

FINAL DRAFT: March 2004

**ASSESSMENT OF THE POTENTIAL COSTS,
BENEFITS, & OTHER IMPACTS OF THE
HAZARDOUS WASTE COMBUSTION MACT
REPLACEMENT STANDARDS:
PROPOSED RULE**

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NOTICE

The U.S. Environmental Protection Agency, Office of Solid Waste has reviewed this document and accepts the findings presented herein.

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LIST OF ACRONYMS

ACC	American Chemistry Council
ACI	Activated Carbon Injection
APCD	Air Pollution Control Device
ARAR	Applicable, Relevant, and Appropriate Requirement
AWFCO	Automatic Waste Feed Cutoff
BDAT	Best Demonstrated Available Technology
BEQ	Breakeven Quantity
BIF	Boiler or Industrial Furnace
BRS	Biennial Reporting System
BTF	Beyond the Floor
CAA	Clean Air Act
CE	Cost-Effectiveness
CEM	Continuous Emissions Monitoring
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CKD	Cement Kiln Dust
CKRC	Cement Kiln Recycling Coalition
Cl	Chlorine
CO	Carbon Monoxide
DESP	Dry Electrostatic Precipitator
D/F	Dioxin/Furan
DOM	Design, Operation, and Maintenance
DRE	Destruction and Removal Efficiency
DSCF	Dry Standard Cubic Foot
DSCM	Dry Standard Cubic Meter
EERGC	EERGC Corporation
EPA	Environmental Protection Agency
ESV	Emergency Safety Valve
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
HAP	Hazardous Air Pollutant
HAPF	Hydrochloric Acid Production Furnace
HC	Hydrocarbons
HCl	Hydrochloric Acid
Hg	Mercury
HQ	Hazard Quotient
HSWA	Hazardous and Solid Waste Amendments
HWC	Hazardous Waste Combustion
HWIR	Hazardous Waste Identification Rule

IAQR	Inter-state Air Quality Rule
ICR	Information Collection Request
IEc	Industrial Economics, Inc.
LDR	Land Disposal Restrictions
LVM	Low-Volatile Metals
LWAK	Lightweight Aggregate Kilns
MACT	Maximum Achievable Control Technology
MRAD	Minor Restricted Activity Day
NACR	National Association of Chemical Recyclers
NAFTA	North American Free Trade Agreement
NAICS	North American Industrial Classification System
NIC	Notice of Intent to Comply
NSPS	New Source Performance Standards
O&M	Operating and Maintenance
OMB	Office of Management and Budget
OSW	Office of Solid Waste
OSWER	Office of Solid Waste and Emergency Response
PACE	Pollution Abatement and Control Expenditure
PCDD	Polychlorinated Dibenzo-P-Dioxins
PCDF	Polychlorinated Dibenzo Furans
PIC	Products of Incomplete Combustion
PM	Particulate Matter
RCRA	Resource Conservation and Recovery Act
RFA	Regulatory Flexibility Act
RFSA	Regulatory Flexibility Screening Analysis
ROD	Records of Decision
SBA	Small Business Administration
SBREFA	Small Business Regulatory Enforcement Fairness Act
SDL	Statistical Design Level
SRE	System Removal Efficiency
SVM	Semi-Volatile Metals
TCI	Total Chlorine
TEQ	Dioxin/Furan Toxic Equivalents
TSD	Treatment, Storage, and Disposal Facility
UMRA	Unfunded Mandates Reform Act
VSL	Value of a Statistical Life
WHB	Waste Heat Boiler
WLD	Work Loss Day
WTA	Willingness to Accept
WTP	Willingness to Pay

EXECUTIVE SUMMARY

OVERVIEW

In May of 1993, the Environmental Protection Agency (EPA) introduced a draft Waste Minimization and Combustion Strategy to address the combustion of hazardous waste and encourage reduced generation of these wastes. Among the key objectives of the strategy is the reduction of health and ecological risks posed by the combustion of hazardous waste. In September 1999, as part of this strategy, EPA issued a final rule establishing “maximum achievable control technology” (MACT) emissions standards for hazardous waste combustion facilities. In the “Cement Kiln Recycling Coalition v. EPA” decision in July 2001, the U.S. Court of Appeals ruled that EPA’s final rule was in violation of Section 7412 of the Clean Air Act.¹ In response, EPA implemented Interim MACT standards in 2002 and is now proposing these Hazardous Waste Combustion (HWC) MACT replacement standards to address a variety of air pollutants, including dioxins/furans, particulate matter, mercury, semi-volatile and low-volatility metals, and chlorine. In addition, emissions of carbon monoxide and hydrocarbons will be regulated as proxies for non-dioxin, non-furan toxic organic emissions. The proposed HWC MACT replacement standards would establish emission levels for commercial incinerators, on-site incinerators, waste-burning cement kilns, lightweight aggregate kilns (LWAKs), solid and liquid fuel boilers (including process heaters), and HCl production furnaces.

As part of the original 1999 Rulemaking, EPA conducted an Economic Assessment that examined and compared the costs and benefits of the 1999 standards. The *Assessment of the Potential Costs, Benefits, and Other Impacts of the Hazardous Waste Combustion MACT Standards: Final Rule* (the 1999 *Assessment*) examined both the MACT floor and a more stringent “beyond-the-floor” (BTF) MACT option for dioxins/furans and mercury based on activated carbon injection technology (the “BTF-ACI” MACT option).² This document (*Assessment of the Potential Costs, Benefits, and Other Impacts of the Hazardous Waste Combustion MACT Replacement Standards: Proposed Rule*) is similar in scope to the 1999 *Assessment*, but analyzes the costs specific to the proposed replacement rule incremental to the baseline established by the 2002 Interim standards and the impacts that these costs would have on waste burning behavior.

¹ For complete text of the decision, refer to 255 F3d 855.

² U.S. EPA, *Assessment of the Potential Costs, Benefits, and Other Impacts of the Hazardous Waste Combustion MACT Standards: Final Rule*, Office of Solid Waste, July 1999.

