Revised Economic Impact Analysis:

New Medical Waste Incinerators

U.S. EPA
OAQPS, AQSSD, ISEG

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I. INTRODUCTION

On February 27, 1995, the EPA published the proposed MACT emission standards for new 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 new MWIs. The potential economic impacts of three control options for new MWIs were originally evaluated in *Medical Waste Incinerators - Background Information for Proposed Standards and Guidelines: Analysis of Economic Impacts for New Sources.*[1] An addendum was subsequently prepared to estimate the potential economic impacts of a fourth control option.[2] 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% to 0.16%, depending on the industry, regulatory option, and scenario analyzed. These industries are expected to experience output and employment impacts in the range of 0% to 0.21%. In addition, the revenue impacts for these industries are expected to range from an increase of 0.05% to a decrease of 0.05%. 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%, assuming regulatory option 3, 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 in-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. The total annual control cost (for the emission guidelines for existing MWIs and these emission standards new MWIs) for hospitals required to comply with regulatory option 3 is estimated as $101,652,807. Assuming that the ratio of adjusted patient- days to revenue doesn't significantly change over time, the expected average price increase for each hospital patient-day is expected to equal 33 cents.

The average price impact for the commercial medical waste incinerator industry is approximately a 3.8% increase in price. Cost and economic impact estimates are the same for the commercial MWI industry regardless of the regulatory option analyzed because all three 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 concluded that all new 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 new MWIs. This section summarizes these new regulatory options and the EPA's initial assessment of their merits.

The MACT "floor" defines the least stringent emission standards the EPA may adopt for new MWIs. However, the Clean Air Act also requires EPA to examine alternative emission standards (i.e., regulatory options) more stringent than the MACT floor.

Based on new information submitted to the EPA following proposal of the MACT emission standards for new MWIs, new MACT floor emission levels were developed for new small, medium, and large MWIs. Next, the EPA determined the type of emission control technology(s) new MWIs would probably need to use to meet regulations based on these floor emission limits. The floor for small new MWIs appears to require good combustion and moderate efficiency wet scrubbers; add-on wet scrubbing systems would not be necessary to meet the MACT floor. For medium new MWIs, the MACT floor appears to require good combustion and a combined wet dry scrubbing system without activated carbon injection. The MACT floor for large new MWIs appears to require good combustion and a high efficiency wet scrubber and a combined wet/dry scrubbing system with activated carbon injection.

Having identified the emission control technology most new 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 new 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 new 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 new MWIs. In reviewing this table, therefore, there are several important points to keep in mind.

First, these emission standards for new MWIs will not include requirements to use a specific emission control system or technology; these standards 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 these emission standards for new MWIs 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

TABLE 1
Regulatory Options For New MWIs

MWI Size	Regulatory Options		
	1	2	3
Small ≤200 lb/hr	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, dry injection/fabric filter system, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber
Large >500 lb/hr	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber	Good combustion, dry injection/fabric filter system with carbon, and high efficiency wet scrubber

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.

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.

Based upon the above information, this analysis estimates that a likely reaction and outcome associated with the adoption of the standards for new MWIs will be 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 emission standards for new MWIs that fulfill the requirements of the Clean Air Act. In doing so, however, it is clear that one outcome associated with adoption of these emission standards 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 MACT emission standards.

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 emission standard could lead to as many as 80 percent of health care facilities that might have installed MWIs to choose an alternative means of medical waste treatment and disposal. However, the economic impacts presented with the proposed MACT for new sources were only evaluated using the costs under a "no switching" scenario. Although the EIA presented a qualitative discussion of the likely possibility of facilities that might have installed 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 three new regulatory options discussed above for new MWIs. The new analyses incorporate three scenarios; one scenario which ignores switching and two scenarios which consider switching.

Scenario A assumes that each new MWI will be installed and will comply with the appropriate regulatory option by having the appropriate emission control equipment installed. This scenario results in the highest costs because it assumes no new MWI owner will switch to a less expensive waste disposal method. This scenario most likely overstates the national costs and economic impacts associated with the new source emission standards and therefore, should not be viewed as representative of the impacts associated with the standards. 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 MACT for new MWIs. Only these scenarios merit serious review and consideration in gauging the potential impacts associated with the emission standards. Both scenarios B and C assume switching will occur when the cost associated with purchasing and installing the air pollution control technology or system necessary to comply with the MACT emission standards (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 will be 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 expected to be burned at a health care facility operating an on-site waste incinerator is infectious medical waste; the remaining 85 percent is expected to be 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 operation of an on-site medical waste incinerator, in response to adoption of the emission standards, a health care facility need only choose an alternative form of medical waste treatment and disposal for 15 percent of the waste stream to be 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 will be able to or will decide to segregate the waste stream. For example, a facility 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 that would be burned at a health care facility with an on-site medical waste incinerator is infectious medical waste and must be treated and disposed of accordingly. As a result, scenario C leads to slightly higher costs than scenario B.

Scenarios B and C represent the likely range of impacts associated with the MACT emission standards for new MWIs. The actual impacts of a MACT emission standard (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 MACT emission standards on industries that generate medical waste and may operate on-site MWIs, commercial MWIs, and industries that generate medical waste but are not expected to 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 may operate on-site MWIs will be directly affected by the MACT emission standards because these facilities will need to initiate some action to comply with the regulation (i.e., purchase 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 emission standards by installing emission control equipment.

