



Hospital/Medical/Infectious Waste Incinerators: Background Information for Promulgated Standards and Guidelines -

Analysis of Economic Impacts for Existing Sources



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Hospital/Medical/Infectious Waste Incinerators: Background Information for Promulgated Standards and Guidelines – Analysis of Economic Impacts for Existing Sources

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I. INTRODUCTION

On February 27, 1995, the EPA published the proposed Emission Guidelines (EG) for existing medical waste incinerators (MWIs). The proposal was the result of several years of effort reviewing available information in light of the Clean Air Act requirements. Following proposal, a large number of comment letters were received, some including new information and some indicating that commenters were in the process of gathering information for the EPA to consider. The large amount of new information that was ultimately submitted addressed every aspect of the proposed standards and guidelines, including: the existing population of MWIs; the performance capabilities of air pollution control systems; monitoring and testing; operator training; alternative medical waste treatment technologies; and the definition of medical waste. In almost every case, the new information has led to different conclusions. One change made to the final rule as a result of comments regarding the definition of medical waste has been a change in the title of the rulemaking. For reasons discussed in other documents, the official title of the rulemaking is "Hospital/Medical/Infectious Waste Incinerators" or "HMIWI." However, for purposes of this document, the terms "MWI" and "HMIWI" should be viewed as interchangeable.

The purpose of this revised economic impact analysis (EIA) document is to reassess the economic impacts of new regulatory options that have been developed for existing MWIs. The potential economic impacts of four EG control options for existing MWIs were originally evaluated in *Medical Waste Incinerators - Background Information for Proposed Standards and Guidelines: Analysis of Economic Impacts for Existing Sources*.¹ An addendum was subsequently prepared to estimate the potential economic impacts of a fifth 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 the change in affected labor markets in terms of the number of employees lost. Industries that generate medical waste (hospitals, nursing homes, etc.) are expected to experience average price increases in the range of 0 to 0.14 percent, depending on the industry, regulatory option, and scenario analyzed. These industries are expected to experience output and employment impacts in the range of 0 to -0.18 percent. In addition, revenue impacts for these industries are expected to range from an increase of 0.05 percent to a decrease of 0.04 percent. An increase in industry revenue will occur if demand for the industry's service is relatively price-inelastic, i.e., between -1 and 0. Such a price elasticity indicates that output is not very responsive to a change in price, specifically that the percentage decrease in output will be less than the percentage increase in price. Since revenue is the product of price and output, a less than proportional change in output compared to price means that total revenue will increase.

The following example illustrates how the above price impacts could be interpreted for the hospital industry. The estimated average industry-wide price increase for hospitals under regulatory option six (the most stringent regulatory option) and scenario C, switching with no waste segregation, is 0.03 percent. This can be expressed in terms of the increased cost of hospitalization due to the regulation. Total nationwide adjusted patient days at hospitals in 1993 were an estimated 304.5 million days. ("Adjusted" patient days include both in-patient days and the in-patient day equivalent of out-patient visits.) Annualized control costs under regulatory option six and scenario C are \$92,186,286, or \$0.30 per adjusted patient day. This means that the average price increase that an individual would experience for each hospital patient-day is expected to equal 30 cents.

The estimated average price increase for the commercial medical waste incineration industry is 2.6 percent, regardless of the regulatory option (control requirements for commercial MWIs do not vary by regulatory option). This price increase is considered achievable because of the cost advantage (i.e., lower cost per ton of waste burned) – due to economies of scale – that commercial MWIs have over smaller on-site MWIs.

Impacts were also estimated at the facility level by employing the concept of the model facility, i.e., by defining key parameters to describe typical facilities in the affected industries. The vast majority of facilities impacted by the regulation are those that send their medical waste off-site to be incinerated and will have to pay more for commercial incineration. All impacts on these facilities are minuscule. At the most, the increased cost of commercial incineration could be recovered with a price increase of only 0.02 percent. For facilities that operate on-site MWIs ("MWI operators"), impacts are also generally insignificant. Either the cost of controls or the cost of switching to an alternative medical waste treatment and disposal method could be recovered with a price increase that does not significantly exceed the market price increase.

