Appendix B

BASELINE COST REPORT

Revised Estimation of Baseline Costs for Hazardous Waste Combustors for Final MACT Rule

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FIGURES

ACRONYMS

APCD	Air pollution control device
BIF	Boilers and Industrial Furnaces Rule
CK	Cement kiln
CO	Carbon monoxide
EPA	U.S. Environmental Protection Agency
HC	Hydrocarbons
HWC	Hazardous waste combustor
LWAK	Lightweight aggregate kiln
MACT	Maximum Achievable Control Technology
OAQPS	EPA's Office of Air Quality and Planning Standards
OSW	EPA's Office of Solid Waste
PCDD/PCDF	Polychlorinated dioxin and furans
RCRA	Resource Conservation and Recovery Act

1.0 INTRODUCTION

The U.S. Environmental Protection Agency is establishing maximum achievable control technology (MACT) emissions standards for the hazardous waste combustor (HWC) categories of incinerators, cement kilns (CKs), and lightweight aggregate kilns (LWAKs) which burn hazardous waste. These standards are being developed as specified under Title III of the 1990 Clean Air Act Amendments (CAAA). The final MACT standards limit emissions for the hazardous air pollutants (HAP) of polychlorinated dioxins/furans (PCDD/PCDF), mercury (Hg), semi-volatile metals (SVM), low-volatile metals (LVM), hydrogen chloride (HCl) and chlorine gas (Cl_2) as total chlorides (TCl), and HAP surrogates of particulate matter (PM), and carbon monoxide (CO) and/or hydrocarbons (HC).

This document estimates "baseline" costs incurred by sources currently burning hazardous waste. Baseline costs include capital equipment investment and operating and maintenance costs estimates for currently operating HWCs under current RCRA hazardous waste burning requirements. Note that baseline costs do not include system retrofit costs (such as those for new equipment or existing equipment upgrades) which are projected to be required to meet the new MACT emissions standards.

Baseline costs are estimated for the following categories of combustion facilities:

- Hazardous waste incinerators, including:

  -- Commercial. These are facilities which are used solely for burning/treating hazardous waste supplied by off-site generators for a fee.

  -- On-Site. These "captive" incinerators burn wastes generated at the facility site only.

  -- Government. Although the baseline economics for government and on-site incinerators are similar, this category is used to assess the effects of liability and specialized wastes (for example handling mixed radioactive and hazardous wastes, warfare agents, etc.). This category includes units operated by the Department of Defense and Department of Energy.

- Industrial kilns, including:

-- Cement Kilns. Industrial process kilns used for making cement, as well as burning off-site generated hazardous wastes.

-- Lightweight Aggregate Kilns. Industrial process kilns used for making lightweight aggregate, as well as burning off-site generated hazardous wastes.

This work is a "second generation" effort, and is used for analysis of the impacts of the final HWC MACT rule on the existing HWC universe. The first generation was used and included as part of the HWC MACT Proposed Rule analysis. This second version is an update of the first, and includes consideration of stakeholder comments on the Proposed Rule first generation analysis.

2.0 COMBUSTION FACILITY UNIVERSE

Tables 2-1a, 2-1b, 2-1c, 2-1d, and 2-1e list the baseline universe of combustion facilities considered in the analysis (for commercial incinerators, on-site incinerators, government incinerators, cement kilns, and lightweight aggregate kilns, respectively). See the HWC MACT Final Rule Regulatory Impact Assessment and the Final Rule Technical Support Documents (in particular Volume V) for a detailed discussion on the determination of the existing HWC facility universe.

Each combustion system contained in the EPA/OSW HWC trial burn database is assigned a three-digit "Site ID No.". Note that:

- A combustion system may contain one or more combustion units that are emitting to a common stack (or common multiple stacks).

- A facility may have one or more combustion systems. In this case, they would be assigned multiple Site ID Nos.

