

IV A 008

A-91-61

**Revised Economic Impact Analysis:  
Existing Medical Waste Incinerators**

U.S. EPA  
OAQPS, AQSSD, ISEG

June 1996

## I. INTRODUCTION

On February 27, 1995, the EPA published the proposed Emission Guidelines (EG) for existing medical waste incinerators (MWIs). The proposal was the result of several years of effort reviewing available information in light of the Clean Air Act requirements. Following proposal, a large number of comment letters were received, some including new information and some indicating that commenters were in the process of gathering information for the EPA to consider. The large amount of new information that was ultimately submitted addressed every aspect of the proposed standards and guidelines, including: the existing population of MWIs; the performance capabilities of air pollution control systems; monitoring and testing; operator training; alternative medical waste treatment technologies; and the definition of medical waste. In almost every case, the new information has led to different conclusions.

The purpose of this revised economic impact analysis (EIA) document is to reassess the economic impacts of new regulatory options that have been developed for existing MWIs. The potential economic impacts of four EG control options for existing MWIs were originally evaluated in *Medical Waste Incinerators - Background Information for Proposed Standards and Guidelines: Analysis of Economic Impacts for Existing Sources*.<sup>1</sup> An addendum was subsequently prepared to estimate the potential economic impacts of a fifth control option.<sup>2</sup> The economic impacts presented in this document should be viewed as a revision to the original economic impact documents.

## II. EXECUTIVE SUMMARY

Industry-wide impacts presented in this analysis include estimates of the change in market price for the services provided by the affected industries, the change in market output or production, the change in industry revenue, and impact on affected labor markets in terms of full time equivalent workers lost.

Industries that generate medical waste (i.e., hospitals, nursing homes, etc.) are expected to experience average price increases in the range of 0 percent to 0.13 percent, depending on the industry, regulatory option, and scenario analyzed. These industries are expected to experience output and employment impacts in the range of 0 percent to 0.18 percent. In addition, the revenue impacts for these industries are expected to range from an increase of 0.05 percent to a decrease of 0.04 percent. An increase in industry revenue is expected to occur in cases where the price elasticity of demand for an industry's product is less than one. A price elasticity of less than one indicates that the percentage decrease in output will be less than the percentage increase in price. Since total revenue is a product of price and output, a less than proportional change in output compared to price means that total revenue should increase.

The following example illustrates how the above price impacts could be interpreted for the hospital industry. The average industry-wide price increase for hospitals is estimated as 0.03

percent, assuming regulatory option six, the most stringent regulatory option, and scenario C, switching with no waste segregation. This change in price can be expressed in terms of the increased cost of hospitalization due to the regulation. The 1993 estimate of adjusted patient days nationwide totals 304,500,000 days. This estimate of adjusted patient-days is based on a combined estimate of in-patient and out-patient days at hospitals. Calculating the ratio of annualized control cost, \$86,167,082, to the number of adjusted patient days provides an estimate of \$0.28. Therefore, the average price increase that an individual would experience for each hospital patient-day is expected to equal 28 cents.

The average price impact for the commercial medical waste incinerator industry is approximately a 2.6 percent increase in price. Cost and economic impact estimates are the same for the commercial MWI industry regardless of the regulatory option analyzed because all six regulatory options specify identical regulatory requirements. Average industry-wide output, employment, and revenue impacts were not estimated for this sector because data such as price elasticity estimates and employment levels were not available.

This economic impact analysis examines possible economic impacts that may occur in industries that will be directly affected by this regulation. Therefore, the analysis includes an examination of industries that generate medical waste or dispose medical waste. Secondary impacts such as subsequent impacts on air pollution device vendors and MWI vendors are not estimated due to data limitations. Air pollution device vendors are expected to experience an increase in demand for their products due to the regulation. This regulation is also expected to increase demand for commercial MWI services. However, due to economies of scale, this regulation is expected to shift demand from smaller incinerators to larger incinerators. Therefore, small MWI vendors may be adversely affected by the regulation. Lack of data on the above effects prevent quantification of the economic impacts on these secondary sectors.

### **III. BACKGROUND INFORMATION**

#### **A. Regulatory Options**

At proposal, the EPA examined the impacts of five control options for existing sources but concluded that all existing MWIs would need good combustion and dry scrubbers to meet the MACT floors for CO, PM, and HCl. Consequently, the EPA was left to consider only two control options for MACT.

After proposal, the EPA received numerous comments containing substantially new information. Review of this new information appears to lead to new conclusions in a number of areas: the MWI inventory; MWI subcategories; performance of emission control technologies; MACT floors; and monitoring and testing options. As a result, the EPA now believes there are several new regulatory options which merit consideration in selecting MACT for existing MWIs. This section summarizes these new regulatory options and the EPA's initial assessment of their merits.

Based on new information submitted to the EPA following proposal of the EG, new MACT floor emission levels were developed for small, medium, and large MWIs. Next, the EPA determined the type of emission control technology(s) existing MWIs would probably need to use to meet regulations based on these floor emission limits. The floor for small existing MWIs appears to require good combustion; add-on wet scrubbing systems would not be necessary to meet the MACT floor. For medium existing MWIs, the MACT floor appears to require good combustion and a moderate efficiency wet scrubber. The MACT floor for large existing MWIs appears to require good combustion and a high efficiency wet scrubber.

Having identified the emission control technology most existing MWIs would likely install to meet the MACT floor emission limits, the EPA also reviewed the performance capabilities of other emission control technologies that would reduce emissions by an amount greater than the MACT floor level of control. This process enables the EPA to identify more stringent regulatory options which could be selected as MACT. Table 1 summarizes the emission control technology that would probably be required for small, medium, and large MWIs to meet the emission limits specified for each of the regulatory options. The regulatory options are a combination of the various emission guidelines the EPA believes merit consideration as MACT for existing MWIs. This table is constructed only for the purpose of organizing and structuring an analysis of the costs, environmental, energy, and economic impacts associated with determining or selecting MACT for existing MWIs. In reviewing this table, therefore, there are several important points to keep in mind.

First, the EG for existing MWIs will not include requirements to use a specific emission control system or technology; the EG will only include emission limits, which may be met by any means or using any control system or technology the owner or operator of the MWI decides to use to meet these emission limits. Second, to the extent possible, it is an objective of the EPA to adopt emission limits in the EG that can be met through the use of several emission control systems or technologies. Consequently, where not constrained by the Act, the actual emission limits associated with some of the regulatory options shown in Table 1 have been selected at a level designed to encourage or permit the use of both wet and dry scrubbing control systems.

## **B. Analysis Scenarios**

Health care facilities may choose from among a number of alternatives for treatment and disposal of their medical waste. (It should be noted that these alternatives are generally more limited for health care facilities located in rural areas than for those located in urban areas.) At the time of proposal, inventory estimates indicated that fewer than half of hospitals operated on-site medical waste incinerators. The clear trend over the past several years has been for more and more hospitals to turn to the use of alternative on-site medical waste treatment technologies or the use of commercial off-site treatment and disposal services. Consequently, it is quite likely that even fewer hospitals now operate on-site medical waste incinerators.

**TABLE 1**  
**Regulatory Options For Existing MWIs**

MWI Size	Regulatory Options					
	1	2	3	4	5	6
Small ≤200 lb/hr	Good combustion	Good combustion on rural; Good combustion and low efficiency wet scrubber on urban	Good combustion and low efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and high efficiency wet scrubber
Medium 201-500 lb/hr	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber
Large >500 lb/hr	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber

Given the above data, it can be assumed that more than half of existing hospitals today have chosen to use other means of treatment and disposal of their medical waste rather than operate an on-site incinerator. This occurrence indicates that alternatives to the use of on-site incinerators exist and that they are readily available in many cases. For other health care facilities, such as nursing homes, etc., only a small number of facilities currently operate on-site MWIs. Therefore, for these types of health care facilities, the percentage of such facilities using alternative means of treatment and disposal of medical waste - particularly commercial treatment and disposal services - is much higher; probably higher than 95 percent, or more. This estimate is further confirmation of the availability of alternatives to the use of an on-site incinerator for the treatment and disposal of medical waste.

A likely reaction and outcome associated with the adoption of the EG for existing MWIs, therefore, is an increase in the use of these alternatives by health care facilities for treatment and disposal of their medical waste. It is not the objective of the EPA to encourage the use of alternatives or to discourage the continued use of on-site medical waste incinerators; rather, it is the objective of the EPA to adopt the EG for existing MWIs that fulfill the requirements of Section 129 of the Clean Air Act. In doing so, however, it is clear that one outcome associated with adoption of these EG is likely to be an increase in the use of alternatives and a decrease in the continued use of on-site medical waste incinerators. Consequently, it is an outcome the EPA should acknowledge and incorporate into the analyses of the costs and economic impacts associated with the EG.

In these analyses of the costs and economic impacts, selection of an alternative form of medical waste treatment and disposal by a health care facility, rather than continued operation of an on-site medical waste incinerator, including the purchase of emission control technology necessary to meet the MACT emission limits, is referred to as "switching". Switching was incorporated into the cost analyses at proposal and was the basis for the conclusion at proposal that adoption of the proposed EG could lead to as many as 80 percent of health care facilities with MWIs to choose an alternative means of medical waste treatment and disposal over continued operation of their MWI. However, the economic impacts presented with the proposed EG were only evaluated using the costs under a "no switching" scenario. Although the EIA presented a qualitative discussion of the likely possibility of facilities with on-site MWIs deciding to switch to alternative treatment and disposal methods, the likely economic impacts under a switching scenario were not quantified due to time constraints.

Currently, switching has been incorporated into the new cost and economic impact analyses of the six new regulatory options discussed above for existing MWIs. The new analyses incorporate three scenarios; one scenario which ignores switching and two scenarios which consider switching. Scenario A assumes that each existing MWI remains in operation (i.e., no switching) and complies with the appropriate regulatory option by purchasing emission control equipment. This scenario results in the highest costs because it assumes no existing MWI will switch to a less expensive waste disposal method. This scenario most likely overstates the national costs and economic impacts associated with the EG and therefore, should not be viewed as representative

of the impacts associated with the EG. This scenario is included in this analysis only to fulfill the goal of providing a complete analysis.

Switching scenarios B and C are considered much more realistic and are more representative of the cost and economic impacts associated with the EG for existing MWIs. Only these scenarios merit serious review and consideration in gauging the potential impacts associated with the EG. Both scenarios B and C assume switching occurs when the cost associated with purchasing and installing the air pollution control technology or system necessary to comply with the MACT emission guideline (i.e., a regulatory option) is greater than the cost of using an alternative means of treatment and disposal.

