Appendix A

DATA COLLECTION METHODS AND CORE DATA INPUTS

DATA COLLECTION METHODS

We compiled data on the universe of combustion facilities using the 1999 U.S. EPA *Biennial Reporting System* (BRS) and permitting information collected by EERGC corporation. The 1999 BRS provides data on waste combusted, including quantity, waste form, and waste codes. EERGC collected data on facility structure (e.g. number of sources per facility), facility type (e.g. on-site incinerator, cement kiln, etc.), and facility closures and openings since 1999 through a data collection process that included collection of recent trial burn data and conversations with EPA regional offices.[1]

Identifying and Verifying Facilities in Universe

Our first step was to identify facilities in BRS that reported combusting hazardous waste. We initially identified "combustion" by selecting facilities reporting treatment codes M041-M049 (incineration) and M051-M059 (energy recovery). We searched two files in BRS to capture all of the facilities that reported treating waste by at least one of the combustion M-codes. The GM-6 file includes facilities that generate and treat waste on-site, and the WR-1 file includes facilities that treat waste received from off-site sources.

The initial list of facilities with M codes M041-M049 and M051-M059 in the GM-6 and WR-1 files yielded more facilities than those in the final universe. However, if the facility fell into one of the following four categories, we removed them from the universe: (1) military facilities that are classified as open-source burners, (2) facilities that no longer burn waste (as of early 2001, according to EPA permitting information and research by EERGC Corporation), (3) facilities that store and transfer waste but do not treat it, and (4) facilities that offer medical and educational services, and are regulated separately as Medical Waste Incinerators.

We also added several facilities that were not captured in the initial BRS search based on consultation with EERGC. Eight facilities were in the 1999 BRS but did not list incineration or energy recovery as combustion methods. These facilities were included based on individual facility information provided by EERGC. They listed system type codes including M031 (acid regeneration) and M073 (Cyanide destruction), as well as system types that were not otherwise classified as M-codes but should be included in the universe (see Exhibit A-1).

[1] Data from the 2001 BRS report were published in October 2003, but were not available in time to be used in this assessment.

Exhibit A-1

FACILITIES IN UNIVERSE WITH APPLICABLE SYSTEM TYPES OUTSIDE OF INCINERATION AND ENERGY RECOVERY

EPA ID	Facility Name	Applicable System Type [a]	Facility Type	Waste Quantity Treated (tons) (1999 BRS)
LAD001890367	Dupont Dow Elastomers	M031 (Acid Regeneration)	HCl Production Furnace	13,164.58
LAD003913449	Borden Chemicals and Plastics (BCP)	M039	HCl Production Furnace	5,983.70
LAD092681824	Vulcan Materials Co	M032 (non-solvent organic recovery)	HCl Production Furnace	2,942.85
MND00617296	3M	M136 (Direct discharge to surface waster under NPDES)	On-site Incinerator	18,619.14
OHD98704873	Lafarge	M061(Fuel blending)	Cement Kiln	98,278.00
SCD98050005	3V Inc.	M039	Boiler	2,627.42
TXD00170080	Solutia (Chocolate Bayou Plant)	M073, M078 (Cyanide Treatment)	Boiler	58,863.82
TXD06726141	BASF Corporation	M031 (Acid Regeneration)	Boiler	1,208.98

Notes:
[a] We consulted with EERGC to determine which system codes to use for particular facilities. System codes with no explanation are not specified in the BRS manual (e.g., they are "other" categories).

Facilities not in 1999 BRS

There are a total of 12 facilities in the universe that do not report burning waste in the 1999 BRS (see Exhibit A-2). Four of these facilities reported to the 1997 BRS, and we used this information for our baseline analysis. For the final eight facilities, we use a simple regression analysis by facility type with hazardous waste feed rate as the independent variable and waste quantity as the dependent variable to estimate the total waste quantities combusted.[2] Ultimately, we resolved the list of facilities we identified in BRS to be consistent with the universe identified by EERGC.

[2] The incinerator regression analysis was statistically significant, with a coefficient value equaling 1.152 and a standard error of 0.134 (95 percent confidence interval of 0.883 to 1.422). The boiler regression analysis was statistically significant, with a coefficient value equaling 1.178 and a standard error of 0.098 (95 percent confidence interval of 0.980 to 1.375). The kiln regression analysis was statistically significant, with a coefficient value equaling 1.729 and a standard error of 0.197 (95 percent confidence interval of 1.311 to 2.147).

Exhibit A-2 FACILITIES NOT INCLUDED IN 1999 BRS		
EPA ID	**Facility Type**	**Facility Name**
Facilities Included in 1997 BRS		
CAD009547050 - Note: performed regression analysis to derive waste quantity.	Liquid Boiler	Dow Chemical Co.
GAD981237118 - Note: performed regression analysis to derive waste quantity.	Liquid Boiler	Monsanto (Nutrasweet Kelco Co.)
ILD065237851 - Note: performed regression analysis to derive waste quantity.	On-site Incinerator	Akzo Chemie America
KS0213820467 - Note: performed regression analysis to derive waste quantity.	On-site Incinerator	Kansas Army Ammunition Plant
NJD001787944 - Note: performed regression analysis to derive waste quantity.	On-site Incinerator	Asahi Glass (ZENECA, ICI)
NJD002373579 -Used 1997 BRS waste quantity data.	On-site Incinerator	Air Products And Chemicals Inc
TX0000201202 - Note: performed regression analysis to derive waste quantity.	Liquid Boiler	Huntsman Corp. (formerly Texaco)
TXD000838896 - Used 1997 BRS waste quantity data.	Commercial Incinerator	Chemical Waste Management
Facilities Included in 1999 BRS With Inapplicable System Types (M-codes)		
PRD090613357 - Used 1997 BRS waste quantity data.	On-site Incinerator	Chemsource (SK&F)
Facilities re-entering HWC universe		
TXD058260977 - Used 1997 BRS waste quantity data.	On-site Incinerator	Bayer (Miles Corp.)
Other Facilities Employing Regression Analysis		
KSD007148034 - Note: this facility appeared in the 1997 BRS, but it only reported treating 0.64 tons of waste; therefore performed regression analysis to estimate actually treats 48,511.6 tons of waste.	Cement Kiln	Lafarge
OK6213822798 - Note: performed regression analysis to derive waste quantity.	On-site Incinerator	U.S. McAlester Army Ammunition

For each facility in the universe, we gathered the EPA ID number, facility name, and location from the BRS Form-IC files. The facility type (e.g. on-site incinerator, off-site incinerator, boiler, HCl production furnace, cement kiln, LWAK) was reported by EERGC.

Identifying Applicable Waste Streams

After identifying the facilities in the universe, we gathered information from BRS on the waste burned. To do this we first specified waste that should be included in this analysis, since not all waste burned at facilities is affected by the HWC MACT replacement standards (e.g., waste treated in ways other than incineration or energy recovery). From the GM-6 and WR-1 files we identified each waste stream associated with the appropriate M-codes. Further data on this waste - quantity burned, waste form, waste codes, etc. - was based on these waste streams.

It is important to note that an idiosyncrasy in BRS reporting can cause the user to mistakenly include waste streams that are not in the universe. Waste streams are broken down into waste stream sub-page numbers. While in most cases, the entire waste stream is identified by one treatment code, in several cases it is possible that the sub-page numbers indicate one step in a treatment process. In this case, the original quantity was listed each time it underwent treatment. We corrected for this by including the sub-page number associated only with applicable treatment (or system) types.

Collecting Information on Waste

Once we isolated the relevant waste streams of facilities in the universe, we collected details on each stream. First, we gathered the quantity of waste (in tons) from the GM-6 and WR-1 files for each stream. Since pricing depends not only on the quantity of waste but on the form and constituents that make up the waste, we also collected the waste form and waste codes associated with each waste stream.

Waste form data, which is broken down into lab packs, liquid (organic and inorganic), solid (organic and inorganic), sludge (organic and inorganic), and gas (organic and inorganic) waste, is available from the GM-6 and WR-1 files. Although waste codes are broken into more specific categories, the general categories listed above were the most detailed information we gathered. Each waste stream is identified by a unique waste form.

Waste codes provide some information about the composition of a waste stream (which are included in the GM-1 and WR-2 files). **To support the development of Exhibit 2-10, we reported waste code data in broad categories (e.g. D codes, F codes, K codes, U codes, F codes, and P codes).** Since one waste stream can be made up of any number of materials, each waste stream generally has several waste codes.

Finally, we collected the North American Industry Classification System (NAICS) code for each hazardous waste combustion facility present in the baseline universe. These NAICS codes are associated with the facilities treating the waste, not the facilities generating the waste.

CORE DATA INPUTS

Below we present core data inputs used in our hazardous waste combustion market model.

Hazardous Waste Incineration Prices (2002 Dollars)	
Waste Form	**Price per ton**
Halogenated Liquids	$1,081
Nonhalogenated Liquids	$127
Halogenated Sludges	$1,010
Nonhalogenated Sludges	$560
Halogenated Solids	$1,067
Nonhalogenated Solids	$557
Lab Packs	$2,820
Gases	$940

Source: Derived from January 2002 Combustion Pricing Data, Hazardous Waste Resource Center, http://www.etc.org/costsurvey6.cfm

Inflation Index for Scaling Prices and Costs to 2002 Dollars		
Year	**GDP Price Deflator**	**Inflation Factor**
1996	100	1.11
1997	101.95	1.09
1998	103.2	1.07
1999	104.69	1.06
2000	106.89	1.04
2001	109.42	1.01
2002	110.66	1.00

Source: U.S. Department of Commerce, National Income and Product Accounts, Table 7.1: Quantity and Price Indexes for Gross Domestic Product National Income and Product Accounts.

Conventional Fuel Costs (2002 Dollars)	
Energy Source	Price per MMBtus
Natural Gas	$4.85
Coal	$1.64

Source: Table 4 of Natural Gas Monthly, U.S. Department of Energy, Energy Information Administration, March 2003.

Transportation Mileage Costs (dollars per mile)		
Distance (miles)	Tanker	Van
0-300	$2.62	$2.55
300-400	$2.59	$2.44
400-500	$2.54	$2.23
500-600	$2.48	$2.12
600-700	$2.46	$2.09
700-800	$2.42	$2.02
800-900	$2.40	$2.00
900-1000	$2.39	$2.00
1000+	$2.37	$1.98

Source: "Estimating Costs for the Economic Benefit of RCRA Noncompliance" prepared by DPRA, Incorporated for EPA's Office of Regulatory Enforcement, September 1994.

Transportation Inputs*		
Cost	Tanker	Van
Loading	$307.00	$3.12
Unloading	$307.00	$3.12
Wages	$42.28	$42.28
Washout	$158.55	$158.55

* All costs given on either a per tanker or per van bases except for van loading and unloading costs, which are given on a per ton bases.

Source: "Estimating Costs for the Economic Benefit of RCRA Noncompliance" prepared by DPRA, Incorporated for EPA's Office of Regulatory Enforcement, September 1994.

Appendix B

BASELINE COST REPORT

The following report contains baseline cost information prepared for the 1999 *Assessment*. Since the analysis presented in this report assumes full compliance with the 2002 Interim Standards, the baseline specified in this report includes costs reported in this appendix as well as the expected costs of the 2002 Interim Standards.

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

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CONTENTS

Tables and Figures ii
Acronyms iii
1.0 Introduction 1
2.0 Combustion Facility Universe 3
3.0 Baseline Cost Estimates 5
3.1 Facility Characteristics 6
3.2 System Capital Expenditures 9
3.3 Annual Operating and Maintenance Costs 11
3.4 Capital Recovery 15
3.5 Credits 15
3.6 Output Summary Results 15
4.0 References 16

TABLES

2-1a Universe of Hazardous Waste Burning On-site Incinerators
2-1b Universe of Hazardous Waste Burning Government Incinerators
2-1c Universe of Hazardous Waste Burning Commercial Incinerators
2-1d Universe of Hazardous Waste Burning Cement Kilns
2-1e Universe of Hazardous Waste Burning Lightweight Aggregate Kilns

3-1 Baseline Cost Model Spreadsheet for Commercial Incinerators
3-2 Baseline Cost Model Spreadsheet for On-site Incinerators
3-3 Baseline Cost Model Spreadsheet for Government Incinerators
3-4 Baseline Cost Model Spreadsheet for Cement Kilns
3-5 Baseline Cost Model Spreadsheet for Lightweight Aggregate Kilns

3-6a Summary of Baseline Costs for Commercial Incinerators
3-6b Summary of Baseline Costs for On-site Incinerators
3-6c Summary of Baseline Costs for Government Incinerators
3-6d Summary of Baseline Costs for Cement Kilns
3-6e Summary of Baseline Costs for Lightweight Aggregate Kilns

3-7 Site-specific Input Characteristics for Baseline Costs
3-8 Employment Requirement Summary at Hazardous Waste Combustors
3-9 Combustion Facility Size Category Breakdown

FIGURES

3-1 Cement kilns penalties for burning hazardous waste
3-2 Rotary kiln incinerator costs
3-3 Liquid injection incinerator costs

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.

4.0 REFERENCES

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TABLE 2-1a. UNIVERSE OF HAZARDOUS WASTE BURNING ON-SITE INCINERATORS

Site ID	Sys	Company	City	State	EPA ID
229	OINC	Vulcan Materials Co.	Wichita	KS	KSD007482029
334	OINC	3M	Cottage Grove	MN	MND006172969
337	OINC	Olin Chemicals	East Alton	IL	ILD006271696
338	OINC	Dupont	Orange	TX	TXD008081101
340	OINC	Miles, Inc.	New Martinsville	WV	WVD056866312
341	OINC	GLAXO Inc.	Research Triangle Park	NC	NCD065655599
342	OINC	Upjohn Co.	Kalamazoo	MI	MID000820381
348	OINC	Occidental Chemical Corp.	Niagara Falls	NY	NYD000824482
350	OINC	Dupont - Beaumont Works	Beaumont	TX	TXD008079212
353	OINC	Dow Chemical Co.	Midland	MI	MID000724724
354	OINC	Dow Chemical Co.	Midland	MI	MID000724724
358	OINC	Eli Lilly And Company	Lafayette	IN	IND006050967
453	OINC	Cargill Chemical Products Division	Forest Park	GA	GAD084823301
454	OINC	FMC Agricultural Chemical Group	Baltimore	MD	MDD003071875
455	OINC	Dupont	Parkersburg	WV	WVD045875291
456	OINC	Curwood, Inc.	New London	WI	WID006144737
457	OINC	University Of Wisconsin At Madison	Arlington	WI	WID000713594
458	OINC	Trane Thermal Company	Conshohocken	PA	PAD069006419
459	OINC	Trane Thermal Company	Conshohocken	PA	PAD069006419
460	OINC	Akzo Chemie America	Morris	IL	ILD065237851
461	OINC	Cook Composites (Freeman Chemical Co.)	Chatham	VA	VAD055046049
463	OINC	Miles (Mobay Chemical Corporation)	Kansas City	MO	MOD056389828
464	OINC	B.P. Chemicals (Standard Oil)	Lima	OH	OHD042157644
465	OINC	Allied Fibers	Hopewell	VA	VAD065385296
468	OINC	Lonza Chemicals-Riveriside (Smithkline)	Conshohocken	PA	PAD980550412
477	OINC	American Cyanamid	Hannibal	MO	MOD050226075
478	OINC	American Cyanamid	Hannibal	MO	MOD050226075
480	OINC	CIBA-Geigy Corporation	St. Gabriel	LA	LAD053783445
483	OINC	Hoechst Celanese	Seabrook	TX	TXD000719286
484	OINC	Arkansas Eastman	Batesville	AR	ARD089234884
490	OINC	CIBA-Geigy Corporation	Mcintosh	AL	ALD001221902
495	OINC	PPG Industries, Inc.	Circleville	OH	OHD004304689
504	OINC	Chevron Chemical Co.	Philadelphia	PA	PAD049791098
505	OINC	BASF Corporation	Freeport	TX	TXD008081697
506	OINC	BASF Corporation	Freeport	TX	TXD008081697
600	OINC	Dow Chemical Co.	Freeport	TX	TXD008092793
604	OINC	BASF Corporation	Geismer	LA	LAD040776809
605	OINC	Shell Oil Company	Deer Park	CA	TXD067285973
606	OINC	Georgia Gulf Corporation	Plaquemine	LA	LAD057117434
607	OINC	Merck, Sharp And Dohme	West Point	PA	PAD002387926
610	OINC	Shell Oil Co	Norco	LA	LAD980622104
611	OINC	Shell Oil Co	Norco	LA	LAD980622104
613	OINC	Texas Eastman	Longview	TX	TXD007330202
614	OINC	Occidental Chemical Corp.	Gregory	TX	TXD982286932
700	OINC	Dupont	Wilmington	DE	DED003930807
701	OINC	Eli Lilly And Company	Clinton	IN	IND072040348
702	OINC	Dupont - Beaumont Works	Beaumont	TX	TXD008079212
704	OINC	Ashland Chemical Company	Los Angeles	CA	CAD044046274
705	OINC	CIBA-Geigy Corporation	Mcintosh	AL	ALD001221902

