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Development Document for Final Effluent Limitations Guidelines and Standards for Commercial Hazardous Waste Combustors

DEVELOPMENT DOCUMENT
FOR
FINAL EFFLUENT LIMITATIONS
GUIDELINES AND STANDARDS
FOR THE
COMMERCIAL HAZARDOUS WASTE COMBUSTOR SUBCATEGORY
OF THE
WASTE COMBUSTORS POINT SOURCE CATEGORY

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Credit must also be given to the additional members of the CHWC project team (William Anderson, Charles White, Patricia Harrigan, and Richard Witt) for their professional manner, conscientious effort and contributions.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES

SECTION 1
LEGAL AUTHORITY

1.1 LEGAL AUTHORITY

Effluent limitations guidelines and standards for the Commercial Hazardous Waste Combustor Industry (formerly Industrial Waste Combustor Industry) are promulgated under the authority of Sections 301, 304, 306, 307, 308 and 501 of the Clean Water Act, 33 U.S.C. 1311, 1314, 1316, 1317, 1318, 1342, and 1361.

1.2 BACKGROUND

1.2.1 *Clean Water Act (CWA)*

The Federal Water Pollution Control Act Amendments of 1972 established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (Section 101(a)). To implement the Act, EPA is to issue effluent limitations guidelines, pretreatment standards and new source performance standards for industrial discharges. These guidelines and standards are summarized briefly in the following sections.

1.2.1.1 Best Practicable Control Technology Currently Available (BPT) (Section 304(b)(1) of the CWA)

In the guidelines for an industry category, EPA defines BPT effluent limits for conventional, priority, and non-conventional pollutants. In specifying BPT, EPA looks at a number of factors. EPA first considers the cost of achieving effluent reductions in relation to the effluent reduction benefits. The Agency next considers: the age of the equipment and facilities; the processes employed and any required process changes; engineering aspects of the control technologies; non-water quality environmental impacts (including energy requirements); and such other factors as the Agency deems appropriate (CWA §304(b)(1)(B)).

Traditionally, EPA establishes BPT effluent limitations based on the average of the best performances of facilities within the industry of various ages, sizes, processes or other common characteristics. Where, however, existing performance within a category or subcategory is uniformly inadequate, EPA may require higher levels of control than currently in place in an industrial category (or subcategory) if the Agency determines that the technology can be practically applied.

1.2.1.2 Best Conventional Pollutant Control Technology (BCT) (Section 304(a)(4) of the CWA)

The 1977 amendments to the CWA required EPA to identify effluent reduction levels for conventional pollutants associated with BCT technology for discharges from existing industrial point sources. In addition to other factors specified in Section 304(b)(4)(B), the CWA requires that EPA establish BCT limitations after consideration of a two part "cost-reasonableness" test. EPA explained its methodology for the development of BCT limitations in the July 1986 Federal Register (51 FR 24974).

Section 304(a)(4) designates the following as conventional pollutants: five day biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, pH, and any additional pollutants defined by the Administrator as conventional. The Administrator designated oil and grease as an additional conventional pollutant on July 30, 1979 (44 FR 44501).

1.2.1.3 Best Available Technology Economically Achievable (BAT) (Section 304(b)(2)(B) of the CWA)

In general, BAT effluent limitations guidelines represent the best economically achievable performance of plants in the industrial subcategory or category. The factors considered in assessing BAT include the cost of achieving BAT effluent reductions, the age of equipment and facilities involved, the process employed, potential process changes, and non-water quality environmental impacts, including energy requirements. The Agency retains considerable discretion in assigning the weight to be accorded these factors. Unlike BPT limitations, BAT limitations may be based on effluent reductions attainable through changes in a facility's processes and operations. As with BPT, where existing performance is uniformly inadequate, BAT may require a higher level of performance than is currently being achieved based on technology transferred from a different subcategory or category. BAT may be based upon process changes or internal controls, even when these technologies are not common industry practice.

1.2.1.4 New Source Performance Standards (NSPS) (Section 306 of the CWA)

NSPS reflect effluent reductions that are achievable based on the best available demonstrated control technology. New facilities have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent controls attainable through the application of the best available control technology for all pollutants (i.e., conventional, non-conventional, and priority pollutants). In establishing NSPS, EPA is directed to take into consideration the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements.

1.2.1.5 Pretreatment Standards for Existing Sources (PSES) (Section 307(b) of the CWA)

PSES are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of publicly owned treatment works (POTW). The CWA authorized EPA to establish pretreatment standards for pollutants that pass through POTWs or interfere with treatment processes or sludge disposal methods at the POTW. Pretreatment standards are technology-based and analogous to BAT effluent limitations guidelines.

The general Pretreatment Regulations, which set forth the framework for the implementation of categorical pretreatment standards, are found in 40 CFR Part 403. Those regulations contain a definition of pass through that addresses localized rather than national instances of pass through and establish pretreatment standards that apply to all non-domestic dischargers (see 52 FR 1586, January 14, 1987).

1.2.1.6 Pretreatment Standards for New Sources (PSNS) (Section 307(b) of the CWA)

Like PSES, PSNS are designed to prevent the discharges of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. PSNS are to be issued at the same time as NSPS. New indirect dischargers have the opportunity to incorporate into their plants the best available demonstrated technologies. The Agency considers the same factors in promulgating PSNS as it considers in promulgating NSPS.

1.2.2 *Section 304(m) Requirements*

Section 304(m) of the Act (33 U.S.C. 1314(m)), added by the Water Quality Act of 1987, requires EPA to establish schedules for (1) reviewing and revising existing effluent limitation guidelines and standards ("effluent guidelines"), and (2) promulgating new effluent guidelines. On January 2, 1990, EPA published an Effluent Guidelines Plan (55 FR 80), that included schedules for developing new and revised effluent guidelines for several industry categories. One of the industries for which the Agency established a schedule was the Hazardous Waste Treatment Industry.

The Natural Resources Defense Council (NRDC) and Public Citizen, Inc. filed suit against the Agency, alleging violation of Section 304(m) and other statutory authorities requiring promulgation of effluent guidelines (NRDC et al. v. Reilly, Civ. No. 89-2980 (D.D.C.)). Under the terms of the consent decree in that case, as amended, EPA agreed, among other things, to propose effluent guidelines for the ALandfills and Industrial Waste Combusters@ category by November 1997 and final action by November 1999. Although the Consent Decree lists "Landfills and Industrial Waste Combusters" as a single entry, EPA is publishing separate regulations for Industrial Waste Combusters and for Landfills.

In order to reflect accurately the segment of the combustion industry being regulated today, EPA has now changed the name for this final regulation from "Industrial Waste Combustor" to "Commercial Hazardous Waste Combustor" regulations.

SECTION 2
DATA COLLECTION

In 1986, the Agency initiated a study of waste treatment facilities which receive waste from off site for treatment, recovery, or disposal. The Agency looked at various segments of the waste management industry including combustors, centralized waste treatment facilities, landfills, fuel blending operations, and waste solidification/stabilization processes (Preliminary Data Summary for the Hazardous Waste Treatment Industry, EPA 440-1-89-100, September 1989).

Development of effluent limitations guidelines and standards for the Commercial Hazardous Waste Combustor (CHWC) (formerly Industrial Waste Combustor (IWC)) Subcategory began in 1993. EPA originally looked at RCRA hazardous waste incinerators, RCRA boilers and industrial furnaces (BIFs), and non-hazardous combustion units that treat industrial waste. Sewage sludge incinerators, municipal waste incinerators, and medical waste incinerators were not included in the 1989 study or in the initial data collection effort in 1993. EPA limited the proposed rulemaking to the development of regulations for industrial waste combustors. Based on comments received on the proposed rulemaking, EPA has limited the final rulemaking to regulations for Commercial Hazardous Waste Combustors.

EPA has gathered and evaluated technical and economic data from various sources in the course of developing the final effluent limitations guidelines and standards for the CHWC Industry. These data sources include:

- Responses to EPA's "1992 Waste Treatment Industry Phase II: Incinerators Screener Survey,"
- Responses to EPA's "1994 Waste Treatment Industry Phase II: Incinerators Questionnaire,"
- Responses to EPA's "1994 Detailed Monitoring Questionnaire,"
- EPA's 1993 - 1995 sampling of selected CHWC facilities,
- Literature data, and

- Facility NPDES and POTW wastewater discharge permit data.

EPA has used data from these sources to profile the industry with respect to: wastes received for treatment or recovery, treatment/recovery processes, geographical distribution, and wastewater and solid waste disposal practices. EPA then characterized the wastewater generated by treatment/recovery operations through an evaluation of water usage, type of discharge or disposal, and the occurrence of conventional, non-conventional and priority pollutants.

2.1 CLEAN WATER ACT SECTION 308 QUESTIONNAIRES AND SCREENER SURVEYS

2.1.1 *Development of Questionnaires and Screener Surveys*

A major source of information and data used in developing effluent limitations guidelines and standards is industry responses to questionnaires and screener surveys distributed by EPA under the Authority of Section 308 of the Clean Water Act (CWA). The questionnaires typically request information concerning treatment processes, wastes received for treatment, and disposal practices as well as wastewater treatment system performance data. Questionnaires also request financial and economic data for use in assessing economic impacts and the economic achievability of technology options. Screener surveys generally request less detailed information than the questionnaires regarding treatment processes, wastes received for treatment and disposal practices.

EPA used its experience with previous questionnaires to develop one screener survey (the 1992 Waste Treatment Industry Phase II: Incinerators Screener Survey) and two questionnaires (the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire and the Detailed Monitoring Questionnaire) for this project. The 1992 Waste Treatment Industry Phase II: Incinerators Screener Survey was designed to obtain general infomation on facility operations from a census of the industry. The 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire was designed to request 1992 technical, economic, and financial data to describe industrial operations adequately from a census of facilities in the industry that were operating commercially and from a sample of facilities in the industry that were not operating commercially. The Detailed Monitoring Questionnaire was designed to elicit daily analytical data from a limited number of facilities which would be selected after receipt and review of the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire responses.

For the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire, EPA wanted to minimize the burden to industrial waste combustor facilities. Thus, only a statistical sample of the non-commercial facilities meeting the preliminary scope qualifications received the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire. The questionnaire specifically requested information on:

- combustion processes,
- types of waste received for combustion,
- wastewater and solid waste disposal practices,
- ancillary waste management operations,
- summary analytical monitoring data,
- the degree of co-combustion (combustion of waste received from off-site with other on-site industrial waste),
- cost of waste combustion processes, and
- the extent of wastewater recycling or reuse at facilities.

In the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire, EPA requested summary monitoring data from all recipients, but summary information is not sufficient for determining limitations and industry variability. Therefore, the Detailed Monitoring Questionnaire was designed to collect daily analytical data from a limited number of facilities. Facilities were chosen to complete the Detailed Monitoring Questionnaire based on technical information submitted in the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire. The burden was minimized in the Detailed Monitoring Questionnaire by tailoring the questionnaire to the facility operations.

EPA sent draft screener surveys and questionnaires to industry trade associations, incinerator facilities who had expressed interest, and environmental groups for review and comment. A pre-test for both the 1992 Waste Treatment Industry Phase II: Incinerators Screener Survey and the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire was conducted at nine industrial waste combustor facilities to determine if the type of information necessary would be received from the questions posed as well as to determine if questions were designed to minimize the burden to facilities.

Based on comments from the reviewers, EPA modified the draft questionnaire.

As required by the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq*., EPA submitted the Questionnaire package (including the 1992 Waste Treatment Industry Phase II: Incinerators Screener Survey and the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire and the Detailed Monitoring Questionnaire) to the Office of Management and Budget (OMB) for review. EPA also redistributed the questionnaire package to industry trade associations, industrial waste combustor facilities, environmental groups, and to any others who requested a copy of the questionnaire package.