Two types of MWI operators may not be able to switch to an alternative, however: commercial MWI operators, because their line of business is commercial incineration; and small, rural, remote MWIs (defined as more than 50 miles away from an SMSA and burning less than 2,000 pounds of medical waste per year), which may not have access to waste hauling and/or commercial incineration services. For commercial MWI operators, three of the 59 facilities operating the 79 commercial MWIs in the MWI inventory were found to be significantly impacted by the regulation (under all six regulatory options). These facilities may not have to shut down, though, considering that they are completely uncontrolled in the baseline and therefore may currently enjoy a cost advantage over their competitors (most of which are at least partially controlled in the baseline), and that the regulation will bring about – due to switching away from on-site incineration – an increase in the demand for commercial incineration services. Impacts are not significant for small, rural, remote MWI operators under regulatory options one and two. Under regulatory options three through six, on the other hand, some of these facilities are significantly impacted and might therefore have to shut down.

This economic impact analysis examines industries that are directly impacted by the regulation, namely industries that generate or treat medical waste. Secondary impacts such as those on air pollution device vendors and MWI vendors were not evaluated due to data limitations. However, it can be said that air pollution device vendors are expected to experience an increase in demand for their products due to the regulation. The regulation is also expected to increase the demand for commercial MWI services. Due to economies of scale, however, there is likely to be a demand shift from smaller incinerators to larger incinerators. Therefore, vendors of small MWIs may be adversely affected by the regulation.

In accordance with the Regulatory Flexibility Act of 1980 and its amendment in 1996 by the Small Business Regulatory Enforcement Fairness Act (SBREFA), an analysis of impacts on small “entities” – including small businesses, small nonprofit organizations, and small governmental jurisdictions – was performed. This analysis indicates that the Emission Guidelines will not have a “significant impact on a substantial number of small entities” under any regulatory option. Impacts are not significant for the vast majority of medical waste generators that send their waste off-site to be treated and disposed. Impacts are also not significant for the great majority of MWI operators that would have the opportunity to switch to an alternative method of medical waste treatment and disposal if control costs are prohibitive. Some significant impacts were found for commercial MWI operators under all six regulatory options and for small on-site MWI operators that are remote from an urban area under regulatory options three through six. These facilities might not have the opportunity to switch to an alternative medical waste treatment and disposal method – commercial MWI operators because medical waste incineration is their line of business, and small, remote MWIs because they may not have access to commercial incineration services. However, the number of small entities that may be significantly impacted by this regulation is not considered “substantial”. Only one commercial MWI operator, and perhaps at the most half of the 114 small, remote MWIs identified in the MWI inventory (under regulatory options three through six only) potentially could have significant impacts as a result of this regulation.

III. BACKGROUND INFORMATION

A. Regulatory Options

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

After proposal, the EPA received numerous comments containing substantially new information. Review of this new information led 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 examined several new regulatory options which merit consideration in selecting MACT for existing MWIs. This section summarizes these new regulatory options and the EPA’s assessment of their merits.

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

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

First, the EG for existing MWIs will not include requirements to use a specific emission control system or technology; the EG will only include emission limits, which may be met by any means or by any control system or technology of the MWI owner's or operator's choice. Second, to the extent possible, it is an objective of the EPA to adopt emission limits in the EG that can be met through the use of several emission control systems or technologies. Consequently, where not constrained by the Act, the actual emission limits associated with some of the regulatory options shown in Table 1 have been selected at a level designed to encourage or permit the use of either wet or 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 all hospitals operated on-site medical waste incinerators. The clear trend over the past several years has been for more and more hospitals to turn to the use of alternative on-site medical waste treatment technologies or the use of commercial off-site treatment and disposal services. Consequently, it is quite likely that even fewer hospitals now operate on-site medical waste incinerators.

Table 1
Regulatory Options For Existing MWIs

MWI Size	Regulatory Option					
	1	2	3	4	5	6
Small ≤200 lb/hr	Good combustion	Good combustion on units meeting the rural criteria; good combustion and low efficiency wet scrubber on other units ¹	Good combustion and low efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and high efficiency wet scrubber
Medium >200 lb/hr and ≤500 lb/hr	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and moderate efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber
Large >500 lb/hr	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber	Good combustion and high efficiency wet scrubber

¹Units "meeting the rural criteria" are more than 50 miles from an SMSA and burn less than 2,000 pounds of medical waste per week.