This analysis also examines the economic impacts of the emission standards 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 related cost increases. Therefore, these off-site generators are expected to experience a price increase for waste treatment 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.

D. Five-Year Projections

This analysis attempts to estimate the impacts of these MACT emission standards over a five-year time period between 1996 and 2000. This type of analysis is only possible if projections of key analysis parameters are made. The parameters required to establish a future fifth year baseline include: the number of new MWI units that would have begun operation in the absence of these emission standards for new sources, the costs of control technologies to enable the new MWI units to meet these emission standards, the population of facilities expected to exist in each of the industries (e.g., hospitals, etc.) and all relevant financial and economic data used in this analysis to estimate the economic impacts of these emission standards.

Where possible, projections of some parameters are based on historical trends. For example, the number of new commercial MWIs that would have begun operation in the absence of these emission standards is estimated by examining the annual number of new commercial incinerators that have begun operation in the past few years. This survey is possible because the MWI inventory contains this information. An examination of the MWI inventory reveals that approximately two new commercial incinerators have begun operation in each of the past few years. Using this historical information, the cost and economic impact analyses project that in the absence of these emission standards, two new commercial incinerators would begin operation in each year of the five-year analysis time frame. Therefore, this analysis uses a future baseline of ten new commercial MWIs that would potentially be affected by these emission standards by the fifth year of this analysis time frame. This methodology is applied to the projection of new MWI units in each of the industry categories. Table 2 presents the number of new MWIs that are projected to be constructed in the absence of these MACT emission standards for new MWIs.

Although these standards specify only an emission limit that must be met, rather than a specific emission control technology that must be installed, costs are estimated by identifying the emission control technology that most new MWIs would likely install given the current available technology. Therefore, no projections are made regarding future innovations or future changes in the price of these emission control technologies.

Lack of historical data regarding the population of facilities in each of the industry categories requires that a simple scheme be used to estimate these future populations. Therefore, the future population of facilities in each industry is assumed to remain constant during this five-year analysis time frame. This supposition implicitly assumes that new MWI units replace exising MWIs that may be retired during this five year period. The base year of analysis for the emission guidelines (EG) for existing MWIs was 1993. The 1993 data were used for this analysis of new MWIs since it was readily available.

Lack of historical data regarding key financial and economic parameters (e.g., revenue, employment, etc.) also required that a simple scheme be adopted to estimate these future values. Once again, since 1993 data were available from the EIA for the EG for existing MWIs, these data were also used for this analysis of new MWIs. These data are presented in the economic impact section of this report. Note that adoption of this projection scheme does not allow economic growth or growth within an industry to be taken into account. However, consideration of these types of factors are not possible without information regarding historical economic trends. This type of information was not available at the time this analysis was prepared.

Table 2
Number of New Medical Waste Incinerators

MWI Size	Projected Number of New MWIs Per Year	Projected Number of New MWIs from 1996 to 2000
Small	17	85
Medium	18	90
Large	12	60
Commercial	2	10
Total	49	245

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 New Sources.* Although this analysis attempts to forecast future events and reactions to these emission standards, the basis of the forecast is 1993 financial and economic data. Therefore, all prices presented in this analysis are stated at 1993 levels.

Economic impacts for new MWIs are calculated under several assumptions. First, the costs that are used to estimate the economic impacts of these MACT emission standards include control costs from both the emission guidelines (EG) for existing MWIs and these emission standards for new MWIs. This approach is used to account for market adjustments (e.g., price impacts) that would have had to occur under implementation of the EG first. This approach allows for the establishment of a future baseline scenario. Second, due to lack of information, revenue data for each of the affected industries were not adjusted for growth during the five year time frame.

The MACT "floor" defines the least stringent emission standards the EPA may adopt for new MWIs. However, the Clean Air Act also requires EPA to examine alternative emission standards (i.e., regulatory options) more stringent than the MACT floor.

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[3]

Tables 3A, 3B, and 3C 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 emission standard cost estimates for the three 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 3A). The annualized costs under scenario A range from approximately $222.2 million under regulatory option one to approximately $240.4 million under regulatory option three. As previously explained, scenario A impacts are calculated under the unlikely assumption that all facilities operating and expected to operate 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 that would have operated 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 are approximately $68.5 million under regulatory options one, two, and three. 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 4 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 expected to be 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 expected throughput. The incremental cost of commercial incineration is calculated to be 0.9 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 3A
Industry-wide Annualized Control Costs
Scenario A: No Switching
Industries Utilizing Onsite Medical Waste Incineration: Existing and New Sources

Industry	Regulatory Option		
	One[1]	Two[2]	Three[3]
Hospitals:			
New	$ 21,630,095	$ 26,149,040	$ 26,772,090
Existing	$135,505,756	$135,505,756	$143,747,984
Total	$157,135,851	$161,654,796	$170,520,074
Nursing homes:			
New	$ 3,423,045	$ 4,138,185	$ 4,236,785
Existing	$ 21,444,294	$ 21,444,294	$ 22,748,658
Total	$ 24,867,339	$ 25,582,479	$ 26,985,443
Commercial research labs:			
New	$ 3,423,045	$ 4,138,185	$ 4,236,785
Existing	$ 21,444,294	$ 21,444,294	$ 22,748,658
Total	$ 24,867,339	$ 25,582,479	$ 26,985,443
Other:			
New	$ 1,032,815	$ 1,248,590	$ 1,278,340
Existing	$ 6,470,262	$ 6,470,262	$ 6,863,820
Total	$ 7,503,077	$ 7,718,852	$ 8,142,160
Commercial:			
New	$ 2,830,000	$ 2,830,000	$ 2,830,000
Existing	$ 4,960,759	$ 4,960,759	$ 4,960,759
Total	$ 7,790,759	$ 7,790,759	$ 7,790,759
Total Existing and New	$222,164,365	$228,329,365	$240,423,879

1 Assumes Regulatory Option 5 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 1 of the emission standards for new sources.
2 Assumes Regulatory Option 5 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 2 of the emission standards for new sources.
3 Assumes Regulatory Option 6 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 3 of the emission standars for new sources.