The difference between scenarios B and C is the assumption of whether separation of the medical waste stream is practiced at a facility. Some facilities currently separate their waste into an infectious medical waste stream and a non-infectious waste stream. Some commenters have stated it is a good assumption to assume that hospitals which currently operate on-site medical waste incinerators practice little separation of medical waste into infectious and non-infectious waste; generally all the waste at the facility is incinerated.

Based on estimates in the literature that only 10 percent to 15 percent of medical waste is infectious and the remaining 85 percent to 90 percent is non-infectious, scenario B assumes that only 15 percent of the waste currently being burned at a health care facility operating an on-site waste incinerator is infectious medical waste; the remaining 85 percent is non-infectious medical waste. This non-infectious waste is municipal waste; it needs no special handling, treatment, transportation, or disposal, and can be sent to a municipal landfill or a municipal combustor for disposal. Thus, under scenario B, when choosing an alternative to continued operation of an on-site medical waste incinerator, in response to adoption of the EG, a health care facility need only choose an alternative form of medical waste treatment and disposal for 15 percent of the waste stream currently burned on-site and may send the remaining 85 percent to a municipal landfill. This scenario results in the lowest costs because 85 percent of the waste is disposed at the relatively inexpensive cost of municipal waste disposal.

On the other hand, it is unlikely that all health care facilities which currently operate an MWI will be able to or will decide to segregate the waste stream currently being burned in their incinerator. For example, a facility not currently segregating waste may decide that the cost and inconvenience of training its staff to segregate waste is not acceptable. Scenario C, therefore, assumes that all medical waste being burned at a health care facility currently operating a medical waste incinerator is infectious medical waste and must be treated and disposed of accordingly. As a result, scenario C leads to higher costs than scenario B.

For the purposes of determining the impacts of the EG under switching scenarios B and C, the MWI inventory was separated into commercial (off-site) incinerators and on-site incinerators used to burn health care waste. The existing commercial incinerators were not subjected to the switching analyses under scenarios B and C because switching to an alternative method of waste

disposal (e.g., commercial disposal) is not feasible for commercial facilities. The cost and economic impact analyses assumed that commercial facilities would add on the control equipment associated with the EG. Only the on-site MWIs in the inventory were subject to the switching analyses under scenarios B and C.

Scenarios B and C represent the likely range of impacts associated with the EG for existing MWIs. The actual impacts of a MACT emission guideline (i.e., a regulatory option) is most likely to fall somewhere within the range represented by scenarios B and C.

### **C. Industry Sectors**

Similar to the original EIA, this analysis examines the impacts of the EG on industries that generate medical waste and operate on-site MWIs, commercial MWIs, and industries that generate medical waste but do not operate on-site MWIs. Facilities engaging in the above activities will generally fall into one of two categories: directly affected facilities and off-site generators.

Facilities in industries that generate medical waste and operate on-site MWIs will be directly affected by the EG because these facilities will need to initiate some action to comply with the regulation (i.e., install emission control equipment or switch to alternative technologies). Therefore, costs and economic impacts associated with these facilities and industries will be referred to as direct costs and economic impacts. Industries belonging to this category include: hospitals, nursing homes, and research laboratories. Also included in this category of directly affected industry sectors is the commercial MWI sector. Although the commercial MWI industry does not generate medical waste, it will be required to comply with the EG by installing emission control equipment.

This analysis also examines the economic impacts of the EG on facilities that generate medical waste but do not operate an on-site MWI. Facilities in these industries are termed "off-site generators" in this analysis. Facilities in these industries will be indirectly affected by this regulation because they must send their medical waste off-site to be treated or disposed. Commercial MWIs or other waste treatment facilities that provide service to these types of facilities are expected to pass on to their customers at least a portion of their EG-related cost increases. Therefore, these off-site generators are expected to experience a price increase for their service. Industries belonging to this off-site generator category include: hospitals, nursing homes, research laboratories, funeral homes, physicians' offices, dentists' offices and clinics, outpatient care facilities, freestanding blood banks, fire and rescue operations, and correctional facilities.

## IV. ECONOMIC IMPACTS

### A. Methodology

This section briefly describes the analytical approach used to estimate industry-wide and facility-specific economic impacts and to evaluate the economic feasibility of switching. All economic impacts presented in this document were re-estimated using the original methodology described in the original EIA. Therefore, for a more detailed description of the methodology used to estimate economic impacts, refer to the *Background Information for Proposed Standards and Guidelines: Analysis of Economic Impacts for Existing Sources*. The base year of this analysis is 1993. Therefore, all prices presented in this analysis are stated at 1993 levels.

The average price changes that are anticipated to occur in each industry sector for each of the regulatory options are estimated by comparing the annualized control cost estimates to annual revenue for each affected industry. The resulting ratio of cost-to-revenue represents the average price increase that would be necessary in order for firms in each industry to recover the increased cost of environmental controls. Percent changes in output or production are estimated using the price impact estimate and a high and low estimate of the price elasticity of demand. Resulting changes in revenue are estimated based upon the estimated changes in price and output for an industry. Employment or labor market impacts result from decreases in the output for an industry and are assumed to be proportional to the estimated decrease in output for each industry.

Facility-specific economic impacts are estimated by using model facility information under the three switching scenarios. These facility-specific price impacts are then compared to the average industry-wide price impacts to determine if the difference between the two impacts is significant. A determination of significant economic impacts may be made if the difference is greater than one percent.

The assumption of no switching (scenario A) will represent the highest cost and economic impact scenario for most of the affected industries while the assumption of switching with waste segregation (scenario B) will represent the lowest cost and economic impact scenario for most of the affected industries. As previously stated, the EPA considers scenario A to be an unlikely scenario so the economic impacts presented under scenarios B and C should be regarded as the impacts most likely to occur.

### B. Industry-wide Impacts

#### 1. Industry-wide Annualized Control Costs<sup>3</sup>

Tables 2A, 2B, and 2C present industry-wide capital and annualized control costs for those facilities that operate MWIs, referred to as "direct annualized control costs". These national costs represent EG cost estimates for the six regulatory options under the three switching scenarios. As can be seen from the tables, annualized control costs are highest under scenario A (presented in Table 2A). The annualized costs under scenario A range from approximately \$119.5 million under regulatory option one to approximately \$201.1 million under regulatory option six. As previously explained, scenario A impacts are calculated under the unlikely assumption that all

**Table 2A**  
**Industry-wide Annualized and Capital Control Costs**  
**Scenario A: No Switching**  
**Industries Utilizing On-site Medical Waste Incineration: Existing Sources**

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals: Annualized Capital	\$ 83,956,183 \$237,352,212	\$102,672,253 \$304,630,491	\$122,995,505 \$377,869,394	\$128,915,406 \$401,712,912	\$135,505,756 \$430,374,100	\$143,747,984 \$471,410,347
Nursing homes: Annualized Capital	\$ 13,286,381 \$ 37,561,878	\$ 16,248,269 \$ 48,208,918	\$ 19,464,500 \$ 59,799,249	\$ 20,401,346 \$ 63,572,575	\$ 21,444,294 \$ 68,108,315	\$ 22,748,658 \$ 74,602,456
Commercial research labs: Annualized Capital	\$ 13,286,381 \$ 37,561,878	\$ 16,248,269 \$ 48,208,918	\$ 19,464,500 \$ 59,799,249	\$ 20,401,346 \$ 63,572,575	\$ 21,444,294 \$ 68,108,315	\$ 22,748,658 \$ 74,602,456
Other: Annualized Capital	\$ 4,008,822 \$ 11,333,325	\$ 4,902,495 \$ 14,545,795	\$ 5,872,909 \$ 18,042,877	\$ 6,155,579 \$ 19,181,380	\$ 6,470,262 \$ 20,549,922	\$ 6,863,820 \$ 22,509,361
Commercial: Annualized Capital	\$ 4,937,696 \$ 13,192,605	\$ 4,937,696 \$ 13,192,605	\$ 4,937,696 \$ 13,192,605	\$ 4,937,696 \$ 13,192,605	\$ 4,960,759 \$ 13,298,125	\$ 4,960,759 \$ 13,298,125
<b>Total : Annualized Capital</b>	<b>\$119,475,463 \$337,001,898</b>	<b>\$145,008,982 \$428,786,727</b>	<b>\$172,735,110 \$528,703,374</b>	<b>\$180,811,373 \$561,232,047</b>	<b>\$189,825,365 \$600,438,777</b>	<b>\$201,069,879 \$656,422,745</b>

**Table 2B**  
**Industry-wide Annualized and Capital Control Costs**  
**Scenario B: Switching With Waste Segregation**  
**Industries Utilizing On-site Medical Waste Incineration: Existing Sources**

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals: Annualized Capital	\$38,154,615 \$29,805,151	\$38,263,243 \$29,451,625	\$38,434,001 \$29,156,373	\$38,436,185 \$29,132,037	\$38,654,258 \$28,645,325	\$38,654,258 \$28,645,325
Nursing homes: Annualized Capital	\$ 6,038,111 \$ 4,716,777	\$ 6,055,303 \$ 4,660,830	\$ 6,082,325 \$ 4,614,105	\$ 6,082,671 \$ 4,610,254	\$ 6,117,181 \$ 4,533,230	\$ 6,117,181 \$ 4,533,230
Commercial research labs: Annualized Capital	\$ 6,038,111 \$ 4,716,777	\$ 6,055,303 \$ 4,660,830	\$ 6,082,325 \$ 4,614,105	\$ 6,082,671 \$ 4,610,254	\$ 6,117,181 \$ 4,533,230	\$ 6,117,181 \$ 4,533,230
Other: Annualized Capital	\$ 1,821,844 \$ 1,423,166	\$ 1,827,031 \$ 1,406,285	\$ 1,835,184 \$ 1,392,187	\$ 1,835,289 \$ 1,391,025	\$ 1,845,702 \$ 1,367,785	\$ 1,845,702 \$ 1,367,785
Commercial: Annualized Capital	\$ 4,937,696 \$13,192,605	\$ 4,937,696 \$13,192,605	\$ 4,937,696 \$13,192,605	\$ 4,937,696 \$13,192,605	\$ 4,960,759 \$13,298,125	\$ 4,960,759 \$13,298,125
<b>Total : Annualized Capital</b>	<b>\$56,990,377</b> <b>\$53,854,476</b>	<b>\$57,138,576</b> <b>\$53,372,175</b>	<b>\$57,371,531</b> <b>\$52,969,375</b>	<b>\$57,374,512</b> <b>\$52,936,175</b>	<b>\$57,695,081</b> <b>\$52,377,695</b>	<b>\$57,695,081</b> <b>\$52,377,695</b>