Given the above data, it can be assumed that more than half of all hospitals today have chosen to use other means of treatment and disposal of their medical waste rather than operate an on-site incinerator. This 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 95 percent or more. This further confirms the availability of alternatives to on-site incineration for the treatment and disposal of medical waste.

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

In this analysis of 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 analysis at proposal and was the basis for the conclusion at proposal that adoption of the proposed EG could lead to as many as 80 percent of health care facilities with MWIs to choose an alternative means of medical waste treatment and disposal rather than continue operation of their MWI. However, the economic impacts presented with the proposed EG were only evaluated using the costs under a "no switching" scenario. Although the EIA presented a qualitative discussion of the likely possibility of facilities with on-site MWIs deciding to switch to alternative treatment and disposal methods, the economic impacts under a switching scenario were not quantified due to time constraints.

Switching has now been incorporated into the cost and economic impact analysis. Three scenarios are evaluated: one scenario which ignores switching, and two scenarios which consider switching. Scenario A assumes that each existing MWI remains in operation (i.e., no switching) and complies with the appropriate regulatory option by purchasing emission control equipment. This scenario, which results in the highest costs because it assumes no existing MWI will switch to a less expensive waste disposal method, most likely overstates national costs and economic impacts and therefore should not be viewed as representative of the EG. It is included only to fulfill the goal of providing a complete analysis.

Switching scenarios B and C are considered more representative of the cost and economic impacts of the EG. Both scenarios assume switching occurs when the cost associated with purchasing and installing the air pollution control technology or system necessary to comply with the MACT emission guideline (i.e., a regulatory option) is greater than the cost of using an alternative means of treatment and disposal.*

The difference between the two scenarios is the assumption of whether or not the medical waste stream is separated. Some facilities currently separate their medical waste into an infectious stream and a non-infectious stream. Some commenters have stated it is a good assumption that hospitals which currently operate on-site medical waste incinerators practice little separation of medical waste into infectious and non-infectious streams; generally all the waste is incinerated.

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

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

For purposes of determining the impacts of the EG under switching scenarios B and C, the MWI inventory was separated into commercial (off-site) incinerators and on-site incinerators. Commercial incinerators were not subject to the switching analyses under scenarios B and C

*Under both scenarios, however, switching is assumed to not be possible for up to 114 small MWIs (out of a total existing small MWI population of 1,139) that meet two "rural criteria:" located more than 50 miles away from a Standard Metropolitan Statistical Area (SMSA), and burn less than 2,000 pounds of medical waste per week. This acknowledges that remote and small medical waste generators may have difficulty getting treatment and disposal service (e.g., it may not be worth the while of commercial providers). For these units, scenarios B and C do not apply. Only scenario A, no switching, applies.

because switching to an alternative method of waste disposal is not an option for them. Rather, it was assumed that commercial facilities will add on the control equipment associated with the EG. Only the on-site MWIs in the inventory were subject to the switching analyses under scenarios B and C.

Scenarios B and C represent the likely range of impacts associated with the EG for existing MWIs. The actual impacts of a MACT emission guideline (i.e., a regulatory option) are 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 economic impacts of the EG on industries that generate medical waste and operate on-site MWIs, commercial MWIs, and industries that generate medical waste but do not operate on-site MWIs. Facilities engaging in the above activities will generally fall into one of two categories: directly affected facilities, and “off-site generators.”

Facilities in industries that generate medical waste and operate on-site MWIs will be directly affected by the EG because they will need to initiate some action to comply with the regulation (i.e., install emission control equipment or switch to an alternative). Costs and economic impacts associated with these facilities and industries are 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 industries are commercial MWIs. Although the commercial MWI industry does not generate medical waste, it will be required to comply with the EG by installing emission control equipment.