Table 3B
Industry-wide Annualized Control Costs
Scenario B: Switching With Waste Segregation
Industries Utilizing Onsite Medical Waste Incineration: Existing and New Sources

Industry	Regulatory Option		
	One[1]	Two[2]	Three[3]
Hospitals:			
New	$ 5,839,810	$ 5,839,810	$ 5,839,810
Existing	$38,654,258	$38,654,258	$38,654,258
Total	$44,494,068	$44,494,068	$44,494,068
Nursing homes:			
New	$ 924,175	$ 924,175	$ 924,175
Existing	$ 6,117,181	$ 6,117,181	$ 6,117,181
Total	$ 7,041,356	$ 7,041,356	$ 7,041,356
Commercial research labs:			
New	$ 924,175	$ 924,175	$ 924,175
Existing	$ 6,117,181	$ 6,117,181	$ 6,117,181
Total	$ 7,041,356	$ 7,041,356	$ 7,041,356
Other:			
New	$ 278,850	$ 278,850	$ 278,850
Existing	$ 1,845,702	$ 1,845,702	$ 1,845,702
Total	$ 2,124,552	$ 2,124,552	$ 2,124,552
Commercial:			
New	$ 2,830,000	$ 2,830,000	$ 2,830,000
Existing	$ 4,960,759	$ 4,960,759	$ 4,960,759
Total	$ 7,790,759	$ 7,790,759	$ 7,790,759
Total Existing and New	$68,492,091	$68,492,091	$68,492,091

1 Assumes Regulatory Option 5 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 1 of the emission standards for new sources.
2 Assumes Regulatory Option 5 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 2 of the emission standards for new sources.
3 Assumes Regulatory Option 6 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 3 of the emission standards for new sources.

Table 3C
Industry-wide Annualized Control Costs
Scenario C: Switching With No Waste Segregation
Industries Utilizing Onsite Medical Waste Incineration: Existing and New Sources

Industry	Regulatory Option		
	One[1]	Two[2]	Three[3]
Hospitals:			
New	$ 15,485,725	$ 15,485,725	$ 15,485,725
Existing	$ 85,865,550	$ 85,865,550	$ 86,167,082
Total	$101,351,275	$101,351,275	$101,652,807
Nursing homes:			
New	$ 2,450,675	$ 2,450,675	$ 2,450,675
Existing	$ 13,588,546	$ 13,588,546	$ 13,636,265
Total	$ 16,039,221	$ 16,039,221	$ 16,086,940
Commercial research labs:			
New	$ 2,450,675	$ 2,450,675	$ 2,450,675
Existing	$ 13,588,546	$ 13,588,546	$ 13,636,265
Total	$ 16,039,221	$ 16,039,221	$ 16,086,940
Other:			
New	$ 739,430	$ 739,430	$ 739,430
Existing	$ 4,099,992	$ 4,099,992	$ 4,114,390
Total	$ 4,839,422	$ 4,839,422	$ 4,853,820
Commercial:			
New	$ 2,830,000	$ 2,830,000	$ 2,830,000
Existing	$ 4,960,759	$ 4,960,759	$ 4,960,759
Total	$ 7,790,759	$ 7,790,759	$ 7,790,759
Total Existing and New	$146,059,858	$146,059,858	$146,471,266

1 Assumes Regulatory Option 5 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 1 of the emission standards for new sources.
2 Assumes Regulatory Option 5 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 2 of the emission standards for new sources.
3 Assumes Regulatory Option 6 for existing MWIs, the most stringent Emission Guidelines that would be considered in combination with Regulatory Option 3 of the emission standards for new sources.

Table 4
Industry-wide Annual Cost
For Industries Using Offsite Waste Disposal

Industry	Medical Waste Generated Annually (tons per year)	Annual Control Costs[1]
Medical / dental laboratories	17,600	$317,042
Funeral homes	900	$ 16,212
Physicians' offices	35,200	$634,084
Dentists' offices & clinics	8,700	$156,720
Outpatient care	26,300	$473,761
Freestanding blood banks	4,900	$ 88,267
Fire & rescue operations	1,600	$ 28,822
Correctional facilities	3,300	$ 59,445
Total	98,500	$1,774,353

1 Assumes that all medical waste is incinerated offsite at an incremental cost of 0.9 cents per pound, the average cost increase for commercial MWIs.

Table 5 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 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 6A, 6B, and 6C. Each table provides price impact estimates for all three regulatory options under each of the three scenarios. As can be seen from Tables 6A through 6C, 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.