TABLE 2-1a. UNIVERSE OF HAZARDOUS WASTE BURNING ON-SITE INCINERATORS

Site ID	Sys	Company	City	State	EPA ID
706	OINC	CIBA-Geigy Corporation	St. Gabriel	LA	LAD053783445
707	OINC	Dupont - Beaumont Works	Beaumont	TX	TXD008079212
708	OINC	Burroughs Wellcome	Greenville	NC	NCD047373766
711	OINC	Chevron Chemical Co.	Bell Chasse	LA	LAD034199802
712	OINC	Nepera	Harriman	NY	NYD002014595
714	OINC	Olin Chemicals	Lake Charles	LA	LAD008080681
725	OINC	ZENECA	Bayonne	NJ	NJD001707944
726	OINC	Shell Oil Co.	Martinez	CA	CAD009164021
728	OINC	Eli Lilly And Company	Mayaquez	PR	PRD091024786
784	OINC	Cook Composites	Port Washington	WI	WID980615439
805	OINC	American Cyanamid	Hannibal	MO	MOD050226075
806	OINC	Amoco Oil Co.	Whiting	IN	IND000810861
808	OINC	Dow Chemical Co.	Plaquemine	LA	LAD008187080
809	OINC	Tennessee Eastman Co.	Kingsport	TN	TND003376928
810	OINC	Tennessee Eastman Co.	Kingsport	TN	TND003376928
824	OINC	Pennwalt Corporation	Thorofare	NJ	NJD980753875
825	OINC	General Electric Co.	Waterford	NY	NYD002080034
904	OINC	First Chemical Corporation	Pascagoula	MS	MSD033417031
905	OINC	Velsicol Chemical Corporation	Memphis	TN	TND007024664
906	OINC	Monsanto Agricultural Company	Muscatine	IA	IAD005273594
915	OINC	Eastman Kodak	Rochester	NY	NYD980592497
A10	OINC	Air Products And Chemicals Inc	Paulsboro	NJ	NJD002373579
A12	OINC	Aztec Peroxides Inc	Elyria	OH	OHD046202602
A21	OINC	Cytec Industries	Willow Island	WV	WVD004341491
A22	OINC	Dow Chemical Company/La Porte Site	La Porte	TX	TXD000017756
A27	OINC	EIF Atochem North America, Inc.	Calvert City	KY	KYD006370159
A28	OINC	EIF Atochem North America, Inc.	Houston	TX	TXD008090011
A31	OINC	Hercules Inc-Franklin Plant	Franklin	VA	VAD003122165
A33	OINC	Hoechst Celanese Corp.	Clear Lake	TX	TXD078432457
A36	OINC	Lubrizol Corporation	Painesville	OH	OHD004172623
A37	OINC	Mcwhorter Inc (Cargill)	Carpentersville	IL	ILD005083316
A38	OINC	Merck & Co Inc - Cherokee Plant	Riverside	PA	PAD003043353
A39	OINC	Merck Sharp & Dohme Quimica	Barceloneta	PR	PRD090028101
A41	OINC	NALCO Chemical Company	Sugar Land	TX	TXD008084618
A43	OINC	Occidental Chemical Corp	Niagara Falls	NY	NYD002103216
A45	OINC	Occidental Chemical Vcm	Deer Park	TX	TXD981911209
A46	OINC	OSI Specialties, Inc.	Sisterville	WV	WVD004325353
A47	OINC	Phillips Research Center	Bartlesville	OK	OKD000803601
A50	OINC	Quantum Chemical Company	La Porte	TX	TXD058276130
A53	OINC	Rmi Titanium Co. Sodium Plant	Ashtabula	OH	OHD000810242
A54	OINC	Sandoz Agro, Inc.	Beaumont	TX	TXD067261412
A55	OINC	Schenectady International, Inc.	Rotterdam Jct.	NY	NYD002070118
A56	OINC	Searle	Augusta	GA	GAD039046800
A57	OINC	Searle & Co.	Caguas	PR	PRD090378225
A59	OINC	Squibb Manufacturing, Inc.	Humacao	PR	PRD090021056
A60	OINC	Sterling Chemicals, Inc.	Texas City	TX	TXD008079527
A61	OINC	Teledyne Wah Chang Albany	Albany	OR	ORD050955848
A62	OINC	Texaco Chemical Company	Conroe	TX	TXD008076853
A64	OINC	Thiokol Corp	Elkton	MD	MDD003067121

TABLE 2-1a. UNIVERSE OF HAZARDOUS WASTE BURNING ON-SITE INCINERATORS

Site ID	Sys	Company	City	State	EPA ID
A66	OINC	Union Carbide Corporation, Texas City Pl	Texas City	TX	TXD000461533
B10	OINC	Aerojet	Sacramento	CA	CAD981457302
B14	OINC	B.P. Chemicals	Port Lavaca	TX	TXD000751172
B15	OINC	Ecova Corp.	Kimball	NE	NED981723513
B17	OINC	FMC Corporation	Pasadena	TX	TXD083570051
B20	OINC	GSX Chemical Services	Cleveland	OH	OHD980569438
B21	OINC	Hercules Aerospace	Magna	UT	UTD001705029
B23	OINC	Huntsman Corp.	Port Neches	TX	TXD008076846
B30	OINC	Lubrizol Corp.	Wickliffe	OH	OHD004172565
B32	OINC	Miles Corp.	Baytown	TX	TXD058260977
B33	OINC	Nissan	Smyrna	TN	TND054481205
B34	OINC	Organic Incineration Technologies	Fairbanks	AK	AK0000094888
B35	OINC	Parkens International	Houston	TX	TXD008105959
B36	OINC	Phillips	Sweeney	TX	TXD048210645
B39	OINC	Quantum Chemical	Morris	IL	ILD048296180
B46	OINC	Texas Instruments	Sherman	TX	TXD982759706
B56	OINC	U.T. Southwestern Medical Ctr.	Dallas	TX	TXD071378822
B57	OINC	Uniroyal	Geismar	LA	LAD008194060
B58	OINC	Vulcan Chemicals	Geismar	LA	LAD092681824
C12	OINC	Atochem	Beaumont	TX	TXD074180019
C16	OINC	Dupont	La Porte	TX	TXD008079642

TABLE 2-1b. UNIVERSE OF HAZARDOUS WASTE BURNING GOVERNMENT INCINERATORS

Site ID	Sys	Company	City	State	EPA ID
344	GOV	Department Of The Army	Johnston Atoll	TT	TT0570090011
346	GOV	Department Of The Army	Johnston Atoll	TT	TT0570090011
347	GOV	Department Of The Army South	Tooele	UT	UT5210090002
349	GOV	Radford Army Ammunition Plant	Radford	VA	VA1210020730
351	GOV	Iowa Army Ammunition Plant	Middletown	IA	IA7213820445
357	GOV	Department Of Energy	Oak Ridge	TN	TN0890090004
470	GOV	Department Of The Army	Johnston Atoll	TT	TT0570090011
471	GOV	Department Of The Army	Johnston Atoll	TT	TT0570090011
493	GOV	Department Of The Army North	Tooele	UT	UT3213820894
494	GOV	Department Of The Army North	Tooele	UT	UT3213820894
503	GOV	Lake City Army Ammunition Plant	Independence	MO	MO4213820489
602	GOV	Westinghouse Savannah River Company	Aiken	SC	SC1890008989
727	GOV	Iowa Army Ammunition Plant	Middletown	IA	IA7213820445
A42	GOV	Nat'L Inst Of Envr Health Sci	R.T.P.	NC	NC2750890004
B12	GOV	Anniston Army Depot	Anniston	AL	AL3210020027
B24	GOV	Idaho National Engineering Laboratory	Idaho Falls	ID	ID4890008952
B25	GOV	Iowa State University	Ames	IA	IAD981121486
B26	GOV	Kansas Army Ammunition Plant	Parsons	KS	KS0213820467
B37	GOV	Pine Bluff Arsenal	Pine Bluff	AR	AR0213820707
B45	GOV	Sierra Army Depot	Herlong	CA	CA5210020843
B49	GOV	U.S. Aberdeen Proving Grounds	Aberdeen	MD	MD3210021355
B51	GOV	U.S. Army Hawthorne	Hawthorne	NV	NV1210090006
C13	GOV	U.S. Army Savanna Army Depot	Savanna	IL	ILD3210020803
C14	GOV	Sterling	Barceloneta	PR	PRD991291949
C15	GOV	U.S. Air Force Minot Air Force Base	Minot	ND	ND4571924758

TABLE 2-1c. UNIVERSE OF HAZARDOUS WASTE BURNING COMMERCIAL INCINERATORS

Site ID	Sys	Company	City	State	EPA ID
209	CINC	Laidlaw Environmental Services	Roebuck	SC	SCD981467616
210	CINC	LWD, Inc.	Calvert City	KY	KYD088438817
211	CINC	LWD, Inc.	Calvert City	KY	KYD088438817
212	CINC	LWD, Inc.	Calvert City	KY	KYD088438817
214	CINC	Rollins Environmental Services	Baton Rouge	LA	LAD010395127
216	CINC	Rollins Environmental Services	Bridgeport	NJ	NJD053288239
222	CINC	Waste Technologies Industries	East Liverpool	OH	OHD980613541
324	CINC	Allied Corporation	Birmingham	AL	ALD031499833
325	CINC	Aptus	Coffeyville	KS	KSD981506025
327	CINC	Aptus	Aragonite	UT	UTD981552177
331	CINC	Ross Incineration Services	Grafton	OH	OHD048415665
333	CINC	Trade Waste Incineration	Sauget	IL	ILD098642424
359	CINC	Atochem	Carrollton	KY	KYD006373922
486	CINC	ENSCO	El Dorado	AR	ARD069748192
487	CINC	ENSCO	El Dorado	AR	ARD069748192
601	CINC	Laidlaw Environmental Services, Inc.	Clive	UT	UTD982595795
603	CINC	Chemical Waste Management	Port Arthur	TX	TXD000838896
609	CINC	Rollins Environmental Services	Deer Park	TX	TXD055141378
612	CINC	Trade Waste Incineration	Sauget	IL	ILD098642424
A15	CINC	BDT Inc (Laidlaw)	Clarence	NY	NYD000632372
A34	CINC	I C I Explosives USA Incorporated	Joplin	MO	MOD9857988164
B60	CINC	Waste Research And Reclamation	Eau Claire	WI	WID990829475
C10	CINC	American Envirotech	Channelview	TX	TXD982562787
C11	CINC	Reynolds Aluminum	Gum Springs	AR	ARD006354161

TABLE 2-1d. UNIVERSE OF HAZARDOUS WASTE BURNING CEMENT KILNS

Site ID	Sys	Company	City	State	EPA ID
200	CK	Giant Cement Company	Harleyville	SC	SCD003351699
201	CK	Giant Cement Company	Harleyville	SC	SCD003351699
202	CK	Heartland Cement Company	Independence	KS	KSD980739999
203	CK	Holnam Inc.	Artesia	MS	MSD077655876
204	CK	Holnam Inc.	Clarksville	MO	MOD029729688
205	CK	Holnam Inc.	Holly Hill	SC	SCD003368891
206	CK	Holnam Inc.	Holly Hill	SC	SCD003368891
207	CK	Keystone Cement Company	Bath	PA	PAD002389559
208	CK	Keystone Cement Company	Bath	PA	PAD002389559
228	CK	Ash Grove Cement Company	Foreman	AR	ARD981512270
300	CK	ESSROC Corporation	Logansport	IN	IND005081542
302	CK	Lafarge	Paulding	OH	OHD987048733
303	CK	Lone Star Industries, Inc.	Cape Girardeau	MO	MO981127319
304	CK	Lone Star Industries, Inc.	Greencastle	IN	IND006419212
305	CK	Medusa Cement Company	Wampum	PA	PAD083965897
318	CK	Texas Industries, Inc.	Midlothian	TX	TXD0007349327
319	CK	Continental Cement Company	Hannibal	MO	MOD054018288
320	CK	Lafarge	Alpena	MI	MID005379607
321	CK	Medusa Cement Company	Demopolis	AL	ALD983192402
322	CK	Lafarge	Fredonia	KS	KSD007148034
323	CK	Lafarge	Fredonia	KS	KSD007148034
335	CK	Medusa Cement Company	Wampum	PA	PAD083965897
401	CK	Ash Grove Cement Company	Chanute	KS	KSD031203318
402	CK	Ash Grove Cement Company	Chanute	KS	KSD031203318
403	CK	Ash Grove Cement Company	Foreman	AR	ARD981512270
404	CK	Ash Grove Cement Company	Foreman	AR	ARD981512270
473	CK	Texas Industries, Inc.	Midlothian	TX	TXD0007349327
491	CK	ESSROC Corporation	Logansport	IN	IND005081542
680	CK	Giant Cement Company	Harleyville	SC	SCD003351699
681	CK	Giant Cement Company	Harleyville	SC	SCD003351699

TABLE 2-1e. UNIVERSE OF HAZARDOUS BURNING LIGHTWEIGHT AGGREGATE KILNS

Site ID	Sys	Company	City	State	EPA ID
225	LWAK	Solite	Norwood	NC	NCD003152642
307	LWAK	Thermalkem (Norlite)	Cohoes	NY	NYD080469935
310	LWAK	Solite	Brooks	KY	KYD059568220
311	LWAK	Solite	Cascade	VA	VAD046970521
312	LWAK	Solite	Cascade	VA	VAD046970521
313	LWAK	Solite	Arvonia	VA	VAD042755082
314	LWAK	Solite	Arvonia	VA	VAD042755082
336	LWAK	Solite	Cascade	VA	VAD046970521
475	LWAK	Solite	Brooks	KY	KYD059568220
479	LWAK	Thermalkem (Norlite)	Cohoes	NY	NYD080469935

TABLE 3-1. BASELINE COST MODEL SPREADSHEET FOR COMMERCIAL INCINERATORS

Parameters		Input	Values
A. Facility Characteristics			
A1	System Type	= site specific input	Rotary Kiln
A2	Number of Units at This Facility	= site specific input	3
A3	Number of Units Tested	= site specific input	2
A4	Stack Gas Flow (acfm)	= site specific input	17,735
A5	Stack Gas Flow (dscfm)	= site specific input	5,838
A6	Stack Oxygen Fraction	= site specific input	0.10
A7	Waste Feed Capacity (lb/hr)	= site specific input	19,116
A8	Existing APCDs	= site specific input	SD/FF
A9	Capital Cost	= site specific input	$357,522.
A10	Annualized Capital Cost ($/yr)	= site specific input	$36,017.
A11	Fixed Annual O&M Costs ($/yr)	= site specific input	$198,346.
A12	Variable Annual O&M Costs ($/ton/yr)	= site specific input	$19.
A13	Waste Heat Boiler (Yes or No)	= site specific input	No
	Auxiliary Fuel Type		
A14	Natural Gas	= site specific input	0
A15	Fuel Oil	= site specific input	FUEL OIL
A16	Coal	= site specific input	0
A17	None	= site specific input	0
A18	Liquid Feed % of Total	= site specific input	0.17
A19	Sludge Feed % of Total	= site specific input	0.07
A20	Solid Feed % of Total	= site specific input	0.76
A21	Liquid Waste Heating Value (Btu/lb)	= site specific input	3,770
A22	Sludge Waste Heating Value (Btu/lb)	= site specific input	10,467
A23	Solid Waste Heating Value (Btu/lb)	= site specific input	6,544
A24	Total Waste Heating Value (Btu/lb)	=A18*A21+A19*A22+A20*A23	6,362
A25	Annual Liquid Waste Feedrate	=A28*A18	3,832
A26	Annual Sludge Waste Feedrate	=A28*A19	1,635
A27	Annual Solid Waste Feedrate	=A28*A20	17,659
A28	Total Annual Waste Feedrate	= site specific input	23,126
A29	Total Hourly Feedrate	=A28*2000/8000	5,781
A30	Waste Ash %	= site specific input	0.00
	Auxiliary Fuel Ash %		
A31	Fuel Oil	= site specific input	0.01
A32	Coal	= site specific input	0.00

TABLE 3-1. BASELINE COST MODEL SPREADSHEET FOR COMMERCIAL INCINERATORS

Parameters		Input	Values
A33	Ash Feedrate	=IF(A30="",0,(A28*A30))+IF(A31<>"",((A36*8000*A31*10^6)/(2000*18265)),0)+IF(A32<>"",((A37*8000*A32*10^6)/(2000*13000)),0)	4
A34	Waste Thermal Input (mmBtu/hr)	=A24*A29/10^6	36.78
	Auxiliary Fuel Thermal Input (mmBtu/hr)		
A35	Natural Gas	= site specific input	0.00
A36	Fuel Oil	= site specific input	3.66
A37	Coal	= site specific input	0.00
A38	None	=0	0
A39	Estimated Thermal Input (mmBtu/hr)	=(A5/10000)*60*((21-(A6*100))/21)	18.29
B. Capital Expenditures			
B1	Incinerator System	=IF(OR(A1="Rotary Kiln",A1="Fluidized Bed"),(((EXP(-0.66149808))*(A39^0.5542949))*10^6, IF(OR(A1="Liquid Injection",A1="Two Chamber"),((EXP(2.104595))*(A39^0.5057352))*10^6,IF(A1="Rotary Hearth",(((((EXP(0.6614908))*(A39^0.5542949))*10^6)+((EXP(2.104595))*(A39^0.5057352))*10^6)/2,FALSE)))	$2,584,612.
B2	Waste Heat Boiler	=IF(A13="Yes",(40000*(A39/10)^0.6),0)*(1052/813.6)	$0.
B3	Waste Storage	=764328*((A7/40000)^0.6)	$490,777.
B4	Auxiliary Buildings & Warehouses	=146594*(A7^0.2076)	$1,134,841.
B5	Waste Water	=(3200000*(A5/66300)^0.6)	$744,745.
B6	Total Equipment and Installation (TE&I)	=SUM(B1,A9)+SUM(B2:B5)	$5,312,497.
B7	Engineering (10% of TE&I)	=0.1*B6	$531,250.
B8	Start-Up (2% of TE&I)	=0.02*B6	$106,250.
B9	Subtotal Capital Equipment	=SUM(B6:B8)	$5,949,996.
B10	Contingency (20%)	=0.2*B9	$1,189,999.
B11	Total Capital Equipment	=SUM(B9:B10)	$7,139,996.
Other Capital Investments			
	Permit Acquisition		
B12	RCRA or BIF Permit Acquisition	=IF(A3>1,((IF(A5<13000,300000,(121988*LN(A5))-850000))+((IF(A5<13000,300000,(121988*(LN(A5))-850000))/2)*(A3-1)))/A3),IF(A5<13000,300000,(121988*(LN(A5))-850000)))	$225,000.
B13	Updating RCRA Permit	=B12*0.25	$56,250.