The analysis also examines the impacts of the EG on facilities that generate medical waste but do not operate an on-site MWI. Such facilities are termed “off-site generators” in this analysis. These facilities will be indirectly affected by the regulation because they must send their medical waste off-site to be treated and disposed. Commercial MWIs or other waste treatment facilities that provide service to these types of facilities are expected to pass on to their customers at least a portion of their EG-related cost increases. Off-site generators are therefore expected to have to pay more for off-site treatment and disposal. Industries belonging to this off-site generator category include hospitals, nursing homes, research laboratories, funeral homes, physicians’ offices, dentists’ offices and clinics, outpatient care facilities, freestanding blood banks, fire and rescue operations, and correctional facilities.

IV. ECONOMIC IMPACTS

A. Methodology

This section briefly describes the analytical approach used to estimate industry-wide and facility-specific economic impacts and to evaluate the economic feasibility of switching. All economic impacts presented in this document were re-estimated using the methodology described in the

original EIA. Therefore, for a more detailed description of the methodology used to estimate economic impacts, refer to the *Background Information for Proposed Standards and Guidelines: Analysis of Economic Impacts for Existing Sources*. The base year for this analysis is 1993. Therefore, all dollar figures (e.g., costs, prices) are stated at 1993 levels.

Average industry-wide price increases are estimated by comparing annualized control costs to annual revenue for each affected industry. The ratio of annualized control costs to revenue represents the average industry-wide price increase necessary to recover control costs. Percent changes in industry-wide output are estimated in turn using high and low estimates of the price elasticity of demand. Resulting changes in industry revenue are estimated based on the price and output calculations. Employment or labor market impacts are estimated assuming they are proportional to the output impacts.

Facility-specific economic impacts are estimated using model facility information. Facility-specific price impacts are compared to average industry-wide price impacts to determine if the difference between the two is significant. A determination of significance – implying that the facility price increase may not be achievable – is made for all but commercial MWI operators if the facility price increase exceeds the average industry-wide, or “market,” price increase by more than one percentage point. For commercial MWI operators, the facility price increase is considered significant if it exceeds the market price increase by more than two percentage points. More pricing latitude is given to commercial MWI operators for two reasons: 1) commercial incineration is not subject to the same institutional pricing constraints as the health care sector, and 2) commercial incineration fees could actually get a boost from the regulation as a result of switching from on-site incineration and an increase in the demand for commercial incineration services. Where significance is found, the impact on net income (earnings) of absorbing control costs is estimated and evaluated.

Table 2A
Industry-wide Annualized and Capital Control Costs
for Industries Operating On-site Medical Waste Incinerators: Existing Sources
Scenario A: No Switching

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals: Annualized costs Capital costs	\$ 58,794,683 \$153,387,845	\$122,328,625 \$369,093,928	\$126,027,425 \$382,596,503	\$131,943,171 \$406,413,438	\$138,533,521 \$435,074,626	\$146,776,634 \$476,105,619
Nursing homes: Annualized costs Capital costs	\$ 9,304,479 \$ 24,274,202	\$19,358,964 \$ 58,410,498	\$ 19,944,313 \$ 60,547,332	\$ 20,880,502 \$ 64,316,451	\$ 21,923,449 \$ 68,852,191	\$ 23,227,953 \$ 75,345,500
Research labs: Annualized costs Capital costs	\$ 9,304,479 \$ 24,274,202	\$19,358,964 \$ 58,410,498	\$ 19,944,313 \$ 60,547,332	\$ 20,880,502 \$ 64,316,451	\$ 21,923,449 \$ 68,852,191	\$ 23,227,953 \$ 75,345,500
Other: Annualized costs Capital costs	\$ 2,807,387 \$ 7,324,113	\$ 5,841,067 \$17,623,858	\$ 6,017,681 \$ 18,268,591	\$ 6,300,152 \$ 19,405,825	\$ 6,614,834 \$ 20,774,368	\$ 7,008,434 \$ 22,733,556
Commercial incineration: Annualized costs Capital costs	\$ 4,948,460 \$13,209,321	\$ 4,948,460 \$13,209,321	\$ 4,948,460 \$13,209,321	\$ 4,948,460 \$13,209,321	\$ 4,971,523 \$13,314,841	\$ 4,971,523 \$13,314,841
Total : Annualized costs Capital costs	\$ 85,159,488 \$222,469,683	\$171,836,080 \$516,748,103	\$176,882,192 \$535,169,079	\$184,952,787 \$567,661,486	\$193,966,776 \$606,868,217	\$205,212,497 \$662,845,016