Table 5
Industry-wide Financial and Economic Impact Analysis Inputs

Industry	Number of Facilities	Industry Revenue or Budget (millions of dollars)	Industry Employment [1]	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[2]	4,170	$17,102	159,097	-1.33	-1.00
Medical / dental	15,961	$14,749	177,866	-1.33	-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[3]	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[4]	N/A	NE	NE
Total	**415,461**	**$666,735**	**9,376,432**		

1 Full-time equivalent workers
2 SIC 8731, Commercial Physical and Biological Research
3 Defined restrictively as ambulatory care centers (represented by "general medical clinics," a subset of SIC 8011) and kidney dialysis facilities.
4 Based on 393,934.8 tons per year and $.24 per pound charges.
N/A - not available
NE - not estimated.

Table 6A
Industry-wide Price* Impacts: New and Existing Sources

Industry	Scenario A - No Switching		
	Regulatory Option 1	Regulatory Option 2	Regulatory Option 3
Hospitals	0.05	0.05	0.05
Nursing homes	0.05	0.05	0.05
Laboratories: Research Medical/dental	 0.15 0	 0.15 0	 0.16 0
Funeral homes	0	0	0
Physicians' offices	0	0	0
Dentists' offices and clinics	0	0	0
Outpatient care	0	0	0
Freestanding blood banks	0.01	0.01	0.01
Fire and rescue operations	0	0	0
Correctional facilities	0	0	0
Commercial incineration	3.75	3.75	3.75

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

Table 6B
Industry-wide Price* Impacts: New and Existing Sources

Industry	Scenario B - Switching With Waste Segregation		
	Regulatory Option 1	**Regulatory Option 2**	**Regulatory Option 3**
Hospitals	0.01	0.01	0.01
Nursing homes	0.01	0.01	0.01
Laboratories: Research Medical/dental	 0.04 0	 0.04 0	 0.04 0
Funeral homes	0	0	0
Physicians' offices	0	0	0
Dentists' offices and clinics	0	0	0
Outpatient care	0	0	0
Freestanding blood banks	0	0	0
Fire and rescue operations	0	0	0
Correctional facilities	0	0	0
Commercial incineration	3.75	3.75	3.75

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

Table 6C
Industry-wide Price* Impacts: New and Existing Sources

Industry	Scenario C - Switching With No Waste Segregation		
	Regulatory Option 1	Regulatory Option 2	Regulatory Option 3
Hospitals	0.03	0.03	0.03
Nursing homes	0.03	0.03	0.03
Laboratories:			
Research	0.09	0.09	0.09
Medical/dental	0	0	0
Funeral homes	0	0	0
Physicians' offices	0	0	0
Dentists' offices and clinics	0	0	0
Outpatient care	0	0	0
Freestanding blood banks	0.01	0.01	0.01
Fire and rescue operations	0	0	0
Correctional facilities	0	0	0
Commercial incineration	3.75	3.75	3.75

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

Under scenario C, which assumes switching without waste segregation, hospitals and nursing homes required to comply with regulatory option one, two, or three are estimated to experience a price increase of approximately 0.03 percent. This analysis scenario shows that the laboratory industry sector would experience approximately a 0.09 percent price impact under regulatory options one, two, or three.

Industry sectors such as funeral homes, physicians' offices, outpatient care, fire and rescue operations, and correctional facilities would experience such small average industry-wide price impacts that these impacts can be considered zero. Freestanding blood banks would experience industry-wide impacts of approximately zero under scenario B and 0.01 percent under Scenario C for regulatory options one, two, and three.

With the exception of the commercial MWI industry, all market price increases presented in Tables 6A through 6C 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 are not expected to 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 6A through 6C also present average industry-wide price impacts for the commercial MWI industry sector. These price impacts are estimated as 3.75 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 new commercial MWIs switching to alternative technologies was not incorporated into the cost analysis. 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 will be able to offer in comparison to the high costs that facilities with on-site MWIs would face if they decide to operate an MWI and 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

and specifying time periods 0 and 1, the percent change in output (%ΔQ) 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 %ΔP equal to the estimated market price increase. These impacts are presented in Tables 7A, 7B, and 7C. Due to the relatively small market price increase and/or relatively inelastic demand, all of the output impacts are less than one percent.

Table 7A
Industry-wide Output, Employment and Revenue Impacts: New and Existing Sources
Scenario A

Industry	Scenario A - No Switching		
	Regulatory Option 1	Regulatory Option 2	Regulatory Option 3
Hospitals			
Output decrease (%)	0-0.02	0-0.02	0-0.02
Employment decrease (FTEs)	0-707	0-727	0-767
Revenue increase or (decrease) (%)	0.03-0.05	0.03-0.05	0.04-0.05
Nursing homes			
Output decrease (%)	0.02-0.03	0.02-0.03	0.02-0.04
Employment decrease (FTEs)	260-529	268-544	283-574
Revenue increase or (decrease) (%)	0.02-0.03	0.02-0.03	0.02-0.04
Laboratories:			
Research			
Output decrease (%)	0.15-0.20	0.15-0.20	0.16-0.21
Employment decrease (FTEs)	231-307	238-316	251-333
Revenue increase or (decrease) (%)	(0.05)-0	(0.05)-0	(0.05)-0
Medical/dental			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	3-5	3-5	3-5
Revenue increase or (decrease) (%)	0	0	0
Funeral homes			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0	0	0
Physicians' offices			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0-2	0-2	0-2
Revenue increase or (decrease) (%)	0	0	0
Dentists' offices and clinics			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	1-2	1-2	1-2
Revenue increase or (decrease) (%)	0	0	0
Outpatient care			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0
Freestanding blood banks			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0-0.01	0-0.01	0-0.01
Fire and rescue operations			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0	0	0
Correctional facilities			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0	0	0