- If the multiple combustion systems are identical and only one system was tested, a single Site ID is assigned to the tested combustion system. The combustion systems not tested were assumed to have identical data to the tested system.

The breakdown of combustion facility categories with measured data and trial burn reports in the EPA/OSW HWC database is as follows:

- Incinerators

  -- 19 commercial incinerators.

  -- 70 on-site incinerators.

  -- 13 government incinerators.

- Industrial kilns

-- 30 CKs (which is the entire population of cement kilns processing hazardous waste in the U.S.).

-- 10 LWAKs (which is the entire population of LWAKs processing hazardous waste in the U.S.).

Additionally, the HWC universe includes facilities that are known to be permitted and burning hazardous waste (from government surveys and other documentation) but are not represented in the EPA/OSW HWC database due to lack of a collected trial burn test report. For these units (66 in total, which include only incinerators), Site IDs starting with the letters "A", "B", or "C" followed by two numbers (e.g., Site ID A10) are used. Site IDs starting with "A" refer to combustion systems identified from the Biannual Reporting System (BRS) database. Site IDs starting with "B" or "C" refer to combustion systems identified from the EPA/OSW February 1996 list on the complete universe of hazardous waste burning sources.

3.0 BASELINE COST ESTIMATES

Tables 3-1 through 3-5 show generic baseline cost spreadsheets that contain all elements of the baseline costs estimates for each combustion facility category, including ones for commercial incinerators, on-site incinerators, government incinerators, cement kilns, and lightweight aggregate kilns, respectively. The source and method used to determine each line item given on the baseline cost summary spreadsheets is discussed in the following, including where necessary, differences between facility types. The spreadsheets contain the specific equations used for calculation of the cost elements. Also:

- Tables 3-6a, 3-6b, 3-6c, 3-6d, and 3-6e provide a summary of costs for each site-specific Site ID (all hazardous waste burning sources effected by the MACT rule).

- Table 3-7 provides a detailed listing of all site-specific input parameters (operational system characteristics discussed below) that are used for evaluating the baseline system costs.

Additionally note that:

- Baseline cost estimates are made using site-specific combustion system characteristics. (Note that this differs from the baseline costs made for the Proposed Rule which were estimated based on a model plant group approach.) When available, measured data from trial burn and compliance testing reports contained in the EPA/OSW HWC database are used in the baseline cost analysis. However, for data not measured and/or reported, this measured data is used to impute the missing data. Imputation involves randomly selecting a data point from a set of measured data within a source category and substituting it for the missing data in the same group.

- All cost estimates, including capital equipment, have been standardized to the base year of 1996. In this respect, they represent replacement costs, and not the cost to originally install when the facility was built, which is typically many years ago. Escalations (or deescalations) are made using standard Marshall and Swift Equipment Cost Indicies.

- Capital equipment costs are scaled-up to different sizes using a standard engineering equipment "economy of scale" power fit with an exponent of 0.6.

- Operating and maintenance costs have been divided up into "fixed" and "variable" costs. Fixed operating and maintenance costs include those that are not generally a function of the amount of waste (or hazardous air pollutant concentration in the flue gas) that is being treated, such as operating and supervisory labor, equipment maintenance and materials, overhead, administrative, property tax, insurance, etc. Alternatively, variable costs include those that are more strongly dependent on the amount of waste that is being treated, and are given as the cost per ton of waste that is handled. They include considerations such as acid gas absorbing or mercury or PCDD/PCDF adsorbing sorbent (e.g., lime, sodium, or carbon) usage, water injection requirements for gas cooling, electricity for fan, solid waste disposal (waste water and ash), auxiliary fuel requirements, etc.

3.1 Facility Characteristics

System Physical Operational and Design Characteristics:

- System Type: The type of incinerator used. May include rotary kiln, liquid injection, fluidized bed, or fixed hearth (controlled air) or rotary hearth types.

- Number of Units at This Facility: The number of combustion systems. The combustion system may contain one or more combustion units emitting to a common stack (or common multiple stacks).