In addition, this assessment compares the costs to the benefits of the proposed regulation. In this document, we analyze the impacts of three proposed replacement rule MACT floor options reflecting different methods of measuring performance. These options are referred to as Option 1 Floor, Option 2 Floor, and Option 3 Floor in later chapters. Furthermore, we examine a beyond-the-floor option, referred to as the Agency Preferred Approach. Exhibit ES-1 lists the emission standards for existing sources by pollutant and combustion source category for the four proposed MACT alternatives analyzed in this document.³

This assessment seeks to satisfy OMB's requirements for regulatory review under Executive Order 12866 (as amended by Executive Order 13258), which applies to any significant regulatory action. This document also fulfills the requirements of the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act of 1996; Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations"; Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks"; the Unfunded Mandates Reform Act of 1995; Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments"; Executive Order 13132, "Federalism"; Executive Order 12630, "Government Action and Interference with Constitutionally Protected Property Rights"; and Executive Order 13211, "Actions Concerning Regulations that Affect Energy Supply, Distribution, Or Use."

³ The proposed standards for new sources are generally more stringent in controlling emissions than the proposed standards for existing sources.

Exhibit ES-1

REGULATORY ALTERNATIVES FOR EXISTING SOURCES

MACT	Source Category	Chlorinated D/F (ng TEQ/dscm) ^a	PM	Hg (µg/dscm)	SVM (µg/dscm)	LVM (µg/dscm)	TCl (ppmv)	CO (ppmv)	HC ^b (ppmv)
Agency Preferred Approach ^c	Incinerators	0.28 for dry apcnds and WHBs; 0.2 or 0.40 + 400°F at inlet for others ^d	0.010 gr/dscf	130 ug/dscm	59 ug/dscm	84 ug/dscm	1.5 ppmv	100* or	10 *
	Cement Kilns	0.20 or 0.40 + 400°F at inlet to PM control device	0.014 gr/dscf	64 ug/dscm	4.0E-4 lbs SVM in HW per MMBtu in HW	1.4E-5 lbs LVM in HW per MMBtu in HW	110 ppmv	100 or	10 (◆)
								100 or	20 (◇)
	LWAKs	0.4 ng TEQ/dscm	0.017 gr/dscf	67 ug/dscm	3.1E-4 lbs SVM in HW per MMBtu in HW and 250 ug/dscm	9.5E-5 lbs LVM in HW per MMBtu in HW and 110 ug/dscm	150 ppmv	100 or	20
	Solid Fuel Boilers	100 ppm CO or 10 ppmv HC	0.03 gr/dscf	10 ug/dscm	170 ug/dscm	210 ug/dscm	110 ppmv	100 or	20
	Liquid Fuel Boilers	0.4 ng TEQ/dscm for dry apcd sources; CO or TCl as surrogate for others	0.026 gr/dscf	3.7E-6 lbs Hg in HW per MMBtu in HW	1.1E-5 lbs SVM in HW per MMBtu in HW	1.1E-4 lbs Cr in HW per MMBtu in HW	2.5E-2 lbs Cl in HW per MMBtu in HW	100 or	20
HCl Production Furnaces	0.4 ng TEQ/dscm	TCl as surrogate	TCl as surrogate	TCl as surrogate	TCl as surrogate	14 ppmv or 99.9927% SRE	100 or	20	

Exhibit ES-1

REGULATORY ALTERNATIVES FOR EXISTING SOURCES

MACT	Source Category	Chlorinated D/F (ng TEQ/dscm) ^a	PM	Hg (µg/dscm)	SVM (µg/dscm)	LVM (µg/dscm)	TCl (ppmv)	CO (ppmv)	HC ^b (ppmv)
Option 1 Floor	Incinerators	0.28 for dry apcnds and WHBs; 0.2 or 0.40 + 400°F at inlet for others ^d	0.010 gr/dscf	130 ug/dscm	59 ug/dscm	84 ug/dscm	1.5 ppmv	100* or	10 *
	Cement Kilns	0.20 or 0.40 + 400°F at inlet to PM control device	0.014 gr/dscf	64 ug/dscm	4.0E-4 lbs SVM in HW per MMBtu in HW	1.4E-5 lbs LVM in HW per MMBtu in HW	110 ppmv	100 or	10 (◆)
								100 or	20 (◇)
	LWAKs	0.20 ng TEQ/dscm or rapid quench of flue gas at exit of kiln to less than 400°F	0.017 gr/dscf	67 ug/dscm	3.1E-4 lbs SVM in HW per MMBtu in HW and 250 ug/dscm	9.5E-5 lbs LVM in HW per MMBtu in HW and 110 ug/dscm	600 ppmv	100 or	20
	Solid Fuel Boilers	100 ppm CO or 10 ppmv HC	0.060 gr/dscf	10 ug/dscm	170 ug/dscm	210 ug/dscm	440 ppmv	100 or	20
	Liquid Fuel Boilers	3.0 for dry apcd + less than 400°F at inlet to dry apcd	0.026 gr/dscf	3.7E-6 lbs Hg in HW per MMBtu in HW	1.1E-5 lbs SVM in HW per MMBtu in HW	1.1E-4 lbs Cr in HW per MMBtu in HW	2.5E-2 lbs Cl in HW per MMBtu in HW	100 or	20
HCl Production Furnaces	CO as surrogate	TCl as surrogate	TCl as surrogate	TCl as surrogate	TCl as surrogate	14 ppmv or 99.9927% SRE	100 or	20	

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MACT	Source Category	Chlorinated D/F (ng TEQ/dscm) ^a	PM	Hg (µg/dscm)	SVM (µg/dscm)	LVM (µg/dscm)	TCl (ppmv)	CO (ppmv)	HC ^b (ppmv)
Option 2 Floor	Incinerators	0.28 for dry apcnds and WHBs; 0.2 or 0.40 + 400°F at inlet for others ^d	0.010 gr/dscf	130 ug/dscm	19 ug/dscm	14 ug/dscm	0.93 ppmv	100* or	10 *
	Cement Kilns	0.20 or 0.40 + 400°F at inlet to PM control device	0.014 gr/dscf	31 ug/dscm	1.3E-4 lbs SVM in HW per MMBtu in HW	1.1E-5 lbs LVM in HW per MMBtu in HW	41 ppmv	100 or	10 (◆)
								100 or	20 (◇)
	LWAKs	0.20 ng TEQ/dscm or rapid quench of flue gas at exit of kiln to less than 400°F	0.017 gr/dscf	19 ug/dscm	3.1E-4 lbs SVM in HW per MMBtu in HW and 250 ug/dscm	9.5E-5 lbs LVM in HW per MMBtu in HW and 110 ug/dscm	600 ppmv	100 or	20
	Solid Fuel Boilers	100 ppm CO or 10 ppmv HC	0.060 gr/dscf	10 ug/dscm	170 ug/dscm	210 ug/dscm	440 ppmv	100 or	20
	Liquid Fuel Boilers	3.0 for dry apcd + less than 400°F at inlet to dry apcd	0.026 gr/dscf	3.7E-6 lbs Hg in HW per MMBtu in HW	1.1E-5 lbs SVM in HW per MMBtu in HW	7.7E-5 lbs Cr in HW per MMBtu in HW	5.7E-3 lbs Cl in HW per MMBtu in HW	100 or	20
HCl Production Furnaces	CO as surrogate	TCl as surrogate	TCl as surrogate	TCl as surrogate	TCl as surrogate	14 ppmv or 99.9927% SRE	100 or	20	