TABLE 3-1. BASELINE COST MODEL SPREADSHEET FOR COMMERCIAL INCINERATORS

Parameters		Input	Values
B14	Compliance Testing/Trial Burn	=IF(A3>1,((290000+((0.75*290000)*(A3-1)))/A3),290000)	$253,750.
B15	Legal and Financing	=IF(A3>1,(((B6*0.12)+((B6*0.06)*(A3-1)))/A3),(B6*0.12))	$478,125.
B16	Total Other Capital Investments	=SUM(B12:B15)	$1,013,125.
B17	Total Capital Expenditures	=B16+B11	$8,153,120.
C. Annual Costs			
Annual Direct Costs			
	Labor Requirements		
	Labor (Burdened at 23%)		
C1	Waste Feeding	=IF(A1="Liquid Injection",0,(16*2080*6*1.23))	$245,606.
C2	Combustor and CEM Operations	=16*2080*6*1.23	$245,606.
C3	Maintenance	=0.35*SUM(C1:C2)	$171,924.
C4	Supervisor	=(0.15*SUM(C1:C2))/A2	$24,561.
C5	Waste Handling and Storage	=IF(AND(A1="Liquid Injection",A4<=50000),10*2080*3*1.23/A2,IF(AND(A1="Liquid Injection",A4>50000),10*2080*6*1.23/A2,IF(AND(A1<>"Liquid Injection",A4<=50000),10*2080*6*1.23/A2,IF(AND(A1<>"Liquid Injection",A4>50000),10*2080*9*1.23/A2,ERROR))))	$51,168.
C6	Manager and Technical/Regulatory Support	=50000*1*1.23/A2	$20,500.
C7	Administrative	=60000*1*1.23/A2	$24,600.
C8	Clerical	=IF(A4<=50000,(25000*1*1.23/A2),(25000*2*1.23/A2))	$10,250.
C9	Safety Coordinator	=45760*1*1.23/A2	$18,762.
	Operating Costs		
C10	Administrative Labor	=SUM(C6:C9,C4)	$98,672.
C11	Operations Labor	=SUM(C1:C3,C5)	$714,305.
C12	Utilities	=IF(OR(A1="Liquid Injection",A1="Two Chamber"),(3.1911*(A5)),IF(OR(A1="Rotary Kiln",A1="Fluidized Bed"),(6.295*(A5)^0.8977),IF(A1="Rotary Hearth",(((3.1911*(A5))+(6.295*(A5)^0.8977))/2),FALSE)))	$15,135.
C13	Liquid Waste Sampling and Analysis	=(533*((A25*2000)/0.72)/(8.33*20000))	$34,052.
C14	Solid Waste Sampling and Analysis	=(533*((A27*2000)/40000))	$470,603.
C15	Ash Leachability Sampling	=(271*A33/100)	$11.
	Auxiliary Fuel		
C16	Natural Gas	=IF(A14="Natural Gas",(A35*3.27*8000),0)	$0.
C17	Fuel Oil (Residual)	=IF(A15="Fuel Oil",(A36*4.62*8000),0)	$135,274.
C18	Coal	=IF(A16="Coal",(A37*1.33*8000),0)	$0.
C19	Solid Waste Disposal	=A33*200	$802.

TABLE 3-1. BASELINE COST MODEL SPREADSHEET FOR COMMERCIAL INCINERATORS

Parameters		Input	Values
C20	Heat Recovery Credit	=IF(A13="Yes",(-0.6*A39*1.33*8000),0)	$0.
	Replacement Parts for Operation and Maintenance		
C21	Incineration System	=B1*0.05	$129,231.
C22	System Monitors	=20000	$20,000.
C23	Fixed Annual O&M Costs of APCDs	=A11/10	$19,835.
C24	Variable Annual O&M Costs of APCDs	=A12*A28	$433,207.
C25	Waste Heat Boiler	=0.08*B2	$0.
C26	Automatic Shutdown	=5735*(A7/40000)^0.6	$3,682.
C27	Waste Storage and Feed	=0.02*B3	$9,816.
C28	Total Annual Direct Costs	=SUM(C10:C15)+SUM(C16:C20)+SUM(C21:C27)	$2,084,624.
Annual Indirect Costs			
C29	Administrative Charges (2% Capital)	=0.02*B11	$142,800.
C30	Property Taxes (1% Capital)	=0.01*B11	$71,400.
C31	Insurance (1% Capital)	=0.01*B11	$71,400.
C32	Environmental Damage Liability Insurance	=150000	$150,000.
C33	Medical Surveillance	=500*(IF(AND(A1="Liquid Injection",A4<=50000),13,IF(AND(A1="Liquid Injection",A4>50000),17,IF(AND(A1<>"Liquid Injection",A4<=50000),22, IF(AND(A1<>"Liquid Injection",A4>50000),26,ERROR)))))	$11,000.
C34	Security	=300000	$300,000.
C35	Total Annual Indirect Costs	=SUM(C29:C34)	$746,600.
D. Capital Recovery			
D1	Permitting Capital Recovery @ 20 Years	=((0.07*(1+0.07)^20)/((1+0.07)^20-1)*B12)	$21,238.
D2	System Equipment Capital Recovery @ 15 Years	=((0.07*(1+0.07)^15)/((1+0.07)^15-1)*((B11-A9)+B15))	$797,175.
D3	Permitting Updating Capital Recovery @ 5 Years	=((0.07*(1+0.07)^5)/((1+0.07)^5-1))*(B13+B14)	$75,606.
D4	Total Annualized Capital Costs	=SUM(D1:D3)	$894,019.
E. Output			
E1	Hazardous Waste (ton/yr)	=A28	23,126
	Costs		
E2	Capital Costs ($)	=B17	$8,153,120.
E3	Annualized Capital Costs ($/yr)	=D4	$894,019.
E4	Fixed Annual O&M Costs ($/yr)	=C35+C10+C23	$865,107.
E5	Variable Annual O&M Costs ($/yr)	=SUM(C16:C20)+SUM(C21:C27)+SUM(C11:C15)-C23	$1,966,117.
	Costs ($/ton)		
E6	Annualized Capital Costs ($/ton)	=E3/E1	$39.

TABLE 3-1. BASELINE COST MODEL SPREADSHEET FOR COMMERCIAL INCINERATORS

Parameters		Input	Values
E7	Fixed Annual O&M Costs ($/ton)	=E4/E1	$37.
E8	Variable Annual O&M Costs ($/ton)	=E5/E1	$85.
	Employees		
E9	Number of Full-Time Employees per System	=SUM(C1:C3)/35000	20.4
E10	Number of Full-Time Employees per Facility	=SUM(C4:C9)/40000	2.5

TABLE 3-2. BASELINE COST MODEL SPREADSHEET FOR ON-SITE INCINERATORS

Parameters		Input	Values
A. Facility Characteristics			
A1	System Type	= site specific input	Rotary Kiln
A2	Number of Units at This Facility	= site specific input	2
A3	Number of Units Tested	= site specific input	1
A4	Stack Gas Flow (acfm)	= site specific input	103,727
A5	Stack Gas Flow (dcsfm)	= site specific input	55,032
A6	Stack Oxygen Fraction	= site specific input	0.15
A7	Waste Feed Capacity (lb/hr)	= site specific input	35,612
A8	Existing APCDs	= site specific input	QC/VS/C
A9	Capital Costs	= site specific input	$887,797.
A10	Annualized Capital Costs ($/yr)	= site specific input	$111,924.
A11	Fixed Annual O&M Costs ($/yr)	= site specific input	$179,021.
A12	Variable Annual O&M Costs ($/ton/yr)	= site specific input	$9.
A13	Waste Heat Boiler (Yes or No)	= site specific input	No
	Auxiliary Fuel Type		
A14	Natural Gas	= site specific input	0
A15	Fuel Oil	= site specific input	FUEL OIL
A16	Coal	= site specific input	0
A17	None	= site specific input	0
A18	Liquid Feed % of Total	= site specific input	0.18
A19	Sludge Feed % of Total	= site specific input	0.00
A20	Solid Feed % of Total	= site specific input	0.82
A21	Liquid Waste Heating Value (Btu/lb)	= site specific input	8,763
A22	Sludge Waste Heating Value (Btu/lb)	= site specific input	6,269
A23	Solid Waste Heating Value (Btu/lb)	= site specific input	6,544
A24	Total Waste Heating Value	=A18*A21+A19*A22+A20*A23	6,941
A25	Annual Liquid Waste Feedrate	=A28*A18	15,731
A26	Annual Sludge Waste Feedrate	=A28*A19	0
A27	Annual Solid Waste Feedrate	=A28*A20	72,153
A28	Total Annual Waste Feedrate	= site specific input	87,884
A29	Total Hourly Waste Feedrate	=A28*2000/8000	21,971
A30	Waste Ash (%)	= site specific input	0.00
	Auxiliary Fuel Ash (%)		
A31	Fuel Oil	= site specific input	0.01
A32	Coal	= site specific input	0.00

TABLE 3-2. BASELINE COST MODEL SPREADSHEET FOR ON-SITE INCINERATORS

Parameters		Input	Values
A33	Ash Feedrate	=IF(A30="",0,(A28*A30))+IF(A31<>"",((A36*8000*A31*10^6)/(2000*18265)),0)+IF(A32<>"",((A37*8000*A32*10^6)/(2000*13000)),0)	21
A34	Waste Thermal Input (mmBtu/hr)	=A24*A29/10^6	152.51
	Auxiliary Fuel Thermal Input (mmBtu/hr)		
A35	Natural Gas	= site specific input	0.00
A36	Fuel Oil	= site specific input	19.60
A37	Coal	= site specific input	0.00
A38	None	= 0	0
A39	Estimated Thermal Input	=(A5/10000)*60*((21-(A6*100))/21)	98.01
B. Capital Expenditures			
B1	Incinerator System	=IF(OR(A1="Rotary Kiln",A1="Fluidized Bed"),(((EXP(-0.6614908))*(A39^0.5542949))*10^6),IF(OR(A1="Liquid Injection",A1="Two Chamber"),((EXP(2.104595))*(A39^0.5057352))*10^6,IF(A1="Rotary Hearth",(((((EXP(-0.6614908))*(A39^0.5542949))*10^6)+((EXP(-2.104595))*(A39^0.5057352))*10^6)/2,FALSE)))	$6,553,415.
B2	Waste Heat Boiler	=IF(A13="Yes",(40000*(A39/10)^0.6),0)*(1052/813.6)	$0.
B3	Waste Storage	=764328*((A7/40000)^0.6)	$712,858.
B4	Waste Water Treatment	=(2000000*(A5/86900)^0.6)	$1,520,503.
B5	Total Equipment and Installation (TE&I)	=SUM(B1,A9)+SUM(B2:B4)	$9,674,573.
B6	Engineering (10% of TE&I)	=0.1*B5	$967,457.
B7	Start-Up (2% of TE&I)	=0.02*B5	$193,491.
B8	Subtotal Capital Equipment	=SUM(B5:B7)	$10,835,522.
B9	Contingency (20%)	=0.2*B8	$2,167,104.
B10	Total Capital Equipment	=SUM(B8:B9)	$13,002,626.
Other Capital Investments			
	Permit Acquisition		
B11	RCRA or BIF Permit Acquisition	=IF(A3>1,((IF(A5<13000,300000,(121988*(LN(A5))-850000))+((IF(A5<13000,300000,(121988*(LN(A5))-850000))/2)*(A3-1)))/A3),IF(A5<13000,300000,(121988*(LN(A5))-850000)))	$481,581.
B12	Updating RCRA Permit	=B11*0.25	$120,395.
B13	Compliance Testing/Trial Burn	=IF(A3>1,((290000+((0.75*290000)*(A3-1)))/A3),290000)	$290,000.
B14	Legal & Financing (12% Capital Equipment)	=IF(A3>1,(((B5*0.12)+((B5*0.06)*(A3-1)))/A3),(B5*0.12))	$1,160,949.

TABLE 3-2. BASELINE COST MODEL SPREADSHEET FOR ON-SITE INCINERATORS

Parameters		Input	Values
B15	Total Other Capital Investments	=SUM(B11:B14)	$2,052,925.
B16	Total Capital Expenditures	=B15+B10	$15,055,551.
C. Annual Costs			
Annual Direct Costs			
	Labor Requirements		
	Labor (Burdened at 23%)		
C1	Waste Handling, Storage and Feeding	=0	$0.
C2	Combustor and CEM Operations	=IF(AND(A1="Liquid Injection",A4<=20000),20*2080*1*1.23,IF(AND(A1="Liquid Injection",A4>20000,A4<45000),20*2080*1.5*1.23,IF(AND(A1="Liquid Injection",A4>=45000,20*2080*2*1.23, IF(AND(A1<>"Liquid Injection,A4<=20000),20*2080*3*1.23,IF(AND(A1<>"Liquid Injection",A4>20000,A4<45000),20*2080*6*1.23,IF(AND(A1<>"Liquid Injection",A4>=45000),20*2080*6*1.23,"Error"))))))	$307,008.
C3	Maintenance	=0.35*SUM(C1:C2)	$107,453.
C4	Supervisor	=0.15*SUM(C1:C2)	$23,026.
C5	Manager and Technical/Regulatory Support	=IF(AND(A1="Liquid Injection",A4<=20000),0.5*55000*1.23/A2,IF(AND(A1="Liquid Injection",A4>20000,A4<45000),1*55000*1.23/A2,IF(AND(A1="Liquid Injection",A4>=45000,1.5*55000*1.23/A2, IF(AND(A1<>"Liquid Injection,A4<=20000),0.5*55000*1.23/A2,IF(AND(A1<>"Liquid Injection",A4>20000,A4<45000),1*55000*1.23/A2,IF(AND(A1<>"Liquid Injection",A4>=45000),1.5*55000*1.23/A2,"Error"))))))	$50,738.
	Operating Costs		
C6	Administrative Labor	=SUM(C4:C5)	$73,763.
C7	Operations Labor	=SUM(C1:C3)	$414,461.
C8	Utilities	=IF(OR(A1="Liquid Injection",A1="Two Chamber"),(3.1911*(A5)),IF(OR(A1="Rotary Kiln",A1="Fluidized Bed"),(6.295*(A5)^0.8977),IF(A1="Rotary Hearth",(((3.1911*(A5))+(6.295*(A5)^0.8977))/2),FALSE)))	$113,409.
C9	Waste Sampling and Analysis	=(IF(A21>0,1,0)+IF(A22>0,1,0)+IF(A23>0,1,0)*3*12*533)	$19,190.
	Auxiliary Fuel		
C10	Natural Gas	=IF(A14="Natural Gas",(A35*3.27*8000),0)	$0.

TABLE 3-2. BASELINE COST MODEL SPREADSHEET FOR ON-SITE INCINERATORS

Parameters		Input	Values
C11	Fuel Oil (Residual)	=IF(A15="Fuel Oil",(A36*4.62*8000),0)	$724,416.
C12	Coal	=IF(A16="Coal",(A37*1.33*8000),0)	$0.
C13	Solid Waste Disposal	=A33*200	$4,292.
C14	Heat Recovery Credit	=IF(A13="Yes",(-0.6*A39*1.33*8000),0)	$0.
	Replacement Parts for Operation & Maintenance		
C15	Incineration System	=B1*0.05	$327,671.
C16	System Monitors	=$20000	$20,000.
C17	Fixed Annual O&M Costs of APCDs	=A11/10	$17,902.
C18	Variable Annual O&M Costs of APCDs	=A12*A28	$785,880.
C19	Waste Heat Boiler	=0.08*B2	$0.
C20	Waste Storage and Feed	=0.02*B3	$14,257.
C21	Total Annual Direct Costs	=SUM(C6:C9)+SUM(C10:C14)+SUM(C15:C20)	$2,515,241.
Annual Indirect Costs			
C22	Administrative Charges (2% Capital)	=0.02*B10	$260,053.
C23	Property Taxes (1% Capital)	=0.01*B10	$130,026.
C24	Insurance	=0.01*B10	$130,026.
C25	Recordkeeping	=$25000	$25,000.
C26	Medical Surveillance	=500*(IF(AND(A1="Liquid Injection",A4<=20000),1.5,IF(AND(A1="Liquid Injection",A4>20000,A4<45000),2.5,IF(AND(A1="Liquid Injection",A4>=45000,3.5, IF(AND(A1<>"Liquid Injection,A4<=20000),3.5,IF(AND(A1<>"Liquid Injection",A4>20000,A4<45000),7,IF(AND(A1<>"Liquid Injection",A4>=45000),7.5,"Error")))))))	$3,500.
C27	Total Annual Indirect Costs	=SUM(C22:C26)	$548,605.
D. Capital Recovery			
D1	Permitting Capital Recovery @ 20 Years	=((0.07*(1+0.07)^20)/((1+0.07)^20-1)*B11)	$45,458.
D2	System Equipment Capital Recovery @ 15 Years	=((0.07*(1+0.07)^15)/((1+0.07)^15-1))*((B10-A8)+B14)	$1,457,609.
D3	Permitting Updating Capital Recovery @ 5 Years	=((0.07*(1+0.07)^5)/((1+0.07)^5-1))*(B12+B13)	$100,092.
D4	Total Annualized Capital Costs	=SUM(D1:D3)	$1,603,158.
E. Output			
E1	Hazardous Waste (ton/yr)	=A28	87,884
	Costs		
E2	Capital Costs ($)	=B16	$15,055,551.