- Number of Units Tested: The number of combustion units tested. If multiple combustion systems are identical and only one system was tested, the non-tested combustion systems were assumed to have identical data to the tested system.

- Stack Gas Flowrate: The stack gas flowrate (provided in both acfm and dscfm), based on trial burn and compliance test data in the EPA/OSW HWC database.

- Stack Oxygen Fraction: The stack gas oxygen content (volume %), based on trial burn and compliance test data in the EPA/OSW HWC database.

- Waste Feed Capacity: The maximum incinerator hazardous waste feedrate design capacity, based on trial burn and compliance test data in the EPA/OSW HWC database.

Note that the handling of non-hazardous wastes has not been considered due to: (1) limited data on the quantities and types of non-hazardous wastes; (2) relatively limited economic value of burning non-hazardous wastes; and (3) the costs provided are fully consistent with burning hazardous wastes only.

- Existing Air Pollution Control Devices (APCDs): Types of air pollution control devices used. Also, costs of the existing APCDs, including capital costs and annual operating and maintenance costs (broken down by both fixed and variable components) are estimated. These are based on EPA OAQPS APCD cost models (EPA OAQPS, 1996).

- Waste Heat Boiler: Identifying the use of a waste heat boiler.

- Auxiliary Fuel Type: The type of auxiliary fuel used (natural gas, fuel oil, coal, or none).

Hazardous Waste / Auxiliary Fuel Characteristics:

- Solid/Liquid/Sludge Composition:

  -- Liquid Feed % of Total: The % of liquid feed in the total waste feed, based on trial burn and compliance test data in the EPA/OSW HWC database.

  -- Sludge Feed % of Total: The % of sludge feed in the total waste feed, based on trial burn and compliance test data in the EPA/OSW HWC database.

  -- Solid Feed % of Total: The % of solid feed in the total waste feed, based on trial burn and compliance test data contained in the EPA/OSW HWC database.

- Waste Heating Value:

  -- Liquid Waste Heating Value: The heating value of liquid waste, based on trial burn and compliance test data in the EPA/OSW HWC database.

  -- Sludge Waste Heating Value: The heating value of sludge waste, based on trial burn and compliance test data in the EPA/OSW HWC database.

-- Solid Waste Heating Value: The heating value of solid waste, based on trial burn and compliance test data in the EPA/OSW HWC database.

-- Total Waste Heating Value: Calculated from the above waste stream feedrates and heating values.

- Waste Feedrate:

  -- Annual Liquid Waste Feedrate: Calculated from the total annual waste feedrate and liquid waste % of total waste feed.

  -- Annual Sludge Waste Feedrate: Calculated from the total annual waste feedrate and sludge waste % of total waste feed.

  -- Annual Solid Waste Feedrate: Calculated from the total annual waste feedrate and solid waste % of total waste feed.

  -- Total Annual Waste Feedrate: The hazardous waste feedrate processed, based on trial burn and compliance test data in the EPA/OSW HWC database.

  -- Total Hourly Waste Feedrate: The hourly hazardous waste feedrate, based on the yearly waste feedrate, and a 8,000 hr/yr facility operating schedule.

- Waste Ash Content:

  -- Waste Ash %: The % of ash in the total waste feed, based on trial burn and compliance test data in the EPA/OSW HWC database.

  -- Auxiliary Fuel Ash %: The % of ash in the auxiliary fuel (fuel oil or coal) used.

  -- Ash Feedrate: Calculated from the hazardous waste and auxiliary fuel inputs and the waste and auxiliary fuel ash contents.

- Thermal Input Rate:

-- Waste Thermal Input: Calculated from total hazardous waste heating value and total hazardous waste feedrate.

-- Auxiliary Fuel Thermal Input: For each auxiliary fuel stream, calculated from auxiliary fuel heating value and auxiliary fuel feedrate. Incinerators without auxiliary fuel data were assumed to burn natural gas. Thermal inputs for these incinerators were calculated by taking 20% of the estimated thermal input as described below.

