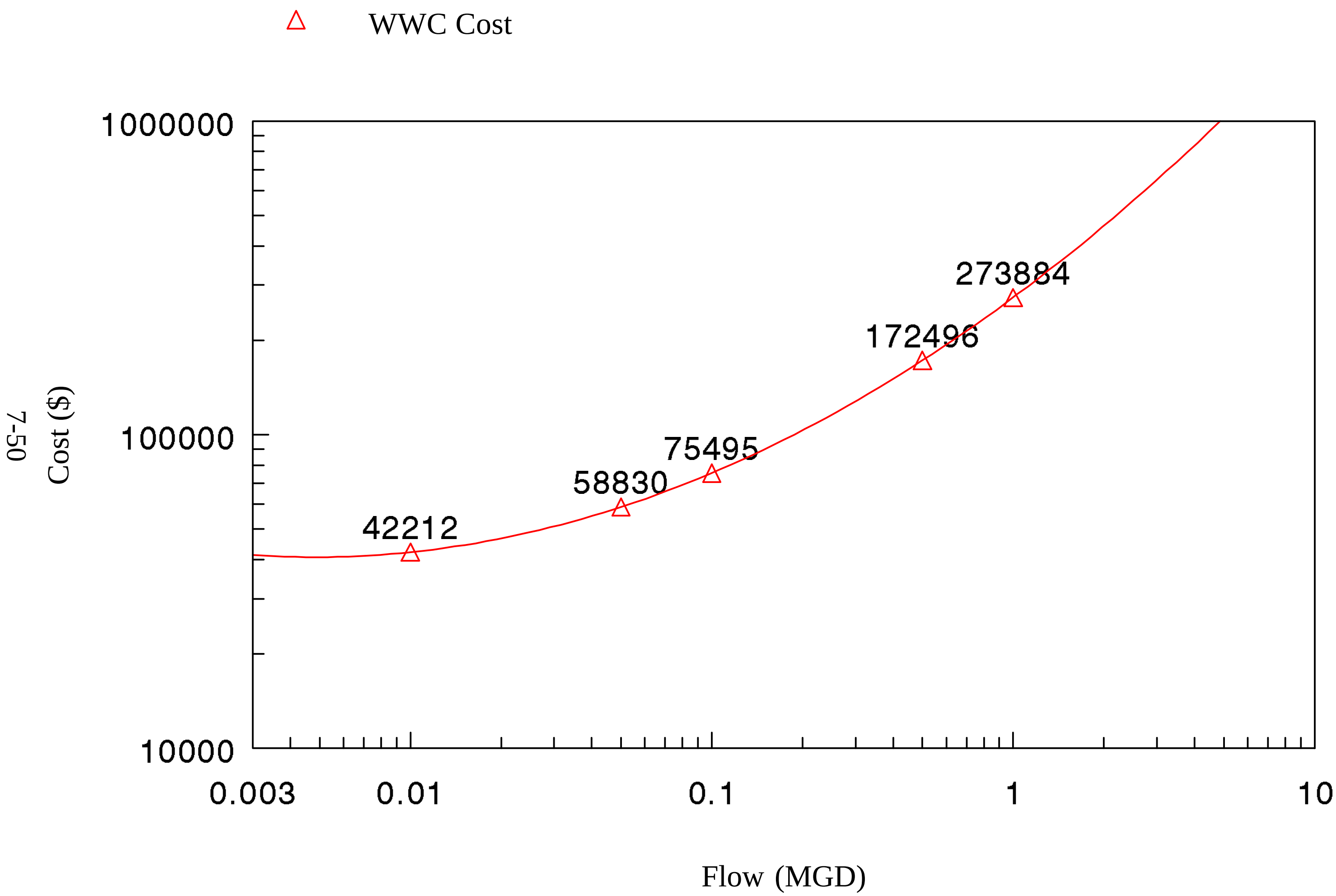


Figure 7-24
Sludge Dewatering O&M Cost Curve



maintenance, labor, taxes and insurance, and filter cake disposal costs. The labor requirement for the plate and frame pressure filtration system was approximated at 30 minutes per cycle per filter press.

7.3.2.2 Filter Cake Disposal Costs

Filter cake was costed for off-site disposal at a landfill. A facility's filter cake generation was calculated using the difference between the facility's loadings and allowable effluent concentration. A facility's total influent loading was calculated by taking the sum of the average metals and TSS concentrations multiplied by the baseline flow. Effluent concentrations were developed similarly using the LTAs for each option. Then, the sludge generation in the treatment system was calculated as the influent loading minus the amount in effluent loading, converted to an annual amount (lbs/yr). The amount of treatment chemicals added to the system (based upon BPT/PSES option) was also included in the calculation of sludge generation. The amount of total sludge generated in the treatment system was then converted to a wet weight basis assuming 35 percent solids filter cake. Off-site disposal costs were estimated at $0.19/lb and was based upon the medium cost reported by IWC facilities in questionnaire responses. This cost includes transportation, handling, conditioning, and disposal of the cake. Costs are based upon a filter cake of 35 percent solids.

7.4 *ADDITIONAL COSTS*

In order to complete the costing for each proposed regulatory option, costs other than treatment component costs were developed. These additional costs are required in order to accommodate for other costs associated with the development of the guideline. The following additional costs were included in the total guideline option costs for each facility, as needed:

- retrofit
- monitoring
- RCRA permit modifications
- land costs

Each of these additional costs are further discussed and defined in the following sections. Total facility compliance costs under each proposed BPT/BAT and PSES option were developed by adding individual treatment technology costs with these additional costs.

Final capital costs developed for each facility were then amortized using a 7 percent interest rate over 15 years. This annualized capital cost was then added to the annual O&M cost to develop a total annual cost for each guideline option.

7.4.1 *Retrofit and Upgrade Costs*

A retrofit cost factor was applied when additional equipment or processes were needed to be added to existing systems. Retrofit costs cover the need for system modifications and components, such as piping, valves, controls, etc., which are necessary in order to connect new treatment units and processes to an existing treatment facility. An upgrade cost factor was also applied to allow for existing treatment systems to be enhanced to provide sufficient treatment capability. The combined retrofit and upgrade cost factor was estimated at 25 percent of the installed capital cost of the equipment.

7.4.2 *Land Costs*

Land costs provide for the value of the land requirements needed for the installation of the proposed treatment technology. Land costs were estimated based upon the expected land requirements for the proposed new treatment units. Land size increments of either 0.5, 1 or 2 acres were used depending on the expected size of the required treatment system.

Land costs vary greatly across the country depending upon the region and state. Therefore, a national average would not be appropriate for costing purposes. State-specific unit land costs ($/acre) were developed for each state. These state-specific unit land costs were based upon the average land costs for suburban sites in each state and were obtained from the 1990 Guide to Industrial and Real Estate Office Markets Survey. Costs were corrected to 1992 dollars using engineering cost factors.

According to the survey, unimproved sites are the most desirable location for development and are generally zoned for industrial usage. State-specific unit land costs were developed by averaging the reported unimproved site survey data for the various size ranges (zero to 10 acres, 10 to 100 acres, and greater than 100 acres). Regional averages were used for states which did not have data provided. Hawaii was not used in developing regional average costs, due to extremely high costs. Table 7-8 presents the developed state-specific unit land costs used in costing. Facility land costs in the proposed regulatory options varied from $11,500 to $237,628.

7.4.3 *RCRA Permit Modification Costs*

A cost associated with the modification of an existing RCRA Part B permit was included for all hazardous waste facilities requiring an upgrade or additional treatment processes. Legal, administrative, public relations, monitoring, and engineering fees are included in this cost. This cost was added to the installed capital for the new or modified equipment. Permit modification costs were estimated at $50,000 for the initial new or modified equipment, with an additional $10,000 for each new or modified piece of equipment. A permit modification cost of $50,000 was also provided for facilities not requiring new or modified equipment in order to allow for permit modifications due to operational changes imposed by this regulation. Facility costs for permit modification in the proposed regulatory options ranged from $50,000 to $130,000.

7.4.4 *Monitoring Costs*

Costs were developed for the monitoring of treatment system effluent. Costs were developed for both direct and indirect dischargers and were based upon the following assumptions:

- Monitoring costs are based on the number of outfalls through which wastewater is discharged. The costs associated with a single outfall is multiplied by the total number of outfalls to arrive at the total cost for a facility. The estimated monitoring costs are incremental to the costs already incurred by the facility.
- The capital costs for flow monitoring equipment are included in the estimates.

Table 7-8. State Land Costs[1]

State	Land Cost (1992 $/acre)	State	Land Cost (1992 $/acre)
Alabama	24,595	Nebraska	26,659
Alaska[2]	87,593	Nevada	39,204
Arizona	49,790	New Hampshire	57,238
Arkansas	17,170	New Jersey	96,598
California	325,000	New Mexico	29,083
Colorado	47,045	New York	118,814
Connecticut	58,570	North Carolina	36,590
Delaware	58,806	North Dakota[2]	22,127
Florida	68,335	Ohio	15,744
Georgia	78,408	Oklahoma	26,267
Hawaii	1,176,120	Oregon	54,886
Idaho[2]	87,593	Pennsylvania	34,892
Illinois	39,204	Rhode Island[2]	64,608
Indiana	22,764	South Carolina	23,000
Iowa	9,670	South Dakota[2]	22,127
Kansas	7,605	Tennessee	22,543
Kentucky	31,363	Texas	51,488
Louisiana	61,158	Utah[2]	87,593
Maine	21,170	Vermont[2]	64,608
Maryland	121,532	Virginia	43,124
Massachusetts	64,687	Washington	68,764
Michigan	14,740	West Virginia[2]	51,133
Minnesota	22,738	Wisconsin	18,818
Mississippi	14,113	Wyoming[2]	87,593
Missouri	43,124	Washington, DC	188,179
Montana[2]	87,593		

(1) Source: 1990 Guide to Industrial and Real Estate Office Markets Survey.

(2) No data available for State, regional average used.

- Sample collection costs (equipment and labor) and sample shipment costs are not included in the estimates because it is assumed that the facility is already conducting these activities as part of its current permit requirements.

Based upon a review of current monitoring practices at IWC facilities, many conventional and non-conventional parameters, as well as metals, are already being monitored on a routine basis. Therefore, monitoring costs were developed based upon daily monitoring of TSS and weekly monitoring of metals. Current compliance monitoring for existing facilities is generally less than the frequency used for estimating the monitoring costs of this proposal. Table 7-9 presents the monitoring costs per sample type for the IWC Industry.

Table 7-9. Analytical Monitoring Costs

Pollutants	Cost/Sample ($)[1]
TSS	6.00
Metals	35.00/metal

Notes:
(1) Cost based on 1995 analytical laboratory costs adjusted to 1992 dollars.

7.5 *WASTEWATER OFF-SITE DISPOSAL COSTS*

An evaluation was conducted to determine whether it would be more cost effective for low flow facilities to have their IWC wastewaters hauled off-site and treated/disposed at a centralized waste treatment facility, as opposed to on-site treatment. Total annual costs for new or upgraded wastewater treatment facilities were compared to the costs for off-site treatment at a CWT facility. Off-site disposal costs were estimated at $0.25 per gallon of wastewater treated. Transportation costs were added to the off-site treatment costs at a rate of $3.00 per loaded mile using an average distance of 250 miles to the treatment facility. Transportation costs were based upon the use of a 5,000-gallon tanker truck load. Facilities which treat their wastewaters off-site are considered zero dischargers and hence do not incur ancillary costs such as residual disposal, monitoring and land, except for permit modification costs. For regulatory costing, the lower of the two costs were used; on-site verses off-site treatment. Table 7-10 presents the facilities which were costed using off-site treatment.

Table 7-10. IWC Facilities Costed for Off-Site Disposal

Facility ID#	Flow (gpd)	BPT/PSES Option A and B Cost ($/yr)
5037	96	23,448
5624	28	10,727

7.6 *COSTS FOR REGULATORY OPTIONS*

The following sections present the treatment costs for complying with the proposed IWC guideline for the BPT/BAT, PSES, NSPS, and PSNS options.

7.6.1 *BPT/BAT Costs*

Two BPT/BAT options were proposed based upon the treatment technology sampled at the selected BPT/BAT facility. Engineering costs for these two BPT/BAT options are presented below.

7.6.1.1 BPT/BAT Option A: Two-stage Chemical Precipitation

BPT/BAT Option A consists of a two-stage chemical precipitation treatment system using sodium hydroxide in the first precipitation stage with ferric chloride and sodium hydroxide in the second stage. Sodium bisulfite is used at the head of the treatment system for chromium removal.

Sludge dewatering is also provided in this option. Table 7-11 presents the total capital and O&M costs for this option. This table also presents the total amortized annual cost for each facility.

7.6.1.2 BPT/BAT Option B: Two-stage Chemical Precipitation and Multimedia Filtration

BPT/BAT Option B is BPT/BAT Option A with the addition of a multimedia filter at the end of the treatment process. BPT/BAT Option B consists of a two-stage chemical precipitation treatment system using sodium hydroxide in the first precipitation stage with ferric chloride and sodium hydroxide in the second stage. Sodium bisulfite is used at the head of the treatment system for chromium removal. A multimedia filter is provided at the end of the treatment system to polish the effluent. Sludge dewatering is also provided in this option. Table 7-12 presents the total capital and O&M costs for this option. This table also presents the total amortized annual cost for each facility.