Exhibit ES-1

REGULATORY ALTERNATIVES FOR EXISTING SOURCES

MACT	Source Category	Chlorinated D/F (ng TEQ/dscm) ^a	PM	Hg (µg/dscm)	SVM (µg/dscm)	LVM (µg/dscm)	TCl (ppmv)	CO (ppmv)	HC ^b (ppmv)
Option 3 Floor	Incinerators	0.28 for dry apcds and WHBs; 0.2 or 0.40 + 400°F at inlet for others ^d	0.0033 gr/dscf	130 ug/dscm	19 ug/dscm	14 ug/dscm	0.93 ppmv	100* or	10 *
	Cement Kilns	0.20 or 0.40 + 400°F at inlet to PM control device	0.011 gr/dscf	31 ug/dscm	68 ug/dscm	8.9 ug/dscm	41 ppmv	100 or	10 (◆)
	LWAKs	0.20 ng TEQ/dscm or rapid quench of flue gas at exit of kiln to less than 400°F	0.017 gr/dscf	19 ug/dscm	130 ug/dscm	82 ug/dscm	600 ppmv	100 or	20
	Solid Fuel Boilers	100 ppm CO or 10 ppmv HC	0.060 gr/dscf	10 ug/dscm	170 ug/dscm	210 ug/dscm	440 ppmv	100 or	20
	Liquid Fuel Boilers	3.0 for dry apcd + less than 400°F at inlet to dry apcd	0.0025 gr/dscf	0.47 ug/dscm	8.7 ug/dscm	28 ug/dscm (Cr only)	2.4 ppmv	100 or	20
	HCl Production Furnaces	CO as surrogate	TCl as surrogate	TCl as surrogate	TCl as surrogate	2.4 ppmv	2.0 ppmv	100 or	20

Notes:

- ^a Across all options, a DRE of 99.99% is required (99.9999% for sources burning dioxin-listed wastes) to control emissions of non-dioxin/furan organic HAPs.
- ^b Across all options, cement kilns sources have the option to continuously comply with a CO standard of 100 ppmv in lieu of complying with the HC standard. Cement kilns that choose to do this, however, must demonstrate compliance with the HC standard during the comprehensive performance test.
- ^c Shaded cells indicate that the standards represent beyond-the-floor levels compared with Option 1.
- ^d WHB are incinerators with waste heat boilers.
- (*) Incinerators can comply with either the HC or CO standards.
- (◆) Cement kilns with bypass ducts have the option to comply with either a CO standard in the bypass duct of 100 ppmv, or an HC standard in the bypass duct of 10 ppmv (no main stack standard).
- (◇) Cement kilns without bypass ducts have the option to comply with either a CO standard in the main stack of 100 ppmv, or an HC standard in the main stack of 20 ppmv.

SUMMARY OF FINDINGS

This assessment estimates the costs and benefits of EPA's proposed HWC MACT replacement standards for hazardous waste combustion facilities. We estimate that the total social costs of the proposed replacement rule range from \$48.5 to \$88.9 million across the floor and BTF options.⁴ This estimate reflects a dynamic scenario that allows facilities to adjust prices and make waste management changes in response to changes in regulatory costs. We assume that as waste-burning becomes more expensive, the market will adjust as producers seek lower-cost options for waste management. These market responses will take the form of higher combustion prices, decisions to stop burning hazardous waste (these primarily take place among the on-site incinerator and boiler facilities), reallocation of waste from systems that stop burning, and employment shifts. We also estimate an upper bound engineering cost estimate assuming that all facilities upgrade to comply with the proposed regulations, regardless of cost. This upper-bound estimate ranges from \$74.3 to \$121.3 million across the four compliance options.

Government administrative costs represent approximately \$447,500 of the social costs for the Option 1 Floor and the Agency Preferred Approach, \$419,500 of the social costs for the Option 2 Floor, and \$427,500 of the social costs for the Option 3 Floor under the market adjusted scenario. Under the upper bound engineering cost scenario, government administrative costs total \$543,400 million, reflecting the fact that all facilities continue to burn hazardous waste.

Human health benefits, visibility benefits, and, to a lesser extent, ecological improvements are expected to result from decreased emissions associated with the proposed HWC MACT replacement standards. We adjust the estimates from the 1998 multi-pathway risk assessment presented in the 1999 *Assessment* in order to evaluate these benefits, and findings suggest that both mortality and morbidity risk reductions will result from the proposed HWC MACT replacement standards. The benefits associated with the 2002 Interim standards are considered to be similar to those expected to result from the 1999 MACT standards. The human health and ecological benefits discussed in this assessment are incremental to those resulting from the 2002 Interim standards as modeled in the 1998 risk assessment.

For the proposed rule, the mortality risk reductions translate into less than one avoided premature death per year beyond deaths already avoided as a result of the 2002 Interim standards. Particulate matter (PM) reductions are responsible for the majority of human health benefits. More stringent dioxin emissions standards are also expected to result in fewer cancer deaths per year. Morbidity risk reductions (on an annual basis) include 1.3 (Agency Preferred Approach, Option 1 Floor, and Option 2 Floor) to 2.5 (Option 3 Floor) avoided hospital admissions associated with respiratory and heart conditions and 52 (Option 1 Floor) to 102 (Option 3 Floor) avoided occurrences of acute respiratory conditions. More stringent emissions standards should also prevent 447 (Option 1 Floor and Option 2 Floor) to 875 (Option 3 Floor) work loss days and 3,726 (Option 1 Floor and

⁴ All dollar values presented in this assessment are 2002 dollars.