2.1.2 *Distribution of Screener Surveys and Questionnaires*

Under the authority of Section 308 of the Clean Water Act, EPA sent the 1992 Waste Treatment Industry Phase II: Incinerators Screener Survey (OMB Approval Number: 2040-0162, Expired: 08/31/96) in September 1993 to 606 facilities that the Agency had identified as possible industrial waste combustor facilities. EPA identified the 606 facilities as possible industrial waste combustor facilities from various sources; such as, companies listed in the 1992 Environmental Information (EI) Directory, companies that were listed as incinerators in the RCRIS National Oversight Database (November, 1992 and February, 1993 versions), companies that were listed as BIF Facilities by EPA (updated December, 1992), and incinerator facilities identified in the development of the Centralized Waste Treatment (CWT) effluent guidelines. Since industrial waste combustors were not represented by a SIC code at the time of the survey, identification of facilities was difficult. The screener survey requested summary information on: (1) the types of wastes accepted for combustion; (2) the types of combustion units at a facility; (3) the quantity, treatment, and disposal of wastewater generated from combustion operations; (4) available analytical monitoring data on wastewater treatment; and (5) the degree of co-treatment (treatment of CHWC wastewater with wastewater from other industrial operations at the facility). The responses from

564 facilities indicated that 357 facilities burned industrial waste in 1992. The remaining 207 did not burn industrial waste in 1992. Of the 357 facilities that burned industrial waste, 142 did not generate any wastewater from air pollution control systems or water used to quench flue gas or slag generated as a result of their combustion operations. Of the remaining 215 facilities that generated these types of wastewater, 59 operated commercially, and 156 only burned wastes generated on site, and/or only burned wastes generated from off-site facilities under the same corporate structure.

Following an analysis of the screener survey results, EPA sent the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire (OMB Approval Number: 2040-0167, Expired: 12/31/96) in March, 1994 to selected facilities which burned industrial waste and generated wastewater from air pollution control systems or water used to quench flue gas or slag generated as a result of their combustion operations. EPA sent the questionnaire to all 59 of the commercial facilities and all 16 of the non-commercial facilities that burned non-hazardous industrial waste. Further, EPA sent 32 of the remaining 140 non-commercial facilities a questionnaire. These thirty-two were selected based on a statistical random sample. The questionnaire specifically requested information on: (1) the type of wastes accepted for treatment; (2) the types of combustion units at a facility; (3) the types of air pollution control devices used to control emissions from the combustion units at a facility; (4) the quantity, treatment, and disposal of wastewater generated from combustion operations; (5) available analytical monitoring data on wastewater treatment; (6) the degree of co-treatment (treatment of industrial waste combustor wastewater with wastewater from other industrial operations at the facility); and (7) the extent of wastewater recycling and/or reuse at the facility. Information was also obtained through follow-up telephone calls and written requests for clarification of questionnaire responses.

EPA also requested a subset of industrial waste combustor facilities that received a questionnaire to submit wastewater monitoring data in the form of individual data points rather than monthly or annual aggregates. Only facilities that had identified a sample point location where the stream was over 50 percent wastewater from air pollution control systems or water used to quench flue gas or slag generated as a result of their combustion operations received the Detailed Monitoring Questionnaire. These wastewater monitoring data included information on pollutant concentrations at various points in the wastewater treatment processes. Data were requested from 26 facilities. Sixteen of these facilities operated commercially and 10 operated non-commercially.

2.2 SAMPLING PROGRAM

2.2.1 *Pre-1989 Sampling Program*

In the sampling program for the 1989 Hazardous Waste Treatment Industry Study, twelve facilities were sampled to characterize the wastes received and evaluate the on-site treatment technology performance at combustors, landfills, and hazardous waste treatment facilities. Since all of the facilities sampled had more than one on-site operation (e.g., combustion and landfill leachate generation), the data collected can not be used for this project because data were collected for mixed waste streams and the waste characteristics and treatment technology performance for the combustor facilities cannot be differentiated. Information collected in the study is presented in the Preliminary Data Summary for the Hazardous Waste Treatment Industry (EPA 440/1-89/100, September 1989).

2.2.2 *1993 - 1995 Sampling Program*

2.2.2.1 Facility Selection

Between 1993 and 1995, EPA visited 14 industrial waste combustor facilities. Eight of the fourteen industrial waste combustors EPA visited were captive facilities because captive facilities were still being considered for inclusion in the scope of the CHWC regulation at the time of the site visits. During each visit, EPA gathered the following information:

- the process for accepting waste for combustion,
- the types of waste accepted for combustion,
- design and operating procedures for combustion technologies,
- general facility management practices,

- water discharge options,
- solid waste disposal practices, and
- other facility operations.

EPA also took one grab sample of untreated industrial waste combustor scrubber blowdown water at twelve of the fourteen facilities. EPA analyzed most of these grab samples for over 450 analytes to identify pollutants at these facilities. The grab samples from the twelve site visits allowed EPA to assess whether there was a significant difference in raw wastewater characteristics from a wide variety of combustion unit types. (See Section 3 for a description of the types of combustion units.) EPA determined that the raw wastewater characteristics were similar for all types of combustion units both in types of pollutants found and the concentrations of the pollutants found. Specifically, organics, pesticides/herbicides, and dioxins/furans were generally only found, if at all, in low concentrations in the grab samples. (See Section 5 of this document for a discussion of dioxins/furans found at 7 of the 12 CHWC facilities sampled.) However, a variety of metal analytes were found in significant concentrations in the grab samples.

Based on these data and the responses to the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire, EPA selected three of the industrial waste combustor facilities for the BAT sampling program in order to collect data to characterize discharges and the performance of selected treatment systems. Using data supplied by the facilities, EPA applied five criteria in initially selecting which facilities to sample. The criteria were based on whether the wastewater treatment system: (1) was effective in removing pollutants, (2) treated wastes received from a variety of sources (solids as well as liquids), (3) employed either novel treatment technologies or applied traditional treatment technologies in a novel manner, (4) applied waste management practices that increased the effectiveness of the treatment unit, and (5) discharged its treated wastewater under a NPDES permit. The other 11 facilities visited were not sampled because they did not meet these criteria. Eight of these 11 facilities visited did not operate commercially, and are thus no longer included in the CHWC Industry.

2.2.2.2 Five-Day Sampling Episodes

After a facility was chosen to participate in the five-day sampling program, a draft sampling plan was prepared which described the location of sample points and analyses to be performed at specific sample points as well as the procedures to be followed during the sampling episode. Prior to sampling, a copy of the draft sampling plan was provided to the facility for review and comment to ensure that EPA properly described and understood facility operations. All comments were incorporated into the final sampling plan. During the sampling episode, teams of EPA employees and contractors collected and preserved samples. Samples were sent to EPA approved laboratories for analysis. Samples were collected at influent and effluent points. Samples were also taken at intermediate points to assess the performance of individual treatment units. Facilities were given the option to split all samples with EPA, but most facilities split only effluent sample points with EPA. Following the sampling episode, a draft sampling report was prepared that included descriptions of the treatment/recovery processes, sampling procedures and analytical results. After all information was gathered, the reports were provided to the facilities for review and comment. Corrections were incorporated into the final report. The facilities also identified any information in the draft sampling report that were considered to be Confidential Business Information.

During each sampling episode, wastewater treatment system influent and effluent streams were sampled. Samples were also taken at intermediate points to assess the performance of individual treatment units. Selected sampling information is summarized in Section 4 and Appendix A of this document . In all sampling episodes, samples were analyzed for over 450 analytes to identify the pollutants at these facilities. Again, organic compounds, pesticides/herbicides, and dioxins/furans were generally only found in low concentrations in the composite daily samples, if they were found at all. Dioxin/furan analytes were not detected in the sampling episode used to establish BPT/BAT/PSES. However, dioxin/furan analytes were found in the two other sampling episodes (see discussion in Section 5 of this document).

EPA completed the three sampling episodes for the Commercial Hazardous Waste Combustor Subcategory from 1994 to 1995. Selection of facilities to be sampled was limited due to the small number of facilities in the scope of the project. Only eight of the operating facilities identified discharged their treated wastewater under a NPDES permit. Of these eight facilities, only five burned solid as well as liquid waste. All of the facilities sampled used some form of chemical precipitation for treatment of the metal-bearing waste streams. All of the facilities were direct dischargers and were therefore designed to effectively treat the only conventional pollutant found in this industry, total suspended solids (TSS). Data from one of these facilities could not be used to calculate the proposed limitations and standards because influent concentrations for many parameters were low and thus performance data for the treatment systems could not be adequately ascertained. Also, as discussed in Section 6.4.2, EPA determined that only one of the two remaining facilities employed BPT technology. However, data from all three facilities were used to characterize the raw waste streams. Thus, for the proposal, only one sampling episode contained data which were used to characterize the treatment technology performance of Commercial Hazardous Waste Combustors.

As described in the Notice of Availability on May 17, 1999 (64 FR 26714), EPA received additional wastewater treatment system performance data from CHWC facilities in early 1999, subsequent to the close of the comment period for the proposal. Three CHWCs submitted influent and effluent wastewater treatment system performance data and related information on the operation of their treatment systems. Each facility submitted daily measurements for chlorides, total dissolved solids (TDS), TSS, sulfate, pH and 15 metals (aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, mercury, molybdenum, selenium, silver, tin, titanium and zinc.) One facility provided 11 days of sampling data and the two other facilities provided 30 days of sampling data each.

Following an evaluation of the three facilities, EPA determined that two of these three facilities employed BPT treatment technology. EPA used data from these two additional facilities, along with the data used for the proposed regulation, to revise the proposed limitations and standards. The concentrations of pollutants in the treated effluent from these two additional facilities are higher for some pollutants and lower for others, as compared to the facility used to develop limitations and standards for the proposal. On average, the variability of the effluent concentrations at these two additional facilities were lower than those at the facility used as the basis for the proposed numerical guidelines. EPA did not use data from these two facilities in determining the variability factors used to calculate the numerical guidelines because

EPA concluded that the average variability observed in the data used to calculate the limitations and standards for proposal was greater than the average variability determined from the data for the other two CHWCs. The variability factors used at proposal better reflect the variability seen in waste receipts accepted for burning over longer periods of time at CHWCs.

Information on waste stream characteristics is included in Section 4 of this document and information on system performances is included in Section 6.

SECTION 3
DESCRIPTION OF THE INDUSTRY AND SUBCATEGORIZATION

3.1 GENERAL INFORMATION

The universe of combustion facilities currently in operation in the United State is broad. These include municipal waste incinerators that burn household and other municipal trash and incinerators that burn hazardous wastes. Other types of incinerators include those that burn medical wastes exclusively and sewage sludge incinerators for incineration of POTWs' wastewater treatment residual sludge. In addition, some boilers and industrial furnaces (e.g., aggregate kilns) may burn waste materials for fuel.

While many industries began incinerating some of their wastes as early as the late 1950's, the current market for waste combustion (particularly combustion of hazardous wastes) is essentially a creature of the Resource Conservation and Recovery Act (RCRA) and EPA's resulting regulation of hazardous waste disposal. Among the major regulatory spurs to combustion of hazardous wastes have been the land-ban restrictions under the Hazardous and Solid Waste Amendments (HSWA) of 1984 and clean-up agreements for Superfund sites called "Records of Decision" (RODs).

Prior to the promulgation of EPA's Land Disposal Restrictions (LDRs)(40 CFR Part 268), hazardous waste generators were free to send untreated wastes directly to landfills. The LDRs mandated alternative treatment standards for wastes, known as Best Demonstrated Available Technologies (BDATs). Quite often, combustion was the stipulated BDAT. Future modifications to the LDRs may either increase or decrease the quantity of wastes directed to the combustion sector.

The LDRs have also influenced hazardous waste management under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)(42 U.S.C §§ 9601, et. seq.). The RODs set out the clean-up plan for contaminated sites under CERCLA. A key attribute of the RODs is the choice of remediation technology. Incineration is often a technology selected for remediation. While remediation efforts contribute a minority of the wastes managed by combustion, combustion has been used frequently on remediation projects. In addition, future Congressional changes to CERCLA may affect remediation disposal volumes directed to the combustion sector.