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

Table 7B
Industry-wide Output, Employment and Revenue Impacts: New and Existing Sources
Scenario B

Industry	Scenario B - Switching With Waste Segregation		
	Regulatory Option 1	**Regulatory Option 2**	**Regulatory Option 3**
Hospitals			
Output decrease (%)	0-0.01	0-0.01	0-0.01
Employment decrease (FTEs)	0-200	0-200	0-200
Revenue increase or (decrease) (%)	0.01	0.01	0.01
Nursing homes			
Output decrease (%)	0.01	0.01	0.01
Employment decrease (FTEs)	74-150	74-150	74-150
Revenue increase or (decrease) (%)	0-0.01	0-0.01	0-0.01
Laboratories:			
Research			
Output decrease (%)	0.04-0.06	0.04-0.06	0.04-0.06
Employment decrease (FTEs)	65-87	65-87	65-87
Revenue increase or (decrease) (%)	(0.01)-0	(0.01)-0	(0.01)-0
Medical/dental			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	3-5	3-5	3-5
Revenue increase or (decrease) (%)	0	0	0
Funeral homes			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0	0	0
Physicians' offices			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0-2	0-2	0-2
Revenue increase or (decrease) (%)	0	0	0
Dentists' offices and clinics			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	1-2	1-2	1-2
Revenue increase or (decrease) (%)	0	0	0
Outpatient care			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0
Freestanding blood banks			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0-0.01	0-0.01	0-0.01
Fire and rescue operations			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0	0	0
Correctional facilities			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	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 7C
Industry-wide Output, Employment and Revenue Impacts: New and Existing Sources
Scenario C

Industry	Scenario C - Switching With No Waste Segregation		
	Regulatory Option 1	Regulatory Option 2	Regulatory Option 3
Hospitals			
Output decrease (%)	0-0.01	0-0.01	0-0.01
Employment decrease (FTEs)	0-456	0-456	0-457
Revenue increase or (decrease) (%)	0.02-0.03	0.02-0.03	0.02-0.03
Nursing homes			
Output decrease (%)	0.01-0.02	0.01-0.02	0.01-0.02
Employment decrease (FTEs)	168-341	168-341	169-342
Revenue increase or (decrease) (%)	0.01-0.02	0.01-0.02	0.01-0.02
Laboratories:			
Research			
Output decrease (%)	0.09-0.13	0.09-0.13	0.09-0.13
Employment decrease (FTEs)	149-198	149-198	150-199
Revenue increase or (decrease) (%)	(0.03)-0	(0.03)-0	(0.03)-0
Medical/dental			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	3-5	3-5	3-5
Revenue increase or (decrease) (%)	0	0	0
Funeral homes			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0	0	0
Physicians' offices			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0-2	0-2	0-2
Revenue increase or (decrease) (%)	0	0	0
Dentists' offices and clinics			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	1-2	1-2	1-2
Revenue increase or (decrease) (%)	0	0	0
Outpatient care			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0
Freestanding blood banks			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0-0.01	0-0.01	0-0.01
Fire and rescue operations			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	0	0	0
Correctional facilities			
Output decrease (%)	0	0	0
Employment decrease (FTEs)	0	0	0
Revenue increase or (decrease) (%)	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.

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, 0.02 to 0.04 percent for nursing homes, and undetectable impacts to 0.21 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 to 0.01 percent decreases for the hospital industry, a 0.01 percent impact for the nursing home industry, and impacts ranging from undetectable impacts to a 0.06 percent for laboratories. For each of these industries, the impacts vary only slightly among the regulatory options. All other industry sectors would experience undetectable output impacts.

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 7A through 7C. 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 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 707 FTEs for the hospital industry, 260 to 529 FTEs for the nursing home industry, 234 to 312 FTEs for the laboratory industry, undetectable to two FTEs for physicians' offices, one to two for dentists' offices and clinics, 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 three would produce employment impacts in the range of undetectable impacts to 767 FTEs for the hospital industry, 283 to 574 FTEs for the nursing home industry, 254 to 338 FTEs for the laboratory industry, undetectable impacts to 2 FTEs for the physicians' offices, one to two FTEs for dentists' offices, 0 to 1 FTE for the outpatient care industry sector, 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 200 FTEs for the hospital industry, 74 to 150 FTEs for the nursing home industry, 68 to 92 FTEs for the laboratory industry, one to two FTEs for the dentistry industry, and undetectable impacts to two FTEs for the physicians' offices and undetectable to one FTE for the outpatient care industry sector. All other industry sectors would experience undetectable employment impacts under regulatory option one. Regulatory option three would produce employment decreases in the range of undetectable impacts to 200 FTEs for the hospital industry, 74 to 150 FTEs for the nursing home industry, 68

to 92 FTEs for the laboratory industry, one to two FTEs for dentists' offices, undetectable impacts to two FTEs for physicians' offices, undetectable to one FTE for the outpatient care industry sector, and one to two for dentists' offices, 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:

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

Revenue impacts (in percentage increase or decrease terms) are also presented in Tables 7A through 7C. 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 7A through 7C are small and are not considered significant.