TABLE 3-2. BASELINE COST MODEL SPREADSHEET FOR ON-SITE INCINERATORS

Parameters		Input	Values
E3	Annualized Capital Costs ($/yr)	=D4	$1,603,158.
E4	Fixed Annual O&M Costs ($/yr)	=C27+C6+C17	$640,270.
E5	Variable Annual O&M Costs	=SUM(C10:C14)+SUM(C15:C20)+SUM(C7:C9)-C17	$2,423,575.
	Costs ($/ton)		
E6	Annualized Capital Costs	=E3/E1	$18.
E7	Fixed Annual O&M Costs	=E4/E1	$7.
E8	Variable Annual O&M Costs	=E5/E1	$28.
	Employees		
E9	Number of Full-TimeEmployees per System	=(SUM(C1:C3)/35000)	11.8
E10	Number of Full-Time Employees per Facility	=(SUM(C4:C5)/40000)	1.8

TABLE 3-3. BASELINE COST MODEL SPREADSHEET FOR GOVERNMENT INCINERATORS

Parameters		Input	Values
A. Facility Characteristics			
A1	System Type	= site specific input	Rotary Kiln
A2	Number of Units at This Facility	= site specific input	2
A3	Number of Units Tested	= site specific input	2
A4	Stack Gas Flow (acfm)	= site specific input	3,143
A5	Stack Gas Flow (dcsfm)	= site specific input	2,686
A6	Stack Oxygen Fraction	= site specific input	0.18
A7	Waste Feed Capacity (lb/hr)	= site specific input	178
A8	Existing APCDs	= site specific input	GC/C/FF
A9	Capital Costs	= site specific input	$273,918.
A10	Annualized Capital Costs ($/yr)	= site specific input	$28,976.
A11	Fixed Annual O&M Costs ($/yr)	= site specific input	$151,778.
A12	Variable Annual O&M Costs ($/ton/yr)	= site specific input	$11.
A13	Waste Heat Boiler (Yes or No)	= site specific input	No
	Auxiliary Fuel Type		
A14	Natural Gas	= site specific input	NATURAL GAS
A15	Fuel Oil	= site specific input	0
A16	Coal	= site specific input	0
A17	None	= site specific input	0
A18	Liquid Feed % of Total	= site specific input	0.00
A19	Sludge Feed % of Total	= site specific input	0.00
A20	Solid Feed % of Total	= site specific input	1.00
A21	Liquid Waste Heating Value (Btu/lb)	= site specific input	8,763
A22	Sludge Waste Heating Value (Btu/lb)	= site specific input	6,269
A23	Solid Waste Heating Value (Btu/lb)	= site specific input	6,544
A24	Total Waste Heating Value	=A18*A21+A19*A22+A20*A23	6,544
A25	Annual Liquid Waste Feedrate	=A28*A18	0
A26	Annual Sludge Waste Feedrate	=A28*A19	0
A27	Annual Solid Waste Feedrate	=A28*A20	368
A28	Total Annual Waste Feedrate	= site specific input	368
A29	Total Hourly Waste Feedrate	=A28*2000/8000	92
A30	Waste Ash (%)	= site specific input	0.00
	Auxiliary Fuel Ash (%)		

TABLE 3-3. BASELINE COST MODEL SPREADSHEET FOR GOVERNMENT INCINERATORS

Parameters		Input	Values
A31	Fuel Oil	= site specific input	0.00
A32	Coal	= site specific input	0.00
A33	Ash Feedrate	=IF(A30="",0,(A28*A30))+IF(A31<>"",((A36*8000*A31*10^6)/(2000*18265)),0)+IF(A32<>"",((A37*8000*A32*10^6)/(2000*13000)),0)	0
A34	Waste Thermal Input (mmBtu/hr)	=A24*A29/10^6	0.60
	Auxiliary Fuel Thermal Input (mmBtu/hr)		
A35	Natural Gas	= site specific input	0.47
A36	Fuel Oil	= site specific input	0.00
A37	Coal	= site specific input	0.00
A38	None	= 0	0
A39	Estimated Thermal Input	=(A5/10000)*60*((21-(A6*100))/21)	2.35
B. Capital Expenditures			
B1	Incinerator System	=IF(OR(A1="Rotary Kiln",A1="Fluidized Bed"),(((EXP(-0.6614908))*(A39^0.5542949))*10^6),IF(OR(A1="Liquid Injection",A1="Two Chamber"),((EXP(2.104595))*(A39^0.5057352))*10^6,IF(A1="Rotary Hearth",(((((EXP(-0.6614908))*(A39^0.5542949))*10^6)+((EXP(-2.104595))*(A39^0.5057352))*10^6)/2,FALSE)))	$829,396.
B2	Waste Heat Boiler	=IF(A13="Yes",(40000*(A39/10)^0.6),0)*(1052/813.6)	$0.
B3	Waste Storage	=764328*((A7/40000)^0.6)	$29,669.
B4	Waste Water Treatment	=(2000000*(A5/86900)^0.6)	$248,366.
B5	Total Equipment and Installation (TE&I)	=SUM(B1,A9)+SUM(B2:B4)	$1,381,349.
B6	Engineering (10% of TE&I)	=0.1*B5	$138,135.
B7	Start-Up (2% of TE&I)	=0.02*B5	$27,627.
B8	Subtotal Capital Equipment	=SUM(B5:B7)	$1,547,111.
B9	Contingency (20%)	=0.2*B8	$309,422.
B10	Total Capital Equipment	=SUM(B8:B9)	$1,856,533.
Other Capital Investments			
	Permit Acquisition		

TABLE 3-3. BASELINE COST MODEL SPREADSHEET FOR GOVERNMENT INCINERATORS

Parameters		Input	Values
B11	RCRA or BIF Permit Acquisition	=IF(A3>1,((IF(A5<13000,300000,(121988*(LN(A5))-850000))+((IF(A5<13000,300000,(121988*(LN(A5))-850000))/2)*(A3-1)))/A3),IF(A5<13000,300000,(121988*(LN(A5))-850000)))	$225,000.
B12	Updating RCRA Permit	=B11*0.25	$56,250.
B13	Compliance Testing/Trial Burn	=IF(A3>1,((290000+((0.75*290000)*(A3-1)))/A3),290000)	$253,750.
B14	Legal and Financing (12% Capital Equipment)	=IF(A3>1,(((B5*0.12)+((B5*0.06)*(A3-1)))/A3),(B5*0.12))	$124,321.
B15	Total Other Capital Investments	=SUM(B11:B14)	$659,321.
B16	Total Capital Expenditures	=B15+B10	$2,515,855.
C. Annual Costs			
Annual Direct Costs			
Labor Requirements			
Labor (Burdened at 23%)			
C1	Waste Handling, Storage and Feeding	=0	$0.
C2	Combustor & CEM Operations	=IF(AND(A1="Liquid Injection",A4<=20000),20*2080*1*1.23,IF(AND(A1="Liquid Injection",A4>20000,A4<45000),20*2080*1.5*1.23,IF(AND(A1="Liquid Injection",A4>=45000,20*2080*2*1.23, IF(AND(A1<>"Liquid Injection,A4<=20000),20*2080*3*1.23,IF(AND(A1<>"Liquid Injection",A4>20000,A4<45000),20*2080*6*1.23,IF(AND(A1<>"Liquid Injection",A4>=45000),20*2080*6*1.23,"Error"))))))	$153,504.
C3	Maintenance	=0.35*SUM(C1:C2)	$53,726.
C4	Supervisor	=0.15*SUM(C1:C2)	$11,513.
C5	Manager and Technical/Regulatory Support	=IF(AND(A1="Liquid Injection",A4<=20000),0.5*55000*1.23/A2,IF(AND(A1="Liquid Injection",A4>20000,A4<45000),1*55000*1.23/A2,IF(AND(A1="Liquid Injection",A4>=45000,1.5*55000*1.23/A2, IF(AND(A1<>"Liquid Injection,A4<=20000),0.5*55000*1.23/A2,IF(AND(A1<>"Liquid Injection",A4>20000,A4<45000),1*55000*1.23/A2,IF(AND(A1<>"Liquid Injection",A4>=45000),1.5*55000*1.23/A2,"Error"))))))	$16,913.
	Operating Costs		
C6	Administrative Labor	=SUM(C4:C5)	$28,425.

TABLE 3-3. BASELINE COST MODEL SPREADSHEET FOR GOVERNMENT INCINERATORS

Parameters		Input	Values
C7	Operations Labor	=SUM(C1:C3)	$207,230.
C8	Utilities	=IF(OR(A1="Liquid Injection",A1="Two Chamber"),(3.1911*(A5)),IF(OR(A1="Rotary Kiln",A1="Fluidized Bed"),(6.295*(A5)^0.8977),IF(A1="Rotary Hearth",(((3.1911*(A5))+(6.295*(A5)^0.8977))/2),FALSE)))	$7,539.
C9	Waste Sampling and Analysis	=(IF(A21>0,1,0)+IF(A22>0,1,0)+IF(A23>0,1,0)*3*12*533)	$19,190.
	Auxiliary Fuel		
C10	Natural Gas	=IF(A14="Natural Gas",(A35*3.27*8000),0)	$12,295.
C11	Fuel Oil (Residual)	=IF(A15="Fuel Oil",(A36*4.62*8000),0)	$0.
C12	Coal	=IF(A16="Coal",(A37*1.33*8000),0)	$0.
C13	Solid Waste Disposal	=A33*200	$0.
C14	Heat Recovery Credit	=IF(A13="Yes",(-0.6*A39*1.33*8000),0)	$0.
	Replacement Parts for Operation & Maintenance		
C15	Incineration System	=B1*0.05	$41,470.
C16	System Monitors	=$20000	$20,000.
C17	Fixed Annual O&M Costs of APCDs	=A11/10	$15,178.
C18	Variable Annual O&M Costs of APCDs	=A12*A28	$4,132.
C19	Waste Heat Boiler	=0.08*B2	$0.
C20	Waste Storage and Feed	=0.02*B3	$593.
C21	Total Annual Direct Costs	=SUM(C6:C9)+SUM(C10:C14)+SUM(C15:C20)	$356,053.
Annual Indirect Costs			
C22	Administrative Charges (2% Capital)	=0.02*B10	$37,131.
C23	Property Taxes (1% Capital)	=0.01*B10	$18,565.
C24	Insurance	=0.01*B10	$18,565.
C25	Recordkeeping	=$25000	$25,000.
C26	Medical Surveillance	=500*(IF(AND(A1="Liquid Injection",A4<=20000),1.5,IF(AND(A1="Liquid Injection",A4>20000,A4<45000),2.5,IF(AND(A1="Liquid Injection",A4>=45000,3.5, IF(AND(A1<>"Liquid Injection,A4<=20000),3.5,IF(AND(A1<>"Liquid Injection",A4>20000,A4<45000),7,IF(AND(A1<>"Liquid Injection",A4>=45000),7.5,"Error")))))))	$1,750.

TABLE 3-3. BASELINE COST MODEL SPREADSHEET FOR GOVERNMENT INCINERATORS

Parameters		Input	Values
C27	Total Annual Indirect Costs	=SUM(C22:C26)	$101,011.
D. Capital Recovery			
D1	Permitting Capital Recovery @ 20 Years	=((0.07*(1+0.07)^20)/((1+0.07)^20-1)*B11)	$21,238.
D2	System Equipment Capital Recovery @ 15 Years	=((0.07*(1+0.07)^15)/((1+0.07)^15-1))*((B10-A8)+B14)	$187,412.
D3	Permitting Updating Capital Recovery @ 5 Years	=((0.07*(1+0.07)^5)/((1+0.07)^5-1))*(B12+B13)	$75,606.
D4	Total Annualized Capital Costs	=SUM(D1:D3)	$284,257.
E. Output			
E1	Hazardous Waste (ton/yr)	=A28	368
	Costs		
E2	Capital Costs ($)	=B16	$2,515,855.
E3	Annualized Capital Costs ($/yr)	=D4	$284,257.
E4	Fixed Annual O&M Costs ($/yr)	=C27+C6+C17	$144,614.
E5	Variable Annual O&M Costs	=SUM(C10:C14)+SUM(C15:C20)+SUM(C7:C9)-C17	$312,449.
	Costs ($/ton)		
E6	Annualized Capital Costs	=E3/E1	$773.
E7	Fixed Annual O&M Costs	=E4/E1	$393.
E8	Variable Annual O&M Costs	=E5/E1	$850.
	Employees		
E9	Number of Full-TimeEmployees per System	=(SUM(C1:C3)/35000)	5.9
E10	Number of Full-Time Employees per Facility	=(SUM(C4:C5)/40000)	0.7

TABLE 3-4. BASELINE COST MODEL SPREADSHEET FOR CEMENT KILNS

Parameters		Input	Values
A. Facility Characteristics			
A1	System Type	=site specific input	Rotary Kiln
A2	Number of Units at This Facility	=site specific input	4
A3	Number of Units Tested	=site specific input	4
A4	Stack Gas Flow (acfm)	=site specific input	139,440
A5	Stack Gas Flow (dscfm)	=site specific input	62,042
A6	Stack Oxygen Fraction	=site specific input	0.13
A7	Waste Feed Capacity (lb/hr)	=site specific input	13,614
A8	Existing APCDs	=site specific input	FF
	Auxiliary Fuel Type		
A9	Natural Gas	=site specific input	0
A10	Fuel Oil	=site specific input	0
A11	Coal	=site specific input	COAL
A12	None	=site specific input	0
A13	Waste Heat Boiler (Yes or No)	=site specific input	No
A14	Liquid Feed % of Total	=site specific input	0.48
A15	Sludge Feed % of Total	=site specific input	0.35
A16	Solid Feed % of Total	=site specific input	0.17
A17	Liquid Waste Heating Value (Btu/lb)	=site specific input	13,047
A18	Sludge Waste Heating Value (Btu/lb)	=site specific input	12,867
A19	Solid Waste Heating Value (Btu/lb)	=site specific input	8,247
A20	Total Waste Heating Value (Btu/lb)	=A14*A17+A15*A18+A16*A19	12,153
A21	Annual Liquid Waste Feedrate	=A24*A14	24,227
A22	Annual Sludge Waste Feedrate	=A24*A15	17,740
A23	Annual Solid Waste Feedrate	=A24*A16	8,784
A24	Total Annual Waste Feedrate	=site specific input	50,751
A25	Hazardous Waste Burning Penalty ($/ton)	=site specific input	$17.
A26	Total Hourly Waste Feedrate	=A24*2000/8000	12,688
A27	Waste Thermal Input (mmBtu/hr)	=A20*A26/10^6	154.20
	Auxiliary Fuel Thermal Input (mmBtu/hr)		
A28	Natural Gas	=site specific input	0.00
A29	Fuel Oil	=site specific input	0.00
A30	Coal	=site specific input	12.00
A31	None	=0	0
A32	Total Auxiliary Fuel Thermal Input (mmBtu/hr)	=SUM(A28:A31)	12.00
A33	Actual Thermal Input (mmBtu/hr)	=A27+A32	166.20

TABLE 3-4. BASELINE COST MODEL SPREADSHEET FOR CEMENT KILNS

Parameters		Input	Values
B. Capital Expenditures			
B1	Liquid Waste Storage	=761328*(A21/38500)^0.6	$576,605.
B2	Solid Waste Storage	=133000*(A23/7650)^0.6	$144,501.
B3	Liquid Waste Feed System	=379292*(A21/38500)^0.6	$287,264.
B4	Solid Waste Feed System	=114503*(A23/7650)^0.6	$124,404.
B5	Waste Heat Boiler	=IF(A13="Yes",(40000*(A33/10)^0.6),0)*1.29	$0.
B6	Automatic Shutdown System	=71682*(A21/38500)^0	$71,682.
B7	Continuous Monitors	=153044*(A21/42500)^0	$153,044.
B8	Total Equipment and Installation (TE&I)	=SUM(B1:B7)	$1,357,500.
B9	Engineering (10% of Subtotal)	=(10/(100-(10+2)))*B8	$154,261.
B10	Start-Up (2% of Subtotal)	=(2/(100-(10+2)))*B8	$30,852.
B11	Subtotal Capital Equipment	=SUM(B8:B10)	$1,542,613.
B12	Contingency (20% of Subtotal)	=0.2*B11	$308,523.
B13	Total Capital Equipment	=SUM(B11:B12)	$1,851,136.
Other Capital Equipment			
	Permit Acquisition		
B14	RCRA or BIF Permit Acquisition	=IF(A3>1,((IF(A5<13000,300000,(121988*(LN(A5))-850000))+((IF(A5<13000,300000,(121988*(LN(A5))-850000))/2)*(A3-1)))/A3),IF(A5<13000,300000,(121988*(LN(A5))-850000)))	$310,130.
B15	Updating RCRA Permit	=0.25*B14	$77,532.
B16	Compliance Testing/Trial Burn	=IF(A3>1,((340000+((0.75*340000)*(A3-1)))/A3),340000)	$276,250.
B17	Legal and Financing (12% Capital Equipment)	=IF(A3>1,(((B13*0.12)+((B13*0.06)*(A3-1)))/A3),(B13*0.12))	$138,835.
B18	Total Other Capital Investments	=SUM(B14:B17)	$802,747.
B19	Total Capital Expenditures	=B18+B13	$2,653,883.
C. Annual Costs			
Annual Direct Costs			
	Labor Requirements		
	Labor (Burdened at 23%)		
C1	Waste Receiving, Storage and Handling	=10*2080*9*1.23/A2	$69,077.
C2	Supervisor	=1*42000*1.23/A2	$12,915.
C3	Manager and Technical/Regulatory Support (Unburdened)	=1*50000*1.23/A2	$15,375.
C4	Administrator (Unburdened)	=0.5*68000*1.23/A2	$10,455.
C5	Clerical (Unburdened)	=0.5*25000*1.23/A2	$3,844.
C6	Safety Coordinator (Unburdened)	=0.5*45760*1.23/A2	$7,036.

TABLE 3-4. BASELINE COST MODEL SPREADSHEET FOR CEMENT KILNS

Parameters		Input	Values
	Operating Costs		
C7	Administrative Labor	=SUM(C2:C6)	$49,624.
C8	Operations Labor	=C1	$69,077.
C9	Utilities	=25728*(A21/38500)^0.6	$19,486.
C10	Liquid Waste Sampling and Analysis	=533*((A21*2000)/0.72)/(8.33*20000)	$215,306.
C11	Solid Waste Sampling and Analysis	=533*((A23*2000)/40000)	$234,093.
C12	Ash Leachability Sampling	=40650	$40,650.
C13	Heat Recovery Credit	=IF(A13="Yes",(-0.6*A32*1.33*8000),0)	$0.
	Maintenance (8% of Installed Equipment)		
C14	Waste Heat Boiler	=0.08*B5	$0.
C15	Waste Storage and Feed	=0.08*SUM(B1:B4)	$90,622.
C16	Penalty Associated with Burning Hazardous Waste	=A24*A25	$848,561.
C17	Automatic Shutdown	=0.08*B6	$5,735.
C18	System Monitors	=0.08*153044*(A7/42500)^0	$12,244.
C19	Total Annual Direct Costs	=SUM(C7:C18)	$1,585,397.
Annual Indirect Costs			
C20	Administrative Charges (2% Capital)	=0.02*B19	$53,078.
C21	Property Taxes (1% Capital)	=0.01*B19	$26,539.
C22	Insurance (1% Capital)	=0.01*B19	$26,539.
C23	Environmental Damage Liability Insurance	=150000	$150,000.
C24	Medical Surveillance	=500*12.5	$6,750.
C25	Security	=100000	$100,000.
C26	Total Annual Indirect Costs	=SUM(C20:C25)	$362,905.
D. Capital Recovery			
D1	Permitting Capital Recovery @ 20 Years	=((0.07*(1+0.07)^20)/((1+0.07)^20-1)*B14)	$29,274.
D2	System Equipment Capital Recovery @ 15 Years	=((0.07*(1+0.07)^15)/((1+0.07)^15-1))*(B19-(B14+B15+B16))	$218,488.
D3	Permitting Updating Capital Recovery @ 5 Years	=((0.07*(1+0.07)^5)/((1+0.07)^5-1))*(B15+B16)	$86,284.
D4	Total Annualized Capital Cost	=SUM(D2:D3)	$304,772.
E. Credits			
E1	Primary Fuel Credit ($/yr)	=A27*(-1.03)*8000	($1,270,599.)
F. Output Parameter			
F1	Hazardous Waste (ton/yr)	=A24	50,751
	Cost		
F2	Capital Costs ($)	=B19	$2,653,883.
F3	Annualized Capital Cost ($/yr)	=D4	$304,772.
F4	Fixed Annual O&M Costs ($/yr)	=C26+C7	$412,530.