The Agency proposed a draft Waste Minimization and Combustion Strategy in 1993 and 1994 to promote better combustion of hazardous waste and encourage reduced generation of wastes. The key projects under the broad umbrella of the strategy are: "Revised Standards for Hazardous Waste Combustors" 61 FR 17358, April 1996, the Waste Minimization National Plan completed in May 1995, and the "RCRA Expanded Public Participation Rule" 60 FR 63417, December 1995. Waste minimization will directly affect waste volumes sent to the combustion and all other waste management sectors.

In recent years, a number of contrary forces have contributed to a reduction in the volume of wastes being incinerated. Declines in waste volumes and disposal prices have been attributed to: waste minimization by waste generators, intense price competition driven by overcapacity, and changes in the competitive balance between cement kilns (and other commercial boilers and industrial furnaces (BIFs)) and commercial incinerators. These trends have been offset by factors such as increased overall waste generation as part of general economic improvement, industrial waste combustor consolidation, and reductions in on-site combustion.

The segment of the universe of combustion units for which EPA is regulating includes units which operate commercially and which use controlled flame combustion in the treatment or recovery of RCRA hazardous waste. For example, industrial boilers, industrial furnaces, rotary kiln incinerators and liquid-injection incinerators are all types of units included in the Commercial Hazardous Waste Combustor (CHWC) Industry.

Combustion or recovery operations at these facilities generate the following types of wastewater, described more fully in Section 4: air pollution control wastewater, flue gas quench wastewater, slag quench, truck/equipment wash water, container wash water, laboratory drain wastewater, and floor washings from the process area. Typical non-wastewater by-products of combustion or recovery operations may include: slag or ash developed in the combustion unit itself, and emission particles collected using air pollution control systems. There are many different types of air pollution control systems in use by combustion units. The types employed by combustion units include, but are not limited to: packed towers (which use a caustic scrubbing solution for the removal of acid gases), baghouses (which remove particles and do not use any water), wet electrostatic precipitators (which remove particles using water but do not generate a wastewater stream), and venturi scrubbers (which remove particles using water and generate a wastewater stream). Thus, the amount and types of wastewater generated by a combustion unit are directly dependent upon the types of air pollution control systems employed by the combustion unit.

3.2 SCOPE OF THE REGULATION

3.2.1 *CHWC Facilities*

EPA promulgated effluent limitations guidelines and pretreatment standards for new and existing thermal units, except cement kilns, that are subject to either to 40 CFR Part 264, Subpart O; Part 265, Subpart O; or Part 266, Subpart H if the thermal unit burns RCRA hazardous wastes received from off-site for a fee or other remuneration in the following circumstances.

The thermal unit is a commercial hazardous waste combustor if the off-site wastes are generated at a facility not under the same corporate structure or subject to the same ownership as the thermal unit and

(1) the thermal unit is burning wastes that are not of a similar nature to wastes being burned from industrial processes on site, or

(2) there are no wastes being burned from industrial processes on site.

3.2.2 *Captive and Intracompany CHWC Facilities*

As noted above, the rule does not apply to wastewater discharges associated with combustion units that burn only wastes generated on-site. Furthermore, wastewater discharges from RCRA hazardous incinerators and RCRA BIFs that burn waste generated off-site (for fee or other remuneration) from facilities that are under the same corporate ownership (or corporate structure) as the combustor are similarly not included within the scope of this rule.

EPA has decided not to include facilities which only burn waste from off-site facilities under the same corporate structure (intracompany facility) and/or only burn waste generated on-site (captive facility) within the scope of this regulation for the following reasons. First, based on its survey, EPA identified (as of 1992) approximately 185 captive facilities and 89 facilities that burn wastes received from other facilities within the same corporate umbrella. A significant number of these facilities generated no CHWC wastewater. EPA's data show that 73 captive facilities (39 percent) and 36 intracompany facilities (42 percent) generated no wastewater as a result of their waste combustor operations. Second, EPA believes the wastewater generated by waste combustor operations at most of the captive and intracompany facilities that EPA has identified are already subject to national effluent limitations (or pretreatment standards) based on the manufacturing operations at the facility. Specifically, 140 of the 156 captive and intracompany facilities which received a screener survey and generated CHWC wastewater as a result of their combustion operations: 1) were either previously identified as subject to other effluent guidelines by EPA or 2) identified themselves as subject to other effluent guidelines. There are 97 facilities subject to the Organic Chemicals, Plastics and Synthetic Fibers category (40 CFR Part 414), 17 subject to the Pharmaceuticals category (40 CFR Part 439), 16 subject to the Steam Electric Power Generating category (40 CFR Part 423), 3 subject to the Pesticide Manufacturing category (40 CFR Part 455), and 7 subject to other categories. EPA could not identify an effluent guideline category applicable to their discharges for 16 of these 156 facilities (five of these are federal facilities). Moreover, in the case of the small number -- less than 10 percent -- for which EPA could not identify a specific guideline that would apply, the permit writer has authority to obtain any necessary data to write facility-specific best professional judgement (BPJ) limitations or standards.

In addition, EPA looked at the pollutant data for commercial and non-commercial hazardous facilities and concluded that their scrubber water is qualitatively different. EPA evaluated the grab samples of untreated scrubber water it collected from eight non-commercial facilities to determine if there was a difference in wastewater characteristics at non-commercial versus commercial facilities. See Table 3-1 for a presentation of grab sample data from non-commercial facilities. For each regulated pollutant, the average untreated CHWC wastewater concentration is less for the eight non-commercial facilities than for the three commercial facilities used to determine the final limitations (see Table 3-2). EPA concluded these results from the fact that non-commercial facilities do not treat the large variety of different wastes that commercial facilities treat. Additionally, two of the nine regulated metal pollutants (mercury and silver) were not at treatable levels at any of the eight non-commercial facilities. Two more of the nine regulated metal pollutants (arsenic and cadmium) were at treatable levels at only one of the eight non-commercial facilities. Further, only one of the nine regulated metal pollutants (zinc) was at treatable levels at more than half of the eight non-commercial facilities. In contrast, seven of the nine regulated metal pollutants (arsenic, cadmium copper, lead, mercury, titanium and zinc) were found at treatable levels at all three of the commercial facilities used to determine the final limitations. Further, the remaining two metal pollutants (chromium and silver) were found at treatable levels at two of these three commercial facilities. These circumstances further support EPA's decision not to subject non-commercial, captive hazardous incinerators to the limitations and standards developed here.

Table 3-1. Non-Commercial Grab Sample Episode Data

Analyte	Non-Commercial Grab Sample Episodes							
	#9	#1	#2	#11	#6	#10	#A	#B
TSS (mg/l)	310	10	ND(4)	44	40	48	46	95
Arsenic	78.4	42.1	ND(1.9)	ND(1.1)	1420	ND(20)	ND(2)	ND(2)
Cadmium	300	ND(5)	ND(1.2)	19.05	41.9	ND(4)	ND(4)	ND(4)
Chromium	250	236	ND(3.6)	24.42	1650	52.7	19.9	ND(9)
Copper	698	101	16.02	75.85	131	59.7	1960	ND(10)
Lead	3300	ND(47)	84.26	319.46	96.6	ND(49)	ND(49)	ND(49)
Mercury	ND(0.2)	0.68	ND(0.1)	ND(0.1)	1.04	ND(0.2)	0.63	ND(0.2)
Silver	ND(4)	ND(5)	4.12	15.74	ND(5)	ND(5)	ND(5)	ND(5)
Titanium	3770	110	ND(2.2)	59.06	98.9	9.2	134	7.5
Zinc	1830	44.7	47.19	1745.6	341	1120	3200	283

Values in (ug/l) unless otherwise noted.
ND = Non-Detects
Note: Values in parentheses are the detection limits.

Table 3-2. Comparison of Non-Commercial and Commercial Data

Analyte	Number of Detects (out of 8)	Treatable Level (10*QL)	Number of Times at Treatable Level	Avg. Influent Concentration of Non-Commercial Grabs	Avg. Influent Concentration of Three Commercial Facilities Used for Final Limitations
TSS (mg/l)	7	40	6 of 8	74.63	147.40
Arsenic	3	100	1 of 8	195.94	654.33
Cadmium	3	50	1 of 8	47.39	376.57
Chromium	6	100	3 of 8	280.70	835.67
Copper	7	100	4 of 8	381.45	2575.33
Lead	4	100	2 of 8	499.29	2395.33
Mercury	3	2	0 of 8	0.39	93.87
Silver	2	50	0 of 8	6.11	124.27
Titanium	7	100	3 of 8	523.86	2163.67
Zinc	8	200	6 of 8	1076.44	6482.00

Values in (ug/l) unless otherwise noted.
QL = Quantitation Limit

There may be instances when a combustor is operated in conjunction with on-site industrial activities and the combustor wastewater is treated and discharged separately from the treatment of industrial wastewater (or treated separately and mixed before discharge). Permit writers should consider this guideline as one source of information when developing limitations and standards for these situations.

3.3 SUMMARY INFORMATION ON 55 CHWC FACILITIES

For 1992, EPA identified 55 combustor facilities that accept hazardous or hazardous and non-hazardous industrial waste from off-site facilities not under the same corporate umbrella for combustion. The following tables provide summary information from the 1992 Waste Treatment Industry Phase II: Incinerators Screener Survey on these 55 combustor facilities.

Many of the 55 CHWC facilities have more than one unit on-site. The majority of facilities with two or more units on-site operate boilers, industrial furnaces, or aggregate kilns. Table 3-3 presents the number of thermal units at each of the 55 CHWC facilities that provided data in the survey.

Table 3-3. Number of Thermal Units at Each of the 55 CHWC Facility Locations

Number of Units	1	2	3	4	5	6	7	8	>8
Number of Facilities	26	14	6	4	2	1	0	0	0

There are more industrial furnaces, boilers, and aggregate kilns than any other unit types. However, more than one of these units often is present at a single facility. Table 3-4 presents the unit types at all 55 CHWC facilities that provided data in the survey.

Table 3-4. Types of Thermal Units at 55 CHWC Facilities

Type of Thermal Unit	Number of Each Unit Type
Rotary Kiln Incinerator	22
Liquid Injection Incinerator	16
Fluidized-Bed Incinerator	1
Multiple-Hearth Incinerator	6
Fixed-Hearth Incinerator	3
Pyrolytic Destructor	3
Industrial Boiler	19
Industrial Furnace	25
Other	9

Most of the waste burned by the 55 CHWC facilities is hazardous or non-hazardous industrial waste containing organic compounds. Only one facility indicated it burned waste containing dioxins/furans and only four facilities indicated burning waste regulated under the Toxic Substances Control Act (TSCA). Table 3-5 presents the types and amount of waste treated at all 55 CHWC facilities.

Table 3-5. Amount of Waste Treated by 55 Commercial Facilities in Calendar Year 1992 (Tons)

	Tons							# of Facilities
Waste Type	1-50	51-100	101-500	501-1,000	1,001-5,000	5,001-10,000	>10,000	
Non-RCRA								
Sewage Sludge	0	1	0	0	0	0	0	1
Containing Metals	3	0	3	1	4	1	4	16
Containing Organics	5	2	9	0	9	5	6	36
All Others	2	0	2	1	5	0	1	11
RCRA								
Containing Metals	6	0	1	1	7	0	16	31
Containing Organics	9	1	6	3	5	1	24	49
Containing Dioxins/Furans	0	0	1	0	0	0	0	1
Containing Pesticides/ Herbicides	0	2	0	1	8	0	1	12
All Others	3	0	1	1	1	1	6	13
Special								
Radioactive Wastes	1	0	0	0	0	0	0	1
TSCA Wastes (PCBs)	0	0	0	0	1	0	3	4
Medical Wastes	0	0	1	0	0	0	0	1

For the CHWC regulations, only air pollution control water, slag quench and flue gas quench are considered "CHWC wastewater." The largest wastewater stream generated by the 55 CHWC facilities, stormwater runoff, is regulated under other effluent guidelines. The industry also generates large quantities of boiler blowdown. Boiler blowdown wastewater was not considered for regulation for this industry because it does not come into contact with any of the wastes being burned. Table 3-6 presents the quantity of process wastewater generated by the 55 CHWC facilities that provided data in the survey.