-- Total Auxiliary Fuel Thermal Input: Calculated as the sum of the heat inputs from the auxiliary fuel(s) above.

-- Estimated Thermal Input: Directly applicable to incinerators only. Estimated total system heat input rate, based on a the stack gas flowrate, and calculated using an "F-factor" of 10,000 dscf/MMBtu @ 7% O_2 for typical waste fuels.

-- Actual Thermal Input: For CK and LWAKs, the sum of the waste and auxiliary thermal inputs.

Hazardous Waste Burning Penalty: Only applicable to cement kilns, the estimated cost penalty associated with a decrease in clinker yield when using hazardous waste compared with coal. This penalty is due to the following factors:

- For a given heat input, hazardous waste generates more total flue gas flow due to typically higher moisture content and lower heating value compared with coal. Less heat input can be obtained with waste for a given kiln maximum flue gas limit, thus reducing the total clinker produced.

- Coal has a typically higher ash content than hazardous waste. Ash goes directly into the production of clinker, thus additional raw materials are needed when using hazardous waste to produce the same amount of clinker.

- There is additional kiln downtime when using hazardous waste due to increased maintenance requirements from using typically chlorinated hazardous wastes.

Figure 3-1 shows the cost penalty as a function of the hazardous waste % of the total heat input, as reported by the Cement Kiln Recycling Coalition in their comments to the Proposed Rule. Values have been imputed based on kiln size and Figure 3-1.

3.2 System Capital Expenditures

Incinerator System: Costs of installed systems (without APCDs) are based on recent vendor quotes, including Blizzard (1997), Nikfarjam (1997), and Tejpar (1997), as well as Weitzman and Castaldini (1991) and Brunner (1987). Costs were determined for rotary kiln and liquid injection systems (which comprise over 95% of all incinerators) over a large range of system sizes (5 to 100 MMBtu/hr). Costs are correlated with system size (which is most commonly based on total heat input rate) using a common industrial equipment "economy of scale" power fit with an exponent of about 0.6 (i.e., cost is proportional to the heat input rate to the 0.6 power). Figures 3-2 and 3-3 show the installed cost without APCDs for rotary kiln and liquid injection systems, respectively. For the less common system types, fluidized bed costs were assumed to be comparable to rotary kilns while controlled air unit costs were assumed generally to be comparable to liquid injection systems.

Air Pollution Control System: Air pollution control system costs, calculated based on EPA OAQPS Cost Models (EPA OAQPS, 1996), are included above in Section 3.1. The costs are based primarily on flue gas flowrate and waste characteristics. Note that wet/dry scrubber sorbent operating cost requirements are a strong function of the waste chlorine content. Waste chlorine content from trial burns are used. These may be inflated to some degree due to non-representative chlorine spiking that took place for many commercial incinerators. Alternately, for on-site incinerators, trial burn levels are generally more representative of actual waste burned in practice.

Waste Heat Boiler: For incinerators, the cost of a waste heat boiler as a heat recovery device, estimated from the total system heat input, and based on Brunner (1987).

Waste Storage and Feed:

- Incinerator Storage Requirements:

  -- Waste Storage: Estimated from the waste feed capacity, based on McCormick and DeRosier (1983). Applies to commercial, government, and on-site incinerators. For CK and LWAKs, this cost is captured by liquid and solid waste storage items following below.

-- Auxiliary Buildings and Warehouses: Costs are estimated based on McCormick and DeRosier (1983). Applies to commercial incinerators only. Costs for other systems are not "incremental" to waste processing, and/or are included in other line items.

- Industrial Kiln Storage and Feed Requirements:

  -- Liquid Waste Storage: Costs are estimated based on McCormick and DeRosier (1983). This cost applies to CK and LWAKs only. This cost is not incremental to government and on-site incinerator facilities, and is included in the above "auxiliary building and warehouse" category for commercial incinerators.