**Table 2C**  
**Industry-wide Annualized and Capital Control Costs**  
**Scenario C: Switching With No Waste Segregation**  
**Industries Utilizing On-site Medical Waste Incineration: Existing Sources**

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals: Annualized Capital	\$ 75,805,944 \$148,227,222	\$ 79,104,421 \$144,576,460	\$ 82,984,914 \$137,914,530	\$ 83,692,240 \$140,443,114	\$ 85,865,550 \$139,642,585	\$ 86,167,082 \$138,937,099
Nursing homes: Annualized Capital	\$ 11,996,575 \$ 23,457,514	\$ 12,518,572 \$ 22,879,767	\$ 13,132,674 \$ 21,825,492	\$ 13,244,611 \$ 22,225,650	\$ 13,588,546 \$ 22,098,963	\$ 13,636,265 \$ 21,987,317
Commercial research labs: Annualized Capital	\$ 11,996,575 \$ 23,457,514	\$ 12,518,572 \$ 22,879,767	\$ 13,132,674 \$ 21,825,492	\$ 13,244,611 \$ 22,225,650	\$ 13,588,546 \$ 22,098,963	\$ 13,636,265 \$ 21,987,317
Other: Annualized Capital	\$ 3,619,657 \$ 7,077,697	\$ 3,777,156 \$ 6,903,377	\$ 3,962,445 \$ 6,585,277	\$ 3,996,219 \$ 6,706,014	\$ 4,099,992 \$ 6,667,790	\$ 4,114,390 \$ 6,634,104
Commercial: Annualized Capital	\$ 4,937,696 \$ 13,192,605	\$ 4,937,696 \$ 13,192,605	\$ 4,937,696 \$ 13,192,605	\$ 4,937,696 \$ 13,192,605	\$ 4,960,759 \$ 13,298,125	\$ 4,960,759 \$ 13,298,125
<b>Total : Annualized Capital</b>	\$108,356,447 \$215,412,552	\$112,856,417 \$210,431,976	\$118,150,403 \$201,343,396	\$119,115,377 \$204,793,033	\$122,103,393 \$203,806,426	\$122,514,761 \$202,843,962

facilities currently operating an MWI will purchase emission control equipment. This scenario does not allow for the possibility of switching to alternative technologies for waste treatment or disposal.

National costs are lowest under scenario B, which assumes that some facilities currently operating an on-site MWI will switch to an alternative method of waste treatment or disposal. This scenario also assumes that these facilities that decide to switch will also decide to segregate their waste. Annualized costs under scenario B range from approximately \$57.0 million under regulatory option one to approximately \$57.7 million under regulatory option six. Costs under scenarios B and C do not significantly vary among the regulatory options compared to scenario A because the cost of some alternative technologies (such as autoclaving) are unaffected by the emission limits imposed on medical waste incinerators. In addition, the regulatory requirements for commercial MWIs (another type of alternative technology) do not vary by regulatory option. The small changes in national annualized costs observed among the regulatory options reflect the different number of facilities expected to switch from on-site incineration to alternative technologies.

Table 3 presents industry-wide annual costs for those facilities using off-site incineration, referred to as indirect annualized control costs. Annual costs for off-site generators were calculated by multiplying the medical waste generated annually by the incremental cost for commercial incineration. The incremental cost was calculated by dividing industry-wide annualized control costs for commercial incinerators by their throughput. The incremental cost of commercial incineration is calculated to be 0.6 cents per pound of waste incinerated. Note that these commercial incineration costs do not vary by regulatory option because the regulatory requirements do not vary by regulatory option.

## 2. Financial and Economic Inputs

The economic impact methodology used in this report is identical to the methodology used in the original EIA. Therefore, the types of information needed as inputs are identical to the types of data that were gathered for the original analysis. However, all financial and economic data have been updated to include 1993 data where possible.

Table 4 presents the relevant financial and economic data for each of the regulated industries. Specifically, the number of facilities for each industry is reported along with revenue, and employment. Also, where possible, the price elasticity of demand estimate is reported for each industry. These price elasticities are the same values as those estimated in the original EIA. Note that a price elasticity of demand estimate is not presented for the commercial MWI industry. This omission is due to lack of relevant information about this industry and is further complicated by the uncertainty of this regulation's impact on the demand for commercial waste incineration.

## 3. Market Price Increase

The market price increase is defined as the average industry-wide price increase (i.e., increase in revenue) necessary to recover annualized control costs. It is calculated as the ratio of net industry-wide annualized control costs to revenue. Because most, if not all, of the regulated

**Table 3**  
**Industry-wide Annual Cost**  
**For Industries Using Off-site Waste Disposal**

<b>Industry</b>	<b>Medical Waste Generated Annually (tons per year)</b>	<b>Annualized Control Costs<sup>1</sup></b>
Medical / dental laboratories	17,600	\$211,200
Funeral homes	900	\$ 10,800
Physicians' offices	35,200	\$422,400
Dentists' offices & clinics	8,700	\$104,400
Outpatient care	26,300	\$315,600
Freestanding blood banks	4,900	\$ 58,800
Fire & rescue operations	1,600	\$ 19,200
Correctional facilities	3,300	\$ 39,600
<b>Total</b>	<b>98,500</b>	<b>\$1,182,000</b>

<sup>1</sup> Assumes that all medical waste is incinerated off-site at an incremental cost of 0.6 cents per pound, the average cost increase for commercial MWIs.

**Table 4  
Industry-wide Financial and Economic Impact Analysis Inputs**

Industry	Number of Facilities	Industry Revenue or Budget (millions of dollars)	Industry Employment <sup>1</sup>	Price Elasticity of Demand	
				Maximum	Minimum
Hospitals	6,601	\$316,188	4,311,036	-0.33	0
Nursing homes	20,879	\$51,425	1,632,824	-0.67	-0.33
Laboratories: Commercial research <sup>2</sup> Medical / dental	4,170 15,961	\$17,102 \$14,749	159,097 177,866	-1.33 -1.33	-1.00 -0.67
Funeral homes	22,000	\$11,326	136,400	-0.33	0
Physicians' offices	192,965	\$134,637	1,231,342	-0.33	0
Dentists' offices and clinics	108,919	\$37,199	556,011	-0.67	-0.33
Outpatient care <sup>3</sup>	9,238	\$33,021	308,183	-0.33	0
Freestanding blood banks	218	\$1,564	13,298	-0.33	0
Fire & rescue operations	29,840	\$15,695	295,416	-0.33	0
Correctional facilities	4,591	\$33,640	554,959	-0.33	0
Commercial incineration facilities	79	\$189 <sup>4</sup>	N/A	NE	NE
<b>Total</b>	<b>415,461</b>	<b>\$666,735</b>	<b>9,376,432</b>		

<sup>1</sup> Full-time equivalent workers

<sup>2</sup> SIC 8731, Commercial Physical and Biological Research

<sup>3</sup> Defined restrictively as ambulatory care centers (represented by "general medical clinics," a subset of SIC 8011) and kidney dialysis facilities.

<sup>4</sup> Based on 393,934.8 tons per year and \$.24 per pound charges.

N/A - not available

NE - not estimated.

industries are fragmented, actual price increases will vary from market segment to market segment, according to factors such as: 1) the number of facilities in the industry sector; 2) the number of facilities operating an MWI; 3) the distribution of MWI types; and 4) market structure and pricing mechanisms. Ideally, the average price increase in each market segment would be measured. However, it is not possible to define and characterize literally hundreds of regional and local market segments. Therefore, the industry-wide price increase, which is an average price increase across all market segments, is used to represent the average price increase in each individual market segment.

As an average, the industry-wide price increase does not reflect the range of price increases that all facilities in an industry would require to recover control costs. The range of price increases necessary to recover control costs should be particularly wide in industries consisting of both MWI operators and off-site generators. On average, off-site generators will require a lower price increase to recover control costs (passed along from commercial MWIs or other waste treatment service providers) than MWI operators. This is because: 1) the average off-site generator is less dependent on off-site incineration than the average MWI operator is dependent upon on-site incineration; and 2) MWIs used for commercial incineration are larger than average and therefore, have relatively low control costs per unit of waste disposed. Among off-site generators, the price increase necessary to recover control costs will vary with the degree of dependence on off-site incineration.

The industry-wide price impacts are presented in Tables 5A, 5B, and 5C. Each table provides price impact estimates for all six regulatory options under each of the three scenarios. As can be seen from Tables 5A through 5C, scenario A produces the largest price impacts. Due to the unlikely probability that this analysis scenario will occur, attention should be focused on the impacts estimated under scenarios B and C. Scenario B, which assumes switching with waste segregation, produces average industry-wide price increases of approximately 0.01 percent under all regulatory options for both the hospital and nursing home industry sectors. Research laboratories are expected to experience a 0.04 percent price increase, regardless of the regulatory option.

Under scenario C, which assumes switching without waste segregation, hospitals and nursing homes required to comply with regulatory option one are estimated to experience a price increase of approximately 0.02 percent. These industries would experience a price increase of approximately 0.03 percent if they were to be required to comply with regulatory option six. This analysis scenario shows that the laboratory industry sector would experience approximately a 0.07 percent price impact under regulatory option one and a 0.08 percent price increase under regulatory option six.

Industry sectors such as funeral homes, physicians' offices, outpatient care, freestanding blood banks, fire and rescue operations, and correctional facilities would experience such small average industry-wide price impacts that these impacts can be considered zero.

**Table 5A**  
**Industry-wide Percent Price Impacts: Existing Sources**  
**Scenario A**

Industry	Scenario A - No Switching					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Hospitals	0.03	0.03	0.04	0.04	0.04	0.05
Nursing homes	0.03	0.03	0.04	0.04	0.04	0.04
Laboratories: Research Medical/dental	0.08 0	0.10 0	0.11 0	0.12 0	0.13 0	0.13 0
Funeral homes	0	0	0	0	0	0
Physicians' offices	0	0	0	0	0	0
Dentists' offices and clinics	0	0	0	0	0	0
Outpatient care	0	0	0	0	0	0
Freestanding blood banks	0	0	0	0	0	0
Fire and rescue operations	0	0	0	0	0	0
Correctional facilities	0	0	0	0	0	0
Commercial incineration	2.61	2.61	2.61	2.61	2.62	2.62

\* The price increase percentages reported represent the price increase necessary to recover annualized emission control costs for each industry.