Table 3-6. Quantity of Process Wastewater Generated by 55 CHWC Facilities in Calendar Year 1992 (Thousand Gallons)

	Gallons (1,000s)							# of Facilities
Type of Process Water	0-5	5-15	15-50	50-100	100-500	500-750	>750	
None	16	0	0	0	0	0	0	16
Air Pollution Control Water	1	1	2	2	0	0	13	19
Slag Quench	1	0	2	0	2	0	0	5
Process Area Washdown	4	2	3	1	4	0	2	16
Truck/Equipment Wash Water	2	0	1	2	1	0	1	7
Container Wash Water	1	0	1	1	1	0	0	4
Stormwater Runoff	0	0	0	2	3	3	11	19
Laboratory Waste	2	0	0	2	2	0	0	6
Flue Gas Quench	1	0	0	0	0	0	7	8
Boiler Blowdown	4	0	2	1	0	2	8	17
Other	2	0	0	0	0	0	3	5

3.4 SUMMARY INFORMATION ON 22 CHWC FACILITIES WHICH GENERATE CHWC WASTEWATER

Following the distribution of the screener survey, EPA sent the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire only to those commercial facilities that generated CHWC wastewater. Thirty-three of the 55 CHWC facilities did not generate any CHWC wastewater; thus, EPA only has detailed operation information on the 22 CHWC facilities that generated CHWC wastewater. The following tables provide summary information from the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire on these 22 commercial combustor facilities.

3.4.1 *RCRA Designation of 22 CHWC Facilities*

Most of the 22 facilities that generate CHWC wastewater are regulated as incinerators under RCRA. Very few boilers and industrial furnaces regulated under RCRA generate air pollution control water, flue gas quench, or slag quench. Table 3-7 presents the RCRA designation of the 22 commercial facilities.

Table 3-7. 1992 RCRA Designation of 22 Commercial Facilities

	Total Thermal Units
Hazardous Waste Incinerator	25
Boiler and/or Industrial Furnace	6

3.4.2 *Waste Burned at 22 CHWC Facilities*

The number of customers served by a facility varies greatly in this industry. Some facilities burn primarily waste generated on site and only take very few waste shipments from facilities not under their corporate structure. Other facilities operate a strictly commercial operation, serving hundreds or thousands of customers on a regular basis. Table 3-8 presents the number of customers served by the 22 commercial facilities.

Table 3-8. Number of Customers/Facilities Served in 1992 by 22 Commercial Facilities

	Number of Customers
Minimum	1
Maximum	4,000
Mean	858
Median	83
Total	27,450

3.4.3 *Air Pollution Control Systems for 22 CHWC Facilities*

The type of air pollution control system used by a CHWC facility has a direct effect on the characteristics and quantity of the CHWC wastewater generated by that facility. Table 3-9 presents the types of air pollution control systems in use at the 22 commercial facilities. Table 3-10 presents the types of air pollutants for which add-on control systems are in operation for the 22 CHWC facilities. Some of these systems do not generate any wastewater (e.g., a fabric filter for particulate removal). Other systems would generate wastewater (e.g., a packed tower scrubber with lime used for halogenated acid gas removal).

Table 3-9. Types of Air Pollution Control Systems at 22 Commercial Facilities

Type of Air Pollution Control System	Total Thermal Units
Spray Chamber Scrubber	16
Impingement Baffle Scrubber	2
Wet Cyclone (including multiclones)	2
Venturi Scrubber	12
Packed Tower	16
Ionizing Wet Scrubber	4
Wet Electrostatic Precipitator	3
Fabric Filter	11
Dry Scrubber	2
Spray Dryer	1
Other (Includes: Demister; Dry Cyclone; Dry Electrostatic Precipitator; Horizontal Packed Absorber; Scrubber Quench Unit; Steam Atomization)	12

Table 3-10. Air Pollutants for Which Add-On Control Systems are in Operation for 22 Commercial Facilities

Air Pollutant	Total Thermal Units
None	2
Halogenated Acid Gases	21
Sulfur Compounds	17
Nitrogen Compounds	5
Particulates	28
Metals	23
Other (Organics)	1

Of the facilities that use water in their air pollution control systems, the chemicals added to the water and the types of water recirculation systems vary greatly by facility. The addition of chemicals to the water is dependent upon the purpose of the scrubbing system (e.g., no chemicals would be used to trap particulates in a cyclonic scrubber and sodium hydroxide would be used to remove halogenated acid gases in a packed tower scrubber). The chemicals added to the scrubber water would have a direct effect on the characteristics of the wastewater generated. Table 3-11 presents the types of scrubbing liquors in use at the 22 commercial facilities.

Table 3-11. Scrubbing Liquor Used in Air Pollution Control Systems of 22 Commercial Facilities

Scrubbing Liquor	Total Thermal Units
None	7
Water With No Added Chemicals	13
Sodium Hydroxide	17
Lime Slurry	8
Other (Includes: Lime-Hydrated; Sodium Carbonate Solution; Sulfuric Acid)	5

The type of water recirculation system used by a facility also has a direct effect on the amount of wastewater generated. If a facility operated a closed loop air pollution control system with no discharge, no wastewater would be generated. Alternately, a facility that did not recirculate its air pollution control system wastewater, would tend to generate a large quantity of wastewater. Table 3-12 presents the types of water recirculation systems.

Table 3-12. Type of Water Recirculation System Used in Air Pollution Control Systems of the 22 CHWC Facilities

Water Recirculation System	Total Thermal Units
None (once through)	2
Closed Loop (no discharge)	7
Recirculating with Intermittent Blowdown	1
Recirculating with Continuous Blowdown	12

3.5 SUMMARY INFORMATION ON 10 CHWC FACILITIES WHICH GENERATE AND DISCHARGE CHWC WASTEWATER

Twelve of the twenty-two facilities generate CHWC wastewater but do not discharge the wastewater to a receiving stream or to a POTW. These facilities are considered “zero or alternative dischargers” and use a variety of methods to dispose of their wastewater. At these facilities, (1) wastewater is sent off-site for treatment or disposal (four facilities); (2) wastewater is burned or evaporated on site (four facilities); (3) wastewater is sent to a surface impoundment on site (three facilities); and (4) wastewater is injected underground on-site (one facility). Thus, EPA has identified only 10 facilities that were discharging CHWC wastewater to a receiving stream or to a POTW in 1992. Of these 10 facilities, 2 facilities have either stopped accepting waste from off-site for combustion or have closed their combustion operations since 1992. These eight facilities are found near the industries generating the wastes undergoing combustion.

The eight open facilities identified by EPA operate a wide variety of combustion units. Three facilities operate rotary kilns and are regulated as incinerators under RCRA. Three facilities operate liquid injection incinerators and are regulated as incinerators under RCRA. One facility operates a furnace and is regulated as a BIF under RCRA. One facility operates a liquid injection device and is regulated as a BIF under RCRA.

Also, the eight open facilities identified by EPA use a wide variety of air pollution control systems. The types of air pollution control systems in use are: fabric filters, spray chamber scrubbers, packed tower scrubbers, ionizing wet scrubbers, venturi scrubbers, dry scrubbers, dry cyclones, and wet electrostatic precipitators. Seven of the eight open facilities use more than one of the air pollution control systems listed above. Four of the eight facilities use a combination of wet and dry air pollution control systems. Three of the eight facilities use only wet air pollution control systems.

3.6 INDUSTRY SUBCATEGORIZATION

Division of an industry into groupings entitled "subcategories" provides a mechanism for addressing variations between products, raw materials, processes, and other parameters which result in distinctly different effluent characteristics. Regulation of an industry by subcategory provides that each has a uniform set of effluent limitations which take into account technology achievability and economic impacts unique to that subcategory.

The factors considered in the regulation of the CHWC Industry include:

- waste type received;
- type of combustion process;
- air pollution control used;
- nature of wastewater generated;
- facility size, age, and location;
- non-water quality impact characteristics; and
- treatment technologies and costs.

EPA evaluated these factors and determined that subcategorization is not required.

For most facilities in this industry, a wide variety of wastes are combusted. These facilities, however, employ the same wastewater treatment technologies regardless of the specific type of waste being combusted in a given day.

EPA concluded that a number of factors did not provide an appropriate basis for subcategorization. The Agency concluded that the age of a facility should not be a basis for subcategorization because many older facilities have unilaterally improved or modified their treatment process over time. Facility size is also not a useful technical basis for subcategorization for the CHWC Industry because wastes can be burned to the same level regardless of the facility size and has no significant relation to the quality or character of the wastewaters generated or treatment performance. Likewise, facility location is not a good basis for subcategorization; no consistent differences in wastewater treatment performance or costs exist because of geographical location. Non-water quality characteristics (waste treatment residuals and air emission effects) did not constitute a basis for subcategorization. The environmental effects associated with disposal of waste treatment residual or the transport of potentially hazardous wastewater are a result of individual facility practices. The Agency did not identify any consistent basis for these decisions that would support subcategorization. Treatment costs do not appear to be a basis for subcategorization because costs will vary and are dependent on the following waste stream variables: flow rates, waste quality, waste energy content, and pollutant loadings. Therefore, treatment costs were not used as a factor in determining subcategories.

EPA identified three factors with significance for potentially subcategorizing the CHWC Industry: the type of waste received for treatment, the type of air pollution control system used by a facility, and the types of CHWC wastewater sources (e.g., container wash water vs. air pollution control water).

A review of untreated CHWC air pollution control system wastewater showed that there is some difference in the concentration of pollutants between solid and liquid waste combustion units. In particular, for nine of the 27 metals analyzed at six CHWC facilities, the average concentration of a particular metal was higher in the water from facilities that burned solids (as well as liquids) than in facilities that burned liquids only. EPA believes that this difference is probably the result of two factors: the type of air pollution control employed by the facilities and the amount of wastewater generated. Specifically, the data reviewed by EPA showed that two of the three facilities that burn liquid waste use dry scrubbing devices prior to using scrubbing devices which generate wastewater. One of these facilities uses a baghouse initially and the other uses a fabric filter. These dry scrubbers would remove some of the metals which would have ended up in the wastewater stream. In comparison, only one of the three facilities that burn solids uses a dry scrubbing device prior to using scrubber devices which generate wastewater. This facility uses an electrostatic precipitator initially. In addition, all three of the facilities that burn liquid waste do not recycle any of their wastewater for reuse in the scrubbing system following partial wastewater treatment. In comparison, two of the three facilities that burn solids recycle some of their partially treated wastewater for reuse in their scrubbing system. One of these facilities recycles 60 percent and the other recycles 82 percent. The reuse of partially treated wastewater would have the effect of reducing the wastewater discharge and increasing the concentration of metals in the recycled wastewater. Thus, the Agency could not conclude that there is in fact any significant difference in the concentrations of pollutants in wastewater from facilities burning solid versus liquid waste. This situation in general makes subcategorizing on this basis difficult. See CHWC Record W-97-08, #7.2.0.1 for the presentation of this statistical analysis. Therefore, EPA has concluded that available data do not support subcategorization either by the type of waste received for treatment or the type of air pollution control system used by a facility.

Based on analysis of the CHWC Industry, EPA has determined that it should not subcategorize the Commercial Hazardous Waste Combustors for purposes of determining appropriate limitations and standards.