Option 2 Floor) to 7,287 (Option 3 Floor) incidences of minor restricted activity. Reductions in lead and mercury emissions may also provide some additional health benefits, particularly to children. Improved visibility due to PM reductions is expected to create benefits of up to \$11 million annually based on willingness-to-pay estimates. The proposed HWC MACT replacement standards should also cause some ecological and aesthetic improvements for water and terrestrial environments, particularly forests. The proposed replacement standards may also improve agricultural productivity.

The remainder of this section summarizes the central conclusions:

- **Total social costs of the proposed replacement standards are between \$48.5 and \$88.9 million annually across regulatory options, and are not expected to exceed \$121.3 million if all systems upgrade to comply with the most stringent option.** The total annualized social costs associated with the Agency Preferred Approach equal \$57.6 million, with an upper bound estimate of \$85.5 million under the static scenario. The best estimates of total social costs include \$419,500 to \$543,400 in government administrative costs, depending on the compliance option.
- **Total annualized social costs under the market-adjusted scenario are substantially lower than total annualized engineering compliance costs.** The market-adjusted scenario allows for market responses by facilities to regulatory requirements, including price increases, system closures, and waste consolidation. Estimates of annual social costs in which commercial facilities increase prices to cover compliance costs are 27 to 35 percent lower than the upper bound estimated costs associated with upgrading all facilities to comply with the standards.
- **Boilers and Hydrochloric Acid Production Furnaces (HAPFs) bear roughly 76 percent of the social costs associated with the Agency preferred approach.** Under the proposed HWC MACT replacement standards, the market-adjusted estimate of average annual costs for boilers and HAPFs is \$43.9 million of the estimated \$57.6 million in total social costs. This result reflects the fact that boilers and HAPFs have not been required to comply with the 2002 interim standards.
- **Government administrative costs are estimated at \$419,500 to \$447,500 per year, with an upper bound estimate under the engineering cost scenario of \$543,400 million per year.** These government costs are associated with administering and enforcing the proposed HWC MACT replacement standards and related MACT requirements (e.g., notice of intent to comply).

- **Under the proposed replacement standard options, the majority of systems that are anticipated to cease burning hazardous waste are not commercial.** Given the best estimate of dynamic scenario model outcomes, we expect the following market exits: two commercial incinerator systems (but not facilities), 32 to 34 on-site incinerator systems, and between 22 and 25 boiler systems. We do not anticipate that any commercial incinerator facilities or cement kiln, lightweight aggregate kiln, or HCl production furnace systems will exit the market in response to the proposed HWC MACT replacement standards.
- **Expenditures will increase as a result of the proposed HWC MACT replacement standards, but revenues and profits may also increase for commercial hazardous waste combustion facilities.** Incremental expenditures associated with the Agency Preferred Approach represent less than 0.14 percent of current total pollution control expenditures in industries with on-site incinerators,⁵ and roughly 12 percent of current pollution control expenditures for cement kilns.⁶ Compliance costs associated with the proposed HWC MACT replacement standards will increase the total costs of burning hazardous waste by approximately 14 percent for cement kilns, 47 percent for LWAKs, and 4 percent for commercial incinerators, though overall waste-burning costs still remain significantly lower for cement kilns and LWAKs than for commercial incinerators. Although costs will increase under the proposed HWC MACT replacement standards, profits may actually increase for commercial incinerators and cement kilns as a result of increased waste volume and revenues from combusting additional waste associated with on-site incinerators and boilers exiting the market.
- **Market exit and waste consolidation activity is expected to result in the reallocation of 120,900 to 133,000 tons of waste from combustion systems that stop burning.** Under the market adjusted scenario, between 3.4 and 3.7 percent of total combusted wastes in the current universe will be reallocated. Approximately 53,600 to 65,700 tons of this waste will likely be rerouted to off-site commercial facilities as onsite systems exit the market. The remaining 67,300 tons of waste will continue to be treated on site at facilities that consolidate.

⁵ Expenditure estimates do not include O&M savings associated with on-site incinerator systems that exit the market. We are currently in the process of verifying which industries use boilers and industrial furnaces. Our preliminary findings indicate that most boilers and industrial furnaces are used in the chemical industry.

⁶ These expenditures do not account for energy savings or revenues associated with new waste that cement kilns might receive because of the proposed HWC MACT replacement standards. We do not present a corresponding estimate for LWAKs because we lack data on total LWAK pollution control expenditures.

- **Modest employment dislocations and gains will occur in the combustion industry.** As the market adjusts to new output levels after the implementation of the proposed HWC MACT replacement standards and combustion facilities invest in additional pollution control and monitoring equipment, employment shifts will occur. At facilities that consolidate waste burning or that stop burning altogether, the best estimates of employment dislocations are between 387 and 422 full-time equivalent employees. At the same time, employment gains of approximately 502 to 851 full-time equivalent employees are expected at combustion facilities as they invest in new pollution control equipment.
- **Combustion prices may increase moderately as facilities face higher costs.** Under the market adjusted scenario (in which commercial facilities increase their prices to cover compliance costs), prices may increase by 1.4 percent under the Agency Preferred Approach. This increase would affect both “new customers” that are closing on-site combustion systems and also existing consumers of hazardous waste combustion services.
- **Human health benefits will result from the MACT standards.** The MACT standards are expected to result in \$2.76 to \$21.86 million per year in human health and visibility benefits.
- **Potential ecological improvements.** Water and terrestrial ecosystems, particularly forests, are expected to experience some benefits as a result of the proposed HWC MACT replacement standards. Agricultural productivity may also improve.
- **Waste minimization.** The proposed replacement rule should not cause significant short-term waste minimization given the relative inelasticity in the demand for combustion and the excess capacity among commercial combustion facilities. However, more substantial waste generation reductions may occur over the long-term as production systems are upgraded.