**Table 5B**  
**Industry-wide Percent Price\* Impacts: Existing Sources**  
**Scenario B**

Industry	Scenario B - Switching With Waste Segregation					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Hospitals	0.01	0.01	0.01	0.01	0.01	0.01
Nursing homes	0.01	0.01	0.01	0.01	0.01	0.01
Laboratories: Research Medical/dental	0.04 0	0.04 0	0.04 0	0.04 0	0.04 0	0.04 0
Funeral homes	0	0	0	0	0	0
Physicians' offices	0	0	0	0	0	0
Dentists' offices and clinics	0	0	0	0	0	0
Outpatient care	0	0	0	0	0	0
Freestanding blood banks	0	0	0	0	0	0
Fire and rescue operations	0	0	0	0	0	0
Correctional facilities	0	0	0	0	0	0
Commercial incineration	2.61	2.61	2.61	2.61	2.62	2.62

\* The price increase percentages reported represent the price increase necessary to recover annualized emission control costs for each industry.

**Table 5C**  
**Industry-wide Percent Price\* Impacts: Existing Sources**  
**Scenario C**

Industry	Scenario C - Switching With No Waste Segregation					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Hospitals	0.02	0.03	0.03	0.03	0.03	0.03
Nursing homes	0.02	0.02	0.03	0.03	0.03	0.03
Laboratories: Research Medical/dental	0.07 0	0.07 0	0.08 0	0.08 0	0.08 0	0.08 0
Funeral homes	0	0	0	0	0	0
Physicians' offices	0	0	0	0	0	0
Dentists' offices and clinics	0	0	0	0	0	0
Outpatient care	0	0	0	0	0	0
Freestanding blood banks	0	0	0	0	0	0
Fire and rescue operations	0	0	0	0	0	0
Correctional facilities	0	0	0	0	0	0
Commercial incineration	2.61	2.61	2.61	2.61	2.62	2.62

\* The price increase percentages reported represent the price increase necessary to recover annualized emission control costs for each industry.

With the exception of the commercial MWI industry, all market price increases presented in Tables 5A through 5C are under one percent and therefore, are considered achievable. The low values partly reflect the assertion that a large number of facilities in each industry sector do not operate an MWI. Note that the impacts of the regulation are expected to fall within the range estimated for scenarios B and C. Impacts estimated for scenario A are presented in this analysis only for comparison purposes.

Tables 5A through 5C also present average industry-wide price impacts for the commercial MWI industry sector. These price impacts are estimated as 2.6 percent for each of the regulatory options. The price impacts are the same for all regulatory options because the regulatory requirements for the commercial MWI industry sector are the same under each of the regulatory options. These price impacts are also identical for the three analysis scenarios because the option of existing commercial MWIs switching to alternative technologies is not an appropriate option for this industry. Although the estimated price increase for this industry is above one percent, this price impact is considered achievable due to the cost advantage this industry offers in comparison to the high costs that facilities with on-site MWIs would face if they decided to install emission control equipment. This cost advantage (due to economies of scale) is a strong basis for the argument that many facilities will switch from on-site incineration to off-site disposal.

#### 4. Output, Employment, and Revenue Impacts

A market price increase will result in output, employment, and revenue impacts. This analysis presents a range of output, employment, and revenue impacts under each regulatory option due to the use of two price elasticity of demand estimates for each industry. These impacts are not estimated for the commercial MWI industry due to lack of relevant financial and economic information pertaining to this industry.

Output in each industry sector will always decrease in response to a market price increase. Using a constant-elasticity demand function specified as:

$$Q_D = aP^e$$

Where:       $Q_D$  = Quantity Demanded  
               $a$  = a constant  
               $P$  = Price  
               $e$  = Price Elasticity of Demand

By also specifying time periods 0 and 1, the percent change in output ( $\% \Delta Q$ ) can be solved in the following way:

$$\begin{aligned}
Q &= aP^e \\
Q_0 &= aP_0^e \\
Q_1 &= aP_1^e \\
\% \Delta P &= \frac{P_1 - P_0}{P_0} \\
\% \Delta Q &= \frac{Q_1 - Q_0}{Q_0} \\
&= \frac{aP_1^e - aP_0^e}{aP_0^e} \\
&= \frac{P_1^e - P_0^e}{P_0^e} \\
&= \frac{[P_0(1 + \% \Delta P)]^e - P_0^e}{P_0^e} \\
&= \frac{P_0^e(1 + \% \Delta P)^e - P_0^e}{P_0^e} \\
&= (1 + \% \Delta P)^e - 1
\end{aligned}$$

The output impacts can be calculated by setting  $\% \Delta P$  equal to the estimated market price increase. These impacts are presented in Tables 6A, 6B, and 6C. Due to the relatively small market price increase and/or relatively inelastic demand, all of the output impacts are less than one percent.

As with the cost and price impacts, these output impacts are largest under scenario A and smallest under scenario B. Under the unlikely assumption that switching will not occur (scenario A), the output decreases would range from undetectable impacts to 0.02 percent for hospitals, 0.01 to 0.03 percent for nursing homes, and undetectable impacts to 0.18 percent for the laboratory industry sector, depending on the regulatory option examined. All other industry sectors are expected to experience undetectable output impacts.

As expected, output impacts are small under the switching with waste segregation assumption. Using this assumption (scenario B), the regulatory options would produce undetectable impacts for the hospital industry, undetectable impacts to a 0.01 percent impact for the nursing home industry, and impacts ranging from undetectable impacts to a 0.05 percent for laboratories. For each of these industries, the impacts do not vary among the regulatory options. All other industry sectors would experience undetectable output impacts.

**Table 6A**  
**Industry-wide Output, Employment, and Revenue Impacts: Existing Sources**  
**Scenario A**

Industry	Scenario A - No Switching					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
<b>Hospitals</b>						
Output decrease (%)	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01	0-0.02
Employment decrease (FTEs)	0-378	0-462	0-553	0-580	0-610	0-647
Revenue increase or (decrease) (%)	0.02-0.03	0.02-0.03	0.03-0.04	0.03-0.04	0.03-0.04	0.03-0.05
<b>Nursing homes</b>						
Output decrease (%)	0.01-0.02	0.01-0.02	0.01-0.03	0.01-0.03	0.01-0.03	0.02-0.03
Employment decrease (FTEs)	139-283	170-346	204-414	214-434	225-456	238-484
Revenue increase or (decrease) (%)	0.01-0.02	0.01-0.02	0.01-0.03	0.01-0.03	0.01-0.03	0.01-0.03
<b>Laboratories:</b>						
<b>Research</b>						
Output decrease (%)	0.08-0.10	0.10-0.13	0.11-0.15	0.12-0.16	0.13-0.17	0.13-0.18
Employment decrease (FTEs)	124-164	151-201	181-241	190-252	199-265	211-281
Revenue increase or (decrease) (%)	(0.03)-0	(0.03)-0	(0.04)-0	(0.04)-0	(0.04)-0	(0.04)-0
<b>Medical/dental</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	2-3	2-3	2-3	2-3	2-3	2-3
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Funeral homes</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Physicians' offices</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Dentists' offices and clinics</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	1	1	1	1	1	1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Outpatient care</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Freestanding blood banks</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Fire and rescue operations</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Correctional facilities</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0

Output decreases and full time equivalents (FTEs) employment losses as a result of the regulation are shown on this table. Revenue increases and decreases are presented with decreases noted in brackets.

**Table 6B**  
**Industry-wide Output, Employment, and Revenue Impacts: Existing Sources**  
**Scenario B**

Industry	Scenario B - Switching With Waste Segregation					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
<b>Hospitals</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0-172	0-172	0-173	0-173	0-174	0-174
Revenue increase or (decrease) (%)	0.01	0.01	0.01	0.01	0.01	0.01
<b>Nursing homes</b>						
Output decrease (%)	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01
Employment decrease (FTEs)	63-128	63-129	64-129	64-129	64-130	64-130
Revenue increase or (decrease) (%)	0-0.01	0-0.0	0-0.01	0-0.01	0-0.01	0-0.01
<b>Laboratories:</b>						
<b>Research</b>						
Output decrease (%)	0.04-0.05	0.04-0.05	0.04-0.05	0.04-0.05	0.04-0.05	0.04-0.05
Employment decrease (FTEs)	56-75	56-75	57-75	57-75	57-76	57-76
Revenue increase or (decrease) (%)	(0.01)-0	(0.01)-0	(0.01)-0	(0.01)-0	(0.01)-0	(0.01)-0
<b>Medical/dental</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	2-3	2-3	2-3	2-3	2-3	2-3
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Funeral homes</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Physicians' offices</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Dentists' offices and clinics</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	1	1	1	1	1	1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Outpatient care</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Freestanding blood banks</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Fire and rescue operations</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Correctional facilities</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0

Output decreases and full time equivalents (FTEs) employment losses as a result of the regulation are shown on this table. Revenue increases and decreases are presented with decreases noted in brackets.

**Table 6C**  
**Industry-wide Output, Employment, and Revenue Impacts: Existing Sources**  
**Scenario C**

Industry	Scenario C - Switching With No Waste Segregation					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
<b>Hospitals</b>						
Output decrease (%)	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01
Employment decrease (FTEs)	0-341	0-356	0-373	0-376	0-386	0-388
Revenue increase or (decrease) (%)	0.02-0.03	0.02-0.03	0.02-0.03	0.02-0.03	0.02-0.03	0.02-0.03
<b>Nursing homes</b>						
Output decrease (%)	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02
Employment decrease (FTEs)	126-255	131-266	138-279	139-282	142-289	143-290
Revenue increase or (decrease) (%)	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02
<b>Laboratories:</b>						
<b>Research</b>						
Output decrease (%)	0.07-0.09	0.07-0.10	0.08-0.10	0.08-0.10	0.08-0.11	0.08-0.11
Employment decrease (FTEs)	112-148	116-155	122-162	123-164	126-168	127-169
Revenue increase or (decrease) (%)	(0.02)-0	(0.02)-0	(0.03)-0	(0.03)-0	(0.03)-0	(0.03)-0
<b>Medical/dental</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	2-3	2-3	2-3	2-3	2-3	2-3
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Funeral homes</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Physicians' offices</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Dentists' offices and clinics</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	1	1	1	1	1	1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Outpatient care</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Freestanding blood banks</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Fire and rescue operations</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
<b>Correctional facilities</b>						
Output decrease (%)	0	0	0	0	0	0
Employment decrease (FTEs)	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0

Output decreases and full time equivalents (FTEs) employment losses as a result of the regulation are shown on this table. Revenue increases and decreases are presented with decreases noted in brackets.