SECTION 4
WASTEWATER USE AND WASTEWATER CHARACTERIZATION

In 1993, under authority of Section 308 of the Clean Water Act (CWA), the EPA distributed the "1992 Waste Treatment Industry Phase II: Incinerators Screener Survey" and, subsequently, the "1994 Waste Treatment Industry Phase II: Incinerators Questionnaire" to facilities that EPA had identified as possible CHWC facilities. Responses to the screener survey and questionnaire indicated that, in 1992, 10 CHWC facilities operated commercially and discharged their CHWC wastewater to a receiving stream or to a POTW. Of these 10 facilities, 2 facilities have either stopped accepting waste from off site for combustion or have closed their combustion operations since 1992. Thus, this section presents information on water use at only the remaining 8 facilities. This section also presents information on wastewater characteristics for the CHWC facilities that were sampled by EPA and for some of those facilities that provided self-monitoring data.

4.1 WATER USE AND SOURCES OF WASTEWATER

Approximately 820 million gallons of wastewater are generated and discharged annually at the 8 CHWC facilities. EPA has identified the sources described below as contributing to wastewater discharges at CHWC operations. Only air pollution control wastewater, flue gas quench, and slag quench, however, would be subject to the CHWC effluent limitations and standards. Most of the wastewater generated by CHWC operations result from these sources.

a. Air Pollution Control System Wastewater. Particulate matter in the effluent gas stream of a CHWC is removed by four main physical mechanisms (Handbook of Hazardous Waste Incineration, Brunner 1989). One mechanism is interception, which is the collision between a water droplet and a particle. Another method is gravitational force, which causes a particle to fall out of the direction of the streamline. The third mechanism is impingement, which causes a water particle to fall out of the streamline due to inertia. Finally, contraction and expansion of a gas stream allow particulate matter to be removed from the stream. Thus, removal of particulate matter can be accomplished with or without the use of water. Depending upon the type of waste being burned, Commercial Hazardous Waste Combustors may produce acid gases in the air pollution control system. In order to collect these acid gases, a caustic solution is generally used in a wet scrubbing system.

b. Flue Gas Quench Wastewater. Water is used to rapidly cool the gas emissions from combustion units. There are many types of air pollution control systems that are used to quench the gas emission from Commercial Hazardous Waste Combustors. For example, in packed tower scrubbing systems, water enters from the top of the tower and gas enters from the bottom. Water droplets collect on the packing material and are rinsed off by the water stream entering the top of the tower (Handbook of Hazardous Waste Incineration, Brunner 1989). This rapidly cools the gas stream along with removing some particulate matter.

c. Slag Quench Wastewater. Water is used to cool molten material generated in slagging-type combustors.

d. Truck/Equipment Wash Water. Water is used to clean the inside of trucks and the equipment used for transporting wastes.

e. Container Wash Water. Water is used to clean the insides of waste containers.

f. Laboratory Wastewater. Water is used in on-site laboratories which characterize incoming waste streams and monitor on-site treatment performance.

g. Floor Washings and Other Wastewater from Process Area. This includes stormwater which comes in direct contact with the waste or waste handling and treatment areas. (Stormwater which does not come into contact with the wastes would not be subject to today's promlugated limitations and standards. However, this stormwater is covered under the NPDES stormwater rule, 40 CFR 122.26).

4.2 WATER USE

As mentioned in Section 4.1, approximately 820 million gallons of wastewater were discharged from 8 of the 55 commercial industrial combustors identified by EPA based on questionnaire responses.

Table 4-1 presents the total, average, and range of discharge flow rates for the eight discharging facilities. There were 45 facilities that either do not generate any CHWC wastewater (33) or do not discharge their wastewater (12) as discussed previously. In general, the primary types of wastewater discharges from discharging facilities are: air pollution control system wastewater, flue gas quench, and slag quench. EPA is using the phrase "CHWC wastewater" to refer to these three types of wastewaters only. Other types of wastewater generated as a result of combustor operations (e.g., truck washing water) are not considered "CHWC wastewater".

This regulation applies to direct and indirect discharges only.

Table 4-1. Amount of CHWC Wastewater Discharged

Number of Facilities	Total Amount of CHWC Wastewater Discharged (Gallons/Day)	Average Amount of CHWC Wastewater Discharged (Gallons/Day)	Range In Average Amount of CHWC Wastewater Discharged (Gallons/Day)
8	2,247,580	280,948	47,430 to 1,007,640

4.3 WASTEWATER CHARACTERIZATION

EPA conducted 15 sampling episodes at 13 different facilities in an effort to characterize CHWC raw influent wastewaters during the formulation of the CHWC rule. These included three five-day sampling efforts and twelve individual grab samples. A total of 467 pollutants were analyzed in the raw wastewater, including 232 toxic and non-conventional organic compounds, 69 toxic and non-conventional metals, 4 conventional pollutants, and 162 toxic and non-conventional pollutants including pesticides, herbicides, dioxins, and furans. Of these 467 pollutants, only 139 were ever detected at any of the CHWC influent samples; most being metals and other non-organic compounds. Therefore, 328 pollutants analyzed were never found at detectable levels in any CHWC influent samples. Appendix A presents a list of all analytes that were detected at least once, along with: the detection limit, number of observations (samples), number of detects, and minimum, maximum, and mean values of the pollutant. Appendix B lists all of the remaining

328 pollutants never found in CHWC wastewaters, including the number of observations and detection levels of the analytes.

4.3.1 *Five-Day Sampling Episodes*

The Agency's five-day sampling program for this industry detected 21 pollutants (conventional, priority, and non-conventional) in waste streams at treatable levels at the facility that provides the basis for the BPT/BAT limits. Two additional pollutants were detected at treatable levels in the two other five-day sampling episodes: strontium and dichlorprop. The quantity of these pollutants currently being discharged from all facilities is difficult to assess. Limited monitoring data are available from facilities for the list of pollutants identified from the Agency's sampling program prior to commingling of these wastewaters with non-contaminated stormwater and other industrial wastewater before discharge. EPA used monitoring data supplied in the 1994 Waste Treatment Industry Phase II: Incinerators Questionnaire and data supplied in the Detailed Monitoring Questionnaire, wastewater permit information, and EPA sampling data to estimate raw waste and current pollutant discharge levels. EPA used a "non-process wastewater" factor to quantify the amount of non-contaminated stormwater and other industrial process water in a facility's discharge. Section 4.4 of this document provides a more detailed description of "non-process wastewater" factors and their use. A facility's current discharge of treated CHWC wastewater was calculated using the monitoring data supplied multiplied by the "non-process wastewater" factor.

4.3.1.1 Conventional Pollutants

The most appropriate conventional pollutant parameters for characterizing untreated wastewater and wastewater discharged by CHWC facilities are:

- Total Suspended Solids, and
- pH

Total solids in wastewater are defined as the residue remaining upon evaporation at just above the boiling point. Total suspended solids (TSS) is the portion of the total solids that can be filtered out of the solution using a 1 micron filter. Untreated wastewater TSS content is a function of the type and form of waste accepted for treatment (e.g., wastewater that results from the combustion of solid waste receipts would tend to have higher TSS values than waste received in a liquid form). TSS can also be due to treatment chemicals added to the wastewater as it is being generated (e.g., a caustic solution may be used in a CHWC air pollution control system). The total solids are composed of matter which is settleable, in suspension or in solution, and can be removed in a variety of ways, such as during the metals precipitation process or by multimedia filtration, depending on a facility's operation. Untreated wastewater TSS levels found in the three five-day EPA sampling episodes are presented in Table 4-2.

The pH of a solution is a unitless measurement which represents the acidity or alkalinity of a wastewater stream, based on the dissociation of the acid or base in the solution into hydrogen (H+) or hydroxide (OH-) ions, respectively. Untreated wastewater pH is a function of the source of waste receipts as well as a function of the chemicals used in the air pollution control devices. This parameter can vary widely from facility to facility. Control of pH is necessary to achieve proper removal of pollutants in the BPT/BAT treatment system (chemical precipitation).

As shown in Table 4-2, raw waste five-day biochemical oxygen demand and oil and grease are very low, ranging from 1 mg/l to 53 mg/l and from 5 mg/l (not detected) to 6 mg/l, respectively. Both of these parameters are indirect measurements of the organic strength of wastewater. The wastewater sampled by EPA is generated from air pollution control systems and consists primarily of inorganic pollutants and very low concentrations of organic compounds because they are destroyed during combustion. (Furthermore, a more direct measure of the organic strength of the raw wastewater, total organic carbon, also shown in Table 4-2, only ranges from 10 mg/l (not detected) to 16 mg/l).

Table 4-2. Range of Pollutant Influent Concentrations of the Pooled Daily Data from the Three Five-Day EPA Sampling Episodes (ug/l)

Pollutant	Mean	Minimum	Maximum
Aluminum	897.6	13.6	2,538.0

Pollutant	Mean	Minimum	Maximum
Ammonia as Nitrogen	14,312.4	100.0	75,000.0
Antimony	268.2	7.8	958.8
Arsenic	166.4	4.6	827.2
BOD_5	9,960	1,000	53,000
Boron	1,604.6	918.0	3,760.0
Cadmium	312.2	1.8	2,616.0
Calcium	293,146.0	8,140.0	1,270,000.0
Chemical Oxygen Demand	343,140.0	67,000.0	1,036,000.0
Chloride	6,833,746.7	1,010,000.0	17,002,400.0
Chromium	127.2	5.8	529.2
Copper	1,786.7	8.5	10,554.0
Fluoride	82,620.5	16,500.0	360,000.0
Iron	2,904.1	149.0	10,838.0
Lead	1,613.9	2.1	13,248.0
Manganese	114.7	4.0	388.0
Mercury	21.1	0.2	115.4
Molybdenum	336.7	4.6	1024.4
Nitrate/Nitrite	2,650.9	360.0	4,560.0
Oil and Grease	5,067	5,000	6,000
Phosphorus	32,480.0	3,210.0	225,800.0
Potassium	77,743.0	1,310.0	195,400.0
Selenium	102.8	2.3	429.2
Silicon	15,414.0	5,380.0	28,100.0
Silver	98.9	1.0	390.8
Sodium	3,443,333.3	6,400.0	11,250,600.0
Strontium	630.2	100.0	2,280.0
Sulfur	400,788.1	2,145.0	1,078,240.0
Tin	665.9	14.5	6,046.0
Titanium	777.7	5.0	4,474.2
Total Dissolved Solids	12,815,853.3	158,000.0	32,641,200.0
Total Organic Carbon	10,485	10,000	16,000
Total Phosphorus	1,088.6	10.0	4,460.0
Total Sulfide	28,261.3	1,000.0	103,200.0

Pollutant	Mean	Minimum	Maximum
Total Suspended Solids	122,553.3	4,000.0	522,000.0
Zinc	3,718.8	89.8	12,310.0
Dichlorprop	7.7	1.0	47.0
MCPP	375.7	50.0	2,594.0

4.3.1.2 Priority and Non-Conventional Pollutants

Table 4-2 above presents the range of the pooled daily pollutant influent concentration data from the three five-day EPA sampling episodes. This table includes treatment chemicals and nutrients found in CHWC wastewater as well as pollutants to be removed from CHWC wastewater.

4.3.2 *Characterization Sampling Episodes*

As discussed in Section 2.2.2.1 of this document, EPA obtained a grab sample of untreated CHWC wastewater at 12 facilities. These samples were used to help characterize the CHWC wastewaters at a wide range of combustor types, including captive facilities. Data from one facility was excluded due to the sample solidifying soon after collection, thus provided, in the Agency's opinion, data of a poor and misrepresentative nature. Table 4-3 below presents a breakdown of levels of typical pollutants found in the raw CHWC wastewater at 11 different facilities. The pollutants presented in Table 4-3 were detected at more than one facility with a mean concentration of at least 10 times the pollutant detection limit.