TABLE 3-4. BASELINE COST MODEL SPREADSHEET FOR CEMENT KILNS

Parameters		Input	Values
F5	Variable Annual O&M Costs ($/yr)	=SUM(C8:C18)	$1,535,773.
	Credits		
F6	Primary Fuel Credit ($/yr)	=E1	($1,270,599.)
	Cost ($/ton)		
F7	Annualized Capital Cost	=F3/F1	$6.
F8	Fixed Annual O&M Costs	=F4/F1	$8.
F9	Variable Annual O&M Costs	=F5/F1	$30.
F10	HW Burning Penalty	=A25	$17.
	Credit ($/ton)		
F11	Primary Fuel Credit	=F6/F1	($25.)
	Employees		
F12	Number of Full-Time Employees per System		2.0
F13	Number of Full-Time Employees per Facility	=(SUM(C1:C6))/40000	1.2

TABLE 3-5. BASELINE COST MODEL SPREADSHEET FOR LIGHTWEIGHT AGGREGATE KILNS

Parameters			
A. Facility Characteristics			
A1	System Type	=site specific input	Rotary Kiln
A2	Number of Units at This Facility	=site specific input	2
A3	Number of Units Tested	=site specific input	2
A4	Stack Gas Flow (acfm)	=site specific input	59,638
A5	Stack Gas Flow (dscfm)	=site specific input	30,589
A6	Stack Oxygen Fraction	=site specific input	0.15
A7	Waste Feed Capacity (lb/hr)	=site specific input	6,971
A8	Existing APCDs	=site specific input	MC/HE/FF/VS/DM
	Auxiliary Fuel Type		
A9	Natural Gas	=site specific input	0
A10	Fuel Oil	=site specific input	FUEL OIL
A11	Coal	=site specific input	0
A12	None	=site specific input	0
A13	Waste Heat Boiler (Yes or No)	=site specific input	No
A14	Liquid Feed % of Total	=site specific input	0.94
A15	Sludge Feed % of Total	=site specific input	0.00
A16	Solid Feed % of Total	=site specific input	0.06
A17	Liquid Waste Heating Value (Btu/lb)	=site specific input	11,820
A18	Sludge Waste Heating Value (Btu/lb)	=site specific input	0
A19	Solid Waste Heating Value (Btu/lb)	=site specific input	0
A20	Total Waste Heating Value (Btu/lb)	=A14*A17+A15*A18+A16*A19	11,096
A21	Annual Liquid Waste Feedrate	=A24*A14	18,855
A22	Annual Sludge Waste Feedrate	=A24*A15	0
A23	Annual Solid Waste Feedrate	=A24*A16	1,230
A24	Total Annual Waste Feedrate	=site specific input	20,085
A25	Waste Ash %	=site specific input	0.00
A26	Total Hourly Waste Feedrate	=A24*2000/8000	5,021
A27	Waste Thermal Input (mmBtu/hr)	=A20*A26/10^6	56
	Auxiliary Fuel Thermal Input (mmBtu/hr)		
A28	Natural Gas	=site specific input	0.00
A29	Fuel Oil	=site specific input	110.63
A30	Coal	=site specific input	0.00
A31	None	=0	0
A32	Total Auxiliary Fuel Thermal Input (mmBtu/hr)	=SUM(A28:A31)	110.63
A33	Actual Heat Input (mmBtu/hr)	=A32+A27	166.34

TABLE 3-5. BASELINE COST MODEL SPREADSHEET FOR LIGHTWEIGHT AGGREGATE KILNS

Parameters			
B. Capital Expenditures			
B1	Liquid Waste Storage	=761328*((A21*1.3)/38500)^0.6	$580,645.
B2	Solid waste storage	=133000*((A23*1.3)/7650)^0.6	$52,000.
B3	Liquid Waste Feed System	=379292*((A7*A14)/10000)^0.6	$294,102.
B4	Solid Waste Feed System	=114503*((A23/2000)^0.6)	$85,542.
B5	Waste Heat Boiler	=IF(A13="Yes",(40000*(A33/10)^0.6),0)*1.29	$0.
B6	Automatic Shutdown System	=71682*(A7/10000)^0	$71,682.
B7	Continuous Monitors	=153044*(A7/42500)^0	$153,044.
B8	Total Equipment and Installation (TE&I)	=SUM(B1:B7)	$1,237,015.
B9	Engineering (10% of Subtotal)	=(10/(100-(10+2)))*B8	$140,570.
B10	Start-Up (2% of Subtotal)	=(2/(100-(10+2)))*B8	$28,114.
B11	Subtotal Capital Equipment	=SUM(B8:B10)	$1,405,699.
B12	Contingency (20% of Subtotal)	=0.2*B11	$281,140.
B13	Total Capital Equipment	=SUM(B11:B12)	$1,686,839.
Other Capital Investments			
	Permit acquisition		
B14	RCRA or BIF Permit Acquisition	=IF(A3>1,((IF(A5<13000,300000,(121988*(LN(A5))-850000))+((IF(A5<13000,300000,(121988*(LN(A5))-850000))/2)*(A3-1)))/A3),IF(A5<13000,300000,(121988*(LN(A5))-850000)))	$307,455.
B15	Updating RCRA Permit	=B14*0.25	$76,864.
B16	Compliance Testing/Trial Burn	=IF(A3>1,((300000+((0.75*300000)*(A3-1)))/A3),300000)	$262,500.
B17	Legal and Financing (12% Capital Equipment)	=IF(A3>1,(((B13*0.12)+((B13*0.06)*(A3-1)))/A3),(B13*0.12))	$151,816.
B18	Total Other Capital Investments	=SUM(B14:B17)	$798,635.
B19	Total Capital Expenditures	=B18+B13	$2,485,474.
C. Annual Costs			
Annual Direct Costs			
	Labor Requirements		
	Labor (Burdened at 23%)		
C1	Waste Receiving, Storage and Handling	=10*2080*9*1.23/A2	$115,128.
C2	Supervisor	=1*42000*1.23/A2	$25,830.
C3	Manager and Technical/Regulatory Support	=1*50000*1.23/A2	$30,750.
C4	Administrator	=0.5*60000*1.23/A2	$18,450.
C5	Clerical	=0.5*25000*1.23/A2	$7,688.
C6	Safety Coordinator	=0.5*45760*1.23/A2	$14,071.
Operating costs			

TABLE 3-5. BASELINE COST MODEL SPREADSHEET FOR LIGHTWEIGHT AGGREGATE KILNS

Parameters			
C7	Administrative Labor	=SUM(C2:C6)	$96,789.
C8	Operations Labor	=C1	$115,128.
C9	Liquid Waste Sampling and Analysis	=533*((A21*2000)/0.72)/(8.33*20000)	$167,558.
C10	Solid Waste Sampling and Analysis	=533*((A23*2000)/40000)	$32,784.
C11	Heat Recovery Credit	=IF(A13="Yes", (-0.6*A33*1.33*8000),0)	$0.
	Maintenance (8% of Installed Equipment)		
C12	Waste Heat Boiler	=0.08*B5	$0.
C13	Waste Storage and Feed	=0.08*SUM(B1:B4)	$80,983.
C14	Automatic Shutdown	=0.08*B6	$5,735.
C15	Continuous Monitors	=0.08*153044*(A21/42500)^0	$12,244.
C16	Total Annual Direct Costs	=SUM(C7:C15)	$511,221.
Annual Indirect Costs			
C17	Administrative Charges (2% Capital)	=0.02*B19	$49,709.
C18	Property Taxes (1% Capital)	=0.01*B19	$24,855.
C19	Insurance (1% Capital)	=0.01*B19	$24,855.
C20	Environmental Damage Liability Insurance	=150000	$150,000.
C21	Medical Surveillance	=500*12.5	$6,250.
C22	Security	=100000	$100,000.
C23	Recordkeeping	=25000	$25,000.
C24	Total Annual Indirect Costs	=SUM(C17:C23)	$380,669.
D. Capital Recovery			
D1	Permitting Capital Recovery @ 20 years	=((0.07*(1+0.07)^20)/((1+0.07)^20-1))*(B14)	$29,022.
D2	System Equipment Capital Recovery @ 15 years	=((0.07*(1+0.07)^15)/((1+0.07)^15-1))*(B19-(B14+B15+B16))	$201,874.
D3	Permitting Updating Capital Recovery @ 5 years	=((0.07*(1+0.07)^5)/((1+0.07)^5-1))*(B15+B16)	$82,768.
D4	Total Annualized Capital Cost	=SUM(D2:D3)	$284,642.
E. Credits			
E1	Primary Fuel Credit ($/yr)	=A27*(-1.33)*8000	($592,809.)
F. Output Parameter			
F1	Hazardous Waste (ton/yr)	=A24	20,085
	Cost		
F2	Capital Costs ($)	=B19	$2,485,474.
F3	Annualized Capital Cost ($/yr)	=D4	$284,642.
F4	Fixed Annual O&M Costs ($/yr)	=C24+C7	$477,458.
F5	Variable Annual O&M Costs ($/yr)	=SUM(C8:C15)	$414,432.
	Credits		
F6	Primary Fuel Credit ($/yr)	=E1	($592,809.)

TABLE 3-5. BASELINE COST MODEL SPREADSHEET FOR LIGHTWEIGHT AGGREGATE KILNS

Parameters			
	Costs ($/ton)		
F7	Annualized Capital Cost	=F3/F1	$14.
F8	Fixed Annual O&M Costs	=F4/F1	$24.
F9	Variable Annual O&M Costs	=F5/F1	$21.
	Credits ($/ton)		
F10	Primary Fuel Credit	=F6/F1	($30.)
	Employees		
F11	Number of Full-Time Employees per System	=C1/35000	3.3
F12	Number of Full-Time Employees per Facility	=(SUM(C2:C6))/40000	2.4

TABLE 3-6a. SUMMARY OF BASELINE COSTS FOR COMMERCIAL INCINERATORS

Site ID	Capital Cost ($)	Fixed O&M Annual Cost ($)	Variable O&M Annual Cost ($)	Annualized Capital Cost ($)	HW Feed (ton/yr)	Annualized Capital Cost ($/ton/yr)	Fixed O&M Annual Cost ($/ton/yr)	Variable O&M Annual Cost ($/ton/yr)	Empl per Comb Sys	Empl per Facility (EPA ID)
209	$ 7,653,457	$ 1,009,557	$ 6,901,840	$ 775,452	51,360	$ 15.10	$ 19.66	$ 134.38	11.7	6.5
210	$ 20,575,403	$ 1,370,043	$ 17,332,428	$ 1,993,523	120,375	$ 16.56	$ 11.38	$ 143.99	21.1	2.7
211	$ 13,188,030	$ 1,086,939	$ 6,528,203	$ 1,300,319	33,712	$ 38.57	$ 32.24	$ 193.65	21.1	2.7
212	$ 13,554,125	$ 1,101,381	$ 16,395,043	$ 1,332,346	58,504	$ 22.77	$ 18.83	$ 280.24	21.1	2.7
214	$ 17,147,572	$ 1,374,181	$ 13,847,978	$ 1,798,202	91,112	$ 19.74	$ 15.08	$ 151.99	23.3	7.4
216	$ 18,017,112	$ 1,414,240	$ 4,003,384	$ 1,923,760	22,972	$ 83.74	$ 61.56	$ 174.27	23.3	7.4
222	$ 26,520,734	$ 1,788,557	$ 15,817,769	$ 2,395,009	110,919	$ 21.59	$ 16.12	$ 142.61	25.5	8.2
324	$ 3,584,112	$ 864,210	$ 936,418	$ 437,841	2,488	$ 175.98	$ 347.35	$ 376.37	23.3	7.4
325	$ 15,573,212	$ 1,351,894	$ 14,715,356	$ 1,470,749	43,596	$ 33.74	$ 31.01	$ 337.54	23.3	7.4
327	$ 21,497,074	$ 1,604,338	$ 10,457,407	$ 2,026,535	164,504	$ 12.32	$ 9.75	$ 63.57	25.5	8.2
331	$ 19,082,011	$ 1,488,149	$ 14,837,262	$ 1,938,621	90,775	$ 21.36	$ 16.39	$ 163.45	25.5	8.2
333a	$ 11,685,313	$ 998,714	$ 3,940,538	$ 1,250,002	76,465	$ 16.35	$ 13.06	$ 51.53	20.4	2.5
333b	$ 11,685,313	$ 998,714	$ 3,940,538	$ 1,250,002	76,465	$ 16.35	$ 13.06	$ 51.53	20.4	2.5
359	$ 9,499,762	$ 1,107,039	$ 1,646,375	$ 1,016,258	9,856	$ 103.11	$ 112.32	$ 167.05	23.3	7.4
486	$ 13,509,253	$ 1,119,124	$ 2,170,425	$ 1,445,444	49,065	$ 29.46	$ 22.81	$ 44.24	21.1	3.7
487	$ 18,886,532	$ 1,324,644	$ 3,233,650	$ 2,031,583	98,130	$ 20.70	$ 13.50	$ 32.95	22.2	4.1
601	$ 25,357,641	$ 1,732,800	$ 49,248,794	$ 2,559,969	267,465	$ 9.57	$ 6.48	$ 184.13	25.5	8.2
603	$ 23,596,968	$ 1,654,561	$ 3,852,990	$ 2,399,934	114,815	$ 20.90	$ 14.41	$ 33.56	25.5	8.2
609	$ 29,696,870	$ 1,874,319	$ 7,151,971	$ 3,141,895	139,408	$ 22.54	$ 13.44	$ 51.30	25.5	8.2
612	$ 8,153,120	$ 865,107	$ 1,966,117	$ 894,019	23,126	$ 38.66	$ 37.41	$ 85.02	20.4	2.5

TABLE 3-6b. SUMMARY OF BASELINE COSTS FOR ON-SITE INCINERATORS

Site ID	Capital Cost ($)	Fixed O&M Annual Cost ($)	Variable O&M Annual Cost ($)	Annualized Capital Cost ($)	HW Feed (ton/yr)	Annualized Capital Cost ($/ton/yr)	Fixed O&M Annual Cost ($/ton/yr)	Variable O&M Annual Cost ($/ton/yr)	Empl per Comb Sys	Empl per Facility (EPA ID)
229	$ 1,661,696	$ 115,895	$ 1,692,679	$ 201,167	3,521	$ 57.13	$ 32.91	$ 480.71	2.0	1.0
334	$ 15,164,110	$ 729,854	$ 2,367,577	$ 1,475,913	89,863	$ 16.42	$ 8.12	$ 26.35	11.8	3.7
337a	$ 2,446,498	$ 139,214	$ 533,583	$ 296,870	7,359	$ 40.34	$ 18.92	$ 72.51	5.9	0.7
337b	$ 2,446,498	$ 139,214	$ 533,583	$ 296,870	7,359	$ 40.34	$ 18.92	$ 72.51	5.9	0.7
338	$ 17,254,292	$ 812,304	$ 5,485,575	$ 1,780,392	135,190	$ 13.17	$ 6.01	$ 40.58	11.8	3.7
340	$ 9,256,848	$ 481,888	$ 3,357,441	$ 908,142	26,375	$ 34.43	$ 18.27	$ 127.30	11.8	2.8
342	$ 5,073,682	$ 269,180	$ 584,795	$ 557,865	6,118	$ 91.18	$ 44.00	$ 95.58	5.9	1.4
348	$ 3,196,781	$ 182,404	$ 7,758,248	$ 322,494	12,851	$ 25.09	$ 14.19	$ 603.71	2.0	1.0
350	$ 3,048,189	$ 144,720	$ 175,657	$ 354,379	40,846	$ 8.68	$ 3.54	$ 4.30	2.0	0.3
353	$ 15,129,559	$ 657,456	$ 6,846,019	$ 1,494,400	61,424	$ 24.33	$ 10.70	$ 111.46	11.8	1.4
354	$ 13,355,741	$ 601,362	$ 17,771,699	$ 1,309,424	61,424	$ 21.32	$ 9.79	$ 289.33	11.8	1.4
358a	$ 3,309,357	$ 160,893	$ 3,976,927	$ 352,267	18,472	$ 19.07	$ 8.71	$ 215.29	2.0	0.3
358b	$ 3,309,357	$ 160,893	$ 3,976,927	$ 352,267	18,472	$ 19.07	$ 8.71	$ 215.29	2.0	0.3
358c	$ 3,309,357	$ 160,893	$ 3,976,927	$ 352,267	18,472	$ 19.07	$ 8.71	$ 215.29	2.0	0.3
477	$ 5,152,155	$ 253,409	$ 3,038,926	$ 507,227	87,316	$ 5.81	$ 2.90	$ 34.80	3.0	0.7
478	$ 4,362,688	$ 215,019	$ 912,482	$ 457,374	70,560	$ 6.48	$ 3.05	$ 12.93	3.0	0.7
480a	$ 10,844,657	$ 479,299	$ 1,924,063	$ 1,165,437	22,745	$ 51.24	$ 21.07	$ 84.59	11.8	1.2
480b	$ 10,844,657	$ 479,299	$ 2,084,059	$ 1,165,437	22,745	$ 51.24	$ 21.07	$ 91.63	11.8	1.2
490	$ 10,663,098	$ 477,047	$ 3,870,887	$ 1,154,525	44,048	$ 26.21	$ 10.83	$ 87.88	11.8	1.4
504	$ 8,584,774	$ 447,651	$ 2,552,652	$ 933,613	33,794	$ 27.63	$ 13.25	$ 75.54	11.8	2.8
600	$ 14,086,368	$ 658,085	$ 17,602,333	$ 1,420,381	61,361	$ 23.15	$ 10.72	$ 286.86	11.8	2.8
700	$ 4,260,135	$ 306,414	$ 1,545,265	$ 416,837	7,029	$ 59.30	$ 43.59	$ 219.84	11.8	2.8
701	$ 7,801,468	$ 369,832	$ 2,821,210	$ 846,286	20,115	$ 42.07	$ 18.39	$ 140.25	5.9	1.4
702a	$ 3,844,283	$ 186,398	$ 2,869,021	$ 394,811	24,094	$ 16.39	$ 7.74	$ 119.08	3.0	0.5
702b	$ 3,844,283	$ 186,398	$ 2,869,021	$ 394,811	24,094	$ 16.39	$ 7.74	$ 119.08	3.0	0.5
704	$ 2,218,575	$ 124,299	$ 347,418	$ 287,912	69,675	$ 4.13	$ 1.78	$ 4.99	2.0	1.0
705	$ 11,653,125	$ 538,357	$ 2,527,818	$ 1,098,977	13,457	$ 81.67	$ 40.01	$ 187.85	11.8	1.4
706	$ 4,046,145	$ 200,423	$ 1,479,415	$ 426,745	39,752	$ 10.74	$ 5.04	$ 37.22	3.0	0.7
707	$ 5,753,860	$ 267,052	$ 3,989,247	$ 579,970	161,640	$ 3.59	$ 1.65	$ 24.68	3.9	0.7
708	$ 2,763,186	$ 176,280	$ 1,393,159	$ 264,580	3,381	$ 78.25	$ 52.13	$ 412.01	2.0	1.0