Table 2B
Industry-wide Annualized and Capital Control Costs for
Industries Operating On-site Medical Waste Incinerators: Existing Sources
Scenario B: Switching With Waste Segregation

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals: Annualized costs	\$36,838,079	\$39,733,624	\$43,432,425	\$43,989,339	\$44,157,613	\$44,973,911
Capital costs	\$37,095,105	\$31,027,063	\$44,529,639	\$46,759,965	\$46,248,407	\$50,323,218
Nursing homes: Annualized costs	\$ 5,829,764	\$ 6,287,996	\$ 6,873,344	\$ 6,961,478	\$ 6,988,108	\$ 7,117,290
Capital costs	\$ 5,870,440	\$ 4,910,149	\$ 7,046,983	\$ 7,399,940	\$ 7,318,984	\$ 7,963,838
Research labs: Annualized costs	\$ 5,829,764	\$ 6,287,996	\$ 6,873,344	\$ 6,961,478	\$ 6,988,108	\$ 7,117,290
Capital costs	\$ 5,870,440	\$ 4,910,149	\$ 7,046,983	\$ 7,399,940	\$ 7,318,984	\$ 7,963,838
Other: Annualized costs	\$ 1,758,981	\$ 1,897,240	\$ 2,073,854	\$ 2,100,446	\$ 2,108,481	\$ 2,147,458
Capital costs	\$ 1,771,254	\$ 1,481,511	\$ 2,126,246	\$ 2,232,741	\$ 2,208,314	\$ 2,402,882
Commercial incineration:						
Annualized costs	\$ 4,948,460	\$ 4,948,460	\$ 4,948,460	\$ 4,948,460	\$ 4,971,523	\$ 4,971,523
Capital costs	\$13,209,321	\$13,209,321	\$13,209,321	\$13,209,321	\$13,314,841	\$13,314,841
Total : Annualized costs	\$55,205,048	\$59,155,316	\$64,201,427	\$64,961,201	\$65,213,833	\$66,327,472
Capital costs	\$63,816,560	\$55,538,193	\$73,959,172	\$77,001,907	\$76,409,530	\$81,968,617

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

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals: Annualized costs Capital costs	\$ 56,613,561 \$139,528,745	\$ 84,132,595 \$138,957,564	\$ 87,831,396 \$152,460,140	\$ 89,019,615 \$156,968,520	\$ 91,125,328 \$158,894,540	\$ 92,186,286 \$161,850,735
Nursing homes: Annualized costs Capital costs	\$ 8,959,308 \$ 22,080,947	\$ 13,314,299 \$ 21,990,556	\$ 13,899,648 \$ 24,127,389	\$ 14,087,688 \$ 24,840,857	\$ 14,420,925 \$ 25,145,657	\$ 14,588,825 \$ 25,613,486
Research labs: Annualized costs Capital costs	\$ 8,959,308 \$ 22,080,947	\$ 13,314,299 \$ 21,990,556	\$ 13,899,648 \$ 24,127,389	\$ 14,087,688 \$ 24,840,857	\$ 14,420,925 \$ 25,145,657	\$ 14,588,825 \$ 25,613,486
Other: Annualized costs Capital costs	\$ 2,703,240 \$ 6,662,355	\$ 4,017,246 \$ 6,635,081	\$ 4,193,860 \$ 7,279,816	\$ 4,250,596 \$ 7,495,086	\$ 4,351,142 \$ 7,587,051	\$ 4,401,801 \$ 7,728,207
Commercial incineration: Annualized costs Capital costs	\$ 4,948,460 \$ 13,209,321	\$ 4,948,460 \$ 13,209,321	\$ 4,948,460 \$ 13,209,321	\$ 4,948,460 \$ 13,209,321	\$ 4,971,523 \$ 13,314,841	\$ 4,971,523 \$ 13,314,841
Total : Annualized costs Capital costs	\$ 82,183,877 \$203,562,315	\$119,726,899 \$202,783,078	\$124,773,012 \$221,204,055	\$126,394,047 \$227,354,641	\$129,289,843 \$230,087,746	\$130,737,260 \$234,120,755

The assumption of no switching (scenario A) represents the highest cost and economic impact scenario. (The exception is commercial MWIs, for which control costs do not vary by scenario.) Scenario B, switching with waste segregation, represents the lowest cost and economic impact scenario. As previously discussed, the EPA considers scenario A to be unlikely. Scenarios B and C should be regarded as more representative of the impacts of the EG.