Under scenario A, the revenue impacts for regulatory option one are expected to range from a 0.03 percent to a 0.05 percent increase for the hospital industry, 0.02 to 0.03 percent increase for the nursing home industry, zero impacts to a 0.05 decrease for research laboratories, zero to 0.01 percent for freestanding blood banks, and undetectable revenue impacts for all other industry sectors. Using the same analysis scenario under regulatory option three, revenue impacts are expected to range from a 0.04 percent to a 0.05 percent increase for the hospital industry, 0.02 to 0.04 increase for the nursing home industry, undetectable impacts to 0.05 decrease for laboratories, zero to 0.01 percent for freestanding blood banks, 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 laboratories, zero to 0.01 percent for freestanding blood banks, 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 8. 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 9 and 10 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 expected to operate an MWI will have emission control equipment installed rather than decide to use alternative technologies (i.e., switch). 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 potentially new 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.

Table 8
Model Facilities

Industry	Definition	MWI Assignment
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 9
Model Facility Annualized Control Cost - New Sources
Scenario A: No Switching

Model MWI	Regulatory Option		
	One	Two	Three
Small			
Urban			
Annualized	$ 66,400	$ 66,400	$ 76,400
Capital	$217,600	$217,600	$266,000
Small			
Rural			
Annualized	$ 66,400	$ 66,400	$ 76,400
Capital	$217,600	$217,600	$266,000
Medium			
Annualized	$143,300	$211,800	$211,800
Capital	$591,600	$594,800	$594,800
Large Onsite			
Annualized	$182,800	$182,800	$182,800
Capital	$646,000	$646,000	$646,000
Large Commercial			
Annualized	$283,000	$283,000	$283,000
Capital	$751,600	$751,600	$751,600

Table 10
Model Facility Annual Cost of Switching[1]: New Sources

Model MWI	Scenario B - Switching With Waste Segregation	Scenario C - Switching Without Waste Segregation
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

1 Switching costs do not vary by regulatory option.

The incremental annual cost for off-site generators is presented in Table 11. Two estimates are provided as the incremental annual cost. The low estimate is calculated by multiplying 0.9 cents by the estimated amount of medical waste generated per facility. The 0.9 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 a model MWI in the commercial MWI industry. A model commercial MWI is estimated to experience annualized costs of $283, 000 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 $0.037. 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.

2. Financial and Economic Inputs

Table 12 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 8, 13, and 14. 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 12.

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 12. The data used for these calculations is presented in Tables 13 and 14.

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

Table 11
Model Facility Impacts For Firms that Utilize Offsite Waste Incineration: New Sources
Estimated Medical Waste Per Facility and Incremental Annual Cost Per Facility

Industry	Medical Waste Per Facility (tons)	Incremental Annual Cost Per Facility	
		Low[1]	High[2]
Hospitals			
<50 Beds	9.75	$175	$716
50-99 Beds	17.10	$307	$1,255
100-299 Beds	52.08	$935	$3,822
300+ Beds	167.28	$3,004	$12,278
Nursing Homes			
0-19 Employees			
Tax-paying	0.14	$3	$10
Tax-exempt	0.17	$3	$12
20-99 Employees			
Tax-paying	1.14	$20	$84
Tax-exempt	1.04	$19	$77
100+ Employees			
Tax-exempt	2.70	$48	$198
Tax-paying	3.44	$62	$253
Commercial Research Labs			
Tax-paying			
0-19 Employees	0.28	$5	$21
20-99 Employees	2.19	$39	$161
100+ Employees	24.50	$440	$1,799
Tax-exempt	7.28	$131	$534
Outpatient Care Clinics			
Physicians' clinics (Amb. Care)			
Tax-paying	2.26	$41	$166
Tax-exempt	4.19	$75	$307
Freestanding kidney dialysis facilities			
Tax-paying	1.62	$29	$119
Tax-exempt	2.31	$42	$170
Physicians' offices	0.18	$3	$13
Dentists' offices and clinics			
Offices	0.08	$1	$6
Clinics			
Tax-paying	0.14	$2	$10
Tax-exempt	0.19	$3	$14
Medical & dental Labs			
Medical	1.63	$29	$119
Dental	0.51	$9	$38
Freestanding blood banks	22.48	$404	$1,650
Funeral Homes	0.04	$1	$3
Fire & Rescue	0.05	$1	$4
Corrections			
Federal Government	1.64	$29	$120
State Government	1.70	$31	$125
Local Government	0.34	$6	$25

1 The low incremental annual cost per facility estimate is based on the average annual control cost for all commercial MWIs of $0.009 per pound
2 The high incremental annual cost per facility estimate is based on a cost of $0.037 per pound, the control cost for large commercial MWIs in the baseline.

Table 12
Model Facilities: Economic Impact Input Information
(Year = 1993)

Industry - Model Facilities Information	Employment[1]	Annual Revenue/Budget[2]
Hospitals - Short term, excluding psychiatric:		
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
Hospitals - Psychiatric, short term and long term:		
Small		
Urban / Rural	87	$5.3
Medium	259	$15.1
Large	719	$32.6
Nursing Homes:		
Tax-Paying		
Urban / Rural	150	$4.9
Tax-exempt		
Urban / Rural	150	$4.8
Commercial Research Laboratories		
Tax-paying	200	$21.2
Tax-exempt	200	$21.2
Commercial Incineration Facilities	N/A	$2.4

1 Full time equivalent workers
2 Millions of dollars
N/A - not available

Table 13
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 $)
Short-term hospitals excluding psychiatric:						
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	536.2	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
Psychiatric hospitals - short-term and long-term						
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 14
Medical Waste Incineration
Model Facilities: Economic Impact Input Information

Other MWI Operators	Average Employee Per Facility	Average Revenue Per Facility
Nursing Homes		
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
Commercial Research Laboratories		
Tax-paying		
50-99 employees	68.3	$7,299,521
100+ employees	469.7	$49,670,443
Tax-exempt	139.5	14,761,754
Commercial Incineration	N/A	$2,393,528

N/A - not available

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.