TABLE 3-6b. SUMMARY OF BASELINE COSTS FOR ON-SITE INCINERATORS

Site ID	Capital Cost ($)	Fixed O&M Annual Cost ($)	Variable O&M Annual Cost ($)	Annualized Capital Cost ($)	HW Feed (ton/yr)	Annualized Capital Cost ($/ton/yr)	Fixed O&M Annual Cost ($/ton/yr)	Variable O&M Annual Cost ($/ton/yr)	Empl per Comb Sys	Empl per Facility (EPA ID)
711	$ 14,086,620	$ 691,350	$ 1,966,620	$ 1,473,782	22,067	$ 66.79	$ 31.33	$ 89.12	11.8	3.7
712	$ 4,825,609	$ 292,872	$ 701,941	$ 575,329	106,423	$ 5.41	$ 2.75	$ 6.60	3.9	2.9
714a	$ 4,057,243	$ 202,061	$ 2,139,412	$ 439,169	14,804	$ 29.67	$ 13.65	$ 144.52	3.0	1.0
714b	$ 4,057,243	$ 202,061	$ 2,139,412	$ 439,169	14,804	$ 29.67	$ 13.65	$ 144.52	3.0	1.0
725	$ 1,578,253	$ 112,864	$ 295,273	$ 191,292	337	$ 566.98	$ 334.52	$ 875.18	2.0	1.0
726	$ 2,268,478	$ 149,622	$ 633,007	$ 254,333	6,160	$ 41.29	$ 24.29	$ 102.76	2.0	1.0
728a	$ 2,525,012	$ 132,926	$ 1,028,195	$ 278,619	8,646	$ 32.23	$ 15.37	$ 118.93	5.9	0.4
728b	$ 2,525,012	$ 132,926	$ 1,054,450	$ 278,619	8,646	$ 32.23	$ 15.37	$ 121.96	5.9	0.4
728c	$ 2,525,012	$ 132,926	$ 1,028,195	$ 278,619	8,646	$ 32.23	$ 15.37	$ 118.93	5.9	0.4
728d	$ 2,525,012	$ 132,926	$ 1,054,450	$ 278,619	8,646	$ 32.23	$ 15.37	$ 121.96	5.9	0.4
784	$ 1,850,152	$ 110,771	$ 198,252	$ 247,461	8,064	$ 30.69	$ 13.74	$ 24.58	2.0	1.0
805	$ 8,046,233	$ 376,494	$ 3,224,766	$ 848,317	65,592	$ 12.93	$ 5.74	$ 49.16	11.8	0.9
806	$ 9,831,649	$ 492,638	$ 4,832,817	$ 1,070,708	203,409	$ 5.26	$ 2.42	$ 23.76	11.8	2.8
808	$ 13,910,487	$ 651,551	$ 9,055,768	$ 1,363,202	57,770	$ 23.60	$ 11.28	$ 156.75	11.8	2.8
809	$ 10,249,831	$ 462,770	$ 1,975,918	$ 1,105,143	30,538	$ 36.19	$ 15.15	$ 64.70	11.8	1.4
810	$ 4,250,520	$ 229,236	$ 3,142,274	$ 429,523	40,135	$ 10.70	$ 5.71	$ 78.29	3.0	1.0
824	$ 1,833,448	$ 133,358	$ 261,023	$ 213,078	3,129	$ 68.09	$ 42.62	$ 83.41	2.0	1.0
904	$ 2,251,648	$ 141,864	$ 148,714	$ 291,543	7,207	$ 40.45	$ 19.69	$ 20.64	5.9	1.4
905	$ 1,941,306	$ 137,474	$ 1,447,728	$ 221,441	3,999	$ 55.38	$ 34.38	$ 362.05	2.0	1.0
906	$ 2,134,862	$ 133,405	$ 1,727,663	$ 250,215	4,172	$ 59.97	$ 31.97	$ 414.09	2.0	1.0
915a	$ 15,055,551	$ 640,270	$ 2,423,575	$ 1,603,158	87,884	$ 18.24	$ 7.29	$ 27.58	11.8	1.8
915b	$ 15,055,551	$ 640,270	$ 2,423,575	$ 1,603,158	87,884	$ 18.24	$ 7.29	$ 27.58	11.8	1.8

TABLE 3-6c. SUMMARY OF BASELINE COSTS FOR GOVERNMENT INCINERATORS

Site ID	Capital Cost ($)	Fixed O&M Annual Cost ($)	Variable O&M Annual Cost ($)	Annualized Capital Cost ($)	HW Feed (ton/yr)	Annualized Capital Cost ($/ton/yr)	Fixed O&M Annual Cost ($/ton/yr)	Variable O&M Annual Cost ($/ton/yr)	Empl per Comb Sys	Empl per Facility (EPA ID)
347	$ 8,446,666	$ 452,794	$ 2,199,380	$ 901,688	50,216	$ 17.96	$ 9.02	$ 43.80	11.8	2.8
349a	$ 3,518,170	$ 183,867	$ 1,535,559	$ 387,172	4,828	$ 80.19	$ 38.08	$ 318.05	5.9	0.7
349b	$ 3,518,170	$ 183,867	$ 1,535,559	$ 387,172	4,828	$ 80.19	$ 38.08	$ 318.05	5.9	0.7
351	$ 3,248,949	$ 172,203	$ 524,019	$ 363,260	820	$ 442.82	$ 209.92	$ 638.79	5.9	0.7
357	$ 7,903,779	$ 443,819	$ 2,419,714	$ 775,898	11,863	$ 65.41	$ 37.41	$ 203.98	11.8	2.8
503	$ 3,376,357	$ 198,480	$ 352,971	$ 383,019	8,278	$ 46.27	$ 23.98	$ 42.64	5.9	1.4
727	$ 2,515,855	$ 144,614	$ 312,449	$ 284,257	368	$ 773.00	$ 393.26	$ 849.66	5.9	0.7

TABLE 3-6d. SUMMARY OF BASELINE COSTS FOR CEMENT KILNS

Site ID	Capital Cost ($)	Fixed O&M Annual Cost ($)	Variable O&M Annual Cost ($)	Annualized Capital Cost ($)	Primary Fuel Credit ($/yr)	HW Feed (ton/yr)	Annualized Capital Cost ($/ton/yr)	Fixed O&M Annual Cost ($/ton/yr)	Variable O&M Annual Cost ($/ton/yr)	Primary Fuel Credit ($/ton/yr)	HW Burning Penalty ($/ton/yr)	Empl per Comb Sys	Empl per Facility (EPA ID)
200	$ 2,617,827	$411,087	$ 2,044,110	$ 300,378	$(1,217,364)	50,088	$ 6.00	$ 8.21	$ 40.81	$ (24.30)	$ 11.39	3.0	1.2
201	$ 2,582,880	$409,690	$ 2,361,592	$ 295,641	$(1,149,671)	50,747	$ 5.83	$ 8.07	$ 46.54	$ (22.65)	$ 16.72	3.0	1.2
202	$ 4,006,988	$615,527	$ 2,373,578	$ 436,833	$(1,697,615)	62,434	$ 7.00	$ 9.86	$ 38.02	$ (27.19)	$ 11.39	15.8	5.0
203	$ 3,429,787	$592,439	$ 1,716,732	$ 378,339	$(1,023,807)	46,679	$ 8.11	$ 12.69	$ 36.78	$ (21.93)	$ 3.23	15.8	5.0
204	$ 5,547,258	$677,138	$ 2,738,607	$ 601,529	$(4,988,879)	153,439	$ 3.92	$ 4.41	$ 17.85	$ (32.51)	$ 3.23	15.8	5.0
205	$ 2,852,901	$470,115	$ 1,398,715	$ 322,787	$(1,170,068)	39,595	$ 8.15	$ 11.87	$ 35.33	$ (29.55)	$ 16.72	5.9	2.5
206	$ 4,254,438	$526,176	$ 2,619,377	$ 471,879	$(2,420,620)	102,293	$ 4.61	$ 5.14	$ 25.61	$ (23.66)	$ 11.39	7.9	2.5
207	$ 2,267,271	$446,690	$ 841,888	$ 262,828	$ (589,498)	21,933	$ 11.98	$ 20.37	$ 38.38	$ (26.88)	$ 16.72	3.9	2.5
208	$ 3,464,310	$494,571	$ 1,766,108	$ 386,207	$(1,688,965)	62,841	$ 6.15	$ 7.87	$ 28.10	$ (26.88)	$ 11.39	7.9	2.5
228	$ 4,526,705	$503,984	$ 2,163,470	$ 508,650	$(2,860,379)	111,878	$ 4.55	$ 4.50	$ 19.34	$ (25.57)	$ 3.23	3.9	1.7
300	$ 3,561,703	$498,467	$ 2,132,865	$ 400,320	$(1,383,224)	60,768	$ 6.59	$ 8.20	$ 35.10	$ (22.76)	$ 16.72	5.9	2.5
302a	$ 3,134,895	$481,394	$ 917,109	$ 362,096	$(1,280,053)	48,376	$ 7.48	$ 9.95	$ 18.96	$ (26.46)	$ 3.23	3.9	2.5
302b	$ 3,134,895	$481,394	$ 917,109	$ 362,096	$(1,280,053)	48,376	$ 7.48	$ 9.95	$ 18.96	$ (26.46)	$ 3.23	3.9	2.5
303	$ 4,802,670	$647,354	$ 3,464,397	$ 521,111	$(2,236,966)	96,389	$ 5.41	$ 6.72	$ 35.94	$ (23.21)	$ 16.72	15.8	5.0
304	$ 4,684,195	$642,615	$ 3,676,550	$ 515,210	$(3,057,835)	101,012	$ 5.10	$ 6.36	$ 36.40	$ (30.27)	$ 11.39	15.8	5.0
305	$ 3,030,323	$477,212	$ 1,596,683	$ 338,779	$(1,377,879)	44,304	$ 7.65	$ 10.77	$ 36.04	$ (31.10)	$ 16.72	7.9	2.5
318a	$ 3,340,364	$439,989	$ 1,645,850	$ 378,510	$(1,655,612)	61,600	$ 6.14	$ 7.14	$ 26.72	$ (26.88)	$ 12.68	3.0	1.2
318b	$ 3,340,364	$439,989	$ 1,645,850	$ 378,510	$(1,655,612)	61,600	$ 6.14	$ 7.14	$ 26.72	$ (26.88)	$ 12.68	3.0	1.2
318c	$ 3,340,364	$439,989	$ 1,645,850	$ 378,510	$(1,655,612)	61,600	$ 6.14	$ 7.14	$ 26.72	$ (26.88)	$ 12.68	3.0	1.2
319	$ 3,416,154	$591,894	$ 3,000,467	$ 376,519	$(2,682,527)	105,600	$ 3.57	$ 5.61	$ 28.41	$ (25.40)	$ 16.72	15.8	5.0
320	$ 3,555,703	$597,476	$ 3,867,563	$ 385,017	$(1,254,036)	49,971	$ 7.70	$ 11.96	$ 77.40	$ (25.10)	$ 53.54	15.8	5.0
321	$ 3,710,227	$603,656	$ 2,209,768	$ 402,293	$(1,502,034)	56,665	$ 7.10	$ 10.65	$ 39.00	$ (26.51)	$ 16.72	15.8	5.0
322	$ 2,985,943	$475,436	$ 1,487,136	$ 342,054	$(1,100,951)	44,566	$ 7.68	$ 10.67	$ 33.37	$ (24.70)	$ 16.72	3.9	2.5
323	$ 3,224,731	$484,988	$ 1,455,589	$ 366,654	$(1,307,422)	54,400	$ 6.74	$ 8.92	$ 26.76	$ (24.03)	$ 11.39	3.9	2.5
335	$ 2,326,127	$449,044	$ 746,037	$ 267,569	$ (564,068)	22,867	$ 11.70	$ 19.64	$ 32.62	$ (24.67)	$ 11.39	3.9	2.5
401	$ 3,438,662	$493,545	$ 2,054,921	$ 385,599	$(1,386,271)	54,771	$ 7.04	$ 9.01	$ 37.52	$ (25.31)	$ 16.72	5.9	2.5
402	$ 3,033,684	$477,346	$ 1,346,453	$ 339,777	$ (919,178)	38,817	$ 8.75	$ 12.30	$ 34.69	$ (23.68)	$ 11.39	5.9	2.5
403	$ 4,931,214	$520,164	$ 2,602,362	$ 551,965	$(2,784,482)	133,440	$ 4.14	$ 3.90	$ 19.50	$ (20.87)	$ 3.23	3.9	1.7
404	$ 3,932,389	$480,211	$ 2,312,425	$ 441,953	$(2,250,048)	80,765	$ 5.47	$ 5.95	$ 28.63	$ (27.86)	$ 11.39	3.9	1.7
473	$ 2,986,962	$425,853	$ 1,030,354	$ 339,523	$(1,542,205)	61,600	$ 5.51	$ 6.91	$ 16.73	$ (25.04)	$ 3.23	3.0	1.2
491	$ 3,835,931	$509,436	$ 2,473,016	$ 429,919	$(1,644,764)	72,258	$ 5.95	$ 7.05	$ 34.22	$ (22.76)	$ 16.72	5.9	2.5
680	$ 2,671,960	$413,253	$ 1,570,204	$ 305,649	$(1,270,499)	50,747	$ 6.02	$ 8.14	$ 30.94	$ (25.04)	$ 16.72	3.0	1.2
681	$ 2,653,883	$412,530	$ 1,535,773	$ 304,772	$(1,270,599)	50,751	$ 6.01	$ 8.13	$ 30.26	$ (25.04)	$ 16.72	2.0	1.2

TABLE 3-6e. SUMMARY OF BASELINE COSTS FOR LIGHTWEIGHT AGGREGATE KILNS

Site ID	Capital Cost ($)	Fixed O&M Annual Cost ($)	Variable O&M Annual Cost ($)	Annualized Capital Cost ($)	Primary Fuel Credit ($/yr)	HW Feed (ton/yr)	Annualized Capital Cost ($/ton/yr)	Fixed O&M Annual Cost ($/ton/yr)	Variable O&M Annual Cost ($/ton/yr)	Primary Fuel Credit ($/ton/yr)	Empl per Comb Sys	Empl per Facility (EPA ID)
225	$ 2,276,312	$ 565,880	$ 453,722	$ 261,687	$ (520,572)	16,247	$ 16.11	$ 34.83	$ 27.93	$ (32.04)	6.6	4.8
307	$ 2,766,651	$ 488,705	$ 495,018	$ 314,260	$ (631,510)	26,585	$ 11.82	$ 18.38	$ 18.62	$ (23.75)	3.3	2.4
311	$ 1,826,501	$ 418,836	$ 237,853	$ 212,990	$ (308,356)	10,603	$ 20.09	$ 39.50	$ 22.43	$ (29.08)	2.2	1.6
312	$ 1,880,821	$ 421,009	$ 254,701	$ 220,044	$ (469,329)	12,057	$ 18.25	$ 34.92	$ 21.12	$ (38.92)	2.2	1.6
313	$ 1,902,466	$ 454,137	$ 288,706	$ 223,138	$ (440,080)	11,678	$ 19.11	$ 38.89	$ 24.72	$ (37.68)	3.3	2.4
314	$ 2,008,970	$ 458,398	$ 318,533	$ 234,466	$ (624,203)	14,426	$ 16.25	$ 31.78	$ 22.08	$ (43.27)	3.3	2.4
336	$ 1,605,696	$ 410,004	$ 192,597	$ 189,363	$ (213,744)	6,798	$ 27.85	$ 60.31	$ 28.33	$ (31.44)	2.2	1.6
479	$ 2,485,474	$ 477,458	$ 414,432	$ 284,642	$ (592,809)	20,085	$ 14.17	$ 23.77	$ 20.63	$ (29.52)	3.3	2.4