7.6.2 *PSES Costs*

Two PSES options were proposed based upon the technology sampled at the selected BPT/BAT facility. These two PSES options are equivalent to the two BPT/BAT options presented above. Engineering costs for these two PSES options are presented below.

7.6.2.1 PSES Option A: Two-stage Chemical Precipitation

PSES Option A consists of a two-stage chemical precipitation treatment system using sodium hydroxide in the first precipitation stage with ferric chloride and sodium hydroxide in the second stage. Sodium bisulfite is used at the head of the treatment system for chromium removal. Sludge dewatering is also provided in this option. This PSES option is equivalent to BPT/BAT Option A. Table 7-11 (previously referenced) presents the total capital and O&M costs for this option. This table also presents the total amortized annual cost for each facility.

Table 7-11. Summary of Costs - BPT/BCT/BAT/PSES Option A

ID#	DISCHARGE STATUS	AVERAGE FLOW RATE (gpd)	CAPITAL COSTS ($) EQUIPMENT	RETROFIT & UPGRADE	PERMIT MODIFICATION	LAND	TOTAL CAPITAL	AMORTIZED TOTAL CAPITAL* ($/YR)	O & M COSTS ($/YR) EQUIPMENT	SOLIDS DISPOSAL	MONITORING	TOTAL O & M	TOTAL ANNUAL COST ($/YR)
5736	direct	144,290	543,715	135,929	90,000	61,158	830,802	91,218	106,874	8,382	28,554	143,810	235,028
5737	direct	174,360	0	0	50,000	0	50,000	5,490	0	0	27,458	27,458	32,948
5761	direct	510,490	880,521	220,130	90,000	193,198	1,383,849	151,939	178,681	23,543	27,108	229,332	381,271
5765	direct	47,340	716,975	0	120,000	237,628	1,074,603	117,986	164,028	29,684	17,670	211,382	329,367
5782	direct	114,010	496,348	124,087	90,000	23,000	733,435	80,527	100,143	6,679	18,288	125,110	205,638
5797	direct	135,580	528,301	132,075	90,000	51,488	801,864	88,040	104,742	6,124	18,570	129,436	217,476
5798	direct	1,007,640	661,474	165,369	70,000	102,976	999,819	109,775	138,227	48,025	27,046	213,298	323,072
5624	direct	28	0	0	50,000	0	50,000	5,490	0	0	0	5,238	10,727
5720	indirect	113,870	1,123,175	0	120,000	45,530	1,288,705	141,493	254,706	77,802	31,310	363,818	505,311
5775	indirect	111,860	501,686	125,422	90,000	34,892	752,000	82,566	100,874	20,430	25,850	147,154	229,719
5037	indirect	96	0	0	50,000	0	50,000	5,490	0	0	0	17,958	23,448
INDUSTRY TOTALS		2,359,564	5,452,195	903,011	910,000	749,870	8,015,076	880,012	1,148,275	220,669	221,854	1,613,994	2,494,006
DIRECT TOTALS		2,133,738	3,827,334	777,590	650,000	669,448	5,924,372	650,464	792,695	122,437	164,694	1,085,063	1,735,528
INDIRECT TOTALS		225,826	1,624,861	125,422	260,000	80,422	2,090,705	229,548	355,580	98,232	57,160	528,930	758,478

* Assuming 7% interest over a fifteen year period.

NOTE: Due to low flow, costs for 5037 and 5624 were calculated based on off-site disposal cost

Table 7-12. Summary of Costs - BPT/BCT/BAT/PSES Option B

ID#	DISCHARGE STATUS	AVERAGE FLOW RATE (gpd)	CAPITAL COSTS ($) EQUIPMENT	RETROFIT & UPGRADE	PERMIT MODIFICATION	LAND	TOTAL CAPITAL	AMORTIZED TOTAL CAPITAL* ($/YR)	O & M COSTS ($/YR) EQUIPMENT	SOLIDS DISPOSAL	MONITORING	TOTAL O & M	TOTAL ANNUAL COST ($/YR)
5736	direct	144,290	611,635	152,909	100,000	61,158	925,701	101,637	140,834	9,572	28,554	178,960	280,597
5737	direct	174,360	0	0	50,000	0	50,000	5,490	0	0	27,458	27,458	32,948
5761	direct	510,490	880,521	220,130	90,000	193,198	1,383,849	151,939	178,681	27,681	27,108	233,470	385,409
5765	direct	47,340	756,822	0	130,000	237,628	1,124,450	123,459	183,952	30,162	17,670	231,784	355,242
5782	direct	114,010	496,348	124,087	90,000	23,000	733,435	80,527	100,143	6,684	18,288	125,115	205,642
5797	direct	135,580	528,301	132,075	90,000	51,488	801,864	88,040	104,742	7,179	18,570	130,491	218,531
5798	direct	1,007,640	874,679	218,670	80,000	102,976	1,276,325	140,134	244,830	50,603	27,046	322,479	462,612
5624	direct	28	0	0	50,000	0	50,000	5,490	0	0	0	5,238	10,727
5720	indirect	113,870	1,183,368	0	130,000	45,530	1,358,898	149,200	284,802	78,952	31,310	395,065	544,264
5775	indirect	111,860	501,686	125,422	90,000	34,892	752,000	82,566	100,874	21,457	25,850	148,181	230,747
5037	indirect	96	0	0	50,000	0	50,000	5,490	0	0	0	17,958	23,448
INDUSTRY TOTALS		2,359,564	5,833,360	973,292	950,000	749,870	8,506,522	933,970	1,338,857	232,291	221,854	1,816,198	2,750,169
DIRECT TOTALS		2,133,738	4,148,306	847,871	680,000	669,448	6,345,625	696,716	953,181	131,882	164,694	1,254,995	1,951,710
INDIRECT TOTALS		225,826	1,685,054	125,422	270,000	80,422	2,160,897	237,255	385,676	100,409	57,160	561,204	798,459

* Assuming 7% interest over a fifteen year period.

NOTE: Due to low flow, costs for 5037 and 5624 were calculated based on off-site disposal cost

7.6.2.2 PSES Option B: Two-stage Chemical Precipitation and Multimedia Filtration

PSES Option B consists of a two-stage chemical precipitation treatment system using sodium hydroxide in the first precipitation stage with ferric chloride and sodium hydroxide in the second stage. Sodium bisulfite is used at the head of the treatment system for chromium removal. A multimedia filter is provided at the end of the treatment system. Sludge dewatering is also provided in this option. This PSES option is equivalent to BPT/BAT Option B. Table 7-12 (previously referenced) presents the total capital and O&M costs for this option. This table also presents the total amortized annual cost for each facility.

7.6.3 *New Source Performance Standards Costs*

The proposed New Source Performance Standards (NSPS) for the IWC Industry is equivalent to the limitations proposed for BPT/BCT/BAT Option B. Therefore, NSPS consists of a two-stage chemical precipitation treatment system using sodium hydroxide in the first precipitation stage with ferric chloride and sodium hydroxide in the second stage. Sodium bisulfite is used at the head of the treatment system for chromium reduction. A multimedia filter is provided at the end of the treatment system to polish the effluent. Sludge dewatering is also provided in this option. NSPS costs were estimated using an industry average flow rate of approximately 214,500 gpd and loadings similar to the representative BPT/BAT facility (see Section X.0). The total NSPS amortized annual cost is $527,322 assuming an average facility daily flow of 214,500 gpd. A breakdown of the NSPS capital and O&M costs are presented on Table 7-13.

7.6.4 *Pretreatment Standards for New Sources Costs*

The proposed Pretreatment Standards for New Sources (PSNS) for the IWC Industry is equivalent to the limitations proposed for PSES Option A. This option is also equivalent to BPT, BCT, and BAT Option A. Therefore, PSNS consists of a two-stage chemical precipitation treatment system using sodium hydroxide in the first precipitation stage with ferric chloride and sodium hydroxide in the second stage. Sodium bisulfite is used at the head of the treatment system for chromium reduction. Sludge dewatering is also provided in this option. PSNS costs were estimated

Table 7-13. Summary of Costs - NSPS/PSNS

TYPE	AVERAGE FLOW RATE (gpd)	CAPITAL COSTS ($)					AMORTIZED TOTAL CAPITAL* ($/YR)	O & M COSTS ($/YR)				TOTAL ANNUAL COST ($/YR)
		EQUIPMENT	RETROFIT & UPGRADE	PERMIT MODIFICATION	LAND	TOTAL CAPITAL		EQUIPMENT	SOLIDS DISPOSAL	MONITORING	TOTAL O & M	
NSPS	214,506	1,590,598	0	130,000	149,176	1,869,774	205,291	278,658	12,063	31,310	322,030	527,322
PSNS	214,506	1,506,698	0	120,000	149,176	1,775,874	194,981	236,708	11,165	31,310	279,183	474,164

* Assuming 7% interest over a fifteen year period.

using an industry average flow rate of approximately 214,500 gpd and loadings similar to the representative BPT/BAT facility (see Section X.0). The total PSNS amortized annual cost is $474,164 assuming an average facility flow of 214,500 gpd. A breakdown of the PSNS capital and O&M costs are presented on Table 7-13, referenced above.

SECTION 8
DEVELOPMENT OF LIMITATIONS AND STANDARDS

This section describes various waste treatment technologies and their costs, pollutants proposed for regulation, and pollutant reductions associated with the different treatment technologies evaluated for the proposed effluent limitations guidelines and standards for the Industrial Waste Combustor (IWC) Industry. The limitations and standards discussed in this section are Best Practicable Control Technology Currently Available (BPT), Best Conventional Pollutant Control Technology (BCT), Best Available Technology Economically Achievable (BAT), New Source Performance Standards (NSPS), Pretreatment Standards for Existing Sources (PSES), and Pretreatment Standards for New Sources (PSNS).

8.1 *ESTABLISHMENT OF BPT*

Generally, EPA bases BPT upon the average of the best current performance (in terms of pollutant removals in treated effluent) by facilities of various sizes, ages, and unit processes within an industry subcategory. The factors considered in establishing BPT include: (1) the total cost of applying the technology relative to pollutant reductions, (2) the age of process equipment and facilities, (3) the processes employed and required process changes, (4) the engineering aspects of the control technology, (5) non-water quality environmental impacts such as energy requirements, air pollution, and solid waste generation, and (6) such other factors as the Administrator deems appropriate (Section 304(b)(2)(B) of the Act). As noted, BPT technology represents the average of the best existing performances of facilities within the industry. EPA looks at the performance of the best operated treatment systems and calculates limitations from some level of average performance of these “best” facilities. For example, in the BPT limitations for the OCPSF Category, EPA identified “best” facilities on a BOD performance criteria of achieving a 95 percent BOD removal or a BOD effluent level of 40 mg/l (52 FR 42535, November 5, 1987). When existing performance is uniformly inadequate, EPA may require a higher level of control than is currently in place in an industrial category if EPA determines that the technology can be practically applied. BPT may be transferred from a different subcategory or category. However, BPT normally focuses on end-of-process treatment rather than process changes or internal controls, except when these technologies are common industry practice.

The cost/effluent reduction inquiry for BPT is a limited balancing one, committed to EPA's discretion, that does not require the Agency to quantify effluent reduction benefits in monetary terms. (See, e.g., American Iron and Steel v. EPA, 526 F. 2d 1027 (3rd Cir., 1975.)) In balancing costs against the effluent reduction benefits, EPA considers the volume and nature of discharges expected after application of BPT, the general environmental effects of pollutants, and the cost and economic impacts of the required level of pollution control. In developing guidelines, the Act does not require or permit consideration of water quality problems attributable to particular point sources, or water quality improvements in particular bodies of water. Therefore, EPA has not considered these factors in developing the proposed limitations. (See Weyerhaeuser Company v. Costle, 590 F. 2d 1011 (D.C. Cir. 1978)).

EPA concluded that the wastewater treatment performance of the facilities it surveyed was, with very limited exceptions, inadequate and that only two facilities are using best practicable, currently available technology. Even at these two facilities, only one had a significant amount of pollutants at “treatable levels”. Thus, the proposed BPT effluent limitations will be based on the data from this one treatment system only.

As pointed out previously, IWC facilities burn highly variable wastes that, in many cases, are process residuals and sludges from other point source categories. The wastewater produced in combustion of these wastes contains a wide variety of metals. Chemical precipitation for these metals at a single pH is not adequate treatment for metals removal from such a highly variable waste stream. EPA's review of existing permit limitations for the direct dischargers show that, in most cases, the dischargers are subject to “best professional judgment” concentration limitations which were developed from guidelines for facilities treating and discharging much more specific waste streams (e.g., OCPSF limitations).

In determining BPT, EPA evaluated metals precipitation as the principal treatment practice within the IWC Industry. Nine of the eleven facilities in the Industry use some type of metals precipitation as a means for waste treatment. The precipitation techniques used by facilities varied in the treatment chemicals used and in the number of stages of precipitation used.