  -- Solid Waste Storage: Costs are estimated based on McCormick and DeRosier (1983). This cost applies to CK and LWAKs only. The cost is not incremental to government and on-site incinerator facilities, and is also included in the above "auxiliary buildings and warehouse" category for commercial incinerators.

  -- Liquid Waste Feed System: Estimated based on typical liquid waste feed burner system costs. This cost applies to CKs and LWAKs only. The cost is captured by the incineration system cost for commercial, government and on-site incineration facilities.

  -- Solid Waste Feed System: Estimated based on McCormick and DeRosier (1983). This cost applies to CK and LWAKs only. The cost is captured by the incineration system cost for commercial, government and on-site incineration facilities.

Waste Water Treatment: The cost of an wet scrubber wastewater blowdown treatment system. Costs are based on Penta (1994). This system usually includes procedures for solids filtering and separation, dewatering, and waste water pH control and/or biological treatment processes prior to water release.

Automatic Shutdown System: The cost associated with installing a system to automatically shutdown the waste feed system in the event that any critical process parameter does not fall within the required/permitted operating range. System is required under RCRA regulations. Estimated based on typical, currently used waste feed shutdown systems.

Continuous Monitors: The cost associated with purchasing and installing continuous monitors for all process parameters critical to controlling the performance of the hazardous waste combustor,

including emissions monitors required by RCRA regulations (CO and/or HC, and O_2). Monitor costs are only included for CK and LWAKs. Costs for commercial and on-site incinerators are included in the incinerator system costs above. Costs are based on current vendor quotes.

Total Equipment and Installation: The sum of the above installed equipment costs.

Engineering: The engineering cost associated with the equipment. Estimated at 10% of the total equipment and installation cost.

Start-Up: The start-up cost associated with a project to install the indicated equipment. Estimated at 2% of the total equipment and installation cost.

Contingency: The cost of unexpected changes and other unanticipated costs encountered during the installation project. Contingency cost is estimated to at 20% of sum of the total equipment and installation, engineering, and start-up costs.

Compliance:

- RCRA or BIF Permit Acquisition: The cost to obtain a RCRA or BIF permit, based on Brunner (1987). Cost estimate ranges from $250,000 to 500,000, depending on the facility size and type.

- Updating RCRA Permit: The cost to update a RCRA or BIF permit. Cost is estimated to be 25% of the initial RCRA or BIF permit.

- Compliance Testing/Trial Burn: The cost to conduct a trial burn to obtain or renew a Part B permit or obtain interim status from the EPA. Cost of about $300,000 per trial burn is based on current testing firm vendor estimates. Assumed to be required every 5 years.

Legal and Financing: The legal and financing costs associated with installing a hazardous waste incinerator, determined as 12% of capital installed equipment, based on Brunner (1987).

3.3 Annual Operating and Maintenance Costs

Labor: The following discuss facility labor requirements to burn hazardous waste (incremental beyond "normal" facility operation requirements for industrial kilns). Table 3-8 provides an employment summary for each waste combustor category. Note that some labor components are dependent on the system type as well as the size of the facility. Facility size is determined by stack gas flow rate. Table 3-9 shows each combustion facility category with size breakdown. Also, labor costs are divided into those requirements per individual combustor, as well as those required per facility (which may contain multiple combustor units). Additionally, note that:

- All labor costs are estimated based upon a 2,080 hour work year for all employees.

- Labor rates are burdened at a 23% rate to account for taxes, insurance, benefits, vacation, holiday, etc.

- Wage rates are adjusted to 1996 dollars.

- Labor requirements are based on industry discussions, including Guidry (1995), Klein (1995), Metcalf (1995), Molshen (1997), and Wilson (1995), and McCormick and DeRosier (1983) and Weitzman and Castaldini (1991).