TABLE 3-7. SITE-SPECIFIC INPUT CHARACTERISTICS FOR BASELINE COSTS

Site ID	Facility Type	Location	System Type	Existing APCD Sys	WHB	Flow, acfm (APCD T)	Flow, dscfm	Stk Temp, F	Stk H2O, Fraction	Stk O2, Fraction	Waste Capacity, lbs/hr	Natural Gas	Fuel Oil	Coal	None	Estimated Total Heat Input (INCs), MMBtu/hr	Total Heat Input, MMBtu/hr	Natural Gas Heat Input, MMBtu/hr
200	CK	STACK	Rotary Kiln	FF	No	159,449	66,867	427	0.28	0.10	13539			COAL			159.4	
201	CK	STACK	Rotary Kiln	FF	No	200,314	78,059	425	0.30	0.10	16493			COAL			172.7	
202	CK	STACK	Rotary Kiln	FF	No	309,540	199,344	272	0.06	0.17	20291			COAL			238.4	
203	CK	STACK	Rotary Kiln	ESP	No	305,036	117,978	387	0.31	0.08	18373			COAL			243.4	
204	CK	STACK	Rotary Kiln	ESP	No	930,667	320,470	506	0.30	0.08	56706			COAL			1152.4	
205	CK	STACK	Rotary Kiln	ESP	No	217,931	82,108	408	0.36	0.06	21182			COAL			308.6	
206	CK	STACK	Rotary Kiln	ESP	No	441,663	163,100	413	0.37	0.07	33245			COAL			541.5	
207	CK	STACK	Rotary Kiln	MC/ESP	No	90,744	44,085	313	0.25	0.11	7128			COAL			145.8	
208	CK	STACK	Rotary Kiln	ESP	No	300,031	139,707	304	0.29	0.10	20423			COAL			372.0	
209	CINC	STACK	Liquid Injection	WHB/FF/VQ/PT/DM	Yes	33,615	15,102	152	0.27	0.10	13200		FUEL OIL			47.8	149.8	
210	CINC	STACK	Rotary Kiln	SD/FF/PT	No	106,050	47,835	162	0.27	0.14	30978	NATURAL GAS				102.0	286.0	20.40
211	CINC	STACK	Rotary Kiln	SD/FF/PT	No	61,261	26,975	156	0.28	0.16	8552	NATURAL GAS				41.1	129.5	8.22
212	CINC	STACK	Rotary Kiln	SD/FF/PT	No	60,338	25,438	158	0.31	0.15	14820	NATURAL GAS				41.4	86.0	8.28
214	CINC	STACK	Rotary Kiln	Q/IWS	No	33,900	29,593	111	0.06	0.11	26532	NATURAL GAS				88.5	218.0	17.70
216	CINC	STACK	Rotary Kiln	HES/WS	No	47,879	37,242	81	0.03	0.09	5812	NATURAL GAS				122.8	68.0	24.56
222	CINC	STACK	Rotary Kiln	WHB/SD/CI/ESP/Q/PBS	Yes	125,299	55,315	193	0.28	0.13	33063			COAL		119.4	238.0	
225	LWAK	STACK	Rotary Kiln	FF	No	43,624	22,646	302	0.14	0.13	4431				NONE		48.9	
228	CK	STACK	Rotary Kiln	ESP	No	182,964	74,328	433	0.34	0.09	53591			COAL			440.4	
229	INC	STACK	Liquid Injection	WHB/ACS/HCS/CS	Yes	1,568	817	163	0.36	0.05	1036	NATURAL GAS				3.8	4.6	1.00
300	CK	STACK	Rotary Kiln	ESP	No	224,674	85,588	332	0.23	0.12	19750			COAL			267.3	
302a	CK	STACK	Rotary Kiln	ESP	No	53,603	20,830	356	0.38	0.10	19674				NONE		155.3	
302b	CK	STACK	Rotary Kiln	ESP	No	53,603	20,830	356	0.38	0.10	19674				NONE		155.3	
303	CK	STACK-Combined	Rotary Kiln	QC/FF	No	410,765	277,656	222	0.14	0.12	31328			COAL			556.8	
304	CK	STACK	Rotary Kiln	ESP	No	371,072	129,350	529	0.32	0.06	32642			COAL			600.7	
305	CK	STACK	Rotary Kiln	ESP	No	330,138	135,343	406	0.09	0.12	14399			COAL			204.0	
307	LWAK	STACK	Rotary Kiln	FF/VS	No	73,106	36,609	138	0.16	0.15	8640				NONE		59.4	
311	LWAK	STACK	Rotary Kiln	FF	No	55,818	31,744	346	0.06	0.17	3446				NONE		29.0	
312	LWAK	STACK	Rotary Kiln	FF	No	48,936	26,629	352	0.12	0.15	3919				NONE		44.1	
313	LWAK	STACK	Rotary Kiln	FF	No	39,414	21,356	342	0.10	0.15	3795				NONE		41.4	
314	LWAK	STACK	Rotary Kiln	FF	No	42,364	22,507	338	0.11	0.15	4060				NONE		58.7	
318a	CK	STACK	Rotary Kiln	ESP	No	163,846	59,882	366	0.39	0.06	20020			COAL			377.3	
318b	CK	STACK	Rotary Kiln	ESP	No	163,846	59,882	366	0.39	0.06	20020			COAL			377.3	
318c	CK	STACK	Rotary Kiln	ESP	No	163,846	59,882	366	0.39	0.06	20020			COAL			377.3	
319	CK	STACK	Rotary Kiln	ESP	No	353,253	122,147	511	0.34	0.05	34320			COAL			578.9	
320	CK	STACK	Rotary Kiln	FF	No	469,675	254,332	353	0.06	0.10	16241			COAL			418.2	
321	CK	STACK-Combined	Rotary Kiln	ESP	No	413,638	246,000	263	0.18	0.14	18416			COAL			346.0	
322	CK	STACK	Rotary Kiln	ESP	No	94,958	42,108	329	0.30	0.09	14484				NONE		133.6	
323	CK	STACK	Rotary Kiln	ESP	No	135,689	53,095	395	0.35	0.08	22049			COAL			245.0	
324	CINC	STACK	Two Chamber	WHB	Yes	12,083	6,139	438	0.14	0.12	854	NATURAL GAS				15.5	7.43	3.10
325	CINC	STACK	Rotary Kiln	SD/FF/WS/IWS	No	40,556	22,188	96	0.05	0.13	13573	NATURAL GAS				48.0	113.3	15.00
327	CINC	STACK	Rotary Kiln	SD/FF/WS/WESP	No	60,060	26,086	149	0.25	0.10	100461		FUEL OIL			82.0	251.2	
331	CINC	STACK	Rotary Kiln	Q/PT/IWS/DM	No	50,510	35,856	122	0.11	0.11	24000		FUEL OIL			100.7	192.0	
333a	CINC	STACK	Rotary Kiln	SD/FF	No	44,438	15,859	361	0.42	0.12	19116		FUEL OIL			42.5	130.1	
333b	CINC	STACK	Rotary Kiln	SD/FF	No	44,438	15,859	361	0.42	0.12	19116		FUEL OIL			42.5	130.1	
334	INC	STACK	Rotary Kiln	WHB/Q/WS/WESP/PT/WS	Yes	50,078	39,235	76	0.02	0.14	23554	NATURAL GAS				79.5	254.9	15.90
335	CK	STACK	Rotary Kiln	ESP	No	122,399	56,417	377	0.23	0.11	7432			COAL			165.3	
336	LWAK	STACK	Rotary Kiln	FF	No	53,770	28,742	366	0.12	0.16	2209				NONE		20.1	
337a	INC	STACK	Two Chamber	WHB/DA/DI/FF	Yes	16,232	9,160	326	0.08	0.16	1976	NATURAL GAS				11.8	23.4	9.56
337b	INC	STACK	Two Chamber	WHB/DA/DI/FF	Yes	16,232	9,160	326	0.08	0.16	1976	NATURAL GAS				11.8	23.4	9.56
338	INC	STACK	Rotary Kiln	QC/FF/SS/C/HES/DM	No	94,375	43,482	166	0.24	0.10	36870	NATURAL GAS				130.7	279.1	16.00
340	INC	STACK	Fluidized Bed	WHB/ESP/WS	Yes	23,745	9,478	160	0.31	0.08	6629		FUEL OIL			34.8	43.1	
342	INC	STACK	Rotary Kiln	WHB/QC/S/VS/DM	Yes	6,559	5,084	115	0.03	0.12	2000	NATURAL GAS				12.8	16.8	2.57
347	GOV	STACK	Rotary Kiln	C/QT/VS/PBS/DM	No	24,121	10,373	238	0.48	0.09	16320		FUEL OIL			34.5	101.9	

TABLE 3-7. SITE-SPECIFIC INPUT CHARACTERISTICS FOR BASELINE COSTS

Site ID	Fuel Oil Heat Input, MMBtu/hr	Coal Heat Input, MMBtu/hr	Total Waste Heat Input, MMBtu/hr	HW Feed, lb/h	Tot-HW Feed, ton/yr	Liquid HW Feed, Fraction	Sludge HW Feed, Fraction	Solid HW Feed, Fraction	Liquid HW Heating Value, Btu/lb	Sludge HW Heating Value, Btu/lb	Solid HW Heating Value, Btu/lb	Fuel Oil Ash, Fraction	Coal Ash, Fraction	Waste Ash, Fraction	HW Feed Penalty, $/ton HWDF	ExisAPCDs Capital cost	ExisAPCDs Annualized capital cost ($/yr)	ExisAPCDs Fixed annual O&M costs ($/yr)
200		11.70	147.74	12,522	50,088	0.14	0.00	0.86	13047	12867	11602		0.00	0.00	11.39	$ 1,420,163	$ 125,380	$ 216,752
201		33.15	139.52	12,687	50,747	0.11	0.00	0.89	13047	12867	10756		0.00	0.00	16.72	$ 1,766,651	$ 155,857	$ 243,638
202		32.37	206.02	15,608	62,434	0.70	0.00	0.30	14983	12867	9102		0.03	0.01	11.39	$ 2,740,993	$ 241,891	$ 317,428
203		119.17	124.25	11,670	46,679	0.50	0.00	0.50	13047	12867	8247		0.00	0.00	3.23	$ 5,330,088	$ 503,129	$ 317,712
204		547.00	605.45	38,360	153,439	1.00	0.00	0.00	15783	12867	8247		0.04	0.00	3.23	$ 13,651,126	$ 1,288,591	$ 710,797
205		166.64	142.00	9,899	39,595	1.00	0.00	0.00	14345	12867	8247		0.04	0.00	16.72	$ 4,014,344	$ 378,931	$ 255,557
206		247.77	293.76	25,573	102,293	1.00	0.00	0.00	11487	12867	8247		0.04	0.00	11.39	$ 7,282,068	$ 687,377	$ 409,924
207		74.25	71.54	5,483	21,933	1.00	0.00	0.00	13047	12867	8247		0.00	0.00	16.72	$ 2,119,701	$ 200,085	$ 166,054
208		167.08	204.97	15,710	62,841	1.00	0.00	0.00	13047	12867	8247		0.00	0.00	11.39	$ 5,256,258	$ 496,151	$ 314,225
209	9.56		140.26	12,840	51,360	1.00	0.00	0.00	10924	6269	6544	0.00		0.03		$ 998,347	$ 118,794	$ 383,505
210			265.63	30,094	120,375	0.46	0.19	0.36	11574	10014	4695			0.27		$ 2,764,834	$ 303,363	$ 450,776
211			121.28	8,428	33,712	1.00	0.00	0.00	14391	6269	6544			0.12		$ 1,683,410	$ 188,488	$ 386,697
212			77.74	14,626	58,504	0.19	0.08	0.72	12891	9442	2823			0.72		$ 1,757,019	$ 196,551	$ 390,651
214			200.28	22,778	91,112	0.63	0.06	0.32	8956	5480	9077			0.00		$ 1,190,883	$ 159,715	$ 167,632
216			43.48	5,743	22,972	0.49	0.19	0.32	8763	6269	6544			0.10		$ 921,488	$120,343	$ 261,795
222		9.41	228.56	27,730	110,919	0.91	0.07	0.02	8429	6269	6544		0.00	0.03		$ 5,140,981	$ 549,338	$ 576,970
225			48.93	4,062	16,247	1.00	0.00	0.00	12046					0.00		$ 305,424	$ 26,458	$ 135,242
228		93.28	347.13	27,969	111,878	0.81	0.00	0.19	13543	12867	7609		0.00	0.00	3.23	$ 3,464,008	$ 326,980	$ 229,559
229			3.63	880	3,521	1.00	0.00	0.00	4123	6269	6544			0.00		$ 233,188	$ 26,507	$ 120,451
300		99.48	167.87	15,192	60,768	0.86	0.00	0.14	11653	12867	7291		0.00	0.00	16.72	$ 4,118,816	$ 388,790	$ 260,492
302a			155.35	12,094	48,376	1.00	0.00	0.00	12845	12867	8247			0.00	3.23	$ 1,523,299	$ 143,790	$ 137,880
302b			155.35	12,094	48,376	1.00	0.00	0.00	12845	12867	8247			0.00	3.23	$ 1,523,299	$ 143,790	$ 137,880
303		285.30	271.48	24,097	96,389	0.90	0.00	0.10	11412	12867	9954		0.00	0.00	16.72	$ 9,565,736	$ 891,393	$ 924,457
304		229.61	371.10	25,253	101,012	0.55	0.00	0.45	16800	12867	12160		0.06	0.05	11.39	$ 6,287,649	$ 593,507	$ 362,947
305		36.77	167.22	11,076	44,304	1.00	0.00	0.00	15097	12867	8247		0.09	0.01	16.72	$ 5,697,572	$ 537,807	$ 335,072
307			59.35	6,646	26,585	0.94	0.00	0.06	9550					0.00		$ 1,220,981	$ 133,792	$ 323,826
311			28.98	2,651	10,603	1.00	0.00	0.00	10933					0.00		$ 381,175	$ 32,944	$ 142,159
312			44.11	3,014	12,057	1.00	0.00	0.00	14633					0.00		$ 338,317	$ 29,272	$ 138,251
313			41.36	2,920	11,678	1.00	0.00	0.00	14167					0.00		$ 279,471	$ 24,237	$ 132,862
314			58.67	3,606	14,426	1.00	0.00	0.00	16267					0.00		$ 297,648	$ 25,792	$ 134,530
318a		176.33	200.92	15,400	61,600	1.00	0.00	0.00	13047	12867	8247		0.00	0.00	12.68	$ 3,156,228	$ 297,923	$ 215,020
318b		176.33	200.92	15,400	61,600	1.00	0.00	0.00	13047	12867	8247		0.00	0.00	12.68	$ 3,156,228	$ 297,923	$ 215,020
318c		176.33	200.92	15,400	61,600	1.00	0.00	0.00	13047	12867	8247		0.00	0.00	12.68	$ 3,156,228	$ 297,923	$ 215,020
319		253.38	325.55	26,400	105,600	0.34	0.60	0.06	12414	12867	6805		0.11	0.05	16.72	$ 6,032,108	$ 569,385	$ 350,876
320		266.02	152.19	12,493	49,971	1.00	0.00	0.00	12182	12867	8247		0.00	0.00	53.54	$ 4,296,375	$ 380,003	$ 430,687
321		163.67	182.29	14,166	56,665	1.00	0.00	0.00	12868	12867	8247		0.00	0.00	16.72	$ 13,780,995	$ 1,300,845	$ 782,852
322			133.61	11,141	44,566	0.98	0.00	0.02	12089	12867	7672			0.00	16.72	$ 2,180,957	$ 205,865	$ 168,948
323		86.38	158.67	13,600	54,400	0.99	0.00	0.01	11701	12867	7899		0.00	0.00	11.39	$ 2,692,317	$ 254,139	$ 193,105
324			4.33	622	2,488	0.00	0.00	1.00	8763	6269	6968			0.00		$ -	$ -	$ -
325			98.27	10,899	43,596	0.44	0.26	0.30	11814	7168	6544			0.18		$ 2,593,141	$ 320,424	$ 506,762
327	3.79		247.43	41,126	164,504	0.56	0.05	0.39	6736	6269	4949			0.00		$ 3,458,212	$ 358,130	$ 537,453
331	20.15		171.81	22,694	90,775	0.49	0.19	0.32	8763	6269	6544	0.01		0.10		$ 1,850,268	$ 252,399	$ 280,215
333a	8.50		121.61	19,116	76,465	0.17	0.07	0.76	3770	10467	6544	0.01		0.00		$ 651,143	$ 64,293	$ 220,688
333b	8.50		121.61	19,116	76,465	0.17	0.07	0.76	3770	10467	6544	0.01		0.00		$ 651,143	$ 64,293	$ 220,688
334			239.03	22,466	89,863	0.20	0.10	0.70	10979	10994	10493			0.00		$ 2,148,487	$ 224,847	$ 278,420
335		96.89	68.45	5,717	22,867	1.00	0.00	0.00	11974	12867	8247		0.11	0.03	11.39	$ 2,557,624	$ 241,422	$ 186,742
336			20.09	1,700	6,798	1.00	0.00	0.00	11820					0.00		$ 368,392	$ 31,847	$ 140,995
337a			13.81	1,840	7,359	0.00	0.00	1.00	8763	6269	7509			0.02		$ 146,332	$ 13,051	$ 186,193
337b			13.81	1,840	7,359	0.00	0.00	1.00	8763	6269	7509			0.02		$ 146,332	$ 13,051	$ 186,193
338			263.11	33,798	135,190	0.59	0.21	0.21	8763	6269	6544			0.13		$ 1,467,564	$ 159,854	$ 341,131
340	6.95		36.18	6,594	26,375	0.05	0.60	0.35	12448	1956	10599	0.00		0.43		$ 1,389,274	$ 144,912	$ 241,831
342			14.24	1,530	6,118	0.49	0.19	0.32	12332	6269	6544			0.00		$ 396,399	$ 49,023	$ 236,868
347	6.90		95.04	12,554	50,216	0.49	0.19	0.32	8763	6269	6544	0.01		0.05		$ 637,873	$ 81,747	$ 248,395

TABLE 3-7. SITE-SPECIFIC INPUT CHARACTERISTICS FOR BASELINE COSTS

Site ID	ExisAPCDs Variable annual O&M costs ($/ton/yr)	#Comb Sys per EPA ID	(Waste Heat Input)/ (Total Heat Input), CKs Only	#Tested Units per EPA ID
200	$ 3	4	0.91	4
201	$ 3	4	0.81	4
202	$ 5	1	0.86	1
203	$ 4	1	0.56	1
204	$ 4	1	0.56	1
205	$ 4	2	0.58	2
206	$ 3	2	0.54	2
207	$ 3	2	0.49	2
208	$ 3	2	0.55	2
209	$ 108	1		1
210	$ 61	3		3
211	$ 123	3		3
212	$ 92	3		3
214	$ 119	1		1
216	$ 56	1		1
222	$ 121	1		1
225	$ 2	1		1
228	$ 1	3	0.85	3
229	$ 445	1		1
300	$ 3	2	0.63	2
302a	$ 1	2	1.00	1
302b	$ 1	2	1.00	1
303	$ 9	1	0.49	1
304	$ 2	1	0.62	1
305	$ 5	2	0.82	2
307	$ 36	2		2
311	$ 5	3		3
312	$ 4	3		3
313	$ 3	2		2
314	$ 3	2		2
318a	$ 2	4	0.05	2
318b	$ 2	4	0.05	2
318c	$ 2	4	0.05	2
319	$ 2	1	0.56	1
320	$ 9	1	0.36	1
321	$ 11	1	0.53	1
322	$ 2	2	1.00	2
323	$ 2	2	0.70	2
324	$ -	1		1
325	$ 254	1		1
327	$ 39	1		1
331	$ 106	1		1
333a	$ 13	3		2
333b	$ 13	3		2
334	$ 18	1		1
335	$ 4	2	0.41	2
336	$ 7	3		3
337a	$ 3	2		1
337b	$ 3	2		1
338	$ 5	1		1
340	$ 14	1		1
342	$ 38	1		1
347	$ 16	1		1