The two currently available treatment systems for which the EPA assessed performance for BPT are:

- *Option A : Primary Precipitation, Solid-Liquid Separation, Secondary Precipitation, and Solid-Liquid Separation.* Under Option A, BPT limitations would be based upon two stages of chemical precipitation, each followed by some form of separation and sludge dewatering. The pH levels used for the two stages of chemical precipitation would be different in order to promote optimal removal of metals because different metals are preferentially removed at different pH levels. In addition, the first stage of chemical precipitation is preceded by chromium reduction, when necessary. In some cases, BPT limitations would require the current treatment technologies in place to be improved by use of increased quantities of treatment chemicals and additional chemical precipitation/sludge dewatering systems.
- *Option B : Primary Precipitation, Solid-Liquid Separation, Secondary Precipitation, Solid-Liquid Separation, and Sand Filtration.* The second option evaluated for BPT for Industrial Waste Combustor facilities would be based on the same technology as Option A with the addition of sand filtration at the end of the treatment train.

The Agency is proposing to adopt BPT effluent limitations for 11 pollutants based on Option B for the Industrial Waste Combustor Industry. These limitations were developed based on an engineering evaluation of the average level of pollutant reduction achieved through application of the best practical control technology currently available for the discharges of the regulated pollutants. The proposed daily maximum and monthly average BPT limitations for the IWC Industry are presented in Table 8-1. Long-term averages, daily variability factors, and monthly variability factors for Option B are also presented in Table 8-1. A combination of two different methodologies was used in the development of the variability factors (monthly and daily) for this option. Specifically, pollutant-specific variability factors were calculated and used when a metal pollutant was detected a sufficient number of times in the effluent sampling data. However, when a metal pollutant could not be calculated using the effluent sampling data, a group-level variability factor was used. The group-level variability factor is the median of the pollutant-level variability factors calculated for the entire group of metals found in significant concentrations in the IWC Industry. See Section 5.2.2, Tables 5-2, 5-3, and 5-4 for a complete list of the metals included in the analysis. The *Statistical Support Document of Proposed Effluent Limitations Guidelines and Standards for Industrial Waste Combustors* (EPA 821-B-97-008) provides more detailed information on the development of the limitations for this option.

Table 8-1. BPT Effluent Limitations (mg/l)

Pollutant or Pollutant Parameter	Long-Term Average (mg/l)	Daily Variability Factor (Rounded)	Monthly Variability Factor (Rounded)	Maximum for Any One Day (mg/l)	Monthly Average (mg/l)
Conventional Pollutants					
TSS	5.84	4.2	1.3	24.3	7.46
pH					(1)
Priority and Non-Conventional Pollutants					
Arsenic	0.00827	8.3	2.0	0.0166	0.0162
Cadmium	0.0220	6.2	2.2	0.137	0.0493
Chromium	0.0100	2.0	1.3	0.0205	0.0130
Copper	0.0103	2.2	1.3	0.0224	0.0131
Lead	0.0468	2.0	1.3	0.0957	0.0606
Mercury	0.00200	2.0	1.3	0.00409	0.00259
Silver	0.00500	2.0	1.3	0.0102	0.00648
Titanium	0.00738	6.0	2.2	0.0442	0.0159
Zinc	0.0243	2.2	1.5	0.0532	0.0354

(1)Within the range 6.0 to 9.0 pH units.

EPA's tentative decision to base BPT limitations on Option B treatment reflects primarily an evaluation of three factors: the degree of effluent reduction attainable, the total cost of the proposed treatment technologies in relation to the effluent reductions achieved, and potential non-water quality benefits. No basis could be found for identifying different BPT limitations based on age, size, process or other engineering factors. Neither the age nor the size of the IWC facility will significantly affect either the character or treatability of the wastes or the cost of treatment. Further, the treatment process and engineering aspects of the technologies considered have a relatively insignificant effect because in most cases they represent fine tuning or add-ons to treatment technology already in use. These factors consequently did not weigh heavily in the development of these guidelines.

The demonstrated effluent reductions attainable through the Option B control technology represent the BPT performance attainable through the application of demonstrated treatment measures currently in operation in this industry. Option B was chosen for the following reasons. First, these removals are demonstrated by a facility and can readily be applied to all facilities. The adoption of this level of control would represent a significant reduction in pollutants discharged into the environment (from 181,000 to 54,000 pounds of TSS and metals). Second, the Agency assessed the total cost of water pollution controls likely to be incurred for Option B in relation to the effluent reduction and determined these costs were economically reasonable.

EPA estimated the cost of installing Option A and B BPT technologies at the direct discharging facilities. The pretax total estimated annualized cost in 1992 dollars is approximately $1.736 million (if BPT is Option A) and approximately $1.952 million (if BPT is Option B). EPA concluded the cost of installation of either of these control technologies is clearly economically achievable. EPA's assessment shows that none of the direct discharging facilities will experience a line closure as a result of the installation of the necessary technology.

The Agency proposes to select Option B because, EPA concluded that the use of sand filtration as the final treatment step is the best practicable treatment technology currently in operation for the industry. Consequently, effluent levels associated with this treatment option would represent BPT performance levels. Also, Option A was rejected because the greater removals obtained through the addition of sand filtration at Option B were obtained at a relatively insignificant increase in costs over Option A.

8.2 *BCT*

EPA is proposing BCT equivalent to the BPT guidelines for the conventional pollutants covered under BPT. In developing BCT limits, EPA considered whether there are technologies that achieve greater removals of conventional pollutants than proposed for BPT, and whether those technologies are cost-reasonable according to the BCT Cost Test. EPA identified no technologies that can achieve greater removals of conventional pollutants than proposed for BPT that are also cost-reasonable under the BCT Cost Test, and accordingly, EPA proposes BCT effluent limitations equal to the proposed BPT effluent limitations guidelines and pretreatment standards.

8.3 *BAT*

EPA is proposing BAT effluent limitations for the Industrial Waste Combustor Industry based upon the same technologies evaluated and proposed for BPT. The proposed BAT effluent limitations would control identified priority and non-conventional pollutants discharged from facilities. EPA has not identified any more stringent treatment technology option which it considered to represent BAT level of control applicable to facilities in this industry. EPA considered and rejected zero discharge as possible BAT technology for the reasons explained below.

8.4 *NSPS*

As previously noted, under Section 306 of the Act, new industrial direct dischargers must comply with standards which reflect the greatest degree of effluent reduction achievable through application of the best available demonstrated control technologies. Congress envisioned that new treatment systems could meet tighter controls than existing sources because of the opportunity to incorporate the most efficient processes and treatment systems into plant design. Therefore, Congress directed EPA to consider the best demonstrated process changes, in-plant controls, operating methods and end-of-pipe treatment technologies that reduce pollution to the maximum extent feasible.

EPA is proposing NSPS that would control the same conventional, priority, and non-conventional pollutants proposed for control by the BPT effluent limitations. The technologies used to control pollutants at existing facilities are fully applicable to new facilities. Furthermore, EPA has not identified any technologies or combinations of technologies that are demonstrated for new sources that are more effective than those used to establish BPT/BCT/BAT for existing sources. Therefore, EPA is proposing NSPS limitations that are identical to those proposed for BPT/BCT/BAT.

EPA is specifically considering whether it should adopt BPT/BAT and NSPS of zero discharge, since so many facilities are currently not generating or not discharging any wastewater as a result of Industrial Waste Combustor operations (see Section 3 of this document). There are two primary means of achieving zero discharge: the use of dry scrubbing operations or off-site disposal of Industrial Waste Combustor wastewater. EPA evaluated the cost for facilities to dispose of Industrial Waste Combustor wastewater off site and found it was less expensive than on-site treatment of the wastewater for only three of the eleven facilities. EPA also evaluated the cost for facilities to burn the IWC wastewater streams they generated and found that it was also significantly more costly than wastewater treatment. EPA did not evaluate the cost for all facilities to replace their wet scrubbing systems with dry scrubbing systems, as the wet scrubbing systems have been established as the best performers (according to the HWC proposed regulation) for removing acid gases and dioxins from effluent gas streams. Also, dry scrubbing systems have the adverse affect of generating an unstable solid to be disposed of in a landfill, as opposed to the stable solids generated by wastewater treatment of air pollution control wastewater. Given the apparent environmental superiority of wet versus dry scrubbers, EPA has decided a zero discharge requirement could have unacceptable non-water quality effects. EPA also did not evaluate the cost for all facilities to recycle Industrial Waste Combustor wastewater, as EPA discovered that only certain types of air pollution control systems working in conjunction with one another are able to accomplish total recycle of wastewater. Thus, new air pollution control systems would have to be costed for all facilities along with recycling systems.

Overall, zero discharge is not being proposed as BPT/BAT because EPA believes that the cost to facilities to change current air pollution control systems are too high. Also, zero discharge is not being proposed as BPT/BAT or NSPS because the change may cause unacceptable non-water quality impacts.

8.5 *PSES*

Indirect dischargers in the Industrial Waste Combustor Industry, like the direct dischargers, accept for treatment wastes containing many priority and non-conventional pollutants. As in the case of direct dischargers, indirect dischargers may be expected to discharge many of these non-combustible low-volatility pollutants to POTWs at significant mass and concentration levels. EPA estimates that the three identified indirect dischargers annually discharge approximately 49,000 pounds of metals to POTWs.

Section 307(b) requires EPA to promulgate pretreatment standards to prevent pass-through of pollutants from POTWs to waters of the U.S. or to prevent pollutants from interfering with the operation of POTWs. EPA is establishing PSES for this industry to prevent pass-through of the same pollutants controlled by BAT from POTWs to waters of the U.S.

EPA considered the same two regulatory options as in the BPT/BCT/BAT analysis to reduce the discharge of pollutants by Industrial Waste Combustor facilities. The Agency is proposing to adopt PSES pretreatment standards based on Option A for the Industrial Waste Combustor Industry. The technology for Options A and B are the same except that Option A does not require the use of sand filtration as the last treatment step.

In assessing PSES, EPA considered the age, size, process, other engineering factors, and non-water quality impacts pertinent to the facilities treating wastes in this subcategory. No basis could be found for identifying different PSES standards based on age, size, process or other engineering factors.

The Agency is proposing pretreatment standards for existing sources (PSES) for all priority and non-conventional pollutants regulated under BPT/BAT. The proposed daily maximum and monthly average PSES pretreatment standards for the IWC Industry are presented in Table 8-2. Long-term averages, daily variability factors and monthly variability factors for Option A are also presented in Table 8-2. A combination of two different methodologies was used in the development of the variability factors (monthly and daily) for this option. Specifically, pollutant-specific variability factors were calculated and used when a metal pollutant was detected a sufficient number of times in the effluent sampling data. However, when a metal pollutant could not be calculated using the effluent sampling data, a group-level variability factor was used. The group-level variability factor is the median of the pollutant-level variability factors calculated for the entire group of metals found in significant concentrations in the IWC Industry. See Section 5.2.2, Tables 5-2, 5-3, and 5-4 for a complete list of the metals included in the analysis. The *Statistical Support Document of Proposed Effluent Limitations Guidelines and Standards for Industrial Waste Combustors* (EPA 821-B-97-008) provides more detailed information on the development of the pretreatment standards for this option. These standards would apply to existing facilities in the Industrial Waste Combustor Industry that indirectly discharge wastewater to publicly-owned treatment works (POTWs). PSES set at these points would prevent pass-through of pollutants and help control sludge contamination.

Table 8-2. PSES Pretreatment Standards (mg/l)

Pollutant or Pollutant Parameter	Long-Term Average (mg/l)	Daily Variability Factor (Rounded)	Monthly Variability Factor (Rounded)	Maximum for Any One Day (mg/l)	Monthly Average (mg/l)
Arsenic	0.00952	3.4	1.8	0.0323	0.0172
Cadmium	0.0623	7.8	2.6	0.484	0.160
Chromium	0.0100	2.0	1.3	0.0203	0.0130
Copper	0.0196	3.5	1.6	0.0684	0.0322
Lead	0.0477	2.0	1.3	0.0968	0.0620
Mercury	0.00264	2.0	1.3	0.00536	0.00343
Silver	0.00949	2.0	1.3	0.0193	0.0123
Titanium	0.00389	3.3	1.5	0.0131	0.00614
Zinc	0.122	2.0	1.3	0.248	0.159

EPA estimated the cost and economic impact of installing Option A and B PSES technologies at the indirect discharging facilities. The pretax total estimated annualized cost in 1992 dollars is approximately $758,000 (if PSES is Option A) and approximately $798,000 (if PSES is Option B). EPA concluded the cost of installation of either of these control technologies is clearly economically achievable. EPA's assessment shows that only one of the indirect discharging facilities will experience a line closure as a result of the installation of the necessary technology.

EPA is not, however, proposing PSES based on Option B for the following reasons. EPA has determined that, after achievements of Option A treatment levels, metal pollutants do not pass through in amounts that would justify requiring the additional Option B treatment step, sand filtration. The additional removals obtained by sand filtration are small, less than 57 lb.eq. per year discharged to receiving streams. POTW removals for the regulated pollutants range from 59 percent to 90 percent. The total additional removals associated with the Option B technology represents less than one percent of total lb.eq. removals. Consequently, requiring PSES limits based on the Option B technology is not justified by the small quantity of pollutants involved.

8.6 *PSNS*

Section 307(c) of the Act requires EPA to promulgate pretreatment standards for new sources (PSNS) at the same time it promulgates new source performance standards (NSPS). New indirect discharging facilities, like new direct discharging facilities, have the opportunity to incorporate the best available demonstrated technologies, process changes, in-facility controls, and end-of-pipe treatment technologies.