Exhibit ES-2 summarizes the monetized estimates of costs and benefits associated with the proposed HWC MACT replacement standards. The exhibit shows that across regulatory options, costs exceed monetized benefits. However, the proposed HWC MACT replacement standards are expected to provide other benefits that are not expressed in monetary terms. These include health benefits to sensitive sub-populations such as children, subsistence fishermen, and commercial beef and dairy farmers living in proximity to combustion facilities, and improvements to terrestrial and aquatic ecological systems, particularly forests and agricultural productivity. When these benefits are taken into account, along with equity-enhancing effects such as environmental justice and impacts to children's health, the benefit-cost comparison becomes more complex. Consequently, the regulatory decision becomes a policy judgment which takes into account efficiency as well as equity and regulatory concerns.

Exhibit ES-2				
COMPARISON OF SOCIAL COSTS AND BENEFITS				
(millions of 2002 dollars)				
	Social Cost Estimates ^a		Benefits Estimates ^b	
MACT Option	Market Adjusted	Engineering Cost	Lower Bound	Upper Bound
Option 1 Floor	\$48.5	\$74.9	\$2.76	\$11.71
Agency Preferred Approach	\$57.6	\$85.5	\$2.79	\$13.05
Option 2 Floor	\$80.7	\$115.9	\$2.76	\$11.71
Option 3 Floor	\$88.9	\$121.9	\$5.40	\$21.86

Notes:

^a Social cost estimates include government administrative costs. Government costs for our best estimate range from approximately \$419,500 to \$447,500 per year, and government costs for our upper bound engineering cost estimate are approximately \$543,400.

^b Benefits estimates do not include some benefits that are difficult to monetize, such as health improvements for children, subsistence fishermen, and commercial beef and dairy farmers as well as potential ecological improvements. Therefore the benefits presented in this exhibit underestimate the total benefits associated with the proposed HWC MACT replacement standards. The range of potential benefits associated with visibility improvements accounts for the range in benefits estimates. Given the uncertainty of the available data, we were unable to derive a best estimate for benefits.

ENGINEERING COMPLIANCE COST ANALYSIS

We use engineering cost models based on system-specific parameters to estimate compliance costs for the proposed HWC MACT replacement standards. Under this approach, individual combustion systems are assigned air pollution control measures and corresponding cost estimates using engineering parameters such as gas flow rates, waste feed composition, and combustion chamber temperature. From this assignment of pollution control measures, we derive both the capital costs and the fixed and variable operating costs that each combustion system in the economic analysis would incur in complying with the standards. The estimates of compliance costs also include the costs associated with permitting, testing, and record-keeping and reporting requirements. The compliance cost analysis methods are summarized in Exhibit ES-3, and the results are summarized in Exhibit ES-2 as the “engineering” cost estimates.

- The types of facilities with highest compliance costs per combustion system varies across the four alternative proposed HWC MACT replacement standards. For the Option 1 Floor, boilers have the highest compliance costs in the static scenario. For Option 2 Floor and Option 3 Floor, cement kilns have the highest compliance costs. For the Agency Preferred Approach, lightweight aggregate kilns (LWAKs) have the highest compliance costs per system. HCl production furnaces have the lowest compliance costs per system for all of the MACT alternatives.

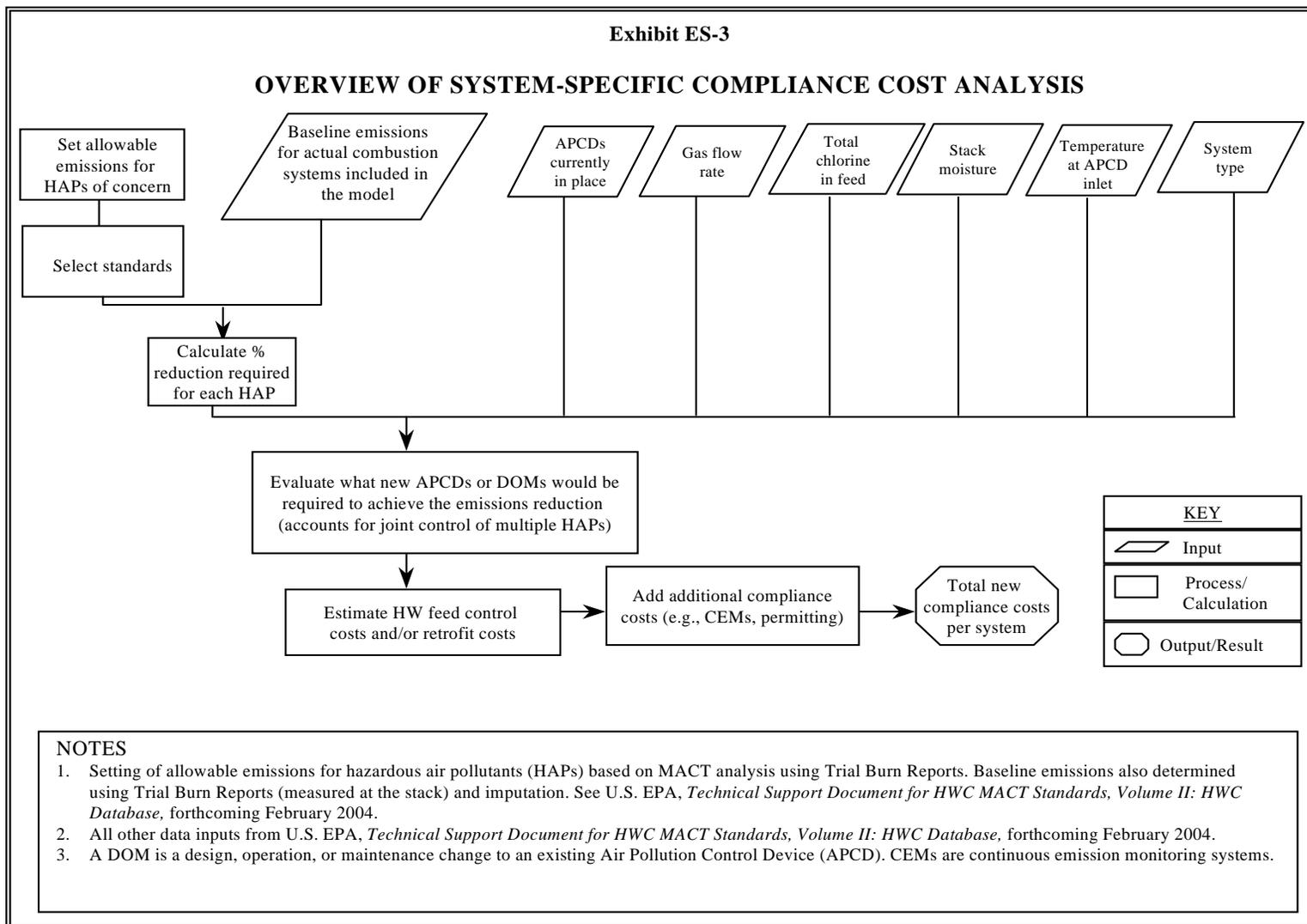
- Under the Agency Preferred Approach, assuming that all systems upgrade and there are no market exits, compliance costs per system average \$323,700 for cement kilns, \$586,700 for LWAKs, \$260,200 for commercial incinerators, \$155,500 for on-site incinerators, \$366,000 for liquid boilers, \$528,000 for coal boilers, and \$153,600 for HCl production furnaces.
- Government administrative costs, borne primarily by EPA offices and state environmental agencies, total \$543,400 per year if all systems upgrade.