TABLE 3-7. SITE-SPECIFIC INPUT CHARACTERISTICS FOR BASELINE COSTS

Site ID	Facility Type	Location	System Type	Existing APCD Sys	WHB	Flow, acfm (APCDT)	Flow, dscfm	Stk Temp, F	Stk H2O, Fraction	Stk O2, Fraction	Waste Capacity, lbs/hr	Natural Gas	Fuel Oil	Coal	None	Estimated Total Heat Input (INCs), MMBtu/hr	Total Heat Input, MMBtu/hr	Natural Gas Heat Input, MMBtu/hr
348	INC	STACK	Liquid Injection	QC/AS/IWS	No	8,031	6,227	92	0.05	0.12	3213		FUEL OIL			15.4	31.1	
349a	GOV	STACK	Rotary Kiln	QC/FF/QC/PT	No	7,171	2,589	191	0.45	0.14	251	NATURAL GAS				5.1	8.6	1.02
349b	GOV	STACK	Rotary Kiln	QC/FF/QC/PT	No	7,171	2,589	191	0.45	0.14	251	NATURAL GAS				5.1	8.6	1.02
350	INC	STACK	Liquid Injection	WHB/HE/FF	Yes	17,936	9,477	332	0.14	0.08	11586	NATURAL GAS				36.6	64.8	7.32
351	GOV	STACK	Rotary Kiln	GC/C/FF	No	4,455	2,988	206	0.07	0.15	300		FUEL OIL			5.3	6.7	
353	INC	STACK	Rotary Kiln	QC/VS/DM/WESP	No	43,035	33,627	97	0.02	0.11	28401		FUEL OIL			95.6	79.2	
354	INC	STACK	Rotary Kiln	QC/AS/VS/DM/IWS	No	38,770	25,350	140	0.18	0.11	18264		FUEL OIL			75.3	129.2	
357	GOV	STACK	Rotary Kiln	QC/VS/PT/IWS	No	20,868	9,394	176	0.45	0.12	3020	NATURAL GAS				24.2	29.0	4.83
358a	INC	STACK	Liquid Injection	QC/VS/C/CT/S/DM	No	13,957	5,730	181	0.49	0.07	8708	NATURAL GAS				23.7	31.5	4.74
358b	INC	STACK	Liquid Injection	QC/VS/C/CT/S/DM	No	13,957	5,730	181	0.49	0.07	8708	NATURAL GAS				23.7	31.5	4.74
358c	INC	STACK	Liquid Injection	QC/VS/C/CT/S/DM	No	13,957	5,730	181	0.49	0.07	8708	NATURAL GAS				23.7	31.5	4.74
359	CINC	STACK	Rotary Kiln	WHB/FF/S	Yes	22,954	11,915	138	0.16	0.13	3590	NATURAL GAS				26.4	27.2	5.28
401	CK	STACK	Rotary Kiln	ESP	No	209,574	101,823	266	0.23	0.13	25905			COAL			249.5	
402	CK	STACK-MAIN	Rotary Kiln	ESP	No	218,790	123,677	287	0.21	0.05	24122			COAL			183.2	
403	CK	STACK	Rotary Kiln	ESP	No	232,104	88,720	413	0.40	0.07	43368			COAL			442.2	
404	CK	STACK	Rotary Kiln	ESP	No	278,775	93,818	489	0.38	0.04	27606			COAL			454.6	
473	CK	STACK	Rotary Kiln	ESP	No	170,156	61,500	367	0.40	0.06	20020			COAL			199.2	
477	INC	STACK	Liquid Injection	QT/PT/VS/DM	No	42,926	16,480	182	0.52	0.07	28963	NATURAL GAS				66.9	221.0	50.39
478	INC	STACK	Liquid Injection	QT/QS/VS/ES/DM	No	38,317	12,330	187	0.60	0.06	30763	NATURAL GAS				54.5	144.4	10.90
479	LWAK	STACK	Rotary Kiln	MC/HE/FF/VS/DM	No	59,638	30,589	139	0.16	0.15	6971		FUEL OIL				166.3	
480a	INC	STACK	Rotary Kiln	QC/HS	No	47,765	17,143	186	0.55	0.06	7392	NATURAL GAS				72.6	57.6	14.52
480b	INC	STACK	Rotary Kiln	QC/HS	No	47,765	17,143	186	0.55	0.06	7392		FUEL OIL			72.6	57.6	
486	CINC	STACK	Rotary Kiln	VQ/C/PT/ES	No	28,819	17,214	168	0.25	0.07	15946	NATURAL GAS				68.4	112.1	13.67
487	CINC	STACK	Rotary Kiln	WS	No	57,638	34,429	168	0.25	0.07	31892	NATURAL GAS				136.7	224.2	27.35
490	INC	STACK	Rotary Kiln	SS/PBS	No	26,532	17,214	168	0.25	0.07	14316	NATURAL GAS				68.4	130.5	13.67
491	CK	STACK	Rotary Kiln	ESP	No	220,753	92,067	381	0.30	0.09	19750			COAL			299.1	
503	GOV	STACK	Rotary Kiln	Q/C/FF	No	4,864	3,265	236	0.05	0.16	2169		FUEL OIL			4.2	18.1	
504	INC	STACK	Fluidized Bed	VS/C	No	32,629	16,106	171	0.41	0.13	8779		FUEL OIL			37.7	32.2	
600	INC	STACK	Rotary Kiln	WHB/QC/PT/IWS	Yes	38,510	23,584	148	0.23	0.08	19942	NATURAL GAS				86.5	139.2	17.29
601	CINC	STACK	Rotary Kiln	WHB/DS/FF/WS	Yes	133,763	48,112	168	0.45	0.09	86926	NATURAL GAS				159.0	477.9	31.80
603	CINC	STACK	Rotary Kiln	QT/S/IWS	No	64,931	42,423	137	0.20	0.07	37315		FUEL OIL			169.7	285.5	
609	CINC	STACK	Rotary Kiln	SS/PT/VS/DM	No	104,834	81,705	108	0.03	0.08	45308	NATURAL GAS				305.3	382.2	61.06
612	CINC	STACK	Rotary Kiln	SD/FF	No	17,735	5,838	349	0.47	0.10	19116		FUEL OIL			18.3	40.4	
680	CK	STACK	Rotary Kiln	FF	No	157,802	75,062	351	0.23	0.11	13614			COAL			308.0	
681	CK	STACK	Rotary Kiln	FF	No	139,440	62,042	396	0.24	0.13	13614			COAL			166.2	
700	INC	STACK	Two Chamber	SD/RJS/VS/WS	No	31,478	13,464	178	0.48	0.11	2342		FUEL OIL			39.8	32.8	
701	INC	STACK	Rotary Kiln	VS/PT	No	13,423	10,457	77	0.03	0.10	6537		FUEL OIL			32.5	44.6	
702a	INC	STACK	Liquid Injection	QT/S/C	No	35,732	11,489	186	0.60	0.05	7008	NATURAL GAS				53.8	45.1	10.77
702b	INC	STACK	Liquid Injection	QT/S/C	No	35,732	11,489	186	0.60	0.05	7008	NATURAL GAS				53.8	45.1	10.77
704	INC	STACK	Liquid Injection	WHB	Yes	5,697	2,258	556	0.24	0.08	18053	NATURAL GAS				8.6	40.8	9.82
705	INC	STACK	Rotary Kiln	QT/VS/PT/WESP	No	36,836	18,288	163	0.41	0.10	3633	NATURAL GAS				55.0	46.7	11.01
706	INC	STACK	Liquid Injection	QT/HS/C/DM	No	35,243	10,717	191	0.62	0.03	15900	NATURAL GAS				55.9	77.5	11.19
707	INC	STACK	Liquid Injection	OS/QC/WS	No	66,022	21,017	186	0.60	0.05	40710	NATURAL GAS				95.9	256.7	19.18
708	INC	STACK	Liquid Injection	VS/PT/WESP	No	5,724	2,982	164	0.35	0.12	853	NATURAL GAS				7.4	9.2	1.48
711	INC	STACK	Rotary Kiln	C/WHB/VS/AS	Yes	61,815	27,613	177	0.44	0.08	7172	NATURAL GAS				102.6	81.4	20.51
712	INC	STACK	Liquid Injection	WHB	Yes	70,965	21,172	706	0.34	0.05	34587		FUEL OIL			96.0	220.6	
714a	INC	STACK	Liquid Injection	PBS	No	22,753	16,433	117	0.10	0.11	4740	NATURAL GAS				49.0	52.7	16.00
714b	INC	STACK	Liquid Injection	PBS	No	22,753	16,433	117	0.10	0.11	4740	NATURAL GAS				49.0	52.7	16.00
725	INC	STACK	Liquid Injection	WS/QT	No	1,934	998	165	0.36	0.09	85	NATURAL GAS				3.4	1.4	0.68
726	INC	STACK	Liquid Injection	QC/CS/DM/VS	No	4,111	3,141	139	0.04	0.13	2002	NATURAL GAS				7.6	20.2	1.52
727	GOV	STACK	Rotary Kiln	GC/C/FF	No	3,143	2,686	150	0.03	0.18	178	NATURAL GAS				2.4	1.1	0.47
728a	INC	STACK	Two Chamber	QT/PT/VS	No	6,225	3,980	157	0.20	0.10	2187	NATURAL GAS				12.2	9.8	2.43
728b	INC	STACK	Two Chamber	QT/PT/VS	No	6,225	3,980	157	0.20	0.10	2187		FUEL OIL			12.2	9.8	

TABLE 3-7. SITE-SPECIFIC INPUT CHARACTERISTICS FOR BASELINE COSTS

Site ID	Fuel Oil Heat Input, MMBtu/hr	Coal Heat Input, MMBtu/hr	Total Waste Heat Input, MMBtu/hr	HW Feed, lb/h	Tot-HW Feed, ton/yr	Liquid HW Feed, Fraction	Sludge HW Feed, Fraction	Solid HW Feed, Fraction	Liquid HW Heating Value, Btu/lb	Sludge HW Heating Value, Btu/lb	Solid HW Heating Value, Btu/lb	Fuel Oil Ash, Fraction	Coal Ash, Fraction	Waste Ash, Fraction	HW Feed Penalty, $/ton HWDF	ExisAPCDs Capital cost	ExisAPCDs Annualized capital cost ($/yr)	ExisAPCDs Fixed annual O&M costs ($/yr)
348	5.69		25.38	3,213	12,851	1.00	0.00	0.00	7899	6269	6544	0.00		0.00		$ 663,240	$ 86,847	$ 221,837
349a			7.57	1,207	4,828	0.00	1.00	0.00	8763	6269	6544			0.00		$ 395,547	$ 44,401	$ 239,199
349b			7.57	1,207	4,828	0.00	1.00	0.00	8763	6269	6544			0.00		$ 395,547	$ 44,401	$ 239,199
350			57.43	10,211	40,846	0.61	0.39	0.00	5741	5442	6544			0.00		$ 148,706	$ 13,061	$ 120,786
351	5.36		1.34	205	820	0.00	0.00	1.00	8763	6269	6544			0.00		$ 287,458	$ 30,271	$ 152,829
353	19.12		60.03	15,356	61,424	0.49	0.19	0.32	2947	6269	3944	0.01		0.09		$ 1,880,787	$ 193,583	$ 292,322
354	25.88		103.28	15,356	61,424	0.22	0.14	0.65	9128	3732	6544	0.00		0.03		$ 1,787,443	$ 244,291	$ 384,267
357			24.15	2,966	11,863	0.62	0.06	0.33	9151	6269	6544			0.11		$ 1,240,667	$ 167,841	$ 358,000
358a			26.78	4,618	18,472	1.00	0.00	0.00	5799	6269	6544			0.05		$ 504,647	$ 63,665	$ 242,057
358b			26.78	4,618	18,472	1.00	0.00	0.00	5799	6269	6544			0.05		$ 504,647	$ 63,665	$ 242,057
358c			26.78	4,618	18,472	1.00	0.00	0.00	5799	6269	6544			0.05		$ 504,647	$ 63,665	$ 242,057
359			21.88	2,464	9,856	0.66	0.34	0.00	10206	6269	6544			0.04		$ 647,476	$ 73,371	$ 255,986
401		81.28	168.24	13,693	54,771	0.76	0.00	0.24	13521	12867	8445		0.00	0.00	16.72	$ 3,884,169	$ 366,633	$ 249,407
402		71.67	111.55	9,704	38,817	0.75	0.00	0.25	12755	12867	7696		0.00	0.00	11.39	$ 4,027,683	$ 380,185	$ 256,187
403		104.26	337.92	33,360	133,440	0.78	0.00	0.22	10667	12867	8271		0.00	0.00	3.23	$ 4,233,364	$ 399,604	$ 265,903
404		181.55	273.06	20,191	80,765	0.80	0.00	0.20	15405	12867	6015		0.00	0.00	11.39	$ 4,940,506	$ 466,348	$ 299,309
473		12.00	187.16	15,400	61,600	0.48	0.35	0.17	13047	12867	8247		0.02	0.00	3.23	$ 3,258,404	$ 307,571	$ 219,846
477			170.59	21,829	87,316	1.00	0.00	0.00	7815	6269	6544			0.01		$ 864,338	$ 112,558	$ 259,102
478			133.55	17,640	70,560	0.49	0.19	0.32	8763	6269	6544			0.00		$ 525,129	$ 64,597	$ 162,398
479	110.63		55.72	5,021	20,085	0.94	0.00	0.06	11820			0.00		0.00		$ 1,062,553	$ 116,938	$ 312,760
480a			43.05	5,686	22,745	0.49	0.19	0.32	8763	6269	6544			0.05		$ 581,878	$ 71,999	$ 165,002
480b	14.52		43.05	5,686	22,745	0.49	0.19	0.32	8763	6269	6544	0.01		0.05		$ 581,878	$ 71,999	$ 165,002
486			98.41	12,266	49,065	0.68	0.10	0.22	8763	6269	6544			0.00		$ 696,254	$ 89,684	$ 251,162
487			196.81	24,533	98,130	0.68	0.10	0.22	8763	6269	6544			0.00		$ 745,499	$ 94,615	$ 146,414
490			116.86	11,012	44,048	0.63	0.00	0.37	12960	6269	6544			0.09		$ 499,767	$ 61,887	$ 133,974
491		99.48	199.61	18,065	72,258	0.86	0.00	0.14	11653	12867	7291		0.00	0.00	16.72	$ 4,058,134	$ 383,056	$ 257,626
503	0.85		17.22	2,070	8,278	0.80	0.00	0.20	8763	6269	6544	0.01		0.00		$ 291,559	$ 30,662	$ 153,151
504	24.39		7.83	8,448	33,794	0.00	1.00	0.00	8763	927	6544	0.00		0.12		$ 490,444	$ 60,086	$ 160,802
600			121.92	15,340	61,361	0.53	0.00	0.47	9199	6269	6544			0.00		$ 1,566,270	$ 212,820	$ 266,241
601			446.09	66,866	267,465	0.32	0.11	0.57	8,063	3,087	6544			0.79		$ 2,472,638	$ 270,554	$ 438,693
603	33.94		251.53	28,704	114,815	1.00	0.00	0.00	8763	6269	6544	0.00		0.00		$ 2,167,013	$ 296,518	$ 295,805
609			321.16	34,852	139,408	0.64	0.09	0.27	11382	6269	4959			0.00		$ 1,522,394	$ 202,214	$ 290,113
612	3.66		36.78	5,781	23,126	0.17	0.07	0.76	3770	10467	6544	0.01		0.00		$ 357,522	$ 36,017	$ 198,346
680		153.81	154.19	12,687	50,747	0.48	0.35	0.17	13047	12867	8247		0.02	0.01	16.72	$ 1,406,403	$ 124,170	$ 215,677
681		12.00	154.20	12,688	50,751	0.48	0.35	0.17	13047	12867	8247		0.02	0.01	16.72	$ 1,254,094	$ 110,789	$ 203,731
700	6.99		25.78	1,757	7,029	0.64	0.00	0.36	18632	6269	7615	0.00		0.01		$ 868,948	$ 109,494	$ 326,465
701	6.51		38.07	5,029	20,115	0.49	0.19	0.32	8763	6269	6544	0.01		0.05		$ 497,270	$ 62,665	$ 241,705
702a			34.32	6,024	24,094	1.00	0.00	0.00	5698	6269	6544			0.00		$ 576,544	$ 72,110	$ 137,862
702b			34.32	6,024	24,094	1.00	0.00	0.00	5698	6269	6544			0.00		$ 576,544	$ 72,110	$ 137,862
704			30.94	17,419	69,675	1.00	0.00	0.00	1776	6269	6544			0.00		$ -	$ -	$ -
705			35.70	3,364	13,457	0.63	0.00	0.37	12960	6269	6544			0.09		$ 1,996,628	$ 216,454	$ 378,515
706			66.32	9,938	39,752	1.00	0.00	0.00	6673	6269	6544			0.06		$ 506,441	$ 62,164	$ 161,539
707			237.56	40,410	161,640	1.00	0.00	0.00	5879	6269	6544			0.02		$ 806,771	$ 102,777	$ 149,516
708			7.67	845	3,381	1.00	0.00	0.00	9077	6269	6544			0.04		$ 757,119	$ 82,529	$ 319,815
711			60.86	5,517	22,067	0.42	0.00	0.58	12836	6269	9734			0.18		$ 1,083,332	$ 142,435	$ 269,374
712	19.20		201.43	26,606	106,423	0.49	0.19	0.32	8763	6269	6544	0.00		0.01		$ -	$ -	$ -
714a			36.75	3,701	14,804	1.00	0.00	0.00	9929	6269	6544			0.00		$ 466,672	$ 57,484	$ 132,298
714b			36.75	3,701	14,804	1.00	0.00	0.00	9929	6269	6544			0.00		$ 466,672	$ 57,484	$ 132,298
725			0.74	84	337	1.00	0.00	0.00	8763	6269	6544			0.00		$ 239,681	$ 27,362	$ 120,782
726			18.66	1,540	6,160	0.49	0.19	0.32	18100	6269	6544			0.00		$ 355,740	$ 43,546	$ 234,903
727			0.60	92	368	0.00	0.00	1.00	8763	6269	6544			0.00		$ 273,918	$ 28,976	$ 151,778
728a			7.35	2,161	8,646	1.00	0.00	0.00	3402	6269	6544			0.01		$ 391,078	$ 48,305	$ 236,612
728b	2.43		7.35	2,161	8,646	1.00	0.00	0.00	3402	6269	6544	0.00		0.01		$ 391,078	$ 48,305	$ 236,612

TABLE 3-7. SITE-SPECIFIC INPUT CHARACTERISTICS FOR BASELINE COSTS

Site ID	ExisAPCDs Variable annual O&M costs ($/ton/yr)	#Comb Sys per EPA ID	(Waste Heat Input)/ (Total Heat Input), CKs Only	#Tested Units per EPA ID
348	$ 574	1		1
349a	$ 247	2		1
349b	$ 247	2		1
350	$ 0	4		3
351	$ 7	2		2
353	$ 67	2		2
354	$ 254	2		2
357	$ 118	1		1
358a	$ 190	3		1
358b	$ 190	3		1
358c	$ 190	3		1
359	$ 52	1		1
401	$ 3	2	0.75	2
402	$ 4	2	0.75	2
403	$ 1	3	0.76	3
404	$ 2	3	0.61	3
473	$ 2	4	1.00	2
477	$ 14	3		3
478	$ 5	3		3
479	$ 44	2		2
480a	$ 24	3		2
480b	$ 24	3		2
486	$ 3	2		2
487	$ 1	2		2
490	$ 45	2		2
491	$ 2	2	0.63	2
503	$ 1	1		1
504	$ 4	1		1
600	$ 275	1		1
601	$ 1	1		1
603	$ 1	1		1
609	$ 15	1		1
612	$ 19	3		2
680	$ 3	4	0.45	4
681	$ 2	4	1.00	4
700	$ 105	1		1
701	$ 96	1		1
702a	$ 98	4		3
702b	$ 98	4		3
704	$ -	1		1
705	$ 94	2		2
706	$ 12	3		2
707	$ 15	4		3
708	$ 351	1		1
711	$ 21	1		1
712	$ -	1		1
714a	$ 99	2		1
714b	$ 99	2		1
725	$ 457	1		1
726	$ 74	1		1
727	$ 11	2		2
728a	$ 77	4		1
728b	$ 77	4		1