The impact of the market price increase on industry-wide employment, assuming that employment is proportional to output (i.e., fixed labor to output ratio), is also presented in Tables 6A through 6C. These impacts are presented in terms of expected decreases in the number of full time equivalents (FTEs) that would be employed in each of the industries. These values can be interpreted as the number of full-time workers that are expected to be affected by this regulation. As a percent of baseline employment, the estimated decreases in FTEs is considered small.

Assuming that no switching would occur, regulatory option one would produce employment decreases in the range of undetectable impacts to 378 FTEs for the hospital industry, 139 to 283 FTEs for the nursing home industry, 126 to 167 FTEs for the laboratory industry, and undetectable impacts to a loss of one FTE for the outpatient care industry sector. All other industry sectors would experience undetectable employment impacts. Regulatory option six would produce employment impacts in the range of undetectable impacts to 647 FTEs for the hospital industry, 238 to 484 FTEs for the nursing home industry, 213 to 284 FTEs for the laboratory industry, undetectable impacts to 1 FTE for both the physicians' offices and the outpatient care industry sectors, and undetectable employment impacts for all other industry sectors. As a percent of baseline employment, these estimated employment decreases are comparable to the estimated decreases of output for each of the industry sectors under each of the regulatory options analyzed under scenario A.

Using the assumption of switching with waste segregation, regulatory option one would produce employment decreases in the range of undetectable impacts to 172 FTEs for the hospital industry, 63 to 128 FTEs for the nursing home industry, 58 to 78 FTEs for the laboratory industry, one FTE for the dentistry industry, and undetectable impacts to one FTE for both the physicians' offices and outpatient care industry sectors. All other industry sectors would experience undetectable employment impacts under regulatory option one. Regulatory option six would produce employment decreases in the range of undetectable impacts to 172 FTEs for the hospital industry, 64 to 130 FTEs for the nursing home industry, 59 to 79 FTEs for the laboratory industry, one FTE for dentists' offices, undetectable impacts to one FTE for physicians' offices and the outpatient care industry sector, and undetectable employment impacts for all other industry sectors. Once again, as a percent of baseline employment, these estimated employment impacts are comparable to the estimated decreases of output for each of the industry sectors under each of the regulatory options analyzed under scenario B. Note that the employment impacts resulting from implementation of this regulation are expected to fall between the range of impacts estimated for scenarios A and B, most likely similar to the impacts estimated under scenario C.

The employment impacts presented in this analysis do not attempt to quantify some positive employment impacts expected to occur as a result of this regulation. For example, employment related to the production of pollution control equipment should increase. In addition, additional people will be needed to provide training to MWI operators. Also, there should be an increase in

employment related to the production and operation of commercial MWIs and alternative medical waste treatment and disposal systems.

Revenue impacts resulting from the estimated average market price increase are calculated by using the following equation:

$$\Delta \text{ Total Revenue} = \text{Total Annual Revenue} * (\% \Delta P + \% \Delta Q) + (\% \Delta P * \% \Delta Q)$$

Revenue impacts (in percentage increase or decrease terms) are also presented in Tables 6A through 6C. Total revenue in an industry is expected to increase with a price increase if the demand for that industry's product or service (e.g., health care) is relatively inelastic (less than one). A price elasticity of less than one indicates that the percentage decrease in output will be less than the percentage increase in price. Since total revenue is a product of price and output, a less than proportional change in output compared to price means that total revenue should increase. All revenue impacts presented in Tables 6A through 6C are small and are not considered significant.

Under scenario A, the revenue impacts for regulatory options one through six are expected to range from a 0.02 percent to a 0.05 percent increase for the hospital industry, 0.01 to 0.03 percent increase for the nursing home industry, zero impacts to a 0.04 decrease for research laboratories, and undetectable revenue impacts for all other industry sectors. Using the same analysis scenario under regulatory option six, revenue impacts are expected to range from a 0.03 percent to a 0.05 percent increase for the hospital industry, 0.01 to 0.03 increase for the nursing home industry, undetectable impacts to 0.04 decrease for research laboratories, and undetectable revenue impacts for all other industry sectors.

Examining the impacts under the more likely assumptions of switching (scenarios B and C), revenue impacts are expected to range from a 0.01 percent increase to a 0.03 percent increase for the hospital industry, undetectable impacts to a 0.02 percent increase for the nursing home industry, undetectable impacts to a 0.03 percent decrease for research laboratories, and undetectable revenue impacts for all other industry sectors.

### **C. Model Facility Analysis**

Facility-specific impacts were also estimated for the affected industries. These facility-specific impacts were calculated by employing the concept of model facilities. This technique allows an analysis to be prepared on a more detailed level by defining key parameters to describe a "typical" facility in each of the affected industries. The EIA prepared for the proposed rule used cost estimates provided on a model combustor basis to estimate economic impacts for model facilities. The model facility concept not only had to incorporate model combustor parameters, (e.g., amount of throughput to determine size, etc.), but also key financial and economic parameters

(e.g., revenue, etc.). Therefore, a scheme to assign model combustors to model facilities had to be developed in the original EIA.

New information received after proposal made it possible for cost estimates to be developed on a model facility basis, with key model combustor (i.e., MWI) parameters already incorporated into the model facility concept. Therefore, this document no longer needs to employ the “linking” scheme to assign model combustors to model facilities used in the earlier EIA. Model facilities as defined in the cost analysis are presented in Table 7. Note that hospitals are defined in terms of the number of beds at a facility while nursing homes and research laboratories are defined in terms of number of employees. Also note that this type of information is not available for the commercial MWI industry.

### 1. Model MWI Costs

Tables 8 and 9 present capital (for scenario A) and annualized (for scenarios A, B, and C) costs for the model facilities in this analysis. Scenario A lists capital costs for the model facilities because this scenario assumes that all facilities that are currently operating an MWI will have emission control equipment installed rather than switch to alternative technologies. Scenarios B and C have no capital costs associated with the model MWIs because switching to an alternative technology precludes the need to invest in emission control equipment for an on-site MWI.

Scenario A is an unlikely representation of the potential facility-specific impacts of this regulation for several reasons. First, the assumption that some currently operated MWIs will not be replaced by alternative technologies is unrealistic. This regulation will impose additional costs on an MWI and therefore, will make alternative technologies seem more attractive compared to MWI technology, from a cost perspective. Additionally, model facility costs developed under scenario A examines the cost of imposing emission control costs on an “uncontrolled” incinerator in the baseline. Many currently operated MWIs already have some emission control equipment installed. The costs of meeting any of the regulatory options would not be from a baseline of “no controls” for these facilities. Therefore, this analysis under scenario A examines only the extreme case of an MWI having no emission controls installed in the baseline.

The incremental annual cost for off-site generators is presented in Table 10. Two estimates are provided as the incremental annual cost. The low estimate is calculated by multiplying 0.6 cents by the estimated amount of medical waste generated per facility. The 0.6 cents per pound of waste incinerated was calculated earlier in section III.B. The high estimate is calculated by using model facility information developed for an uncontrolled model MWI in the commercial MWI industry. An uncontrolled model commercial MWI is estimated to experience annualized costs of \$191,900 and is estimated to burn 7,711,000 pounds of waste annually. Dividing the cost by the amount of waste burned yields a cost per pound value of \$0.025. The use of a low and high cost estimate allows for the consideration of uncertainty in the actual incremental annual cost off-site generators will experience.

**Table 7  
Model Facilities**

<b>Industry</b>	<b>Definition</b>	<b>MWI Assignment</b>
Hospitals		
Large Hospital	400 beds	Large MWI
Medium Hospital	140 beds	Medium MWI
Small Hospital	40 beds	Small MWI
Nursing Home	150 employees	Small MWI
Research Laboratory	200 employees	Medium MWI
Commercial Incineration Facility	N/A	Commercial MWI

**Table 8**  
**Model Facility Annualized Control Cost**  
**Scenario A: No Switching**

Model MWI	Regulatory Option					
	One	Two	Three	Four	Five	Six
Small Urban						
Annualized cost	\$ 17,108	\$ 69,408	\$ 69,408	\$ 76,008	\$ 76,008	\$ 86,008
Capital cost	\$ 49,252	\$ 236,052	\$ 236,052	\$ 261,552	\$ 261,552	\$ 309,952
Small Rural						
Annualized cost	\$ 17,108	\$ 17,108	\$ 69,408	\$ 76,008	\$ 76,008	\$ 86,008
Capital cost	\$ 49,252	\$ 49,252	\$ 236,052	\$ 261,552	\$ 261,552	\$ 309,952
Medium						
Annualized cost	\$ 85,700	\$ 85,700	\$ 85,700	\$ 85,700	\$ 97,000	\$ 97,000
Capital cost	\$ 250,300	\$ 250,300	\$ 250,300	\$ 250,300	\$ 302,400	\$ 302,400
Large On-site						
Annualized cost	\$ 150,700	\$ 150,700	\$ 150,700	\$ 150,700	\$ 150,700	\$ 150,700
Capital cost	\$ 397,100	\$ 397,100	\$ 397,100	\$ 397,100	\$ 397,100	\$ 397,100
Large Commercial						
Annualized cost	\$ 191,900	\$ 191,900	\$ 191,900	\$ 191,900	\$ 191,900	\$ 191,900
Capital cost	\$ 470,000	\$ 470,000	\$ 470,000	\$ 470,000	\$ 470,000	\$ 470,000

**Table 9**  
**Model Facility Annual Cost of Switching<sup>1</sup>**  
**Scenarios B and C**

<b>Model MWI</b>	<b>Scenario B - Switching With Waste Segregation</b>	<b>Scenario C - Switching Without Waste Segregation</b>
Small		
Urban	\$5,260	\$19,200
Rural	\$5,600	\$31,200
Medium		
Urban	\$19,944	\$72,800
Rural	\$21,233	\$118,300
Large		
Urban	\$93,584	\$341,600
Rural	\$99,633	\$555,100

<sup>1</sup> Switching costs do not vary by regulatory option.