- Waste Handling, Storage and Feeding:

  -- Government and On-site Incinerators -- There are no incremental requirements. Waste storage and handling is assumed to be required regardless of the existence of a hazardous waste incinerator.

  -- Commercial Incinerators -- Solid waste requirements for rotary kilns (and controlled air, and fluidized bed incinerators) are estimated as a function of system size. For liquid injection systems, there are no associated personnel requirements.

  -- CK and LWAKs -- Waste receiving, storage and handling costs are combined for CK and LWAKs, and are a function of system size.

- Combustor and CEM Operations: The labor cost associated with monitoring and operating a hazardous waste combustor. No incremental requirements for CK and LWAKs.

- Maintenance: The cost of maintenance labor associated with the hazardous waste combustion equipment. For incinerators, cost is assumed to be 35% of the sum of salaries of employees considered to be part of the system. No incremental requirements for CK or LWAKs.

- Supervisor: The cost of supervising operations and maintenance personnel. For incinerators, cost is assumed to be 15% of the sum of salaries of employees considered to be part of the system.

- Manager and Technical/Regulatory Support: The cost of employing an engineering manager responsible for hazardous waste combustion associated systems and operations.

- Administrative: The cost of employing an administrator responsible for overseeing all hazardous waste operation and handling all regulatory and legal affairs. Cost is not incremental to on-site incinerators or governmental incinerators.

- Clerical: The cost of employing clerical support for the administrative activities. Cost not incremental to on-site and government incinerators.

- Safety Coordinator: The cost of employing a safety coordinator (as required by 40 CFR 264.55). Cost not incremental to on-site and government incinerators.

- Administrative Labor: The total cost of supervisors, managers and technical/regulatory support personnel, administrative, clerical and safety coordinator. Cost not incremental to on-site and government incinerators.

- Total Operations Labor: The total cost of laborers, operators and maintenance personnel.

Utilities: The total cost of utilities associated with hazardous waste combustion related equipment.

Waste Characterization:

- On-site and Government Facilities:

  -- Waste Sampling and Analysis: The cost to characterize liquid, sludge, and solid waste prior to incineration. It is assumed that the analyses are sent to an outside laboratory. Analysis includes ultimate and proximate analysis, chlorine, and metals analyses, and is estimated at about $500 per sample based on current laboratory quotes. It is assumed systems to perform 3 analyses per waste type, once per month (relatively limited characterization due to typical comprehensive waste generation process knowledge, and/or homogeneous wastes streams).

- Commercial Incinerators and Industrial Kilns:

  -- Liquid Waste Sampling and Analysis: The cost to characterize liquid waste prior to incineration. It is assumed that the analyses are sent to an outside laboratory. Analysis includes ultimate and proximate analysis, chlorine, and metals analyses, and is estimated at about $500 per sample based on current laboratory quotes. It is assumed that commercial incinerators, CK and LWAKs analyze one sample for every 20,000 gallons received.

  -- Solid Waste Sampling and Analysis: The cost to characterize solid wastes prior to incineration, assuming analysis of one sample for every 40,000 pounds of solid waste. Refer to liquid waste sampling and analysis for other assumptions.

- Ash Leachability Sampling: The cost to establish leachability characteristics for the residual ash from hazardous waste incineration. Cost assumes performing a toxicity characteristic leaching procedure (TCLP) metals analysis on the ash based on current laboratory quotes. Requirements by system type include:

  -- Commercial incinerators are assumed to take one sample for every 100 tons of ash generated.

-- On-site and government incinerators are assumed to dispose of the ash as a solid hazardous waste and leave the analysis to be performed by the disposing agency (i.e., the cost is covered/contained within the cost of disposing of the ash).

-- CKs are assumed to make one test every 100 tons of cement kiln dust that is disposed of.

-- LWAKs are assumed to combine the ash with the LWA product and perform no testing.

Auxiliary Fuel: Cost of auxiliary fuels used, as indicated above.