Table 4-3. Range of Pollutant Influent Concentrations of the Pooled Daily Data from the Characterization EPA Sampling Episodes (ug/l)

Pollutant	Mean	Minimum	Maximum
Aluminum	5,458.8	21.5	34,800.0
Ammonia as Nitrogen	2,908.8	130.0	13,000.0
Arsenic	323.2	1.1	1,420.0
Benzoic Acid	263,249.8	50.0	3,157,556.0

Pollutant	Mean	Minimum	Maximum
BOD_5	1,092,333.3	1,000.0	10,100,000.0
Boron	22,565.2	20.0	182,000.0
Cadmium	225.7	1.2	1,632.8
Chemical Oxygen Demand	2,284,583.3	13,000.0	19,100,000.0
Chloride	10,203,416.7	40,000.0	28,300,000.0
Chromium	342.0	3.6	1,650.0
Copper	894.2	10.0	4,621.8
Fluoride	879,230.0	120.0	7,500,000.0
Iron	10,413.5	239.2	50,600.0
Lead	1,604.5	45.5	12,358.0
Manganese	245.8	10.8	1,534.6
Mercury	32.7	0.1	217.0
Molybdenum	131.3	4.0	508.5
Nitrate/Nitrite	5,166.7	210.0	33,280.0
Potassium	147,574.2	478.6	805,000.0
Selenium	65.8	0.5	288.0
Silicon	42,997.6	28.2	340,000.0
Sodium	12,377,392.9	8,244.3	62,400,000.0
Sulfur	22,998,416.6	12,500.0	174,000,000.0
Titanium	463.9	2.2	3,770.0
Total Dissolved Solids	37,896,083.3	89,000.0	185,000,000.0
Total Organic Carbon	391,041.7	1,700.0	4,540,000.0
Total Phenols	12,316.3	6.0	146,000.0
Total Phosphorus	1,279.2	10.0	4,520.0
Total Sulfide	163,340.8	10.0	1,180,000.0
Total Suspended Solids	100,000.0	1,000.0	416,000.0
Uranium	10,099.6	608.2	67,100.0
Zinc	5,436.6	44.7	28,569.0

4.4 WASTEWATER POLLUTANT DISCHARGES

As previously discussed, most of the effluent monitoring data received from facilities included non-CHWC wastewater, such as other industrial waste streams and stormwater. Due to the lack of effluent data for CHWC wastewater, the EPA had to develop various methods to estimate their current wastewater pollutant discharge. This section describes the various methodologies used to estimate current performance.

Most of the data supplied by the CHWC facilities represented data that included non-CHWC wastewater in the form of non-contaminated stormwater and other industrial stormwater prior to discharge. Therefore, the amount of a pollutant in the final effluent would be equal to the amount of the pollutant in the CHWC process in addition to the amount in the non-CHWC process, as shown in Equation 4.1.

$$C_T * F_{TOTAL} = C_{CHWC} * F_{CHWC} + C_{NON\text{-}CHWC} * F_{NON\text{-}CHWC} \quad (4.1)$$

where:

C_T	=	Concentration of pollutant in the combined wastewater stream -- the concentration reported in the CHWC Questionnaire, the CHWC Detailed Monitoring Questionnaire, in POTW permits, in NPDES permits, or from EPA sampling program.
F_{TOTAL}	=	Flowrate of total wastewater stream.
C_{CHWC}	=	Concentration of pollutant in the CHWC (and other similar) wastewater streams.
F_{CHWC}	=	Flowrate of CHWC (and other similar) wastewater streams.
$C_{NON\text{-}CHWC}$	=	Concentration of pollutant in stormwater or non-contact wastewater streams.
$F_{NON\text{-}CHWC}$	=	Flowrate of stormwater or non-contact wastewater streams.

Stormwater or non-contact wastewater was assumed to be significantly lower in concentration in comparison to the CHWC wastewater, and thus, the concentration of non-CHWC wastewater streams was set equal to zero. This assumption simplifies Equation 4.1 as shown in Equation 4.2 below. Also, other industrial wastewater streams were assumed to have the same concentrations as the CHWC wastewater streams.

$$C_T * F_{TOTAL} = C_{CHWC} * F_{CHWC} \tag{4.2}$$

For each facility, the EPA calculated the portion of CHWC wastewater in the facility discharge and then calculated the CHWC effluent concentration by solving Equation 4.2. Thus, the non-process wastewater factor is the flowrate of the total wastewater stream divided by the flowrate of the CHWC (and other similar) wastewater stream.

The hierarchy of data used to estimate current loading concentrations was as follows:

1.) *Detailed Monitoring Questionnaire (DMQ) for the CHWC Industry data from effluent sample locations for 1992.* The facility's long-term monitoring data was supplied in this questionnaire. Often, this data had to be corrected for inclusion of non-CHWC wastewater streams using Equation 4.2 above.

2.) *Detailed Monitoring Report (DMR) data from effluent sample locations for 1992.* The facility's long-term monitoring data was supplied to EPA in this report. Often, this data had to be corrected for inclusion of non-CHWC wastewater streams using Equation 4.2.

3.) *Waste Treatment Industry Phase II: Incinerators Questionnaire data from effluent sample locations for 1992.* The facility's year-long monitoring data was supplied in this questionnaire. Often, this data had to be corrected for inclusion of non-CHWC wastewater streams using Equation 4.2.

4.) *POTW or NPDES permit effluent concentrations for 1992.* Often, this data had to be corrected for inclusion of non-CHWC wastewater streams using Equation 4.2.

5.) *EPA Five-Day Sampling Data for three CHWC facilities.* This data was used either for specific facilities sampled or averages were obtained to model facilities for which limited data was available.

6.) *Averages from similar facilities.* Data averages from similar facilities were used to model current loadings concentrations for facilities for which limited data was available.

The average, flow-weighted, estimated 1992 discharge concentration for facilities in the CHWC Industry is presented in Table 4-4.

Table 4-4. CHWC Industry 1992 Discharge Concentration

Pollutant	Discharge Concentration	Unit
Chemical Oxygen Demand	145.2	mg/l
Total Dissolved Solids	10,430.0	mg/l
Total Suspended Solids	30.6	mg/l
Aluminum	663.7	ug/l
Antimony	559.0	ug/l
Arsenic	217.7	ug/l
Boron	1,614.9	ug/l
Cadmium	118.4	ug/l
Chromium	4,276.9	ug/l
Copper	944.2	ug/l
Iron	306.2	ug/l
Lead	363.4	ug/l
Manganese	156.2	ug/l
Mercury	10.6	ug/l
Molybdenum	239.2	ug/l
Selenium	34.2	ug/l
Silver	31.0	ug/l
Tin	88.4	ug/l
Titanium	79.6	ug/l
Zinc	385.6	ug/l

SECTION 5

SELECTION OF POLLUTANTS AND POLLUTANT PARAMETERS FOR REGULATION

5.1 INTRODUCTION

As previously discussed, EPA evaluated sampling data that was collected from the industry prior to the proposal of this regulation as well as data submitted by industry following the proposal of this regulation. EPA used these data (presented in Section 4) to identify which pollutants present in combustor wastewaters it should consider for regulation -- the so called "pollutants of concern" for the Commercial Hazardous Waste Combustor (CHWC) Industry. EPA classifies pollutants into three categories: conventional, non-conventional, and toxic pollutants. Conventional pollutants include 5-day biolgoical oxygen demand (BOD_5), total suspended solids (TSS), oil and grease, and pH. Toxic pollutants -- EPA also refers to them as priority pollutants -- include selected metals, pesticides and herbicides, and over 100 organic parameters that represent a comprehensive list of volatile and semi-volatile compounds. Non-conventional pollutants are any pollutants that do not fall within the specific conventional and toxic pollutant lists, for example, total organic carbon (TOC), chemical oxygen demand (COD), chloride, fluoride, ammonia as nitrogen, nitrate/nitrite, total phenol and total phosphorus.

This section presents the criteria used for the selection of pollutants EPA evaluated for regulation and the selection of pollutants for which EPA has established effluent limitations and standards.

5.2 POLLUTANTS CONSIDERED FOR REGULATION

To characterize CHWC wastewaters and to determine the pollutants that it should evaluate for potential limitations and standards, EPA collected wastewater characterization samples at 12 CHWC facilities, in addition to influent data collected during three five-day sampling episodes. EPA analyzed wastewater samples for 467 conventional, toxic, and non-conventional pollutants including metals, organics, pesticides, herbicides, and dioxins and furans. Section 4 presents this wastewater characterization data.

From the original list of 467 analytes, EPA developed a list of "pollutants of concern" that it would further evaluate for possible regulation. A total of 328 pollutants were never detected in CHWC wastewaters during EPA sampling episodes, leaving 139 pollutants to be considered as pollutants of concern that served as the basis for selecting pollutants for regulation. These 328 pollutants are presented in Section 4.

5.3 SELECTION OF POLLUTANTS OF CONCERN

EPA determined "pollutants of concern" -- pollutants that EPA evaluates for regulation -- using the raw wastewater data collected during the EPA sampling program. EPA only considered the three five-day sampling episodes to determine the pollutants of concern. Therefore, EPA did not include sampling data from the 12 wastewater characterization sampling episodes. Of these 12 facilities, eight were captive facilities that did not operate commercially (outside the scope of this regulation) and the samples from one facility solidified during transport to the analytical laboratory and were not re-sampled. Two of the remaining three facilities were selected for five-day sampling episodes and therefore, characterization data is included as part of these events. A total of 25 pollutants were detected during the wastewater characterization sampling episodes but were not detected during the three five-day sampling episodes and were eliminated as pollutants of concern. These 25 pollutants are listed in Table 5-1.

Table 5-1. Pollutants Detected Only During Wastewater Characterization Sampling

Pollutants	
Amenable Cyanide	N-Decane
Atrazine	N-Docosane
Benzoic Acid	N-Docecane
Beryllium	N-Eicosane
Bromodichloromethane	N-Tetradecane
Carbon Disulfide	P-Cresol
Chloroform	Tribromomethane

Pollutants	
Dibenzothiophene	Trichlorofluoromethane
Dibromochloromethane	Yttrium
Erbium	2-Butanone
Hexanoic Acid	2-Propanone
Isophrone	2-Propenol
Methylene Chloride	

EPA further determined a pollutant to be a potential pollutant of concern if it was detected three or more times in the influent above the method detection limit (MDL) at a five-day sampling episode. This ensured that pollutants that were detected relatively frequently at CHWC facilities were given consideration as pollutants of concern. This criterion eliminated the 47 pollutants listed in Table 5-2.

Table 5-2. Pollutants Not Detected Three or More Times Above MDL

Pollutants	
Acetophenone	Oil and Grease
Cerium	Osmium
Cobalt	Phenol
Dalapon	Platinum
Dicamba	Praseodymium
Dinoseb	Rhenium
Dysprosium	Rhodium
Europium	Ruthenium
Gadolinium	Samarium
Gallium	Scandium
Germanium	Tantalum
Hafnium	Terbium
Holmium	Thallium
Indium	Thorium
Iodine	Thulium

Pollutants	
Iridium	Total Phenols
Lanthanum	Tungsten
Lutetium	Ytterbium
MCPA	Zirconium
Monocrotophos	2,4 - D
Neodymium	2,4 - DB
Niobium	2,4,5 - T
Norflurazon	2,4,5 - TP
OCDF	

EPA then further examined the characteristics of the three facilities that were sampled as part of the five-day episodes. As noted in Section 6, influent concentrations for many parameters were low due to the liquid injection system employed at the facility sampled during Episode # 4733 and the actual raw wastewater characteristics as well as treatment system performance could not be adequately determined. In addition, raw wastewater pollutant concentrations also were lower at the treatment system employed at the facility sampled during Episode 4671 and treatment system performance was not as good as the system considered BAT. Therefore, EPA determined that only data collected from five-day sampling Episode 4646 should be considered further in determining pollutants of concern. This criterion eliminated the six pollutants listed in Table 5-3, leaving a total of 61 pollutants remaining.