As set forth in Section 5.3 of this document, EPA determined that all of the pollutants selected for regulation for the Industrial Waste Combustor Industry pass-through POTWs. The same technologies discussed previously for BAT, NSPS, and PSES are available as the basis for PSNS.

EPA is proposing that pretreatment standards for new sources be set equal to PSES for priority and non-conventional pollutants. The Agency is proposing to establish PSNS for the same priority and non-conventional pollutants as are being proposed for PSES. EPA considered the cost of the proposed PSNS technology for new facilities. EPA concluded that such costs are not so great as to present a barrier to entry, as demonstrated by the fact that currently operating facilities are using these technologies. The Agency considered energy requirements and other non-water quality environmental impacts and found no basis for any different standards than the selected PSNS.

8.7 *COST OF TECHNOLOGY OPTIONS*

The Agency estimated the cost for Industrial Waste Combustor facilities to achieve each of the proposed effluent limitations and standards. All cost estimates in this section are presented in 1992 dollars. The cost components reported in this section represent estimates of the investment cost of purchasing and installing equipment, the annual operating and maintenance costs associated with that equipment, additional costs for discharge monitoring, and costs for facilities to modify existing RCRA permits. The following sections present costs for BPT, BCT, BAT and PSES.

8.7.1 *Proposed BPT Costs*

The Agency estimated the cost of implementing the proposed BPT effluent limitations guidelines and pretreatment standards by calculating the engineering costs of meeting the required effluent limitations for each direct discharging IWC. This facility-specific engineering cost assessment for BPT began with a review of present waste treatment technologies. For facilities without a treatment technology in place equivalent to the BPT technology, the EPA estimated the cost to upgrade its treatment technology, and to use additional treatment chemicals to achieve the new discharge standards. The only facilities given no cost for compliance were facilities with the treatment in place prescribed for the option. Details pertaining to the development of the technology costs are included in Section 7. The capital expenditures for the process change component of proposed BPT are estimated to be $ 6.3 million with annual O&M costs of $1.3 million for the eight facilities under Regulatory Option B, which is: *Primary Precipitation, Solid-Liquid Separation, Secondary Precipitation, Solid-Liquid Separation, and Sand Filtration.*

8.7.2 *Proposed BCT/BAT Costs*

The Agency estimated that there would be no cost of compliance for implementing proposed BCT/BAT, because the technology is identical to BPT and the costs are included with proposed BPT.

8.7.3 *Proposed PSES Costs*

The Agency estimated the cost for implementing proposed PSES with the same assumptions and methodology used to estimate cost of implementing BPT. The capital expenditures for the process change component of PSES are estimated to be $2.1 million with annual O&M costs of $528 thousand for the three facilities under Regulatory Option A, which is: *Primary Precipitation, Solid-Liquid Separation, Secondary Precipitation, and Solid-Liquid Separation*.

8.8 *POLLUTANT REDUCTIONS*

8.8.1 *Conventional Pollutant Reductions*

EPA has calculated how much the adoption of the proposed BPT/BCT limitations would reduce the total quantity of conventional pollutants that are discharged. To do this, the Agency developed an estimate of the long-term average (LTA) loading of TSS that would be discharged after the implementation of BPT. Next, the BPT/BCT LTA for TSS was multiplied by 1992 wastewater flows for each direct discharging facility in the industry to calculate BPT/BCT mass discharge loadings for TSS for each facility. The BPT/BCT mass discharge loadings were subtracted from the estimated current loadings to calculate the pollutant reductions for each facility. The Agency estimates that the proposed regulations will reduce TSS discharges by approximately 120,000 pounds per year for the eight facilities under Regulatory Option B. The current discharges and BPT/BCT discharges for TSS are listed in Table 8-3.

8.8.2 *Priority and Non-conventional Pollutant Reductions*

8.8.2.1 Methodology

The proposed BPT, BCT, BAT and PSES, if promulgated, will also reduce discharges of priority and non-conventional pollutants. Applying the same methodology used to estimate conventional pollutant reductions attributable to application of BPT/BCT control technology, EPA has also estimated priority and non-conventional pollutant reductions for each facility. Because EPA has proposed BAT limitations equivalent to BPT, there are obviously no further pollutant reductions associated with BAT limitations.

Current loadings were estimated using the questionnaire data supplied by the industry, data collected by the Agency in the field sampling program, facility POTW permit information and facility

NPDES permit information. For many facilities, data were not available for all pollutants of concern or without the addition of other non-IWC wastewater. Therefore, methodologies were developed to estimate current performance for the industry (see Section 4.4 of this document).

In the construction of the plant-specific pollutant by pollutant loadings, in any case where the technology option generated an estimated pollutant loading in excess of the current loading, the option loading was set equal to the current loading. The rationale for the adoption of this methodology is consistency with and similarity to the "anti-backsliding" provisions. Also, a well designed and operated treatment system should not increase pollutant loadings above current practice. (It should be noted in the situation described above, no removal of the specific pollutant at the specific plant is achieved under the technology option).

8.8.2.2 Direct Discharges (BPT/BAT)

The Agency estimates that proposed BPT/BAT regulations will reduce direct discharges of priority and non-conventional pollutants by approximately 6,800 pounds per year for the eight facilities under Regulatory Option B. The current discharges and BPT/BCT discharges for priority and non-conventional pollutants are listed in Table 8-3.

8.8.2.3 PSES Effluent Discharges to POTWs

The Agency estimates that proposed PSES regulations will reduce indirect discharges of priority and non-conventional pollutants to POTWs by approximately 47,000 pounds per year for the three facilities under Regulatory Option A. The current discharges and BPT/BCT discharges for priority and non-conventional pollutants are listed in Table 8-4.

Table 8-3. Direct Discharge Loads (in lbs.)

Pollutant Name	CAS NO	Current Load	Option A Load	Option B Load
Total Suspended Solids	C-009	157,365	69,675	37,698
Aluminum	7429905	1,221	1,007	945
Antimony	7440360	3,907	1,770	1,631
Arsenic	7440382	372	45	41
Boron	7440428	10,446	10,089	10,209
Cadmium	7440439	368	276	108
Chromium	7440473	375	65	65
Copper	7440508	682	127	67
Iron	7439896	803	677	403
Lead	7439921	659	215	214
Manganese	7439965	1,028	1,013	1,028
Mercury	7439976	27	9	8
Molybdenum	7439987	1,527	1,527	1,527
Selenium	7782492	175	121	84
Silver	7440224	181	58	32
Tin	7440315	354	207	200
Titanium	7440326	291	26	47
Zinc	7440666	1,116	549	157
Total		180,897	87,455	54,463

Note: One facility is expected to ship wastewater off site for disposal. The facility has a current load of 3 lbs. and has been assigned 0 lbs. in the option loads.

Table 8-4. Indirect Discharge Loads (in lbs.)

Pollutant Name	CAS NO	Current Load	Option A Load	Option B Load
Aluminum	7429905	3,518	67	55
Antimony	7440360	97	4	4
Arsenic	7440382	1,192	3	3
Boron	7440428	1,148	581	590
Cadmium	7440439	482	21	8
Chromium	7440473	30,074	3	3
Copper	7440508	6,059	7	3
Iron	7439896	1,383	373	44
Lead	7439921	1,935	16	16
Manganese	7439965	102	62	62
Mercury	7439976	49	1	1
Molybdenum	7439987	199	83	83
Selenium	7782492	74	18	9
Silver	7440224	46	3	2
Tin	7440315	277	11	11
Titanium	7440326	277	1	3
Zinc	7440666	1,663	42	8
Total		48,574	1,298	904

Note: One facility is projected to cease combustion operations while the facility will remain open (a line closure). The facility has a current load of 42,159 lbs. and has been assigned 0 lbs. in the option loads. Another facility is expected to ship wastewater off site for disposal. The facility has a current load of 7 lbs. and has been assigned 0 lbs. in the option loads.

SECTION 9
NON-WATER QUALITY IMPACTS

Section 304(b) and 306 of the Clean Water Act require EPA to consider non-water quality environmental impacts (including energy requirements) associated with effluent limitations and guidelines. Pursuant to these requirements, EPA has considered the possible effect of the proposed Industrial Waste Combustors (IWC) BPT, BCT, BAT, NSPS, PSES, and PSNS regulations on air pollution, solid waste generation, and energy consumption. In evaluating the environmental impacts across all media, it has been determined that the impacts discussed below are minimal and are justified by the benefits associated with compliance with the IWC regulations.

During IWC wastewater treatment, the pollutants of concern are either removed from the wastewater stream, concentrated, or destroyed. If the pollutants are removed, they are either transferred from the wastewater stream to another medium (e.g., VOC emissions to the atmosphere) or end up as a treatment residual, such as sludge. Subsequent removal of pollutants to another media and the disposition of these wastewater treatment residuals result in non-water quality impacts. Non-water quality impacts evaluated for the IWC Industry regulations include air pollution and solid waste generation.

Wastewater treatment also results in other, non-water, non-residual, impacts. These impacts are the consumption of energy used to power the wastewater treatment equipment.

9.1 *AIR POLLUTION*

IWC facilities treat wastewater streams which contain very low concentrations of volatile organic compounds (VOCs). These concentrations for most organic pollutants are typically below treatable levels. This is due to the nearly total destruction of organic pollutants in the original wastes through the combustion process, which prevents many of these pollutants from being detected in wastewaters and from being released into the atmosphere and affecting air quality. Losses through fugitive emission is not expected to be significant as most of the organics present in the IWC wastewater typically have low volatility. While the wastewater streams usually pass through collection units, cooling towers, and treatment units that are open to the atmosphere, this exposure is not expected to result in any significant volatilization of VOCs from the wastewater.

Since there are no significant air emissions generated by the proposed treatment technologies, EPA believes that there are essentially no adverse air quality impacts anticipated as a result of the IWC regulations.

9.2 *SOLID WASTE*

Several of the wastewater treatment technologies used to comply with the proposed IWC regulations generate a solid waste. The costs for disposal of these waste residuals were included in the compliance cost estimates prepared for the regulatory options.

The solid waste treatment residual generated as a result of implementation of these regulations is filter cake from chemical precipitation processes. In the proposed BPT/PSES wastewater treatment trains of the IWC Industry, hydroxide and ferric chloride precipitation of metals generates a sludge residual. For BPT/BAT Option B, backwash from the multi-media filter is recirculated back to the treatment system prior to the chemical precipitation processes, therefore all solids are removed from the proposed treatment process in the clarifiers. This sludge is dewatered, and the resultant filter cake is typically disposed of off site into a landfill. It is expected that the filter cake generated from chemical precipitation will contain high concentrations of metals. As a result, this filter cake may be a RCRA hazardous waste. Depending upon the wastewater usage and the resultant characteristics of the sludge, the sludge generated at a particular facility may be either a listed or characteristic hazardous waste, pursuant to 40 CFR 261 regulations (Identification and Listing of Hazardous Waste). These filter cakes are considered to be a characteristic hazardous waste based upon toxicity when the waste exceeds allowable standards based upon the Toxicity Characteristic Leaching Procedure or exhibits other hazardous characteristics as defined under 40 CFR 261 Subpart C (e.g., ignitability, corrosivity, or reactivity). Filter cake may also be considered a RCRA listed waste (e.g., waste which are hazardous based upon definition as per 40 CFR 261 Subpart D) depending upon the types of wastewater produced by the combustion process and whether it is in contact with the wastes being combusted or residuals from the combustion process. EPA evaluated the cost of disposing hazardous and non-hazardous filter cake. In the IWC economic evaluation, contract hauling for off-site disposal in a Subtitle C or D landfill was the method costed.

It is estimated that compliance with the proposed BPT/PSES Options would result in the disposal of 1.276 million pounds of hazardous and non-hazardous filter cake. The estimated filter cake generation rate by combustor type is presented in Table 9-1 below.

Table 9-1. Filter Cake Generation for the IWC Industry

Combustor Type	Filter Cake Generated million pounds/year		
	Indirect	Direct	Total
BIFs	0.529	0	0.529
Incinerators	0	0.747	0.747
Total	0.529	0.747	1.276

EPA believes that the disposal of this filter cake would not have an adverse effect on the environment or result in the release of pollutants in the filter cake to other media. The disposal of these wastes into controlled Subtitle D or C landfills are strictly regulated by the RCRA program. New landfills are required to meet lining requirements to prevent the release of contaminates and to capture leachate. Landfill capacity throughout the country can readily accommodate the additional solid waste expected to be generated by the institution of this regulation. For costing purposes, it was assumed that these solid wastes would be considered hazardous and will be disposed of into permitted RCRA landfills with appropriate treatment of these filter cakes prior to disposition to achieve compliance with applicable RCRA Land Ban treatment requirements (e.g., stabilization) pursuant with 40 CFR 268 regulations, if necessary.

9.3 *ENERGY REQUIREMENTS*

In each of the proposed regulatory options, operation of wastewater treatment equipment results in the consumption of energy. This energy is used to power pumps, mixers, and other equipment components, to power lighting and controls, and to generate heat. Since the two regulatory options are comparable with the exception of the multi-media filter, Option B was used in determining the most conservative estimate of energy usage for the IWC Industry. The proposed IWC Option B would require the consumption of 1,790 thousand kilowatt-hours per year of electricity for both direct and indirect dischargers. This is the equivalent of 1003 barrels per year of #2 fuel oil, as compared with the 1992 rate of consumption in the United States of 40.6 million barrels per year. Option B, with the highest energy demand, represents an increase in the production or importation of oil of 2.5×10^{-5} percent annually. Based upon this relatively low increase in oil consumption, EPA believes that the implementation of this regulation would cause no substantial impact to the oil industry.