Solid Waste Disposal: The cost to dispose of ash as a solid hazardous waste at an EPA approved landfill. Cost of 200 $/ton ash is based on that used in the EPA OAQPS APCD cost models (EPA, 1996) and recent vendor quotes.

Heat Recovery Credit: The fuel credit to facilities utilizing a waste heat boiler. Credit assumes a 60% heat recovery rate, based on that recommended in Brunner (1987).

Replacement Parts for Operation and Maintenance: The operating and maintenance costs associated with the:

- Incineration system -- 5% of captial equipment per year.
- System monitors, including CEM and CMSs -- $20,000 per year.
- APCDs -- As estimated by the OAQPS Cost Models (EPA OAQPS, 1996).
- Waste heat boiler -- 8% of capital cost per year.
- Waste storage and feed and automatic shutdown -- 2% of capital cost per year.
- Penalty associated with burning hazardous waste, for cement kilns -- Addressed in a previous cost item.

Indirect Costs for Administrative Charges, Property Taxes, and Insurance: Other overhead charges, including: (1) administrative requirements, at 2% of capital investment; (2) property taxes, at 1% of

captial); and (3) insurance, at 1% of capital. Costs are based on those from EPA OAQPS Cost Models (1996).

Recordkeeping: The cost associated with keeping records which are not captured by labor costs otherwise identified in the analysis, estimated at $25,000 per year.

Medical Surveillance: The cost to perform annual physical examinations on employees handling and/or exposed to hazardous waste, estimated at $500 per employee per year.

Environmental Damage Liability Insurance: The yearly premium for environmental damage liability insurance of $150,000 per year, assuming the minimum coverage required by RCRA of $4 million per occurrence, $8 million total, and a $100,000 deductible. Cost is not incremental to on-site and government incinerators because these facilities are required to carry this insurance because of hazardous waste generation and storage regulations.

Security: The cost of providing security as required by RCRA to prevent unauthorized access to hazardous materials contained at the facility, estimated at $100,000 to 300,000 per year, depending on size and type of facility. Cost is not incremental to on-site and government incinerators because it is required to meet regulations governing hazardous waste generation and storage activities at the facility.

3.4 Capital Recovery

Permitting Capital Recovery @ 20 Years: The cost of the initial RCRA or BIF permit annualized at 7% interest rate over 20 years period.

System Equipment Capital Recovery @ 15 Years: The cost of system equipment annualized at 7% interest rate over 15 years for the majority of the capital equipment.

Permitting Updating Capital Recovery @ 5 Years: The cost of permit updating annualized at 7% interest rate over 5 years.

Total Annualized Capital Costs: The sum of the above capital recovery costs.

3.5 Credits

Primary Fuel Credit: The credit received by cement kilns and lightweight aggregate kilns from displaced coal due to use of hazardous waste fuels. Credit is calculated based on the total waste thermal input and a cost of displaced fuel (coal) estimated at $1.3/MMBtu.

3.6 Output Summary Results

Hazardous Waste: The annual tonnage of waste processed.

Costs:

- Capital Costs: The total capital expenditures incurred.
- Annualized Capital Costs: The total annualized capital costs incurred.
- Fixed Annual Operations and Maintenance Costs: The annual fixed costs for operating and maintaining the HWC.
- Variable Annual Operations and Maintenance Costs: The annual variable costs for operating and maintaining the HWC.

Employees:

- Number of Full-Time Employees per System: Based on the sum of salaries of employees considered to be part of the system or unit (i.e., waste handling, storage and feeding, incinerator and CEM operations, maintenance). System employees vary according to combustion facility category. The average annual salary is estimated to be $35,000.
- Number of Full-Time Employees per Facility: Based on the he sum of salaries of employees considered to be part of the facility (i.e., supervisor, manager and regulatory/technical support). Facility employees vary according to combustion facility category. The average annual salary is estimated to be $40,000.

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