Table 5-3. Pollutants Only Found During Sampling Episodes 4733 and 4671

Pollutants	
Bismuth	Total Cyanide
Dichloroprop	Total Organic Carbon
Strontium	Uranium

Next, EPA evaluated which pollutants were present in raw wastewaters at treatable levels by determining the pollutants that were detected three or more times at an average influent concentration greater than or equal to 10 times the MDL (in the case of aluminium and lead, criteria of five and three times the MDL was used, respectively, to determine treatable levels because of higher MDLs). EPA determined that this criterion eliminated the 11 pollutants listed in Table 5-4, leaving a total of 50 pollutants remaining.

The raw wastewater value for pollutants detected during sampling Episode 4646 was a flow-weighted average of two sample points. Barium (291 ug/l), bis (2-ethylhexyl) phthalate (37 ug/l), BOD_5 (3.7 mg/l), hexavalent chromium (35 ug/l), lithium (497 ug/l), magnesium (5,431 ug/l), nickel (151 ug/l) and vanadium (315 ug/l) were all detected at an average concentration well below the 10 times the MDL threshold for treatable levels. For n-hexacosane, n-octacosane and n-tricotane, samples were analyzed using different analytical methods that yielded values in different units, ug/kg and ug/l. In both cases, the average concentration also was well below the 10 times the MDL threshold for treatable levels for all three pollutants.

Table 5-4. Pollutants Not Detected Three or More Times at an Average Influent Concentration Greater Than or Equal To 10 Times the MDL

Pollutants	
Barium	N-Hexacosane
Bis (2-Ethylhexyl) Phthalate	N-Octacosane
BOD_5	N-Tricotane
Hexavalent Chromium	Nickel
Lithium	Vanadium
Magnesium	

EPA then excluded pollutants that are used as treatment chemicals in this industry from the pollutants of concern list. These compounds include ammonia as nitrogen, calcium, chloride, fluoride, nitrate/nitrite, phosphorus, potassium, silicon, sodium, sulfur, total phosphorus, and total sulfide. Eliminating these 12 pollutants leaves a total of 38 pollutants remaining.

EPA eliminated pollutants that received ineffective treatment by the selected BAT treatment technology. Concentrations of these pollutants increased or decreased insignificantly during sampling Episode 4646 and could not be considered treated. This criterion eliminated the five pollutants listed in Table 5-5, leaving a total of 33 pollutants remaining.

Table 5-5. Pollutants Not Treated by the BAT Treatment System

Pollutants	
Boron	MCPP
Chemical Oxygen Demand	Total Dissolved Soilds
Manganese	

EPA then eliminated those pollutants indirectly controlled through the regulation of other pollutants in the final rule. This criterion eliminated the six pollutants shown in Table 5-6, leaving a total of 27 pollutants remaining.

Table 5-6. Pollutants Indirectly Controlled Through Regulation of Other Pollutants

Pollutants	
Aluminum	Molybdenum
Antimony	Selenium
Iron	Tin

Finally, EPA eliminated the 16 dioxins and furans presented in Table 5-7, for the reasons presented below.

Table 5-7. Dioxins and Furans Eliminated as Pollutants of Concern

Pollutants	
234678 - HXCDF	123678 - HXCDF
23478 - PECDF	12378 - PECDD

Pollutants	
2378 - TCDD	12378 - PECDF
2378 - TCDF	123789 - HXCDD
123478 - HXCDD	123789 - HXCDF
123478 - HXCDF	OCDD
1234789 - HPCDF	1234678 - HPCDD
123678 - HXCDD	1234678 - HPCDF

5.3.1 *Dioxins/Furans in Commercial Hazardous Waste Combustor Industry*

5.3.1.1 Background

Scientific research has identified 210 isomers of chlorinated dibenzo-p-dioxins (CDD) and chlorinated dibenzofurans (CDF). EPA's attention has primarily focused on the 2,3,7,8-substituted congeners, a priority pollutant under the CWA, of which 2,3,7,8-TCDD and 2,3,7,8-TCDF are considered the most toxic. Evidence suggests that non-2,3,7,8-substituted congeners may not be as toxic. Some sources report that these non-2,3,7,8-substituted congeners may either be broken down or quickly eliminated by biological systems. Dioxins and furans are formed as a by-product during many industrial and combustion activities, as well as during several other processes. The combustion activities that may create dioxins under certain conditions may include:

- Combustion of chlorinated compounds, including PCBs;
- Some metals are suspected to serve as catalysts in the formation of dioxin/furans;
- Metal processing and smelting;
- Petroleum refining;
- Chlorinated organic compound manufacturing.

5.3.1.2 Dioxin/Furans in Commercial Hazardous Waste Combustor Wastewater

EPA identified a number of dioxin/furan compounds as present in the untreated wastewater streams at seven of the twelve facilities sampled (including grab and composite samples). Two of the facilities with dioxins detected in their CHWC wastewater are now closed and no longer within the scope of the final rule, so data from these facilities has not been considered further here. Thus, the following discussion relates to data from the ten remaining facilities (a total of 32 aqueous samples). Table 5-8 below summarizes the dioxin/furans detected in CHWC wastewaters during the sampling program. Similar isomers that contain the 2,3,7,8 base were grouped together for this analysis due to their similar nature and characteristics.

Table 5-8. Breakdown of Detected Dioxin/Furans During CHWC Sampling Program

Dioxin/Furan	Toxic Equivalent Value (TEQ)	Universal Treatment Standards	Mean Concentrations CHWC Industry (detects only)	Total # of Aqueous Samples Detected (out of 32)	# of Facilities Detected (out of 10)
2,3,7,8- TCDF	0.1	63,000 pg/l	17 pg/l	2	2
2,3,7,8- PeCDF	0.5	35,000 pg/l	93 pg/l	1	1
2,3,7,8- HxCDD	0.1	63,000 pg/l	68 pg/l	1	1
2,3,7,8- HxCDF	0.1	63,000 pg/l	249 pg/l	7	3
2,3,7,8- HpCDD	0.01	none	272 pg/l	5	4
2,3,7,8- HpCDF	0.01	none	939 pg/l	7	4
OCDD	0.001	none	971 pg/l	10	5
OCDF	0.001	none	6165 pg/l	6	4

It is important to note that EPA did not detect 2,3,7,8-TCDD (the most toxic congener) or 2,3,7,8-PeCDD in the raw wastewater samples collected. The dioxin/furans detected in untreated CHWC wastewaters during EPA sampling at 10 sites show that these dioxin/furans were all detected at levels significantly (orders of magnitude) below the “Universal Treatment Standard” (40 CFR 268.48) level established under RCRA for dioxins/furans. In addition, low levels of HpCDD and OCDD (as indicated above) are generally considered pervasive in the environment and Universal Treatment Standards have not been set for these compounds. EPA identified no dioxin/furans in the CHWC wastewater treated effluent.

CDD/CDFs are lipophilic and hydrophobic. As such, they are most often associated, or have an affinity for, suspended particulates in wastewater matrices. The more highly chlorinated isomers (i.e., the hepta- and octa- congeners) are the least volatile and more likely to be removed through particulate adsorption or filtration. While recommended treatment technologies differ according to the wastewater characteristics, there is some evidence that dioxins generally will bind with suspended solids and some sources (EPA NRMRL Treatability database) have asserted that these compounds may be removed by precipitation and filtration technologies.

Of the three five-day sampling episodes conducted by EPA, the episode from which BAT/BPT limits were developed had no dioxins detected in the influent or effluent. At the other two facilities, HpCDD, HpCDF, OCDD, and OCDF were detected in the influent but none were detected in the effluent. Both facilities employed a combination of chemical precipitation and filtration that may have contributed to these removals.

The most toxic congener, 2,3,7,8-TCDD, was never detected in CHWC wastewater during the sampling program and the CDD/CDFs detected were neither detected at most facilities sampled nor found in any significant quantity. The toxic equivalent (TEQ) values found in the CHWC wastewater were low when compared to other dioxin sources in industry. The detected congeners were of the highly chlorinated type which may be treated by the methods recommended by this guideline (chemical precipitation, filtration, see Section 6). Also, since no dioxins were detected in the treated effluents at any of the three facilities EPA sampled, this may be evidence of dioxin removals.

Based on EPA's sampling program, no CDD/CDF met the criteria for wastewater regulation in the final rule.

The Agency has proposed CDD/CDF air emission limits of 0.2 ng/dscm from the stacks of hazardous waste burning incinerators (see 61 FR 17358 of 4/19/96 and 62 FR 24212 of 5/2/97), and believes that the incinerators have to operate with good combustion conditions to meet the proposed emission limits. In the final Land Disposal Restrictions (LDR) rulemaking that set treatment standards for

CDD/CDF constituents in non-wastewater and wastewater from RCRA code F032 wastes, the Agency has established (62 FR 26000, 5/12/97) incineration as the BDAT, after which the CDD/CDF constituents do not have to be analyzed in the effluent.

Based on the data available and the resulting decision not to establish limitations and standards for dioxins, EPA also cannot justify a monitoring program for dioxins, as suggested by a commenter on the proposal. While EPA recognizes that the promulgation of the Hazardous Waste Combustor (HWC) MACT (64 FR 52828, September 30, 1999) dioxin/furan emission standards may result in some changes in the volume and character of air pollution control wastewater generated, EPA does not believe that the changes will result in a media transfer for dioxins that would change its decision not to establish dioxin limitations and standards. The promulgated MACT standards for 85 percent of the hazardous waste incinerators in the final HWC rule are based on changes in air pollution control device process conditions to minimize generation of dioxins and furans. Various studies have shown that a significant source of dioxin in waste incinerators is from the formation of dioxin in the flue gas as it is cooled to around 400 degrees C. The longer the flue gas is held at this temperature the greater the formation of dioxin. One useful control measure is the rapid cooling of flue gas to levels below this temperature range to minimize this dioxin production window. EPA has concluded that the largest portion of the reduction in dioxin emissions will be through reductions in the amount generated rather than media transfer.

Table 5-9 presents the 11 pollutants selected for regulation for the CHWC Industry.

Table 5-9. Pollutants Selected for Regulation

Pollutants	
Arsenic	pH
Cadmium	Silver
Chromium	Titanium
Copper	Total Suspended Solids
Lead	Zinc
Mercury	

5.4 SELECTION OF POLLUTANTS FOR REGULATION

All of the analytes listed in Table 5-9 were included in data submitted by two facilities (Sampling Episodes 6181 and 6183) following the proposal of the CHWC regulation, presented in Tables 5-10 and 5-11. EPA received additional sampling data from three facilities. These facilities only tested for conventional, priority and non-conventional pollutants that they considered treatable and likely to be found in CHWC wastewater. These pollutants included TSS, total dissolved solids (TDS), chloride, sulfate, aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, mercury, molybdenum, selenium, silver, tin, titanium, and zinc. TDS, chloride and sulfate were included in the testing to characterize the wastewater and evaluate the pollutants' potential effect on the treatability of metals.

Based on several factors, EPA specifically excluded data from the third facility (Episode 6182) from consideration as BAT technology. The facility treated less than 2 percent of their wastewater through the filtration unit considered BPT/BCT/BAT. Hence, the data submitted represents single-stage precipitation with clarification only. Not only does the single-stage treatment sampled during Episode 6183 not represent BPT/BCT/BAT technology, but it does not provide sufficient treatment for the typical profile of metals detected in CHWC wastewaters. There are a variety of metals at significant and treatable concentrations in CHWC wastewaters that pose a problem for a single-stage precipitation system. To properly treat a large number of different metals effectively, several different pH settings and treatment chemicals are ususally required. Hence, many CHWC facilities currently employ two-stage chemical precipitation. When a single-stage of precipitation is employed with a narrow pH range (as was the case for Episode 6182), many of the metals present in the influent are not effectively removed and some are not removed at all. Removal efficiencies and effluent concentrations for Episode 6182 can be characterized as poor when compared to EPA-conducted sampling episodes. Based on these factors, the Agency determined that data from sampling Episode 6182 would not be used in this rulemaking.