In 1992, approximately 2,797.2 billion kilowatt hours of electric power were generated in the United States. The additional energy consumption requirements for Option B, which has the greatest energy demand of the two options, corresponds to approximately 6.1×10^{-7} percent of the national requirements. This increase in energy requirements to implement the BPT/PSES technologies will result in an air emissions impact from electric power generating facilities. It is expected that air emissions parameters generated by electric producing facilities, such as particulates, NO_X and SO_2, will be impacted. This increase in air emissions is expected to be directly proportional to the increase in energy requirements, or in the case of Option B approximately 6.1×10^{-7}percent. EPA believes this additional increase in air emissions from electric generating facilities to be minimal and will result in no substantial impact to air emissions or detrimental results to air quality.

APPENDIX A

US EPA\ Incinerators Analytical Database a011.inci.pgmlib(R064GW3)

Range of Pollutant Influent Concentrations of the Pooled Daily Data from the Three 5-Day EPA Sampling Episodes for all Analytes

Analyte	CAS_NO	Meas. Type [1]	Mean	Min	Max	Unit
ACENAPHTHENE	83329	ND	14.83	10.00	35.56	UG/L
ACENAPHTHYLENE	208968	ND	14.83	10.00	35.56	UG/L
ACEPHATE	30560191	ND	30.53	20.00	71.00	UG/L
ACETOPHENONE	98862	NC	15.47	10.00	35.56	UG/L
ACIFLUORFEN	50594666	ND	15.27	10.00	35.56	UG/L
ACRYLONITRILE	107131	ND	50.00	49.94	50.00	UG/L
ALACHLOR	15972608	ND	0.31	0.20	0.71	UG/L
ALDRIN	309002	ND	0.31	0.20	0.71	UG/L
ALPHA-BHC	319846	ND	0.08	0.05	0.18	UG/L
ALPHA-CHLORDANE	5103719	ND	0.15	0.10	0.36	UG/L
ALPHA-TERPINEOL	98555	ND	14.83	10.00	35.56	UG/L
ALUMINUM	7429905	NC	897.59	13.60	2538.00	UG/L
AMENABLE CYANIDE	C-025	ND	10.00	10.00	10.00	UG/L
AMMONIA AS NITROGEN	7664417	NC	14312.40	100.00	75000.00	UG/L
ANILINE	62533	ND	14.83	10.00	35.56	UG/L
ANILINE, 2,4,5-TRIMETHYL-	137177	ND	29.66	20.00	71.12	UG/L
ANTHRACENE	120127	ND	14.83	10.00	35.56	UG/L
ANTIMONY	7440360	NC	268.16	7.80	958.80	UG/L
ARAMITE	140578	ND	74.14	50.00	177.80	UG/L
ARSENIC	7440382	NC	166.41	4.60	827.20	UG/L
ATRAZINE	1912249	ND	15.27	10.00	35.56	UG/L
AZINPHOS ETHYL	2642719	ND	3.05	2.00	7.10	UG/L
AZINPHOS METHYL	86500	ND	3.19	1.00	5.00	UG/L

1 Measurement type ND means that the pollutant was not detected at any data point. Measurement type NC means that the pollutant was detected for at least one data point.