B. Industry-wide Impacts

1. Industry-wide Annualized Control Costs³

Tables 2A, 2B, and 2C present national capital and annualized control costs for those industries that operate MWIs ("direct control costs"). Annualized control costs are highest under scenario A (Table 2A). Total annualized costs under scenario A range from \$85.2 million for regulatory option one to \$205.2 million for regulatory option six. As previously explained, scenario A impacts are calculated under the unlikely assumption that all facilities currently operating an MWI will purchase emission control equipment. This scenario does not allow for the possibility of switching to alternative methods of waste treatment and disposal.

National costs are lowest under scenario B, which assumes that some facilities currently operating an on-site MWI will switch to an alternative method of waste treatment and disposal.

This scenario also assumes that those facilities deciding to switch will also segregate their waste. Total annualized costs under scenario B range from \$55.2 million for regulatory option one to \$66.3 million for regulatory option six. The range under scenario C, which assumes switching with no waste segregation, is \$82.2 million for regulatory option one to \$130.7 million for regulatory option six. In comparison to scenario A, costs under scenarios B and C do not vary significantly among the regulatory options because the cost of some alternative methods (such as autoclaving) are unaffected by the EG. In addition, control requirements for commercial MWIs (another alternative to on-site incineration) 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 an alternative method of waste treatment and disposal.

Table 3 presents annual costs for those industries not operating MWIs ("indirect control costs"). Annual costs for these "off-site generators," which are assumed to have their medical waste incinerated off-site, were calculated by multiplying estimated medical waste generated annually by the incremental cost for commercial incineration. The incremental cost was calculated by dividing industry-wide annualized control costs for commercial incinerators by their throughput. The incremental cost of commercial incineration is calculated to be 0.63 cents per pound under all regulatory options. Note in Tables 2A through 2C that industry-wide annualized control costs for commercial MWIs vary insignificantly by regulatory option, increasing only slightly from regulatory option 4 and regulatory option 5. This is because control requirements do not vary by regulatory option for commercial MWIs.

Table 3
Industry-wide Annual Costs for Industries Not Operating
On-site Medical Waste Incinerators: Existing Sources

Industry	Medical Waste Generated Annually (tons per year)	Annual Control Cost¹
Medical / dental laboratories	17,600	\$222,115
Funeral homes	900	\$ 11,358
Physicians' offices	35,200	\$444,230
Dentists' offices & clinics	8,700	\$109,795
Outpatient care	26,300	\$331,910
Freestanding blood banks	4,900	\$ 61,839
Fire & rescue operations	1,600	\$ 20,192
Correctional facilities	3,300	\$ 41,647
Total	98,500	\$1,243,087

¹ Assumes that all medical waste is incinerated off-site at an incremental cost of 0.63 cents per pound, the average cost increase for commercial MWIs.

Table 4
Industry-wide Financial and Economic Inputs

Industry	Number of Facilities	Industry Revenue or Budget (millions of dollars)	Industry Employment	Price Elasticity of Demand	
				Maximum	Minimum
Hospitals	6,601	\$316,188	4,311,036 ¹	-0.33	0
Nursing homes	20,879	\$51,425	1,632,824	-0.67	-0.33
Laboratories: Commercial research ² Medical / dental	4,170 15,961	\$17,102 \$14,749	159,097 177,866	-1.33 -1.33	-1.00 -0.67
Funeral homes	22,000	\$11,326	136,400	-0.33	0
Physicians' offices	192,965	\$134,637	1,231,342	-0.33	0
Dentists' offices and clinics	108,919	\$37,199	556,011	-0.67	-0.33
Outpatient care 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

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 787.9 million pounds per year @ \$.24 per pound

N/A - not available

NE - not estimated commercial MWIs vary insignificantly by regulatory option, increasing only slightly from regulatory option 4 to regulatory option 5. This is because control requirements do not vary by regulatory option for commercial MWIs.