Compliance costs vary significantly across individual combustion systems due to the different air pollution controls the systems currently have in place and the differences in combustion systems and waste types handled. For the proposed HWC MACT replacement standards, the variation in potential compliance costs for the Agency Preferred Approach is summarized below.⁷

- **Cement Kilns** -- Annual per-system compliance costs range from \$0 to \$1,500,000 with an average cost of \$323,700 per system.⁸
- **Commercial Incinerators** -- Annual per-system compliance costs range from \$10,600 to \$612,000, with an average cost of \$260,200 per system.
- **LWAKs** -- Annual per-system compliance costs range from \$514,000 to \$682,000, with an average cost of \$586,700 per system.
- **On-Site Incinerators** -- Annual per-system compliance costs range from \$0 to \$590,000, with an average cost of \$155,500 per system.
- **Liquid Boilers** -- Annual per-system compliance costs range from \$0 to \$1,618,000, with an average of \$366,000 per system.
- **Coal Boilers** -- Annual per-system compliance costs range from \$144,000 to \$1,240,000, with an average of \$528,000 per system.
- **HCl Production Furnaces** -- Annual per-system compliance costs range from \$0 to \$323,000, with an average of \$153,600 per system.

⁷ The actual implementation costs may be lower because in some cases facilities requiring high-end upgrade expenditures may opt to consolidate combustion systems or treat waste offsite.

⁸ The compliance cost estimates for cement kilns do not take into account the Portland Cement MACT, which addresses non-hazardous cement kilns. If the Portland Cement MACT is accounted for in these estimates, the compliance costs for cement kilns under proposed hazardous waste combustion MACT replacement standards would likely be lower.



SOCIAL COST AND ECONOMIC IMPACT ANALYSIS

Total social costs of the MACT standards include the value of resources used to comply with the standards by the private sector, the value of resources used to administer the regulation by the government, and the value of output lost due to shifts of resources to less productive uses. As explained in more detail in Chapter 5, we estimate the value of the private sector resource shifts using a simplified approach designed to bracket the welfare loss attributable to the MACT standards. The high end of the economic welfare loss range is based on the a static scenario described above in the engineering compliance cost section, in which all combustion facilities continue to operate at current output levels and upgrade to comply with the MACT standards. In contrast, our market-adjusted estimates for compliance costs assumes a dynamic scenario where on-site facilities may alter waste management practices and commercial facilities are able to increase prices to cover compliance cost increases.

We develop social cost estimates by adding government cost estimates to the economic welfare loss estimates. We estimate the value of government costs using results from an EPA Information Collection Request. As shown in Exhibit ES-4, total annual social costs of the final rule are between \$48.5 and \$88.9 million, with an upper bound of \$121.9 million reflecting the upgrade of all systems to meet the most stringent (Option 3 Floor) regulatory option. Under the Agency Preferred Approach, the best estimate for total social costs of the rule are \$57.6 million, with an upper bound of \$85.5 million assuming the upgrade of all systems. Total incremental government costs represent one to two percent of total social costs across all MACT options.

Exhibit ES-4		
SUMMARY OF SOCIAL COST ESTIMATES ^a		
(millions of 2002 dollars)		
	Best Estimate	Upper Bound ^b
Agency Preferred Approach	\$57.6	\$85.5
Option 1 Floor	\$48.5	\$74.9
Option 2 Floor	\$80.7	\$115.9
Option 3 Floor	\$88.9	\$121.9
<u>Notes:</u>		
^a Government administrative costs are included in the social cost estimates. Government costs for our best estimate range from \$419,500 to \$447,500 per year, depending on the compliance option. For the upper bound estimate, under which all systems upgrade, annual government costs are approximately \$543,400 million.		
^b The upper bound reflects the static scenario in which all facilities upgrade to comply with the proposed HWC MACT replacement standards.		

BENEFITS ASSESSMENT

Benefits from the proposed rule include avoidance of premature mortality, hospital admissions, acute respiratory conditions, work loss days, and restricted activity. The more stringent regulations are also expected to improve visibility. In addition, improvements to aquatic and terrestrial ecosystems may result from reduced emissions associated with the proposed HWC MACT replacement standards. Finally, the replacement MACT standards may also moderately increase waste minimization practices by making these alternatives less expensive relative to combustion.

The basis for the benefits assessment is a 1998 multi-pathway risk assessment originally presented in the 1999 *Assessment*. We adjust the assessment to estimate risks in the baseline assuming implementation of the 2002 Interim standards and compare these risks to those associated with the three MACT floor options (Option 1 Floor, Option 2 Floor, and Option 3 Floor) and the Agency Preferred Approach.

To develop monetary values for the human health benefits, we use established economic valuation techniques for mortality and morbidity benefits. For mortality benefits, we apply the value of a statistical life (VSL) to the fatal risk reduction expected from the proposed HWC MACT replacement standards. The VSL is based on an individual's willingness to pay (WTP) to reduce a risk of premature death. For morbidity benefits, we assign monetary values using a direct cost approach which focuses on the expenditures and opportunity costs averted by decreasing the occurrence of an illness or other health effect. While the WTP approach used for valuing the cancer risk reductions is conceptually superior to the direct cost approach, measurement difficulties, such as estimating the severity of various illnesses, precludes us from using this approach. Applying these valuation techniques to the health and visibility benefits estimates yields a benefits values ranging from \$2.76 to \$21.86 million annually.