After reviewing the data submitted by these two facilities (Sampling Episodes 6181 and 6183), EPA has decided to promulgate the CHWC regulations for the same analytes as proposed. Review of the additional TSS and TDS data submitted brought EPA to the same conclusion as at proposal: TDS should not be regulated because treatment chemicals associated with the technology selected for BPT/BCT/BAT increased TDS levels and TSS should be continue to be regulated. In addition, not all of the analytes proposed for regulation were found in one of the submitted sampling episodes (Episode 6181) in "treatable levels" at the influent sampling point, as defined above in this section. Also, not all of the analytes proposed for regulations were effectively treated (as indicated by the percent removal calculated in Section 6) in Episode 6181.

The following tables illustrate the results of the analyses to determine which pollutant data could be used from Episode 6181 and 6183 to develop the final regulations. For four of the metal analytes (arsenic, lead, selenium and silver), EPA received data for Episodes 6181 and 6183 using more than one analytical method. For arsenic, methods 200.7, 200.8 and 206.3 were used. For lead, methods 200.7 and 200.8 were used. For selenium, methods 200.7, 200.8 and 270.3 were used. For silver, methods 200.7 and 200.8 were used. EPA elected to use the results from method 200.8 for all of these metal analytes because of the quantitation limit achieved by this method and because of the reliability of this method. EPA received data using only method 200.7 for aluminum, antimony, cadmium, chromium, copper, iron, molybdenum, tin, titanium and zinc. EPA received data using only method 245.1 for mercury. Finally, EPA received data using only method 160.2 for TSS.

Table 5-10. Sampling Episode 6181 Analytical Results[1]

Episode 6181				Treatable Level?	Avg. Effluent Conc.	% Removal	Pollutants used from Epsiode 6181 to Develop Final Regulations
Pollutant	Avg. Influent Conc.	Quantitation Limit (QL)[+]	10X QL				
TSS (mg/l)	78.8	4	40	Yes	4.77	93.95	TSS
Aluminum	7000	100	500*	Yes	102	98.54	Aluminum
Antimony	874	60	600	Yes	806	7.78	Antimony
Arsenic	278	10	100	Yes	87.8	68.42	Arsenic
Cadmium	103	5	50	Yes	7.1	93.11	Cadmium
Chromium	37.0	10	100	No	13.1	64.59	-
Copper	528	10	100	Yes	11.9	97.75	Copper
Iron	3050	20	200	Yes	23.6	99.23	Iron

Episode 6181				Treatable Level?	Avg. Effluent Conc.	% Removal	Pollutants used from Epsiode 6181 to Develop Final Regulations
Pollutant	Avg. Influent Conc.	Quantitation Limit (QL)+	10X QL				
Lead	895	10	100	Yes	10.3	98.85	Lead
Mercury	3.40	0.2	2	Yes	0.209	93.85	Mercury
Molybdenum	387	50	500	No	445	-14.99	-
Selenium	136	10	100	Yes	137	-0.74	-
Silver	20.0	5	50	No	5.37	73.15	-
Tin	151	50	500	No	62.6	58.54	-
Titanium	345	10	100	Yes	10	97.10	Titanium
Zinc	1690	20	200	Yes	23.1	98.63	Zinc

1 Values in (ug/l) unless otherwise noted.
+ Quantitation limit development is detailed in Commercial HWC record (W-97-08, Item 16.4.9, Attachment VI.)
* For aluminum, the treatable level was set at 5 times the quantitation limit of 100 ug/l because 100 ug/l is a high quantitation limit.

Table 5-11. Sampling Episode 6183 Analytical Results[1]

Episode 6183				Treatable Level?	Avg. Effluent Conc.	% Removal	Pollutants used from Epsiode 6183 to Develop Final Regulations
Pollutant	Avg. Influent Conc.	Quantitation Limit (QL)+	10X QL				
TSS (mg/l)	350	4	40	yes	84.6	75.83	TSS
Aluminum	61500	100	500*	yes	319	99.48	Aluminum
Antimony	1710	60	600	yes	289	83.10	Antimony
Arsenic	1210	10	100	yes	26.1	97.84	Arsenic
Cadmium	97.7	5	50	yes	5	94.88	Cadmium
Chromium	2250	10	100	yes	10	99.56	Chromium
Copper	1970	10	100	yes	10	99.49	Copper
Iron	231000	20	200	yes	434	99.81	Iron
Lead	1600	10	100	yes	10	99.38	Lead
Mercury	219	0.2	2	yes	0.478	99.78	Mercury
Molybdenum	1550	50	500	yes	856	44.77	Molybdenum
Selenium	113	10	100	yes	32.8	70.97	Selenium

Episode 6183				Treatable Level?	Avg. Effluent Conc.	% Removal	Pollutants used from Epsiode 6183 to Develop Final Regulations
Pollutant	Avg. Influent Conc.	Quanti-tation Limit (QL)+	10X QL				
Silver	69.8	5	50	yes	5.53	92.08	Silver
Tin	1330	50	500	yes	134	89.92	Tin
Titanium	4030	10	100	yes	10	99.75	Titanium
Zinc	8300	20	200	yes	64.3	99.23	Zinc

[1] Values in (ug/l) unless otherwise noted.
\+ Quantitation limit development is detailed in Commercial HWC record (W-97-08, Item 16.4.9, Attachment VI.)
* For aluminum, the treatable level was set at 5 times the quantitation limit of 100 ug/l because 100 ug/l is a high quantitation limit.

5.5 SELECTION OF POLLUTANTS TO BE REGULATED FOR PSES AND PSNS

Indirect dischargers in the CHWC Industry send their wastewater streams to a POTW for further treatment, unlike direct dischargers, whose wastewater will receive no further treatment once it leaves their facility. Therefore, the levels of pollutants allowable in the wastewater of an indirect discharger are dependent upon (1) whether a given pollutant “passes through” the POTW’s treatment system or (2) whether additional treatment provided by the POTW will result in removal of the pollutant to a level equivalent to that obtained through treatment by a direct discharger.

5.5.1 *Removal Comparison Approach*

To establish PSES, EPA must first determine which of the CHWC Industry pollutants of concern (identified earlier in Section 5.3) may not be susceptible to POTW treatment, interfere with, or are incompatible with the operation of POTWs (including interferences with sludge disposal practices). EPA evaluates the susceptibility of a pollutant to POTW treatment by looking at the removal performance of POTWs for a particular pollutant. EPA’s removal comparison evaluates the percentage removed by POTWs with the percentage removed by direct dischargers using BPT/BCT/BAT technology. EPA has assumed, for the purposes of its removal comparison and based upon the data received, that the untreated wastewater at indirect discharge facilities is not significantly different from direct discharge facilities.

EPA's comparison satisfies two competing objectives set by Congress: (1) that standards for indirect dischargers be equivalent to standards for direct dischargers, and (2) that the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers. Rather than compare the mass or concentration of pollutants discharged by the POTW with the mass or concentration of pollutants discharged by a BAT facility, EPA compares the percentage of the pollutants removed by the facility with the POTW removal. EPA takes this approach because a comparison of mass or concentration of pollutants in a POTW effluent with pollutants in a BAT facility's effluent would not take into account the mass of pollutants discharged to the POTW from non-industrial sources, nor the dilution of the pollutants in the POTW effluent to lower concentrations from the addition of large amounts of non-industrial wastewater.

5.5.2 *50 POTW Study Database*

For past effluent guidelines, a study of 50 well-operated POTWs was used for the pass-through analysis. This study is referred to as the "The Fate of Priority Pollutants in Publicly Owned Treatment Works", September 1982 (EPA 440/1-82/303), also known as the 50 POTW Study. Because the data collected for evaluating POTW removals included influent levels of pollutants that were close to the detection limit, the POTW data were edited to eliminate influent levels less than 10 times the minimum level and the corresponding effluent values, except in the cases where none of the influent concentrations exceeded 10 times the minimum level. In the latter case, where no influent data exceeded 10 times the minimum level, the data were edited to eliminate influent values less than 5 times the minimum level. Further, where no influent data exceeded 5 times the minimum level, the data were edited to eliminate influent values less than 20 ug/l and the corresponding effluent values. These editing rules were used to allow for the possibility that low POTW removals simply reflected the low influent levels.

EPA then averaged the remaining influent data and also averaged the remaining effluent data from the 50 POTW database. The percent removals achieved for each pollutant were determined from these averaged influent and effluent levels. This percent removal was then compared to the percent removal for the BAT option treatment technology.

5.5.3 *Final POTW Data Editing*

The final percent removal for each pollutant was selected based on a data hierarchy, which was related to the quality of the data source. This hierarchy was:

1. 50 POTW Study Data (10x NOMDL edit)
2. 50 POTW Study Data (5x NOMDL edit)
3. 50 POTW Study Data (20 ug/l edit)

The final POTW removals for the CHWC regulated pollutants, determined via the data use hierarchy, are presented in Table 5-12.

Table 5-12. Final POTW Removals for CHWC Industry Pollutants

Pollutant	CAS Number	Percent Removal	Source of Data
Arsenic	7440382	66	50 POTW - (20 ug/l edit)
Cadmium	7440439	90	50 POTW - (10x NOMDL edit)
Chromium	7440473	91	50 POTW - (10x NOMDL edit)
Copper	7440508	84	50 POTW - (10x NOMDL edit)
Lead	7439921	92	50 POTW - (10x NOMDL edit)
Mercury	7439976	90	50 POTW - (10x NOMDL edit)
Silver	7440224	88	50 POTW - (10x NOMDL edit)
Titanium	7440326	92	50 POTW - (10x NOMDL edit)
Zinc	7440666	78	50 POTW - (10x NOMDL edit)

5.5.4 *Final Removal Comparison Results*

For each CHWC regulated pollutant, the daily removals were calculated using the BPT/BCT/BAT data. Then, the average overall BPT/BCT/BAT removal was calculated for each pollutant from the daily removals (see Table 5-13). The averaging of daily removals is appropriate for this industry as BPT/BCT/BAT treatment technologies typically have retention times of less than one day. For the final assessment, the final POTW removal data determined for each CHWC regulated pollutant was compared to the percent removal achieved for that pollutant using the BPT/BCT/BAT option treatment technologies. Of the 9 pollutants regulated under BPT/BCT/BAT, all were found to pass through for the regulatory wastewater treatment technology option selected (see Section 7 for a description of the selected BPT/BCT/BAT Regulatory Option) and are proposed for PSES. The final results for the CHWC Regulatory Option are presented in Table 5-14.

Table 5-13. Sampling Episode Percent Removals

	6181 Percent Removal	6183 Percent Removal	4646 Percent Removal	Average Percent Removal
Aluminum	98.54	99.48	85	94
Antimony	7.78	83.10	49	47
Arsenic	68.42	97.84	98	88
Cadmium	93.11	94.88	98	95
Chromium	*64.59	99.56	95	97
Copper	97.75	99.49	99	99
Iron	99.23	99.81	98	99
Lead	98.85	99.38	99	99
Mercury	93.85	99.78	97	97
Molybdenum	*-14.99	44.77	38	41
Selenium	*-0.74	70.97	89	80
Silver	*73.15	92.08	98	95
Tin	*58.54	89.92	99	94
Titanium	97.10	99.75	99	99

	6181 Percent Removal	6183 Percent Removal	4646 Percent Removal	Average Percent Removal
Zinc	98.63	99.23	99	99

* These pollutants from Episode 6181 could not be used to develop final regulations either because they were not found at a treatable level or because the percent removal was a negative value.

Table 5-14. Final Results for CHWC Industry Regulatory Option

Pollutant	Option Percent Removal	POTW Percent Removal
Arsenic	88	66
Cadmium	95	90
Chromium	97	91
Copper	99	84
Lead	99	92
Mercury	97	90
Silver	95	88
Titanium	99	92
Zinc	99	78