Tables 15A and 15B show that facilities with on-site MWIs (with the exception of commercial MWIs) may experience price impacts ranging from 0.09 percent to 1.59 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 new facilities. For many of the 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. 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 15B. 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 16 shows the impacts that would be incurred by medical waste generators that are expected to 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 15A. The analysis shows that new medical waste incinerators required to meet any of the regulatory options would need to increase their prices by approximately 11.82 percent in order to recoup their control costs. The large difference between the facility-specific price increase

Table 15A
Model Facility Impacts Assuming No Switching and Onsite Incineration - New Sources
Annualized Control Cost as a Percent of Revenue/Budget (%)

Industry	Option 1	Option 2	Option 3
Hospitals - Short term, excluding psychiatric:			
Federal Government			
Small			
Urban	0.36	0.36	0.41
Rural	0.36	0.36	0.41
Medium	0.33	0.49	0.49
Large	0.16	0.16	0.16
State Government			
Small			
Urban	0.76	0.76	0.88
Rural	0.76	0.76	0.88
Medium	0.35	0.51	0.51
Large	0.09	0.09	0.09
Local Government			
Small			
Urban	1.18	1.18	1.36
Rural	1.18	1.18	1.36
Medium	0.53	0.78	0.78
Large	0.12	0.12	0.12
Not-for-profit			
Small			
Urban	0.80	0.80	0.93
Rural	0.80	0.80	0.93
Medium	0.39	0.58	0.58
Large	0.14	0.14	0.14
For-profit			
Small			
Urban	0.91	0.91	1.04
Rural	0.91	0.91	1.04
Medium	0.41	0.61	0.61
Large	0.17	0.17	0.17
Hospitals - Psychiatric, short term and long term:			
Small			
Urban	1.25	1.25	1.44
Rural	1.25	1.25	1.44
Medium	0.95	1.40	1.40
Large	0.56	0.56	0.56
Nursing Homes:			
Tax-Paying			
Urban	1.35	1.35	1.56
Rural	1.35	1.35	1.56
Tax-exempt			
Urban	1.39	1.39	1.59
Rural	1.39	1.39	1.59
Commercial research labs			
Tax-paying	0.68	1.00	1.00
Tax-exempt	0.68	1.00	1.00
Commercial Incineration Facilities	11.82	11.82	11.82

Table 15B
Per Facility Impacts Assuming Switching from Onsite 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
Hospitals - Short term, excluding psychiatric:		
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
Hospitals - Psychiatric, short term and long term:		
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
Nursing Homes:		
Tax-Paying - Urban	0.11	0.39
Rural	0.11	0.64
Tax-exempt- Urban	0.11	0.40
Rural	0.12	0.65
Commercial research labs:		
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 16
Per Facility Impacts For Firms that Utilize Offsite Incineration - New Sources
Incremental Annual Cost as a Percent of Revenue/Budget (%)

Industry	Incremental Cost as a Percent of Revenue or Budget	
	Low[1]	High[2]
Hospitals		
<50 Beds	0	0.01
50-99 Beds	0	0.01
100-299 Beds	0	0.01
300+ Beds	0	0.01
Nursing Homes		
0-19 Employees		
Tax-paying	0	0
Tax-exempt	0	0
20-99 Employees		
Tax-paying	0	0.01
Tax-exempt	0	0.01
100+ Employees		
Tax-exempt	0	0
Tax-paying	0	0
Commercial Research Labs		
Tax-paying		
0-19 Employees	0	0
20-99 Employees	0	0
100+ Employees	0	0
Tax-exempt	0	0
Outpatient Care Clinics		
Physicians' clinics (Amb. Care)		
Tax-paying	0	0.01
Tax-exempt	0	0.01
Freestanding kidney dialysis facilities		
Tax-paying	0	0.01
Tax-exempt	0	0.01
Physicians' offices	0	0
Dentists' offices and clinics		
Offices	0	0
Clinics		
Tax-paying	0	0
Tax-exempt	0	0
Medical & dental Labs		
Medical	0	0.01
Dental	0	0.01
Freestanding blood banks	0.01	0.02
Funeral Homes	0	0
Fire & Rescue	0	0
Corrections		
Federal Government	0	0
State Government	0	0
Local Government	0	0

1 The low incremental annual cost per facility estimate is based on the average annual control cost for all commercial MWIs of $0.009 per pound
2 The high incremental annual cost per facility estimate is based on a cost of $0.037 per pound, the control cost for large commercial MWIs in the baseline.

compared to the industry-wide increase (3.8%) suggests that it is unlikely these particular facilities would be able to increase the price of their service by 11.82 percent.

Although a "switching" analysis was not developed for the commercial MWI sector, recent trends in the medical waste treatment and disposal industry suggest that the concept of switching may also be applicable to the commercial MWI sector. A company in this industry that might have decided to open a new incinerator may reconsider the option of opening an alternative technology, such as autoclaving. These alternative technologies will seem more attractive from a cost perspective due to the requirements this regulation places on new MWIs. Therefore, some companies in this industry will have an incentive to choose to open an alternative treatment unit, such as an autoclave unit. Some companies in the medical waste treatment and disposal industry have already begun to make these "switching" decisions. Since companies in this industry have demonstrated the ability to operate various types of medical waste treatment and disposal units, the option of "switching" should be seen as a viable alternative for commercial MWI operators.