The risk modeling suggests that human health benefits will result from the proposed HWC MACT replacement standards. Risk reductions are expected to result in 0.3 (Agency Preferred Approach, Option 1 Floor, and Option 2 Floor) to 0.6 (Option 3 Floor) fewer premature deaths per year. This would carry a benefit of approximately \$0.33 to \$6.42 million per year. Particulate matter controls account for most of the human health benefit by preventing premature deaths associated with respiratory conditions; reductions in carcinogenic pollutants should also prevent some cancer deaths. Reductions in particulate matter also contribute to many avoided nonfatal health effects. In particular, under the proposed replacement rule, hospital admissions for heart and respiratory ailments are expected to be reduced by approximately 1.3 (Agency Preferred Approach, Option 1 Floor, and Option 2 Floor) to 2.5 (Option 3 Floor) cases per year for an annual health benefit of \$0.02 to \$0.03 million. In addition, approximately 52 (Option 1 Floor and Option 2 Floor) to 102 (Option 3 Floor) occurrences of acute respiratory conditions will be avoided annually due to the proposed HWC MACT replacement standards for an annual savings of \$2.12 to \$4.14 million. Furthermore, more stringent emissions standards would also lead to 447 (Option 1 Floor and Option 2 Floor) to 875 (Option 3 Floor) fewer work loss days, resulting in an annual benefit of \$0.05 to \$0.10 million.

The proposed replacement standards would also prevent 3,726 (Option 1 Floor and Option 2 Floor) to 7,287 (Option 3 Floor) fewer incidences of minor restricted activity, creating a human health benefit of \$0.15 million to \$0.29 million. Reductions in lead and mercury emissions may also provide some additional health benefits, particularly to children, subsistence fishermen, and commercial beef and dairy farmers living in proximity to hazardous waste combustion facilities.

Visibility should also improve with the implementation of the proposed HWC MACT replacement standards due to decreased PM emissions. We quantify this benefit by assuming a linear relationship between willingness-to-pay for improved visibility and visibility improvements associated with PM concentration. These incremental benefits range from \$0.10 to \$10.89 million per year across the alternative MACT standards.

Ecological improvements may also result from the proposed HWC MACT replacement standards. The 1999 MACT standards were projected to reduce potential ecosystem risks for 38 square kilometers of water and 115 to 147 square kilometers of land. Assuming that the benefits of the 1999 MACT standards were already realized through the implementation of the 2002 Interim standards, the additional incremental ecological benefits associated with the proposed HWC MACT replacement standards are not expected to exceed the previous improvements. That is, less than 38 square kilometers of water and 115 to 147 square kilometers of land will experience reduced risks as a result of the proposed standards.

It is important to note that certain sensitive sub-populations who may face greater risks, namely children, subsistence fishermen, and commercial beef and dairy farmers, could not be enumerated in the risk assessment. As a result, the monetized estimates do not include benefits to these individuals. We also do not include monetary benefits estimates for the potential ecological improvements because we cannot translate the potential improvements into an end-point benefit measure, such as increased fish populations, for which a benefits transfer approach could assign monetary values. The monetized benefits, therefore, do not reflect the full spectrum of benefits expected from this rule. Any comparison of the costs with the benefits of the proposed HWC MACT replacement standards must account for this limitation.

OTHER REGULATORY ISSUES

Regulatory Flexibility Screening Analysis

The proposed HWC MACT replacement standards will not have significant impacts on a substantial number of small entities. Only six of the 150 combustion facilities (four percent) are classified as small businesses. With the exception of one facility, the upper bound compliance cost estimates associated with the Agency Preferred Approach that do not allow for market adjustments

represent less than 1 percent of total sales for the combustion facilities. This one facility is expected to incur costs totaling approximately two percent of total sales. Under the dynamic scenario, we do not project that this facility will exit the hazardous waste combustion market.

Environmental Justice Analysis

The proposed HWC MACT replacement standards should not have any adverse environmental or health effects on minority populations and low-income populations. Any impacts the rule has on these populations are likely to be positive because the rule will potentially reduce emissions from combustion facilities near minority and low-income population groups. To assess whether the proposed HWC MACT replacement standards will have disproportionate effects on minority or low-income populations, we analyzed demographic data for areas within one and five miles of combustion facilities using a population exposure approach. On-site incinerators, boilers, and HCl production furnaces are located in areas with the highest percentages of minority populations. These facilities also tend to exist in more populated sites than other types of combustion facilities. In addition, populations living within one and five miles of hazardous waste combustion facilities in Louisiana, one of the states in the country with the highest concentration of facilities, are composed of a higher percentage of minorities than the state average. Thus, using the population exposure approach to estimate environmental justice impacts, the proposed HWC MACT replacement standards may result in significant health and environmental benefits to minority and low-income populations.

Children's Health Protection Analysis

Although the impacts of the proposed HWC MACT replacement standards on children's health have not been evaluated quantitatively, qualitative analysis indicates that children would benefit from the replacement rule. Further reductions in particulate matter, mercury, and lead emissions associated with the proposed HWC MACT replacement standards should incrementally reduce the risk of some illnesses and developmental abnormalities. Children within high-risk sub-populations including subsistence fishermen and commercial dairy and beef farmers living in proximity to hazardous waste combustion facilities could potentially experience the greatest positive health effects.

Joint Impacts of Rules

The universe of regulated facilities is affected by a number of regulations. However, these regulations will not have an aggregate impact on the regulated facilities. Specifically, the Portland Cement MACT and the proposed National Emissions Standards for Hazardous Air Pollutants for Industrial/Commercial/Institutional Boilers and Process Heaters are incorporated into the baseline

of this assessment and will affect facilities only if they cease to burn hazardous waste in their boilers, HCl production furnaces, and kilns. Under these conditions, the facility will no longer be subject to the proposed HWC MACT replacement standards.

In some cases, compliance with already existing regulations may ease compliance with the proposed HWC MACT replacement standards. For example, criteria pollutants regulated under the proposed standards are also controlled under the Clean Air Act (CAA). For those facilities that are major or area sources under the CAA, compliance with one standard will contribute to adherence with the other. Therefore, implementation of the proposed HWC MACT replacement standards will not jointly impact the actions of facilities already controlled by other regulations.