**Table 10**  
**Model Facility Impacts For Firms that Utilize Off-site Waste Incineration: Existing Sources**  
**Estimated Medical Waste Per Facility and Incremental Annual Cost Per Facility**

Industry	Medical Waste Per Facility (tons)	Incremental Annual Cost Per Facility	
		Low <sup>1</sup>	High <sup>2</sup>
<b>Hospitals</b>			
<50 Beds	9.75	\$122	\$485
50-99 Beds	17.10	\$214	\$851
100-299 Beds	52.08	\$653	\$2,592
300+ Beds	167.28	\$2,097	\$8,326
<b>Nursing Homes</b>			
0-19 Employees			
Tax-paying	0.14	\$2	\$7
Tax-exempt	0.17	\$2	\$8
20-99 Employees			
Tax-paying	1.14	\$14	\$57
Tax-exempt	1.04	\$13	\$52
100+ Employees			
Tax-exempt	2.70	\$34	\$134
Tax-paying	3.44	\$43	\$171
<b>Commercial Research Laboratories</b>			
Tax-paying			
0-19 Employees	0.28	\$4	\$14
20-99 Employees	2.19	\$27	\$109
100+ Employees	24.50	\$307	\$1,220
Tax-exempt	7.28	\$91	\$362
<b>Outpatient Care Clinics</b>			
Physicians' clinics (Amb. Care)			
Tax-paying	2.26	\$28	\$112
Tax-exempt	4.19	\$52	\$208
Freestanding kidney dialysis facilities			
Tax-paying	1.62	\$20	\$80
Tax-exempt	2.31	\$29	\$115
<b>Physicians' Offices</b>	0.18	\$2	\$9
<b>Dentists' Offices and Clinics</b>			
Offices	0.08	\$1	\$4
Clinics			
Tax-paying	0.14	\$2	\$7
Tax-exempt	0.19	\$2	\$10
<b>Medical &amp; Dental Laboratories</b>			
Medical	1.63	\$20	\$81
Dental	0.51	\$6	\$26
<b>Freestanding Blood Banks</b>	22.48	\$282	\$1,119
<b>Funeral Homes</b>	0.04	\$1	\$2
<b>Fire &amp; Rescue</b>	0.05	\$1	\$3
<b>Corrections</b>			
Federal Government	1.64	\$20	\$81
State Government	1.70	\$21	\$85
Local Government	0.34	\$4	\$17

1 The low incremental annual cost per facility estimate is based on the average annualized control cost for all commercial MWIs of \$0.006 per pound

2 The high incremental annual cost per facility estimate is based on a cost of \$0.025 per pound, the control cost for large commercial MWIs that are uncontrolled in the baseline.

## 2. Financial and Economic Inputs

Table 11 presents employment and revenue data for facilities in the hospital, nursing home, laboratory, and commercial incineration industries. These data were calculated for the purpose of providing more detail based on size, location (rural versus urban), and type of ownership (taxpaying versus tax-exempt) for the model facilities.

The financial and economic information was calculated using information presented in Tables 7, 12, and 13. For example, the employment estimates calculated for the hospital industry used the model facility definition specifying the number of beds that would typically be at a small, medium, or large hospital. The model facility sizes for hospitals match a small incinerator to small hospitals that are defined to have 40 beds, a medium-sized incinerator for medium-sized hospitals of 140 beds, and large incinerators to large hospitals with 400 beds respectively. Data regarding the annual revenue and employment for differing sized hospitals do not match the size designations of 40, 140, and 400 beds directly. For this reason, it was necessary to interpolate the revenue and employment data to match the model plant hospital sizes. For example, the average number of beds in a small federal government hospital is estimated to be 34.8 in the 25-49 bed category and 66.2 in the 50-99 category. A hospital with forty beds is between these two averages, and interpolation of these differences was necessary to determine average revenue for small federal government hospitals of \$18.7 million shown in Table 11.

The number of employees at nursing homes and research laboratories was specified in the model facility definitions for these industries. Employment at a commercial incineration facility was not estimated because this information was not available for this industry.

Annual revenue was calculated for the model facilities in each industry based on the same interpolation methodology described for the number of beds estimated to be at a model size hospital. These model facility revenue estimates are presented in Table 11. The data used for these calculations is presented in Tables 12 and 13.

## 3. Model Facility Price Increase

The facility-specific price increase is defined as the price increase necessary for an individual to fully recover control costs. The facility-specific price increase is calculated by comparing the model facility annualized cost estimate to the annual revenue for each of the model facilities. This ratio provides an indication of the magnitude of the impact of the regulation on a "typical" facility in each industry sector. This calculation is then compared to the industry-wide price impact to determine if the facility's impacts differ significantly from the average industry-wide impacts. To the extent that an industry is competitive, individual firms are constrained to institute price increases that are not far out of line with the market price increase. Therefore, if a model facility's price impacts differ significantly (greater than one percent) from the average industry-wide price impact, this analysis may make the determination that this regulation's impacts are significant.

**Table 11**  
**Model Facilities: Economic Impact Input Information**  
**(Year = 1993)**

Industry - Model Facilities Information	Employment <sup>1</sup>	Annual Revenue/Budget <sup>2</sup>
<b>Hospitals - Short term, excluding psychiatric:</b>		
Federal Government		
Small		
Urban / Rural	393	\$18.7
Medium	674	\$43.2
Large	1,738	\$117.0
State Government		
Small		
Urban / Rural	133	\$8.7
Medium	617	\$41.3
Large	2,753	\$207.3
Local Government		
Small		
Urban / Rural	112	\$5.6
Medium	432	\$27.1
Large	1,987	\$155.0
Not-for-profit		
Small		
Urban / Rural	139	\$8.3
Medium	522	\$36.8
Large	1,725	\$134.6
For-profit		
Small		
Urban / Rural	112	\$7.3
Medium	399	\$34.7
Large	1,156	\$106.7
<b>Hospitals - Psychiatric, short term and long term:</b>		
Small		
Urban / Rural	87	\$5.3
Medium	259	\$15.1
Large	719	\$32.6
<b>Nursing Homes:</b>		
Tax-Paying		
Urban / Rural	150	\$4.9
Tax-exempt		
Urban / Rural	150	\$4.8
<b>Commercial Research Laboratories</b>		
Tax-paying	200	\$21.2
Tax-exempt	200	\$21.2
<b>Commercial Incineration Facilities</b>	N/A	\$2.4

1 Full time equivalent workers

2 Millions of dollars

N/A - not available

**Table 12  
Model Facilities: Economic Impact Input Information**

	Industry Totals			Average Per Facility		
	Number of Facilities	Number of Beds	Employment	Number of Beds	Employment	Annual Revenue (millions \$)
<b>Short-term hospitals excluding psychiatric:</b>						
Federal Government						
6-24 Beds	31	528	9,023	17.0	291.1	8.6
25-49 Beds	61	2,122	22,230	34.8	364.4	16.5
50-99 Beds	22	1,456	11,796	66.2	535.2	29.6
100-199 Beds	56	8,122	38,291	145.0	683.8	44.2
200-299 Beds	32	7,975	36,581	249.2	1,143.2	74.8
300-399 Beds	26	9,188	39,010	353.4	1,500.4	104.1
400-499 Beds	16	7,156	31,672	447.3	1,979.5	130.1
500+ Beds	46	35,321	100,372	767.8	2,182.0	157.6
State Government						
6-24 Beds	3	49	133	16.3	44.3	3.5
25-49 Beds	20	686	2,326	34.3	116.3	7.5
50-99 Beds	10	693	2,218	69.3	221.8	15.1
100-199 Beds	17	2,332	10,327	137.2	607.5	40.3
200-299 Beds	8	1,982	7,961	247.8	995.1	79.6
300-399 Beds	11	3,925	23,720	356.8	2,156.4	171.5
400-499 Beds	10	4,413	33,243	441.3	3,324.3	241.5
500+ Beds	17	10,868	61,888	639.3	3,640.5	306.7
Local Government						
6-24 Beds	129	2,451	6,418	19.0	49.8	2.4
25-49 Beds	408	15,012	42,095	36.8	103.2	5.0
50-99 Beds	370	25,689	72,360	69.4	195.6	10.8
100-199 Beds	242	33,472	102,518	138.3	423.6	26.3
200-299 Beds	73	18,331	73,667	251.1	1,009.1	77.5
300-399 Beds	36	12,279	59,058	341.1	1,640.5	124.5
400-499 Beds	14	6,400	32,525	457.1	2,323.2	184.5
500+ Beds	42	31,516	149,207	750.4	3,552.5	278.1
Not-for-profit hospitals						
6-24 Beds	92	1,748	6,475	19.0	70.4	3.8
25-49 Beds	398	15,148	52,895	38.1	132.9	7.9
50-99 Beds	608	44,407	142,944	73.0	235.1	15.0
100-199 Beds	795	114,670	429,112	144.2	539.8	38.2
200-299 Beds	555	136,231	551,960	245.5	994.5	73.2
300-399 Beds	328	113,066	481,106	344.7	1,466.8	113.2
400-499 Beds	169	75,385	327,941	446.1	1,940.5	152.4
500+ Beds	218	150,905	720,101	692.2	3,303.2	277.0
For-profit hospitals						
6-24 Beds	10	186	553	18.6	55.3	4.3
25-49 Beds	76	3,097	8,633	40.8	113.6	7.4
50-99 Beds	201	14,756	42,217	73.4	210.0	16.3
100-199 Beds	288	39,443	111,940	137.0	388.7	33.7
200-299 Beds	95	22,535	68,204	237.2	717.9	66.8
300-399 Beds	27	9,203	26,404	340.9	977.9	96.1
400-499 Beds	12	5,191	15,051	432.6	1,254.3	112.6
500+ Beds	8	4,553	16,281	569.1	2,035.1	195.7
<b>Psychiatric hospitals - short-term and long-term</b>						
6-24 Beds	18	430	1,345	23.9	74.7	4.3
25-49 Beds	84	3,166	7,073	37.7	84.2	5.1
50-99 Beds	303	22,131	39,192	73.0	129.3	8.5
100-199 Beds	156	20,477	37,091	131.3	237.8	14.3
200-299 Beds	58	14,714	30,928	253.7	533.2	25.8
300-399 Beds	39	13,821	26,319	354.4	674.8	30.6
400-499 Beds	30	13,697	23,191	456.6	773.0	35.0
500+ Beds	72	56,949	99,680	791.0	1,384.4	64.0

**Table 13**  
**Medical Waste Incineration**  
**Model Facilities - Economic Impact Input Information**

<b>Other MWI Operators</b>	<b>Average Employee Per Facility</b>	<b>Average Revenue Per Facility</b>
<b>Nursing Homes</b>		
Tax-paying		
100+ employees	148.2	\$4,846,944
Tax-exempt		
50-99 employees	74.3	\$2,063,489
100+ employees	189.3	\$6,210,832
<b>Commercial Research Laboratories</b>		
Tax-paying		
50-99 employees	68.3	\$7,299,521
100+ employees	469.7	\$49,670,443
Tax-exempt	139.5	14,761,754
<b>Commercial Incineration</b>	N/A	\$2,393,528

N/A - not available

Tables 14A and 14B show that facilities with on-site MWIs (with the exception of commercial MWIs) may experience price impacts ranging from 0.03 percent to 1.79 percent, depending on the industry, regulatory option, and scenario analyzed. A comparison of the economic impacts expected to occur under the three switching scenarios indicates that the option of switching will be attractive to many facilities currently operating an on-site incinerator. For many of the uncontrolled model facilities, the economic impacts of switching to an alternative method of waste disposal are much lower than the economic impacts of choosing to install emission control equipment. These results indicate that from a cost perspective, the option of switching to a lower cost alternative for waste disposal will be an attractive option for some facilities currently using an on-site MWI. The decision to switch to an alternative method of medical waste disposal should preclude any facilities from experiencing a significant economic impact. These results support the assertion that implementation of the regulation will likely result in either scenarios B or C and that the costs and economic impacts of scenario A are not representative of the economic impacts of this regulation.