This economic impact section 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.

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 new medical waste incinerators. 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 MACT emission standards. Therefore, the remainder of this section focuses on small entity impacts as they pertain to facilities that may operate on-site MWIs.

There are four categories of facilities that are expected to 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.[4]

In addition to the above definitions, the EPA defines a small government entity as a community of 50,000 or less in population. 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.[5]

Revenue data for non-governmental hospitals show that only a few are likely to be small, since the smallest model hospital that might incinerate 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[6] shows that there are 122 admissions to community hospitals per 1,000 population and that there are approximately 34 admissions per bed annually. Using the following equation:

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

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 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.[7] Assuming that the current hospital bed size distribution and ownership distribution currently exhibited by this industry will remain constant over the five year time period of this analysis, the above data can be used to estimate the future number of hospitals that are expected to be operated in small communities (i.e., population of less than 50,000). 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 173. Twenty-five percent of 173 equates to 44 hospitals that are local government owned and are potentially affected small entities.

Table 17 presents price impacts for these small hospitals. As can be seen, assuming no switching, these facilities would experience price impacts in the range of 0.53 percent to 1.36 percent, depending on the regulatory option examined. Under the more likely scenario B, these facilities would experience price impacts ranging from 0.07 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. According to the MWI inventory, there are an estimated 27 nursing homes that may decide to operate a new on-site MWI or replace an existing on-site MWI. This analysis assumes that there will only be one MWI at each nursing home. Data from Robert Morris Associates shows that 60 percent of the nursing home industry currently generate less than $5.0 million in annual revenue.[8] Thus, 60 percent of 27 affected facilities equals 17 small nursing homes, assuming that new nursing homes will maintain the same size distribution as existing nursing homes. The model facility analysis shows that these facilities will decide to use alternative waste management practices such as autoclaving wastes or sending the waste to commercial facilities rather than install a new on-site MWI. Under scenario B, the price impacts for these nursing homes range from 0.11 percent to 0.12 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 17 also shows that virtually all affected research laboratories are estimated to have less than 500 employees. For the purpose of estimating small entity impacts, the total population of laboratories is assumed to be small entities. There are an estimated 27 new MWIs that might be affected in the laboratory category. Similar to many hospitals and nursing homes that are expected to decide to use alternative technologies, these facilities are expected to avoid on-site 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 is expected to generate an average revenue of $2.4 million, thus implying that all new commercial MWIs will be small. Under this assumption, all of the estimated ten new commercial MWIs are expected to be affected by these emission standards. As can be seen in Table 16, the model facility analysis estimates that these facilities may experience control cost to revenue impacts of approximately 12%. Compared to an industry-wide price impact of approximately 4%, this price increase is not likely to be achieved by these new commercial MWI 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

Table 17
Small Entity Economic Impacts: New Medical Waste Incinerators

				Small Model Facility Price Impacts (%)		
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.[a]	44	0.53 - 1.36	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	17	1.35 - 1.59	0.11 -0.12	0.39 - 0.65
Laboratories	≤ 500 employees	N.A.	27	0.68 - 1.00	0.09 - 0.10	0.34 - 0.56
Commercial MWIs	≤ $5.0 million annual sales	$2.4 million	10	11.82	N.E.[b]	N.E.

[a]N.A. = Not Applicable

[b]N.E. = Not Estimated

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 and important factor that may negate these adverse economic impacts on small commercial MWIs is the concept of switching. Although a "switching" analysis was not developed for the commercial MWI sector, recent trends in the medical waste treatment and disposal industry suggest that the concept of switching may also be applicable to the commercial MWI sector. A company in this industry that might have decided to open a new incinerator may reconsider the option of opening an alternative technology, such as autoclaving. These alternative technologies will seem more attractive from a cost perspective due to the requirements this regulation places on new MWIs. Therefore, some companies in this industry will have an incentive to choose to open an alternative treatment unit such as an autoclave unit. Some companies in the medical waste treatment and disposal industry have already begun to make these "switching" decisions. Since companies in this industry have demonstrated the ability to operate various types of medical waste treatment and disposal units, the option of "switching" should be seen as a viable alternative for commercial MWI operators.

This regulation is expected to increase demand for commercial MWI services. However, due to economies of scale, these standards are expected to shift demand from smaller incinerators to larger incinerators. Therefore, a disproportionate number of small MWI units or facilities may be adversely affected by this regulation. Given the potential adverse economic impacts that a small commercial MWI would experience as a result of these standards, the "switching" explanation presented in this analysis should be considered to be an appropriate decision option for new MWIs in this industry. These small commercial facilities can avoid the additional emission control costs associated with these standards by deciding to operate alternative waste treatment and disposal technologies rather than operate a new on-site MWI.

A third 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. Due to insufficient data regarding the current ownership distribution of the existing commercial MWI population, it is not possible to estimate future distributions in this industry. For example, of the ten new commercial MWI units projected to be affected in the next five years, it is not possible to estimate the proportion of these units that would have been installed at a facility owned by a firm that operates more than one facility. If several facilities are owned by a single firm, it is likely that these facilities would not be considered small entities under the SBA's definition since the SBA's definition of small entities applies to entire firms rather than individual facilities.

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.

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