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
BARIUM	7440393	NC	237.70	43.10	613.00	UG/L
BENFLURALIN	1861401	ND	0.31	0.20	0.71	UG/L
BENZANTHRONE	82053	ND	74.14	50.00	177.80	UG/L
BENZENE	71432	ND	10.00	9.99	10.00	UG/L
BENZENETHIOL	108985	ND	14.83	10.00	35.56	UG/L
BENZIDINE	92875	ND	74.14	50.00	177.80	UG/L
BENZO(A)ANTHRACENE	56553	ND	14.83	10.00	35.56	UG/L
BENZO(A)PYRENE	50328	ND	14.83	10.00	35.56	UG/L
BENZO(B)FLUORANTHENE	205992	ND	14.83	10.00	35.56	UG/L
BENZO(GHI)PERYLENE	191242	ND	29.66	20.00	71.12	UG/L
BENZO(K)FLUORANTHENE	207089	ND	14.83	10.00	35.56	UG/L
BENZOIC ACID	65850	ND	74.14	50.00	177.80	UG/L
BENZONITRILE, 3,5-DIBROMO-4-HYDROXY-	1689845	ND	74.14	50.00	177.80	UG/L
BENZYL ALCOHOL	100516	ND	14.83	10.00	35.56	UG/L
BERYLLIUM	7440417	ND	0.93	0.30	1.50	UG/L
BETA-BHC	319857	ND	0.15	0.10	0.36	UG/L
BETA-NAPHTHYLAMINE	91598	ND	74.14	50.00	177.80	UG/L
BIPHENYL	92524	ND	14.83	10.00	35.56	UG/L
BIPHENYL, 4-NITRO	92933	ND	14.83	10.00	35.56	UG/L
BIS(2-CHLOROETHOXY)METHANE	111911	ND	14.83	10.00	35.56	UG/L
BIS(2-CHLOROETHYL) ETHER	111444	ND	14.83	10.00	35.56	UG/L
BIS(2-CHLOROISOPROPYL) ETHER	108601	ND	14.83	10.00	35.56	UG/L
BIS(2-ETHYLHEXYL) PHTHALATE	117817	NC	22.57	10.00	53.05	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
BISMUTH	7440699	NC	205.14	0.10	887.00	UG/L
BOD 5-DAY	C-002	NC	9960.00	1000.00	53000.00	UG/L
BORON	7440428	NC	1604.60	918.00	3760.00	UG/L
BROMACIL	314409	ND	1.53	1.00	3.56	UG/L
BROMODICHLOROMETHANE	75274	ND	10.00	9.99	10.00	UG/L
BROMOMETHANE	74839	ND	50.00	49.94	50.00	UG/L
BROMOXYNIL OCTANOATE	1689992	ND	0.76	0.50	1.78	UG/L
BUTACHLOR	23184669	ND	0.76	0.50	1.78	UG/L
BUTYL BENZYL PHTHALATE	85687	ND	14.83	10.00	35.56	UG/L
CADMIUM	7440439	NC	312.19	1.80	2616.00	UG/L
CALCIUM	7440702	NC	293146.00	8140.00	1270000.00	UG/L
CAPTAFOL	2425061	ND	3.05	2.00	7.10	UG/L
CAPTAN	133062	ND	1.53	1.00	3.56	UG/L
CARBAZOLE	86748	ND	29.66	20.00	71.12	UG/L
CARBON DISULFIDE	75150	ND	10.00	9.99	10.00	UG/L
CARBOPHENOTHION	786196	ND	1.53	1.00	3.56	UG/L
CERIUM	7440451	NC	507.47	1.00	1000.00	UG/L
CHEMICAL OXYGEN DEMAND (COD)	C-004	NC	343140.00	67000.00	1036000.00	UG/L
CHLORFENVINPHOS	470906	ND	3.05	2.00	7.10	UG/L
CHLORIDE	16887006	NC	6833746.67	1010000.00	17002400.00	UG/L
CHLOROACETONITRILE	107142	ND	10.00	9.99	10.00	UG/L
CHLOROBENZENE	108907	ND	10.00	9.99	10.00	UG/L
CHLOROBENZILATE	510156	ND	1.53	1.00	3.56	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
CHLOROETHANE	75003	ND	50.00	49.94	50.00	UG/L
CHLOROFORM	67663	ND	10.00	9.99	10.00	UG/L
CHLOROMETHANE	74873	ND	50.00	49.94	50.00	UG/L
CHLORONEB	2675776	ND	1.53	1.00	3.56	UG/L
CHLOROPROPYLATE	5836102	ND	15.27	10.00	35.56	UG/L
CHLOROTHALONIL	1897456	ND	0.31	0.20	0.71	UG/L
CHLORPYRIFOS	2921882	ND	3.05	2.00	7.10	UG/L
CHROMIUM	7440473	NC	127.17	5.80	529.20	UG/L
CHRYSENE	218019	ND	14.83	10.00	35.56	UG/L
CIS-PERMETHRIN	61949766	ND	3.05	2.00	7.10	UG/L
CIS-1,3-DICHLOROPROPENE	10061015	ND	10.00	9.99	10.00	UG/L
COBALT	7440484	NC	10.50	2.30	35.24	UG/L
COPPER	7440508	NC	1786.69	8.50	10554.00	UG/L
COUMAPHOS	56724	ND	7.64	5.00	17.78	UG/L
CROTONALDEHYDE	4170303	ND	50.00	49.94	50.00	UG/L
CROTOXYPHOS	7700176	ND	146.80	99.00	352.04	UG/L
DACTHAL (DCPA)	1861321	ND	0.08	0.05	0.18	UG/L
DALAPON	75990	NC	0.53	0.20	1.06	UG/L
DEF	78488	ND	3.05	2.00	7.10	UG/L
DELTA-BHC	319868	ND	0.08	0.05	0.18	UG/L
DEMETON A	8065483A	ND	3.05	2.00	7.10	UG/L
DEMETON B	8065483B	ND	3.05	2.00	7.10	UG/L
DI-N-BUTYL PHTHALATE	84742	ND	14.83	10.00	35.56	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
DI-N-OCTYL PHTHALATE	117840	ND	14.83	10.00	35.56	UG/L
DI-N-PROPYLNITROSAMINE	621647	ND	29.66	20.00	71.12	UG/L
DIALLATE A	2303164A	ND	3.05	2.00	7.10	UG/L
DIALLATE B	2303164B	ND	3.05	2.00	7.10	UG/L
DIAZINON	333415	ND	3.05	2.00	7.10	UG/L
DIBENZO(A,H)ANTHRACENE	53703	ND	29.66	20.00	71.12	UG/L
DIBENZOFURAN	132649	ND	14.83	10.00	35.56	UG/L
DIBENZOTHIOPHENE	132650	ND	14.83	10.00	35.56	UG/L
DIBROMOCHLOROMETHANE	124481	ND	10.00	9.99	10.00	UG/L
DIBROMOMETHANE	74953	ND	10.00	9.99	10.00	UG/L
DICAMBA	1918009	NC	0.32	0.20	0.71	UG/L
DICHLOFENTHION	97176	ND	3.05	2.00	7.10	UG/L
DICHLONE	117806	ND	3.05	2.00	7.10	UG/L
DICHLORPROP	120365	NC	7.66	1.00	47.00	UG/L
DICHLORVOS	62737	ND	7.64	5.00	17.78	UG/L
DICOFOL	115322	ND	1.53	1.00	3.56	UG/L
DICROTOPHOS	141662	ND	5.00	5.00	5.00	UG/L
DIELDRIN	60571	ND	0.06	0.04	0.14	UG/L
DIETHYL ETHER	60297	ND	50.00	49.94	50.00	UG/L
DIETHYL PHTHALATE	84662	ND	14.83	10.00	35.56	UG/L
DIMETHOATE	60515	ND	1.86	1.00	3.56	UG/L
DIMETHYL PHTHALATE	131113	ND	14.83	10.00	35.56	UG/L
DIMETHYL SULFONE	67710	ND	14.83	10.00	35.56	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
DINOSEB	88857	NC	0.87	0.50	2.63	UG/L
DIOXATHION	78342	ND	5.00	5.00	5.00	UG/L
DIPHENYL ETHER	101848	ND	14.83	10.00	35.56	UG/L
DIPHENYLAMINE	122394	ND	14.83	10.00	35.56	UG/L
DIPHENYLDISULFIDE	882337	ND	29.66	20.00	71.12	UG/L
DISULFOTON	298044	ND	3.05	2.00	7.10	UG/L
DYSPROSIUM	7429916	NC	67.17	0.10	100.00	UG/L
ENDOSULFAN I	959988	ND	0.15	0.10	0.36	UG/L
ENDOSULFAN II	33213659	ND	1.53	1.00	3.56	UG/L
ENDOSULFAN SULFATE	1031078	ND	0.15	0.10	0.36	UG/L
ENDRIN	72208	ND	0.31	0.20	0.71	UG/L
ENDRIN ALDEHYDE	7421934	ND	0.15	0.10	0.36	UG/L
ENDRIN KETONE	53494705	ND	0.15	0.10	0.36	UG/L
EPN	2104645	ND	3.05	2.00	7.10	UG/L
ERBIUM	7440520	ND	66.70	0.10	100.00	UG/L
ETHALFLURALIN	55283686	ND	0.15	0.10	0.36	UG/L
ETHANE, PENTACHLORO-	76017	ND	29.66	20.00	71.12	UG/L
ETHION	563122	ND	3.05	2.00	7.10	UG/L
ETHOPROP	13194484	ND	3.05	2.00	7.10	UG/L
ETHYL CYANIDE	107120	ND	10.00	9.99	10.00	UG/L
ETHYL METHACRYLATE	97632	ND	10.00	9.99	10.00	UG/L
ETHYL METHANESULFONATE	62500	ND	29.66	20.00	71.12	UG/L
ETHYLBENZENE	100414	ND	10.00	9.99	10.00	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
ETHYLENETHIOUREA	96457	ND	29.66	20.00	71.12	UG/L
ETRIDIAZOLE	2593159	ND	0.10	0.10	0.10	UG/L
EUROPIUM	7440531	NC	68.07	0.10	100.00	UG/L
FAMPHUR	52857	ND	7.64	5.00	17.78	UG/L
FENARIMOL	60168889	ND	0.31	0.20	0.71	UG/L
FENSULFOTHION	115902	ND	7.64	5.00	17.78	UG/L
FENTHION	55389	ND	3.05	2.00	7.10	UG/L
FLUORANTHENE	206440	ND	14.83	10.00	35.56	UG/L
FLUORENE	86737	ND	14.83	10.00	35.56	UG/L
FLUORIDE	16984488	NC	82620.53	16500.00	360000.00	UG/L
GADOLINIUM	7440542	NC	236.22	0.50	500.00	UG/L
GALLIUM	7440553	NC	236.12	0.50	500.00	UG/L
GAMMA-BHC	58899	ND	0.08	0.05	0.18	UG/L
GAMMA-CHLORDANE	5103742	ND	0.08	0.05	0.18	UG/L
GERMANIUM	7440564	NC	335.79	0.50	500.00	UG/L
GOLD	7440575	ND	100.33	1.00	200.00	UG/L
HAFNIUM	7440586	NC	500.92	1.00	1000.00	UG/L
HEPTACHLOR	76448	ND	0.15	0.10	0.36	UG/L
HEPTACHLOR EPOXIDE	1024573	ND	0.08	0.05	0.18	UG/L
HEXACHLOROBENZENE	118741	ND	14.83	10.00	35.56	UG/L
HEXACHLOROBUTADIENE	87683	ND	14.83	10.00	35.56	UG/L
HEXACHLOROCYCLOPENTADIENE	77474	ND	14.83	10.00	35.56	UG/L
HEXACHLOROETHANE	67721	ND	14.83	10.00	35.56	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
HEXACHLOROPROPENE	1888717	ND	29.66	20.00	71.12	UG/L
HEXAMETHYLPHOSPHORAMIDE	680319	ND	2.00	2.00	2.00	UG/L
HEXANOIC ACID	142621	ND	14.83	10.00	35.56	UG/L
HEXAVALENT CHROMIUM	18540299	NC	18.67	10.00	76.00	UG/L
HOLMIUM	7440600	NC	336.78	0.50	500.00	UG/L
INDENO(1,2,3-CD)PYRENE	193395	ND	29.66	20.00	71.12	UG/L
INDIUM	7440746	NC	512.02	1.00	1000.00	UG/L
IODINE	7553562	NC	1943.00	500.00	3840.00	UG/L
IODOMETHANE	74884	ND	10.00	9.99	10.00	UG/L
IRIDIUM	7439885	NC	609.97	1.00	1708.00	UG/L
IRON	7439896	NC	2904.13	149.00	10838.00	UG/L
ISOBUTYL ALCOHOL	78831	ND	10.00	9.99	10.00	UG/L
ISODRIN	465736	ND	0.15	0.10	0.36	UG/L
ISOPHORONE	78591	ND	14.83	10.00	35.56	UG/L
ISOPROPALIN	33820530	ND	0.31	0.20	0.71	UG/L
ISOSAFROLE	120581	ND	14.83	10.00	35.56	UG/L
KEPONE	143500	ND	1.53	1.00	3.56	UG/L
LANTHANUM	7439910	NC	68.18	0.10	100.00	UG/L
LEAD	7439921	NC	1613.89	2.10	13248.00	UG/L
LEPTOPHOS	21609905	ND	3.05	2.00	7.10	UG/L
LITHIUM	7439932	NC	231.26	79.00	532.80	UG/L
LONGIFOLENE	475207	ND	74.14	50.00	177.80	UG/L
LUTETIUM	7439943	NC	66.78	0.10	100.00	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
M-XYLENE	108383	ND	10.00	9.99	10.00	UG/L
MAGNESIUM	7439954	NC	7435.80	1140.00	20400.00	UG/L
MALACHITE GREEN	569642	ND	14.83	10.00	35.56	UG/L
MALATHION	121755	ND	3.05	2.00	7.10	UG/L
MANGANESE	7439965	NC	114.72	4.00	388.00	UG/L
MCPA	94746	NC	115.60	50.00	399.20	UG/L
MCPP	7085190	NC	375.68	50.00	2594.00	UG/L
MERCURY	7439976	NC	21.06	0.20	115.36	UG/L
MERPHOS	150505	ND	3.58	2.00	7.10	UG/L
MESTRANOL	72333	ND	29.66	20.00	71.12	UG/L
METHAPYRILENE	91805	ND	14.83	10.00	35.56	UG/L
METHOXYCHLOR	72435	ND	0.31	0.20	0.71	UG/L
METHYL CHLORPYRIFOS	5598130	ND	3.05	2.00	7.10	UG/L
METHYL METHACRYLATE	80626	ND	10.00	9.99	10.00	UG/L
METHYL METHANESULFONATE	66273	ND	29.66	20.00	71.12	UG/L
METHYL PARATHION	298000	ND	3.05	2.00	7.10	UG/L
METHYL TRITHION	953173	ND	5.00	5.00	5.00	UG/L
METHYLENE CHLORIDE	75092	ND	10.00	9.99	10.00	UG/L
METRIBUZIN	21087649	ND	0.15	0.10	0.36	UG/L
MEVINPHOS	7786347	ND	7.64	5.00	17.78	UG/L
MIREX	2385855	ND	0.31	0.20	0.71	UG/L
MOLYBDENUM	7439987	NC	336.68	4.60	1024.40	UG/L
MONOCROTOPHOS	6923224	NC	2.00	2.00	2.00	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
N-DECANE	124185	ND	14.83	10.00	35.56	UG/L
N-DOCOSANE	629970	ND	14.83	10.00	35.56	UG/L
N-DODECANE	112403	ND	14.83	10.00	35.56	UG/L
N-EICOSANE	112958	ND	14.83	10.00	35.56	UG/L
N-HEXACOSANE	630013	NC	20.41	10.00	92.91	UG/L
N-HEXADECANE	544763	ND	14.83	10.00	35.56	UG/L
N-NITROSODI-N-BUTYLAMINE	924163	ND	14.83	10.00	35.56	UG/L
N-NITROSODIETHYLAMINE	55185	ND	14.83	10.00	35.56	UG/L
N-NITROSODIMETHYLAMINE	62759	ND	74.14	50.00	177.80	UG/L
N-NITROSODIPHENYLAMINE	86306	ND	29.66	20.00	71.12	UG/L
N-NITROSOMETHYLETHYLAMINE	10595956	ND	14.83	10.00	35.56	UG/L
N-NITROSOMETHYLPHENYLAMINE	614006	ND	146.80	99.00	352.04	UG/L
N-NITROSOMORPHOLINE	59892	ND	14.83	10.00	35.56	UG/L
N-NITROSOPIPERIDINE	100754	ND	14.83	10.00	35.56	UG/L
N-OCTACOSANE	630024	NC	21.81	10.00	95.71	UG/L
N-OCTADECANE	593453	ND	14.83	10.00	35.56	UG/L
N-TETRACOSANE	646311	ND	14.83	10.00	35.56	UG/L
N-TETRADECANE	629594	ND	14.83	10.00	35.56	UG/L
N-TRIACONTANE	638686	NC	16.53	10.00	46.21	UG/L
N,N-DIMETHYLFORMAMIDE	68122	ND	14.83	10.00	35.56	UG/L
NALED	300765	ND	8.64	5.00	17.78	UG/L
NAPHTHALENE	91203	ND	14.83	10.00	35.56	UG/L
NEODYMIUM	7440008	NC	246.75	0.50	500.00	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
NICKEL	7440020	NC	134.26	4.50	327.00	UG/L
NIOBIUM	7440031	NC	525.87	29.25	1000.00	UG/L
NITRATE/NITRITE	C-005	NC	2650.93	360.00	4560.00	UG/L
NITROBENZENE	98953	ND	14.83	10.00	35.56	UG/L
NITROFEN	1836755	ND	0.31	0.20	0.71	UG/L
NORFLURAZON	27314132	NC	1.59	1.00	4.08	UG/L
O+P XYLENE	136777612	ND	10.00	9.99	10.00	UG/L
O-ANISIDINE	90040	ND	14.83	10.00	35.56	UG/L
O-CRESOL	95487	ND	14.83	10.00	35.56	UG/L
O-TOLUIDINE	95534	ND	14.83	10.00	35.56	UG/L
O-TOLUIDINE, 5-CHLORO-	95794	ND	14.83	10.00	35.56	UG/L
OCDD	3268879	NC	0.00	0.00	0.00	UG/L
OCDF	39001020	NC	0.00	0.00	0.00	UG/L
OIL AND GREASE	C-036	NC	5066.67	5000.00	6000.00	UG/L
OSMIUM	7440042	NC	67.19	0.10	100.00	UG/L
P-CHLOROANILINE	106478	ND	14.83	10.00	35.56	UG/L
P-CRESOL	106445	ND	14.83	10.00	35.56	UG/L
P-CYMENE	99876	ND	14.83	10.00	35.56	UG/L
P-DIMETHYLAMINOAZOBENZENE	60117	ND	29.66	20.00	71.12	UG/L
P-NITROANILINE	100016	ND	74.14	50.00	177.80	UG/L
PALLADIUM	7440053	ND	333.50	0.50	500.00	UG/L
PARATHION (ETHYL)	56382	ND	3.05	2.00	7.10	UG/L
PCB 1016	12674112	ND	1.53	1.00	3.56	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
PCB 1221	11104282	ND	1.53	1.00	3.56	UG/L
PCB 1232	11141165	ND	1.53	1.00	3.56	UG/L
PCB 1242	53469219	ND	1.53	1.00	3.56	UG/L
PCB 1248	12672296	ND	1.53	1.00	3.56	UG/L
PCB 1254	11097691	ND	1.53	1.00	3.56	UG/L
PCB 1260	11096825	ND	1.53	1.00	3.56	UG/L
PENDAMETHALIN	40487421	ND	0.76	0.50	1.78	UG/L
PENTACHLOROBENZENE	608935	ND	29.66	20.00	71.12	UG/L
PENTACHLORONITROBENZENE (PCNB)	82688	ND	0.08	0.05	0.18	UG/L
PENTACHLOROPHENOL	87865	ND	74.14	50.00	177.80	UG/L
PENTAMETHYLBENZENE	700129	ND	14.83	10.00	35.56	UG/L
PERTHANE	72560	ND	15.27	10.00	35.56	UG/L
PERYLENE	198550	ND	14.83	10.00	35.56	UG/L
PHENACETIN	62442	ND	14.83	10.00	35.56	UG/L
PHENANTHRENE	85018	ND	14.83	10.00	35.56	UG/L
PHENOL	108952	NC	17.11	10.00	44.16	UG/L
PHENOL, 2-METHYL-4,6-DINITRO-	534521	ND	29.66	20.00	71.12	UG/L
PHENOTHIAZINE	92842	ND	74.14	50.00	177.80	UG/L
PHORATE	298022	ND	3.05	2.00	7.10	UG/L
PHOSMET	732116	ND	7.64	5.00	17.78	UG/L
PHOSPHAMIDON E	297994	ND	7.64	5.00	17.78	UG/L
PHOSPHAMIDON Z	23783984	ND	7.64	5.00	17.78	UG/L
PHOSPHORUS	7723140	NC	32480.80	3210.00	225800.00	UG/L