Based on the assertion that scenarios B or C are more representative of the results of this regulation, attention should be focused on the model facility price impacts presented in Table 14B. An examination of the impacts on facilities directly affected by this regulation indicates that these impacts do not significantly differ from the average industry-wide price impacts. Therefore, these impacts are considered achievable.

Table 15 shows the impacts that would be incurred by medical waste generators that currently use an off-site medical waste treatment or disposal service. These impacts range from undetectable impacts to 0.02 percent and are not considered significant impacts. These results indicate that the incremental cost for the vast majority of medical waste generators are expected to be small and similar to the other industries, model facility price impacts for off-site generators do not significantly differ from the average industry-wide price impacts. Once again, these impacts are considered achievable.

Price impact estimates for the commercial medical waste incinerator industry sector are presented in Table 14A. The analysis shows that uncontrolled medical waste incinerators required to meet any of the regulatory options would need to increase their prices by approximately 8 percent in order to recoup their control costs. Several factors indicate that it is unlikely these particular facilities would be able to increase the price of their service by 8 percent.

An examination of the MWI inventory indicates that a majority of facilities in this industry sector have already implemented controls that would enable them to meet the requirements of any of the six regulatory options. Only a small number of facilities in this industry would be “uncontrolled” in the baseline and would therefore, incur the majority of the costs estimated for this sector. This distribution suggests that commercial MWIs that must install emission control equipment will not be able to freely increase their prices due to competition from already-controlled commercial MWIs. As indicated in the industry-wide impact calculations, the average industry-wide price increase is expected to be approximately 3 percent. Therefore, commercial MWIs having to incur

**Table 14A**  
**Model Facility Impacts Assuming No Switching and On-site Incineration: Existing Sources**  
**Annualized Control Cost as a Percent of Revenue/Budget (%)**

Industry	Scenario A - No Switching					
	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
<b>Hospitals - Short term, excluding psychiatric:</b>						
Federal Government						
Small						
Urban	0.09	0.37	0.37	0.41	0.41	0.46
Rural	0.09	0.09	0.37	0.41	0.41	0.46
Medium	0.20	0.20	0.20	0.20	0.22	0.22
Large	0.13	0.13	0.13	0.13	0.13	0.13
State Government						
Small						
Urban	0.20	0.80	0.80	0.87	0.87	0.99
Rural	0.20	0.20	0.80	0.87	0.87	0.99
Medium	0.21	0.21	0.21	0.21	0.23	0.23
Large	0.07	0.07	0.07	0.07	0.07	0.07
Local Government						
Small						
Urban	0.31	1.24	1.24	1.36	1.36	1.53
Rural	0.31	0.31	1.24	1.36	1.36	1.53
Medium	0.32	0.32	0.32	0.32	0.36	0.36
Large	0.10	0.10	0.10	0.10	0.10	0.10
Not-for-profit						
Small						
Urban	0.21	0.84	0.84	0.92	0.92	1.04
Rural	0.21	0.21	0.84	0.92	0.92	1.04
Medium	0.23	0.23	0.23	0.23	0.26	0.26
Large	0.11	0.11	0.11	0.11	0.11	0.11
For-profit						
Small						
Urban	0.23	0.95	0.95	1.04	1.04	1.18
Rural	0.23	0.23	0.95	1.04	1.04	1.18
Medium	0.25	0.25	0.25	0.25	0.25	0.28
Large	0.14	0.14	0.14	0.14	0.14	0.14
<b>Hospitals - Psychiatric, short term and long term:</b>						
Small						
Urban	0.32	1.30	1.30	1.43	1.43	1.62
Rural	0.32	0.32	1.30	1.43	1.43	1.62
Medium	0.57	0.57	0.57	0.57	0.64	0.64
Large	0.46	0.46	0.46	0.46	0.46	0.46
<b>Nursing Homes:</b>						
Tax-Paying						
Urban	0.35	1.41	1.41	1.55	1.55	1.75
Rural	0.35	0.35	1.41	1.55	1.55	1.75
Tax-exempt						
Urban	0.36	1.45	1.45	1.59	1.59	1.79
Rural	0.36	0.36	1.45	1.59	1.59	1.79
<b>Commercial Research Laboratories:</b>						
Tax-paying	0.40	0.40	0.40	0.40	0.46	0.46
Tax-exempt	0.40	0.40	0.40	0.40	0.46	0.46
<b>Commercial Incineration Facilities</b>	<b>8.02</b>	<b>8.02</b>	<b>8.02</b>	<b>8.02</b>	<b>8.02</b>	<b>8.02</b>

Table 14B  
**Model Facility Impacts Assuming Switching from On-site Incineration to Commercial Disposal Alternatives**  
**Alternative Waste Disposal Cost as a Percent of Revenue/Budget (%)**

Industry	Scenario B - Switching With Waste Segregation	Scenario C - Switching Without Waste Segregation
<b>Hospitals - Short term, excluding psychiatric:</b>		
Federal Government:		
Small - Urban	0.03	0.10
Rural	0.03	0.17
Medium - Urban	0.05	0.17
Rural	0.05	0.27
Large - Urban	0.08	0.29
Rural	0.09	0.47
State Government:		
Small - Urban	0.06	0.22
Rural	0.06	0.36
Medium - Urban	0.05	0.18
Rural	0.05	0.29
Large - Urban	0.05	0.16
Rural	0.05	0.27
Local Government:		
Small - Urban	0.09	0.34
Rural	0.10	0.56
Medium - Urban	0.07	0.27
Rural	0.08	0.44
Large - Urban	0.06	0.22
Rural	0.06	0.36
Not-for-profit		
Small - Urban	0.06	0.23
Rural	0.07	0.38
Medium - Urban	0.05	0.20
Rural	0.06	0.32
Large - Urban	0.07	0.25
Rural	0.07	0.41
For-profit		
Small - Urban	0.07	0.26
Rural	0.08	0.43
Medium - Urban	0.06	0.21
Rural	0.06	0.34
Large - Urban	0.09	0.32
Rural	0.09	0.52
<b>Hospitals - Psychiatric, short term and long term:</b>		
Small - Urban	0.10	0.36
Rural	0.11	0.59
Medium - Urban	0.13	0.48
Rural	0.14	0.78
Large - Urban	0.29	1.05
Rural	0.31	1.70
<b>Nursing Homes:</b>		
Tax-Paying - Urban	0.11	0.39
Rural	0.11	0.64
Tax-exempt - Urban	0.11	0.40
Rural	0.12	0.65
<b>Commercial research labs:</b>		
Tax-paying - Urban	0.09	0.34
Rural	0.10	0.56
Tax-exempt - Urban	0.09	0.34
Rural	0.10	0.56

**Table 15**  
**Model Facility Impacts For Firms that Utilize Off-site Waste Incineration: Existing Sources**  
**Incremental Annual Cost as a Percent of Revenue/Budget (%)**

Industry	Incremental Annual Cost as a Percent of Revenue	
	Low <sup>1</sup>	High <sup>2</sup>
<b>Hospitals</b>		
<50 Beds	0	0.01
50-99 Beds	0	0.01
100-299 Beds	0	0.01
300+ Beds	0	0.01
<b>Nursing Homes</b>		
0-19 Employees		
Tax-paying	0	0
Tax-exempt	0	0
20-99 Employees		
Tax-paying	0	0
Tax-exempt	0	0
100+ Employees		
Tax-exempt	0	0
Tax-paying	0	0
<b>Commercial Research Laboratories</b>		
Tax-paying		
0-19 Employees	0	0
20-99 Employees	0	0
100+ Employees	0	0
Tax-exempt	0	0
<b>Outpatient Care Clinics</b>		
Physicians' clinics (Amb. Care)		
Tax-paying	0	0
Tax-exempt	0	0
Freestanding kidney dialysis facilities		
Tax-paying	0	0
Tax-exempt	0	0.01
<b>Physician' Offices</b>	0	0
<b>Dentists' Offices and Clinics</b>		
Offices	0	0
Clinics		
Tax-paying	0	0
Tax-exempt	0	0
<b>Medical &amp; Dental Laboratories</b>		
Medical	0	0.01
Dental	0	0.01
<b>Freestanding Blood Banks</b>	0	0.02
<b>Funeral Homes</b>	0	0
<b>Fire &amp; Rescue</b>	0	0
<b>Corrections</b>		
Federal Government	0	0
State Government	0	0
Local Government	0	0

<sup>1</sup> The low incremental annual cost per facility estimate is based on the average annualized control cost for all commercial MWIs of \$0.006 per pound

<sup>2</sup> The high incremental annual cost per facility estimate is based on a cost of \$0.025 per pound, the control cost for large commercial MWIs that are uncontrolled in the baseline.

Another factor indicating the likely possibility that these commercial MWIs would be required to absorb some portion of their cost increases is based on model facility capacity information. Many MWIs are operating below full capacity, indicating that medical waste incinerator operators with excess capacity will act as a competitive force to keep incineration prices from rising.

One advantage that commercial MWI operators will experience due to the regulation will be an increase in demand for commercial incineration service. Table 14B presents impact information under the assumption that some facilities with on-site incinerators will choose to switch to a lower cost alternative for medical waste disposal rather than install emission control equipment to meet the requirements of the regulation. When faced with these lower cost options, it is likely that some facilities will choose a lower cost option, which in many cases may be to switch to commercial incineration. If implementation of the regulation will have such an effect, then demand for commercial incineration should increase as a result of this regulation. Increased demand for this service will increase the revenue basis for many firms in this industry. Lack of relevant financial data prevents quantification of the economic effects of this increase in demand. However, it should be recognized that commercial MWI operators should be able to offset some of their absorbed cost increases due to increased demand for their service.