No capital costs are presented in Table 3. This is because off-site generators, which are not directly impacted by the EG, will not be faced with having to invest in control equipment. Off-site generators are only impacted by the EG by having to pay higher commercial incineration fees, an annual cost.

2. Financial and Economic Inputs

The economic impact methodology used in this report is similar to the methodology used in the original EIA. The types of data inputs needed are the same as in the original analysis. However, all financial and economic data have been updated to 1993 where possible.

Table 4 presents the relevant financial and economic data for each of the regulated industries. Specifically, the number of facilities for each industry is reported along with revenue and employment. Also, where possible, the estimated price elasticity of demand is reported. These price elasticities are the same as those estimated in the original EIA. Note that an elasticity estimate is not presented for the commercial MWI industry. This omission is due to a lack of relevant information about this industry and is further complicated by the uncertainty of the 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 necessary to recover annualized control costs. It is calculated as the ratio of industry-wide annualized control costs to revenue. Because most, if not all, of the regulated industries are characterized by local or regional markets, actual price increases will vary from one location to another according to such factors as: 1) the number of facilities in the market; 2) the number of facilities operating an MWI; 3) the distribution of MWI sizes; and 4) market structure and pricing mechanisms. Ideally, the average price increase in each local or regional market would be measured. However, it is not possible to define and characterize literally hundreds of local and regional markets. Therefore, the industry-wide price increase, which is an average price increase across all market areas, is used to represent the average price increase in each individual local or regional market.

As an average, the market 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) 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 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.

Table 5A
Industry-wide Percent Price Impacts*: Existing Sources
Scenario A: No Switching

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals	0.02	0.04	0.04	0.04	0.04	0.05
Nursing homes	0.02	0.04	0.04	0.04	0.04	0.05
Laboratories: Commercial research	0.05	0.11	0.12	0.12	0.13	0.14
Medical/dental	0	0	0	0	0	0
Funeral homes	0	0	0	0	0	0
Physicians' offices	0	0	0	0	0	0
Dentists' offices and clinics	0	0	0	0	0	0
Outpatient care	0	0	0	0	0	0
Freestanding blood banks	0	0	0	0	0	0
Fire and rescue operations	0	0	0	0	0	0
Correctional facilities	0	0	0	0	0	0
Commercial incineration	2.62	2.62	2.62	2.62	2.63	2.63

* Percent price increases necessary to recover annualized control costs.

Table 5B
Industry-wide Percent Price Impacts*: Existing Sources
Scenario B: Switching With Waste Segregation

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals	0.01	0.01	0.01	0.01	0.01	0.01
Nursing homes	0.01	0.01	0.01	0.01	0.01	0.01
Laboratories: Commercial research Medical/dental	0.03 0	0.04 0	0.04 0	0.04 0	0.04 0	0.04 0
Funeral homes	0	0	0	0	0	0
Physicians' offices	0	0	0	0	0	0
Dentists' offices and clinics	0	0	0	0	0	0
Outpatient care	0	0	0	0	0	0
Freestanding blood banks	0	0	0	0	0	0
Fire and rescue operations	0	0	0	0	0	0
Correctional facilities	0	0	0	0	0	0
Commercial incineration	2.62	2.62	2.62	2.62	2.63	2.63

* Percent price increases necessary to recover annualized control costs.

Table 5C
Industry-wide Percent Price Impacts*: Existing Sources
Scenario C: Switching With No Waste Segregation

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals	0.02	0.03	0.03	0.03	0.03	0.03
Nursing homes	0.02	0.03	0.03	0.03	0.03	0.03
Laboratories: Commercial research Medical/dental	0.05 0	0.08 0	0.08 0	0.08 0	0.08 0	0.09 0
Funeral homes	0	0	0	0	0	0
Physicians' offices	0	0	0	0	0	0
Dentists' offices and clinics	0	0	0	0	0	0
Outpatient care	0	0	0	0	0	0
Freestanding blood banks	0	0	0	0	0	0
Fire and rescue operations	0	0	0	0	0	0
Correctional facilities	0	0	0	0	0	0
Commercial incineration	2.62	2.62	2.62	2.62	2.63	2.63

* Percent price increases necessary to recover annualized control costs.