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
PICLORAM	1918021	ND	0.76	0.50	1.78	UG/L
PLATINUM	7440064	NC	528.11	1.00	1000.00	UG/L
POTASSIUM	7440097	NC	77743.00	1310.00	195400.00	UG/L
PRASEODYMIUM	7440100	NC	927.87	1.00	3910.00	UG/L
PRONAMIDE	23950585	ND	14.83	10.00	35.56	UG/L
PROPACHLOR	1918167	ND	0.15	0.10	0.36	UG/L
PROPANIL	709988	ND	1.53	1.00	3.56	UG/L
PROPAZINE	139402	ND	1.53	1.00	3.56	UG/L
PYRENE	129000	ND	14.83	10.00	35.56	UG/L
PYRIDINE	110861	ND	14.83	10.00	35.56	UG/L
RESORCINOL	108463	ND	74.14	50.00	177.80	UG/L
RHENIUM	7440155	NC	615.13	205.00	1000.00	UG/L
RHODIUM	7440166	NC	670.22	1.00	1000.00	UG/L
RONNEL	299843	ND	3.05	2.00	7.10	UG/L
RUTHENIUM	7440188	NC	504.65	1.00	1000.00	UG/L
SAFROLE	94597	ND	14.83	10.00	35.56	UG/L
SAMARIUM	7440199	NC	336.92	0.50	500.00	UG/L
SCANDIUM	7440202	NC	66.75	0.10	100.00	UG/L
SELENIUM	7782492	NC	102.82	2.30	429.20	UG/L
SILICON	7440213	NC	15414.00	5380.00	28100.00	UG/L
SILVER	7440224	NC	98.92	1.00	390.80	UG/L
SIMAZINE	122349	ND	12.22	8.00	28.46	UG/L
SODIUM	7440235	NC	3443333.33	6400.00	11250600.00	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
SQUALENE	7683649	ND	146.80	99.00	352.04	UG/L
STROBANE	8001501	ND	7.64	5.00	17.78	UG/L
STRONTIUM	7440246	NC	630.23	100.00	2280.00	UG/L
STYRENE	100425	ND	14.83	10.00	35.56	UG/L
SULFOTEP	3689245	ND	4.05	2.00	7.10	UG/L
SULFUR	7704349	NC	400788.06	2145.00	1078240.00	UG/L
SULPROFOS	35400432	ND	3.05	2.00	7.10	UG/L
TANTALUM	7440257	NC	333.89	0.50	500.00	UG/L
TELLURIUM	13494809	ND	667.00	1.00	1000.00	UG/L
TEPP	107493	ND	5.00	5.00	5.00	UG/L
TERBACIL	5902512	ND	3.05	2.00	7.10	UG/L
TERBIUM	7440279	NC	342.22	0.50	500.00	UG/L
TERBUFOS	13071799	ND	3.05	2.00	7.10	UG/L
TERBUTHYLAZINE	5915413	ND	7.64	5.00	17.78	UG/L
TETRACHLOROETHENE	127184	ND	10.00	9.99	10.00	UG/L
TETRACHLOROMETHANE	56235	ND	10.00	9.99	10.00	UG/L
TETRACHLORVINPHOS	22248799	ND	3.05	2.00	7.10	UG/L
THALLIUM	7440280	NC	9.19	1.20	20.00	UG/L
THIANAPHTHENE	95158	ND	14.83	10.00	35.56	UG/L
THIOACETAMIDE	62555	ND	29.66	20.00	71.12	UG/L
THIOXANTHE-9-ONE	492228	ND	29.66	20.00	71.12	UG/L
THORIUM	7440291	NC	512.90	1.00	1000.00	UG/L
THULIUM	7440304	NC	333.98	0.50	500.00	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
TIN	7440315	NC	665.88	14.50	6046.00	UG/L
TITANIUM	7440326	NC	777.71	5.00	4474.20	UG/L
TOKUTHION	34643464	ND	2.00	2.00	2.00	UG/L
TOLUENE	108883	ND	10.00	9.99	10.00	UG/L
TOLUENE, 2,4-DIAMINO-	95807	ND	146.80	99.00	352.04	UG/L
TOTAL CYANIDE	57125	NC	17.93	10.00	105.00	UG/L
TOTAL DISSOLVED SOLIDS	C-010	NC	12815853.33	158000.00	32641200.00	UG/L
TOTAL ORGANIC CARBON (TOC)	C-012	NC	10485.33	10000.00	16000.00	UG/L
TOTAL PHENOLS	C-020	NC	93.20	50.00	681.00	UG/L
TOTAL PHOSPHORUS	14265442	NC	1088.60	10.00	4460.00	UG/L
TOTAL SULFIDE (IODOMETRIC)	18496258	NC	28261.33	1000.00	103200.00	UG/L
TOTAL SUSPENDED SOLIDS	C-009	NC	122553.33	4000.00	522000.00	UG/L
TOXAPHENE	8001352	ND	7.64	5.00	17.78	UG/L
TRANS-PERMETHRIN	61949777	ND	3.05	2.00	7.10	UG/L
TRANS-1,2-DICHLOROETHENE	156605	ND	10.00	9.99	10.00	UG/L
TRANS-1,3-DICHLOROPROPENE	10061026	ND	10.00	9.99	10.00	UG/L
TRANS-1,4-DICHLORO-2-BUTENE	110576	ND	50.00	49.94	50.00	UG/L
TRIADIMEFON	43121433	ND	1.53	1.00	3.56	UG/L
TRIBROMOMETHANE	75252	ND	10.00	9.99	10.00	UG/L
TRICHLORFON	52686	ND	7.64	5.00	17.78	UG/L
TRICHLOROETHENE	79016	ND	10.00	9.99	10.00	UG/L
TRICHLOROFLUOROMETHANE	75694	ND	10.00	10.00	10.00	UG/L
TRICHLORONATE	327980	ND	3.05	2.00	7.10	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
TRICRESYLPHOSPHATE	78308	ND	15.27	10.00	35.56	UG/L
TRIFLURALIN	1582098	ND	0.15	0.10	0.36	UG/L
TRIMETHYLPHOSPHATE	512561	ND	2.00	2.00	2.00	UG/L
TRIPHENYLENE	217594	ND	14.83	10.00	35.56	UG/L
TRIPROPYLENEGLYCOL METHYL ETHER	20324338	ND	146.80	99.00	352.04	UG/L
TUNGSTEN	7440337	NC	649.28	93.20	1000.00	UG/L
URANIUM	7440611	NC	1096.71	10.10	2670.00	UG/L
VANADIUM	7440622	NC	107.67	2.60	488.20	UG/L
VINYL ACETATE	108054	ND	50.00	49.94	50.00	UG/L
VINYL CHLORIDE	75014	ND	10.00	9.99	10.00	UG/L
YTTERBIUM	7440644	NC	68.46	0.10	100.00	UG/L
YTTRIUM	7440655	ND	4.33	3.00	5.00	UG/L
ZINC	7440666	NC	3718.81	89.75	12310.00	UG/L
ZIRCONIUM	7440677	NC	67.89	0.10	100.00	UG/L
1-BROMO-2-CHLOROBENZENE	694804	ND	14.83	10.00	35.56	UG/L
1-BROMO-3-CHLOROBENZENE	108372	ND	14.83	10.00	35.56	UG/L
1-CHLORO-3-NITROBENZENE	121733	ND	74.14	50.00	177.80	UG/L
1-METHYLFLUORENE	1730376	ND	14.83	10.00	35.56	UG/L
1-METHYLPHENANTHRENE	832699	ND	14.83	10.00	35.56	UG/L
1-NAPHTHYLAMINE	134327	ND	14.83	10.00	35.56	UG/L
1-PHENYLNAPHTHALENE	605027	ND	14.83	10.00	35.56	UG/L
1,1-DICHLOROETHANE	75343	ND	10.00	9.99	10.00	UG/L
1,1-DICHLOROETHENE	75354	ND	10.00	9.99	10.00	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
1,1,1-TRICHLOROETHANE	71556	ND	10.00	9.99	10.00	UG/L
1,1,1,2-TETRACHLOROETHANE	630206	ND	10.00	9.99	10.00	UG/L
1,1,2-TRICHLOROETHANE	79005	ND	10.00	9.99	10.00	UG/L
1,1,2,2-TETRACHLOROETHANE	79345	ND	10.00	9.99	10.00	UG/L
1,2-DIBROMO-3-CHLOROPROPANE	96128	ND	29.66	20.00	71.12	UG/L
1,2-DIBROMOETHANE	106934	ND	10.00	9.99	10.00	UG/L
1,2-DICHLOROBENZENE	95501	ND	14.83	10.00	35.56	UG/L
1,2-DICHLOROETHANE	107062	ND	10.00	9.99	10.00	UG/L
1,2-DICHLOROPROPANE	78875	ND	10.00	9.99	10.00	UG/L
1,2-DIPHENYLHYDRAZINE	122667	ND	29.66	20.00	71.12	UG/L
1,2,3-TRICHLOROBENZENE	87616	ND	14.83	10.00	35.56	UG/L
1,2,3-TRICHLOROPROPANE	96184	ND	10.00	9.99	10.00	UG/L
1,2,3-TRIMETHOXYBENZENE	634366	ND	14.83	10.00	35.56	UG/L
1,2,4-TRICHLOROBENZENE	120821	ND	14.83	10.00	35.56	UG/L
1,2,4,5-TETRACHLOROBENZENE	95943	ND	14.83	10.00	35.56	UG/L
1,2:3,4-DIEPOXYBUTANE	1464535	ND	29.66	20.00	71.12	UG/L
1,3-BUTADIENE, 2-CHLORO	126998	ND	10.00	9.99	10.00	UG/L
1,3-DICHLORO-2-PROPANOL	96231	ND	14.83	10.00	35.56	UG/L
1,3-DICHLOROBENZENE	541731	ND	14.83	10.00	35.56	UG/L
1,3-DICHLOROPROPANE	142289	ND	10.00	9.99	10.00	UG/L
1,3,5-TRITHIANE	291214	ND	74.14	50.00	177.80	UG/L
1,4-DICHLOROBENZENE	106467	ND	14.83	10.00	35.56	UG/L
1,4-DINITROBENZENE	100254	ND	29.66	20.00	71.12	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
1,4-DIOXANE	123911	ND	10.00	9.99	10.00	UG/L
1,4-NAPHTHOQUINONE	130154	ND	146.80	99.00	352.04	UG/L
1,5-NAPHTHALENEDIAMINE	2243621	ND	146.80	99.00	352.04	UG/L
1234678-HPCDD	35822469	NC	0.00	0.00	0.00	UG/L
1234678-HPCDF	67562394	NC	0.00	0.00	0.00	UG/L
123478-HXCDD	39227286	ND	0.00	0.00	0.00	UG/L
123478-HXCDF	70648269	ND	0.00	0.00	0.00	UG/L
1234789-HPCDF	55673897	ND	0.00	0.00	0.00	UG/L
123678-HXCDD	57653857	ND	0.00	0.00	0.00	UG/L
123678-HXCDF	57117449	ND	0.00	0.00	0.00	UG/L
12378-PECDD	40321764	ND	0.00	0.00	0.00	UG/L
12378-PECDF	57117416	ND	0.00	0.00	0.00	UG/L
123789-HXCDD	19408743	ND	0.00	0.00	0.00	UG/L
123789-HXCDF	72918219	ND	0.00	0.00	0.00	UG/L
2-(METHYLTHIO)BENZOTHIAZOLE	615225	ND	14.83	10.00	35.56	UG/L
2-BUTANONE	78933	ND	50.00	49.94	50.00	UG/L
2-CHLOROETHYLVINYL ETHER	110758	ND	10.00	9.99	10.00	UG/L
2-CHLORONAPHTHALENE	91587	ND	14.83	10.00	35.56	UG/L
2-CHLOROPHENOL	95578	ND	14.83	10.00	35.56	UG/L
2-HEXANONE	591786	ND	50.00	49.94	50.00	UG/L
2-ISOPROPYLNAPHTHALENE	2027170	ND	14.83	10.00	35.56	UG/L
2-METHYLBENZOTHIOAZOLE	120752	ND	14.83	10.00	35.56	UG/L
2-METHYLNAPHTHALENE	91576	ND	14.83	10.00	35.56	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
2-NITROANILINE	88744	ND	14.83	10.00	35.56	UG/L
2-NITROPHENOL	88755	ND	29.66	20.00	71.12	UG/L
2-PHENYLNAPHTHALENE	612942	ND	14.83	10.00	35.56	UG/L
2-PICOLINE	109068	ND	74.14	50.00	177.80	UG/L
2-PROPANONE	67641	ND	50.00	49.94	50.00	UG/L
2-PROPEN-1-OL	107186	ND	10.00	9.99	10.00	UG/L
2-PROPENAL	107028	ND	50.00	49.94	50.00	UG/L
2-PROPENENITRILE, 2-METHYL-	126987	ND	10.00	9.99	10.00	UG/L
2,3-BENZOFLUORENE	243174	ND	14.83	10.00	35.56	UG/L
2,3-DICHLOROANILINE	608275	ND	14.83	10.00	35.56	UG/L
2,3-DICHLORONITROBENZENE	3209221	ND	74.14	50.00	177.80	UG/L
2,3,4,6-TETRACHLOROPHENOL	58902	ND	29.66	20.00	71.12	UG/L
2,3,6-TRICHLOROPHENOL	933755	ND	14.83	10.00	35.56	UG/L
2,4-D	94757	NC	1.80	1.00	3.56	UG/L
2,4-DB	94826	NC	3.43	2.00	10.46	UG/L
2,4-DICHLOROPHENOL	120832	ND	14.83	10.00	35.56	UG/L
2,4-DIMETHYLPHENOL	105679	ND	14.83	10.00	35.56	UG/L
2,4-DINITROPHENOL	51285	ND	74.14	50.00	177.80	UG/L
2,4-DINITROTOLUENE	121142	ND	14.83	10.00	35.56	UG/L
2,4,5-T	93765	NC	0.35	0.20	0.71	UG/L
2,4,5-TP	93721	NC	0.42	0.20	1.25	UG/L
2,4,5-TRICHLOROPHENOL	95954	ND	14.83	10.00	35.56	UG/L
2,4,6-TRICHLOROPHENOL	88062	ND	14.83	10.00	35.56	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
2,6-DI-TERT-BUTYL-P-BENZOQUINONE	719222	ND	146.80	99.00	352.04	UG/L
2,6-DICHLORO-4-NITROANILINE	99309	ND	146.80	99.00	352.04	UG/L
2,6-DICHLOROPHENOL	87650	ND	14.83	10.00	35.56	UG/L
2,6-DINITROTOLUENE	606202	ND	14.83	10.00	35.56	UG/L
234678-HXCDF	60851345	ND	0.00	0.00	0.00	UG/L
23478-PECDF	57117314	ND	0.00	0.00	0.00	UG/L
2378-TCDD	1746016	ND	0.00	0.00	0.00	UG/L
2378-TCDF	51207319	ND	0.00	0.00	0.00	UG/L
3-CHLOROPROPENE	107051	ND	10.00	9.99	10.00	UG/L
3-METHYLCHOLANTHRENE	56495	ND	14.83	10.00	35.56	UG/L
3-NITROANILINE	99092	ND	29.66	20.00	71.12	UG/L
3,3'-DICHLOROBENZIDINE	91941	ND	74.14	50.00	177.80	UG/L
3,3'-DIMETHOXYBENZIDINE	119904	ND	74.14	50.00	177.80	UG/L
3,6-DIMETHYLPHENANTHRENE	1576676	ND	14.83	10.00	35.56	UG/L
4-AMINOBIPHENYL	92671	ND	14.83	10.00	35.56	UG/L
4-BROMOPHENYL PHENYL ETHER	101553	ND	14.83	10.00	35.56	UG/L
4-CHLORO-2-NITROANILINE	89634	ND	29.66	20.00	71.12	UG/L
4-CHLORO-3-METHYLPHENOL	59507	ND	14.83	10.00	35.56	UG/L
4-CHLOROPHENYLPHENYL ETHER	7005723	ND	14.83	10.00	35.56	UG/L
4-METHYL-2-PENTANONE	108101	ND	50.00	49.94	50.00	UG/L
4-NITROPHENOL	100027	ND	74.14	50.00	177.80	UG/L
4,4'-DDD	72548	ND	0.31	0.20	0.71	UG/L
4,4'-DDE	72559	ND	0.15	0.10	0.36	UG/L