Another consideration regarding the current state of the commercial MWI industry is that the small number of uncontrolled commercial MWIs may currently be enjoying a cost advantage compared to the majority of controlled firms in the industry. Commercial MWI facilities that currently operate with emission control equipment presumably operate at a higher cost per unit than uncontrolled facilities. If the majority of the facilities in this industry are controlled and are able to charge prices that enable them to recapture their costs and earn reasonable profits, then uncontrolled facilities that are probably operating at a lower cost are most likely enjoying profits exceeding the levels earned by the controlled facilities in the industry.

The industry-wide price impact analysis estimated that the price of commercial incineration will likely increase by an average of approximately 2.6 percent. The high model facility price impacts for the uncontrolled facilities in this industry indicates that some of these facilities may need to absorb some of their cost increases due to implementation of this regulation. However, due to factors such as increased demand for commercial incineration and possible cost advantages currently enjoyed by these facilities, the cost of the regulation may be achievable.

## **V. Small Entity Impacts**

This section of the analysis focuses on small entity impacts that are estimated to occur as a result of the regulatory options for controlling medical waste incineration. Impacts calculated for off-site generators showed that these facilities should be minimally affected by the regulation. Industries with off-site generators include: hospitals, nursing homes, laboratories, funeral homes, physicians' offices, dentists' offices, outpatient facilities, freestanding blood banks, fire and rescue

operations, and correctional facilities. Many of the impacts calculated for these facilities are so small that they can be considered undetectable or zero. Given these results, it is unlikely that any size entity, even a small entity, in the off-site generator category will experience adverse economic impacts from implementation of any of the regulatory options being considered for the EG. Therefore, the remainder of this section focuses on small entity impacts as they pertain to facilities currently operating an on-site MWI.

There are four categories of facilities that incinerate medical waste on-site: hospitals; nursing homes; research laboratories; and commercial medical waste incinerators. The U.S. Small Business Administration (SBA) definitions pertaining to business size are either specified by number of employees or sales revenue. For non-governmental hospitals, nursing homes, and commercial waste incinerators, the definition of a small entity is \$5.0 million in annual sales averaged over the past three years. For research laboratories, the definition is 500 employees or less.<sup>4</sup>

In addition to the above definitions, the EPA defines a small government entity as a community of 50,000 or less in population.<sup>5</sup> Under this definition, there may also be hospitals that could be considered small by virtue of being owned by a community of 50,000 people or less.

Revenue data for non-governmental hospitals show that only a few are likely to be small, since the smallest model hospital that incinerates medical waste on-site is estimated to generate revenue of \$7.3 million or greater. However, hospitals that are owned by local communities of less than 50,000 people must also be considered. The 1993 Statistical Abstract of the United States<sup>6</sup> shows that there are 122 admissions to community hospitals per 1,000 population and that there are approximately 34 admissions per bed. Using the following equation:

$$\frac{122 \text{ admissions}}{1000 \text{ population}} \div 34 \text{ beds} * 50,000 \text{ people} = 179 \text{ beds,}$$

we can estimate the number of beds a hospital serving a population of 50,000 people would need on average. This equation estimates a community of 50,000 people would on average would require a hospital with at least 179 beds.

The above information is used along with data from the American Hospital Association which shows that 25 percent of all hospitals of bed sizes less than 200 are local government hospitals.<sup>7</sup> Information provided in the cost analysis estimates that the number of affected incinerators represented by the small (40 beds) and medium (140 beds) size model facilities in the hospital industry is 943. Twenty-five percent of 943 equates to 236 hospitals that are local government owned.

Table 16 presents price impacts for these small hospitals. As can be seen, assuming no switching, these facilities would experience price impacts in the range of 0.10 percent to 1.53 percent,

**Table 16**  
**Small Entity Economic Impacts: Existing Sources**

Industry	SBA Small Business Definition	Small Model Facility Revenue	Number of Potentially Affected Small Entities	Scenario A	Scenario B	Scenario C
Hospitals (local government)	≤ 50,000 population	N.A. <sup>a</sup>	236	0.31 - 1.53	0.07 - 0.10	0.27 - 0.56
Nursing Homes (Tax-paying and Tax-Exempt)	≤ \$5.0 million annual revenue	\$4.8 million to \$4.9 million	160	0.35 - 1.79	0.11 - 0.12	0.39 - 0.65
Laboratories	≤ 500 employees	N.A.	266	0.40 - 0.46	0.09 - 0.10	0.34 - 0.56
Commercial MWIs	≤ \$5.0 million annual sales	\$2.4 million	2 <sup>b</sup>	8.02	N.A.	N.A.

<sup>a</sup>N.A. = Not Applicable

<sup>b</sup>EPA MWI inventory

depending on the regulatory option examined. Under the more likely scenario B, these facilities would experience price impacts ranging from 0.06 to 0.10 percent, depending on the regulatory option examined. Given the above impacts, it is expected that affected facilities in the hospital industry sector will switch to alternative technologies. The impacts under the switching scenarios are small and therefore, are not considered significant.

For nursing homes, the SBA size standard is \$5.0 million in annual revenue. The small model facility used in the economic impact analysis for nursing homes has a revenue slightly less than \$5.0 million, indicating that there may be a significant number of small nursing homes. There are an estimated 266 nursing homes that incinerate medical waste in the inventory of affected facilities. Data from Robert Morris Associates<sup>8</sup> shows that 60 percent of the nursing home industry has revenue less than \$5.0 million. Thus, 60 percent of 266 affected facilities equals 160 small nursing homes. The model facility analysis shows that these facilities will switch from on-site incineration to alternative waste management practices such as autoclaving wastes or sending the waste to commercial facilities. Under scenario B, the price impacts for these nursing homes range from 0.11 percent to 0.65 percent as a percent of total revenue. Once again, these impacts are small and therefore, are not considered significant.

Model facility data presented in Table 16 also shows that virtually all affected research laboratories are estimated to have less than 500 employees. There are an estimated 266 affected facilities in the laboratory category. For the purpose of estimating small entity impacts, the total population of laboratories is assumed to be small entities. Similar to many hospitals and nursing homes with on-site incinerators, these laboratory facilities are expected to avoid incineration and use substitute means of medical waste management (i.e., switch to alternative technologies). Their estimated impacts under scenarios B and C range from 0.09 percent of revenue to 0.56 percent. These estimated impacts are below one percent and are not considered significant.

Only one size MWI was used to model the commercial MWI facility-specific impacts. This model commercial medical waste incinerator has an average revenue of \$2.4 million, thus implying that all commercial MWIs are small. Under this assumption, there would potentially be up to 79 such facilities expected to be affected by this rule.

However, as discussed in the model facility impact section (section V.C.), the MWI inventory indicates that a majority of facilities in this industry sector have already implemented controls that would enable them to meet the requirements of any of the six regulatory options. Only a small number of facilities in this industry sector would be uncontrolled in the baseline. Therefore, many of the facilities in this industry, regardless of size, should be able to meet the EG's requirements without experiencing significant economic impacts.

A further examination of the MWI inventory reveals that only two facilities out of the uncontrolled MWI population might be considered small entities. These facilities will be referred to as facilities Y and Z due to confidential business information concerns. Facility Y operates three on-site incinerators while facility Z operates two on-site incinerators. The model facility

price impact analysis discussed earlier for this industry showed approximately an 8 percent price impact for uncontrolled facilities compared to an average industry-wide price increase of 2.6 percent. This large discrepancy between the industry-wide price impact and the model facility price impact suggests that this regulation may cause significant economic impacts for these facilities.

Several factors make it difficult to state with certainty that these commercial MWI facilities will experience significant economic impacts. As explained in the model facility impact section, these impacts were calculated using baseline revenue data for commercial MWIs. Although it is not the objective of the EPA to encourage the use of alternatives or discourage the continued use of on-site MWIs, it is recognized that many facilities will decide to adopt alternative technologies for treatment of their waste rather than continue to operate their on-site MWIs. Hence, the concept of switching was incorporated into the analysis. One significant result of switching will be increased demand for commercial incineration. Increased demand for this service will increase the revenue basis for many firms in the commercial MWI industry. Due to lack of information, it was not possible to quantify the economic effects of this increase in demand. However, it should be recognized that this increased demand, causing an increase in revenue, would dampen the adverse economic impacts of this regulation on small commercial MWI facilities as presented in this analysis.

A second factor making it difficult to state with certainty that these impacts on small commercial MWI facilities should be considered significant is that the SBA definition of small entity applies to entire firms rather than individual facilities. If detailed information was available regarding ownership of commercial MWI facilities, the EPA would have been able to conduct a more certain analysis of the economic impacts, including small entity impacts, of this regulation. For example, the MWI inventory lists only the name and location of a commercial MWI. As in many industries, the name of a facility does not necessarily reveal the facility's ownership information. Facilities Y and Z may be owned by firms that also operate other commercial MWIs, in which case, these facilities would not be considered small entities under the SBA's definition.

The above argument pertaining to facility ownership also holds true for small entity impacts for hospitals, nursing homes, and research laboratories. The estimates of numbers of small affected facilities in these industry sectors are overstated to the extent that these facilities may be owned by larger entities having combined sales of greater than \$5.0 million or employing greater than 500 people. Once again, due to lack of information, only model facility information was available to calculate these impacts, which ignores the likely possibility of one firm operating multiple facilities.

## References

1. U.S. Environmental Protection Agency. Medical Waste Incinerators - Background Information for Proposed Standards and Guidelines: Analysis of Economic Impacts for Existing Sources. EPA-453/R-94-048a. July 1994.
2. U.S. Environmental Protection Agency. Addendum to Analysis of Economic Impacts for Existing Sources. EPA-453/R-94-048a. July 1994.
3. "Cost Information". Memorandum submitted by Brian Strong, Midwest Research Institute, to Michele McKeever, U.S. Environmental Protection Agency. March 29, 1996.
4. Small Business Administration. "Small Business Size Standards." 13 Code of Federal Register, Part 121. January 31, 1996 (Volume 61, Number 21).
5. Office of Regulatory Management and Evaluation. "EPA Guidelines for Implementing the Regulatory Flexibility Act." April 1992.
6. U.S. Department of Commerce. Statistical Abstract of the United States. 114th Edition. September 1994. p. 127.
7. American Hospital Association. American Hospital Association Hospital Statistics. 1994 - 95 Edition. Chicago, Il. 1994.
8. Robert Morris Associates. Annual Statement Studies 1994. Philadelphia, PA. 1994. p. 716, 717, 752, 753.