Unfunded Federal Mandates

Executive Order 12875, “Enhancing the Intergovernmental Partnership” (October 26, 1993), calls on federal agencies to provide a statement supporting the need to issue any regulation containing an unfunded Federal mandate and describing prior consultation with representatives of affected state, local, and tribal governments. Signed into law on March 22, 1995, the Unfunded Mandates Reform Act (UMRA) supersedes Executive Order 12875, reiterating the previously established directives while also imposing additional requirements for federal agencies issuing any regulation containing an unfunded mandate. Federal rules are exempt from the UMRA requirements if the rule implements requirements specifically set forth in law or compliance with the rule is voluntary for state and local governmental entities.

Based on the criteria set forth by the UMRA and Executive Order 12875, the proposed HWC MACT replacement standards do not contain a significant unfunded Federal mandate. Because the Agency is issuing the replacement standards under the joint statutory authority of the Clean Air Act (CAA) and the Resource Conservation and Recovery Act (RCRA), the rule should be exempt from all relevant requirements of the UMRA. In addition, compliance with the proposed HWC MACT replacement standards is voluntary for non-federal governmental entities since state and local agencies choose whether or not to apply to EPA for the permitting authority necessary to implement the MACT standards.

Tribal Governments Analysis

Executive Order 13175, “Consultation and Coordination With Indian Tribal Governments” (May 14, 1998), addresses related unfunded mandates concerns with regard to the sovereignty of tribal governments. For many of the same reasons described in the UMRA discussion, the requirements of Executive Order 13175 do not apply to the proposed HWC MACT replacement standards. In addition, although there is no specific gauge for determining whether a regulation “significantly or uniquely affects” an Indian tribal government, the replacement standards are not

expected to impose substantial direct compliance costs on tribal governments and their communities because we do not expect that a significant number of hazardous waste combustion facilities are located in tribal communities.

Federalism

Executive Order 13132, “Federalism” (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure “meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications.” Policies that have federalism implications are defined in the Executive Order to include regulations that have “substantial direct effects on the States [in terms of compliance costs], on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.” In addition, policies have federalism implications if they preempt State law.

The proposed HWC MACT replacement standards do not have federalism implications. They will not have direct financial effects on the States because EPA will be responsible for permitting and monitoring hazardous waste combustion facilities. Furthermore, the proposed replacement standards should not alter the relationship between the national government and the States because the States may voluntarily apply for permitting authority in order to implement the proposed HWC MACT replacement standards. Finally, the proposed replacement regulations do not preempt State law because States may still develop air pollution laws that exceed the stringency of the proposed HWC MACT replacement standards.

Regulatory Takings

Executive Order 12630, “Government Actions and Interference with Constitutionally Protected Property Rights” (March 15, 1988), directs federal agencies to consider the private property takings implications of proposed regulation. Under the Fifth Amendment of the U.S. Constitution, the government may not take private property for public use without compensating the owner. Though the exact interpretation of this takings clause as applied to regulatory action is still subject to an ongoing debate, a framework for interpretation has been established by legal precedent through a series of prominent court cases.

Based on our review of relevant case law and mainstream legal interpretation, the proposed HWC MACT replacement standards are not likely to result in any regulatory takings. Today’s action will not require that private property be invaded or taken for public use. The proposed replacement rule also will not interfere with reasonable investor expectations because it does not ban hazardous waste combustion but merely authorizes operating parameters. Furthermore, these operating parameters and performance-based emissions standards originate in statutory authority. The

investment-backed expectations of anyone opening a hazardous waste combustion facility since then would include a recognition of the existence of impending regulatory requirements. Persons already engaged in combustion would have at least three years to adjust their expectations and to prepare for accommodation of the forthcoming regulation. As a result, no facility owner should be able to assert sufficient interference with reasonable investment expectations to support a takings.

Because the rule does not prohibit the burning of hazardous waste, it does not deny the facility owners all viable economic use of their property. Nor does the rule prevent owners from putting their property to other profitable uses should they decide to cease combustion in the face of the regulation. For many facilities in the universe, the primary economic use of property comes from other activities not directly associated with hazardous waste combustion. Even if these facilities stop burning waste, they will still be able to manufacture their primary products, such as cement, lightweight aggregate, or chemicals. Furthermore, if any commercial incinerators were to stop burning hazardous waste, they could still use their property for other industrial purposes.

Energy Impact Analysis

Executive Order 13211, “Actions Concerning Regulations that Affect Energy Supply, Distribution, or Use” (May 18, 2001), addresses the need for regulators to more fully consider the potential energy impacts of the proposed rule and resulting actions. The proposed HWC MACT replacement standards address kilns, boilers, and HCl production furnaces that recover energy by burning hazardous waste, and the implementation of these standards is expected to result in some facilities deciding to transport waste offsite for combustion instead of treating it themselves. In addition, the proposed rule should result in the installation of additional air pollution control devices (APCDs) that require energy to operate. According to the dynamic scenario, the proposed HWC MACT replacement standards will result in an increased annual use of at least 1,012,722 million Btus of energy at an estimated cost of at least \$1,377,396 per year. These energy and cost impacts underestimate total impacts of the proposed standards because we do not include the energy and expenditures associated with APCD upgrades. However, these costs are likely to be relatively modest.

United States’ industries consumed 32,483 trillion Btus of energy in 2002.⁹ The energy impacts of the proposed HWC MACT replacement standards will increase energy use by at least 3.12E-3 percent. This rule is not a “significant energy action” as defined in Executive Order 13211, “Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use” (66 Fed. Reg. 28355 (May 22, 2001)), because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. While energy use may increase slightly as a result of the

⁹ U.S. Department of Energy, Energy Information Administration, “Table 2.4: Industrial Sector Energy Consumption (Quadrillion Btu),” *Monthly Energy Review July 2003*, July 28 2003, August 14, 2003 <http://www.eia.doe.gov/emeu/mer/pdf/pages/sec2_9.pdf>.

proposed HWC MACT replacement standards, production and supply of fuel will not be affected. The incremental increase in energy use in the industrial sector estimated by the preceding analysis (3.12E-3 percent) will have a negligible impact on nationwide fuel prices and supply.