Listing of SCC Data General Summary Statistics

Analyte	CAS_NO	Meas. Type	Mean	Min	Max	Unit
4,4'-DDT	50293	ND	0.15	0.10	0.36	UG/L
4,4'-METHYLENEBIS(2-CHLOROANILINE)	101144	ND	29.66	20.00	71.12	UG/L
4,5-METHYLENE PHENANTHRENE	203645	ND	14.83	10.00	35.56	UG/L
5-NITRO-O-TOLUIDINE	99558	ND	14.83	10.00	35.56	UG/L
7,12-DIMETHYLBENZ(A)ANTHRACENE	57976	ND	14.83	10.00	35.56	UG/L

APPENDIX B ACRONYMS AND DEFINITIONS

Administrator -- The Administrator of the U.S. Environmental Protection Agency
Agency -- The U.S. Environmental Protection Agency
BAT -- The best available technology economically achievable, as described in Sec. 304(b)(2) of the CWA.
BCT -- The best conventional pollutant control technology, as described in Sec. 304(b)(4) of the CWA.
BOD_5 -- Biochemical oxygen demand - Five Day. A measure of biochemical decomposition of organic matter in a water sample. It is determined by measuring the dissolved oxygen consumed by microorganisms to oxidize the organic contaminants in a water sample under standard laboratory conditions of five days and 70°C. BOD_5 is not related to the oxygen requirements in chemical combustion.
Boiler -- means an enclosed device using controlled flame combustion and having the following characteristics:
(1) (I) The unit must have physical provisions for recovering and exporting thermal energy in the form of steam, heated fluids, or heated gases; and

(ii) The unit's combustion chamber and primary energy recovery section(s) must be of integral design. To be of integral design, the combustion chamber and the primary energy recovery section(s) (such as waterwalls and superheaters) must be physically formed into one manufactured or assembled unit. A unit in which the combustion chamber and the primary energy recovery section(s) are joined only by ducts or connections carrying flue gas is not integrally designed; however, secondary energy recovery equipment (such as economizers or air preheaters) need not be physically formed into the same unit as the combustion chamber and the primary energy recovery section. The following units are not precluded from being boilers solely because they are not of integral design: process heaters (units that transfer energy directly to a process stream), and fluidized bed combustion units; and

(iii) While in operation, the unit must maintain a thermal energy recovery efficiency of at least 60 percent, calculated in terms of the recovered energy compared with the thermal value of the fuel; and

(iv) The unit must export and utilize at least 75 percent of the recovered energy, calculated on an annual basis. In this calculation, no credit shall be given for recovered heat used internally in the same unit. (Examples of internal use are the preheating of fuel or combustion air, and the driving of induced or forced draft fans or feedwater pumps); or
(2) The unit is one which the Regional Administrator has determined, on a case-by-case basis, to be a boiler, after considering the standards in Section 260.32.
BPT -- The best practicable control technology currently available, as described in Sec. 304(b)(1) of the CWA.
Captive -- Used to describe a facility that only accepts waste generated on site and/or by the owner operator at the facility.
Centralized waste treatment facility -- Any facility that treats any hazardous or non-hazardous industrial wastes received from off-site by tanker truck, trailer/roll-off bins, drums, barge, pipeline, or other forms of shipment. A "centralized waste treatment facility" includes 1) a facility that treats waste received from off-site exclusively and 2) a facility that treats wastes generated on-site as well

as waste received from off-site.

Clarification -- A treatment designed to remove suspended materials from wastewater--typically by sedimentation.

Clean Water Act (CWA) -- The Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1251 et seq.), as amended, *inter alia*, by the Clean Water Act of 1977 (Public Law 95-217) and the Water Quality Act of 1987 (Public Law 100-4).

Closed -- A facility or portion thereof that is currently not receiving or accepting wastes and has undergone final closure.

Combustion Unit -- A device for waste treatment which uses elevated temperatures as the primary means to change the chemical, physical, biological character or composition of the waste. Examples of combustion units are incinerators, fuel processors, boilers, industrial furnaces, and kilns.

Commercial facility -- Facilities that accept waste from off-site for treatment from facilities not under the same ownership as their facility. Commercial operations are usually made available for a fee or other remuneration. Commercial waste treatment does not have to be the primary activity at a facility for an operation or unit to be considered "commercial."

Conventional pollutants -- The pollutants identified in Sec. 304(a)(4) of the CWA and the regulations thereunder (biochemical oxygen demand (BOD_5), total suspended solids (TSS), oil and grease, fecal coliform, and pH).

Direct discharger -- A facility that discharges or may discharge treated or untreated pollutants into waters of the United States.

Disposal -- Intentional placement of waste or waste treatment residual into or on any land where the material will remain after closure. Waste or residual placed into any water is not defined as disposal, but as discharge.

Effluent -- Wastewater discharges.

Effluent limitation -- Any restriction, including schedules of compliance, established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean. (CWA Sections 301(b) and 304(b).)

EA -- Economic Analysis

EPA -- The U.S. Environmental Protection Agency.

Facility -- A facility is all contiguous property owned, operated, leased or under the control of the same person. The contiguous property may be divided by public or private right-of-way.

Hazardous Waste -- Any waste, including wastewaters defined as hazardous under RCRA, Toxic Substances Control Act (TSCA), or any state law.

Incinerator -- means any enclosed device that:

(1) Uses controlled flame combustion and neither meets the criteria for classification as a boiler, sludge dryer, or carbon regeneration unit, nor is listed as an industrial furnace; or

(2) Meets the definition of infrared incinerator or plasma arc incinerator.

Indirect discharger -- A facility that discharges or may discharge pollutants into a publicly-owned treatment works.

Industrial Furnace -- means any of the following enclosed devices that are integral components of manufacturing processes and that use thermal treatment to accomplish recovery of materials or energy:

(1) Cement kilns
(2) Lime kilns
(3) Aggregate kilns
(4) Phosphate kilns
(5) Coke ovens
(6) Blast furnaces
(7) Smelting, melting and refining furnaces (including pyrometallurgical devices such as cupolas, reverberator furnaces, sintering machine, roasters, and foundry furnaces)
(8) Titanium dioxide chloride process oxidation reactors
(9) Methane reforming furnaces
(10) Pulping liquor recovery furnaces
(11) Combustion devices used in the recovery of sulfur values from spent sulfuric acid
(12) Halogen acid furnaces (HAFs) for the production of acid from halogenated hazardous waste generated by chemical production facilities where the furnace is located on the site of a chemical production facility, the acid product has a halogen acid content of at least 3 percent, the acid product is used in a manufacturing process, and except for hazardous waste burned as fuel, hazardous waste fed to the furnace has a minimum halogen content of 20 percent as generated.
(13) Such other devices as the Administrator may, after notice and comment, add to this list on the basis of one or more of the following factors:
(I) The design and use of the device primarily to accomplish recovery of material products;
(ii) The use of the device to burn or reduce raw materials to make a material product;
(iii) The use of the device to burn or reduce secondary materials as effective substitutes for raw materials, in processes using raw materials as principal feedstocks;
(iv) The use of the device to burn or reduce secondary materials as ingredients in an industrial process to make a material product;
(v) The use of the device in common industrial practice to produce a material product; and,
(vi) Other factors, as appropriate.

Industrial Waste -- Hazardous or non-hazardous waste generated from industrial operation. This definition excludes refuse and infectious wastes.

Industrial Waste Combustor facility -- Any thermal unit that burns any hazardous or non-hazardous industrial wastes received from off-site from facilities not under their same corporate structure or subject to the same ownership. This term includes the following: a facility that burns waste received from off-site exclusively as well as a facility that burns wastes generated on-site and waste received from off-site. Examples of a commercial industrial waste combustor facility include: rotary kiln incinerators, cement kilns, lime kilns, aggregate kilns, boilers, etc.

Industrial Waste Combustor wastewater -- Water used in air pollution control systems of industrial waste combustion operations or water used to quench flue gas or slag generated as a result of industrial waste combustion operations.

Intracompany -- A facility that treats, disposes, or recycles/recovers wastes generated by off-site facilities under the same corporate ownership. The facility may also treat on-site generated wastes. If any waste from other facilities not under the same corporate ownership is accepted for a fee or other remunerations, the facility is considered commercial.

LTA -- Long-term Average. For purposes of the effluent guidelines, LTAs are defined as average pollutant levels achieved over a period of time by a technology option. LTAs were used in developing the limitations and standards in today's proposed regulation.

Minimum level -- The level at which an analytical system gives recognizable signals and an acceptable calibration point.

Municipal Facility -- A facility which is owned or operated by a municipal, county, or regional government.

New Source -- "New source" is defined at 40 CFR 122.2 and 122.29.

Non-conventional pollutants -- Pollutants that are neither conventional pollutants nor priority pollutants listed at 40 CFR Section 401.

Non-detect value -- A concentration-based measurement reported below the sample specific detection limit that can reliably be measured by the analytical method for the pollutant.

Non-hazardous waste -- All waste not defined as hazardous under federal or state law.

Non-water quality environmental impact -- An environmental impact of a control or treatment technology, other than to surface waters.

NPDES -- The National Pollutant Discharge Elimination System authorized under Sec. 402 of the CWA. NPDES requires permits for discharge of pollutants from any point source into waters of the United States.

NSPS -- New Source Performance Standards

OCPSF -- Organic Chemicals, Plastics, and Synthetic Fibers Manufacturing Effluent Guideline.

Off-site -- "Off-site" means outside the boundaries of a facility.

On-site -- "On-site" means within the boundaries of a facility.

Outfall -- The mouth of conduit drains and other conduits from which a facility effluent discharges into receiving waters.

Point Source Category -- A category of sources of water pollutants.

POTW or POTWs -- Publicly-owned treatment works, as defined at 40 CFR 403.3(o).

Pretreatment Standard -- a regulation that establishes industrial wastewater effluent quality as required for discharge to a POTW. (CWA Section 307(b).)

Priority Pollutants -- The pollutants designated by EPA as priority in 40 CFR Part 423 Appendix A.

Process wastewater -- "Process Wastewater" is defined at 40 CFR 122.2.

PSES -- Pretreatment standards for existing sources of indirect discharges, under Sec. 307(b) of the CWA.

PSNS -- Pretreatment standards for new sources of indirect discharges, under Sec. 307(b) and (c) of the CWA.

RCRA -- Resource Conservation and Recovery Act (PL 94-580) of 1976, as amended.

Residuals -- The material remaining after a natural or technological process has taken place, e.g., the sludge remaining after initial wastewater treatment.

Sewage Sludge -- Sludge generated by a sewage treatment plant or POTW.

Sludge -- The accumulated solids separated from liquids during processing.

Small business -- Businesses with annual sales revenues less than $6 million. This is the Small Business Administration definition of small business for SIC code 4953, Refuse Systems (13 CFR Ch.1, § 121.601)

Solids -- For the purpose of this notice, a waste that has a very low moisture content, is not freeflowing, and does not release free liquids. This definition deals with the physical state of the waste, not the RCRA definition.

Treatment -- Any activity designed to change the character or composition of any waste so as to prepare it for transportation, storage, or disposal; render it amenable for recycling or recovery; or reduce it in volume.

TSS -- Total Suspended Solids. A measure of the amount of particulate matter that is suspended in a water sample. The measure is obtained by filtering a water sample of known volume. The particulate material retained on the filter is then dried and weighed.

Waste Receipt -- Wastes received for combustion.

Wastewater treatment system -- A facility, including contiguous land and structures, used to receive and treat wastewater. The discharge of a pollutant from such a facility is subject to regulation under the Clean Water Act.

Waters of the United States -- The same meaning set forth in 40 CFR 122.2

Zero discharge -- No discharge of pollutants to waters of the United States or to a POTW. Also included in this definition are discharge of pollutants by way of evaporation, deep-well injection, off-site transfer and land application.