Market price increases are presented in Tables 5A, 5B, and 5C. As can be seen, scenario A (Table 5A) produces the largest impacts. However, because this scenario is unlikely to 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 0.01 percent under all regulatory options for both hospitals and nursing homes. The commercial research laboratory industry is expected to experience a price increase ranging from 0.03 to 0.04 percent, depending on the regulatory option.

Under scenario C, which assumes switching without waste segregation, the average industry-wide price increases for both hospitals and nursing homes are 0.02 percent under regulatory option one and 0.03 percent under regulatory options two through six. For commercial research labs, the price impacts range from 0.05 to 0.09 percent, depending on the regulatory option.

Under all three scenarios, the price impacts are negligible (not even registering at two decimal places) for medical and dental laboratories, funeral homes, physicians' offices, dentists' offices and clinics, outpatient care, freestanding blood banks, fire and rescue operations, and correctional facilities.

With the exception of the commercial MWI industry, all market price increases in Tables 5A through 5C are under one percent and are therefore considered achievable. The low values partly reflect the fact that in each industry, the majority of facilities do not operate an MWI. Tables 5A through 5C also present average industry-wide price impacts for the commercial MWI industry. The impacts are 2.62 or 2.63 percent, varying only slightly by regulatory option because control requirements for commercial MWIs do not vary by regulatory option. Also, the impacts are the same under all three scenarios because switching is not an option for commercial MWIs. Although the estimated price increases for this industry exceed one percent, they are considered achievable because of the cost advantage (i.e., lower cost per ton of waste burned) – due to economies of scale – that commercial MWIs have over smaller on-site MWIs. This cost advantage, which will be made even more pronounced by the EG, is a strong basis for the argument that many facilities will switch from on-site incineration to off-site disposal in response to the regulation.

4. Output, Employment, and Revenue Impacts

The market price increase will result in output, employment, and revenue impacts. This analysis presents a range of output, employment, and revenue impacts 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 a lack of relevant financial and economic information for the industry.

Since demand is not perfectly inelastic in any of the impacted industries, output will decline in response to the market price increase. The relationship between price and output (or quantity demanded) can be captured by the following constant-elasticity demand function:

$$Q_D = aP^e$$

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

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

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

Output impacts can be calculated by setting % ΔP equal to the market price increase. These impacts are presented in Tables 6A, 6B, and 6C. Due to a relatively small market price increase and/or relatively inelastic demand, all of the output impacts are less than one percent. The greatest output decreases are experienced by commercial research labs, but even these are insignificant: up to 0.18 percent for regulatory option six under scenario A, up to 0.06 percent for regulatory option six under scenario B, and up to 0.11 percent for regulatory options three through six under scenario C.

Table 6A
Industry-wide Output, Employment, and Revenue Impacts: Existing Sources
Scenario A: No Switching

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals						
Output decrease (%)	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01	0-0.02
Employment loss	0-265	0-550	0-567	0-593	0-623	0-660
Revenue increase or (decrease) (%)	0.01-0.02	0.03-0.04	0.03-0.04	0.03-0.04	0.03-0.04	0.03-0.05
Nursing homes						
Output decrease (%)	0.01	0.01-0.03	0.01-0.03	0.01-0.03	0.01-0.03	0.02-0.03
Employment loss	97-198	203-412	209-424	219-444	230-466	243-494
Revenue increase or (decrease) (%)	0.01	0.01-0.03	0.01-0.03	0.01-0.03	0.01-0.03	0.01-0.03
Laboratories:						
Commercial research						
Output decrease (%)	0.05-0.07	0.11-0.15	0.12-0.16	0.12-0.16	0.13-0.17	0.14-0.18
Employment loss	87-115	180-239	185-246	194-258	204-271	216-287
Revenue increase or (decrease) (%)	(0.02)-0	(0.04)-0	(0.04)-0	(0.04)-0	(0.04)-0	(0.04)-0
Medical/dental						
Output decrease (%)	0	0	0	0	0	0
Employment loss	2-4	2-4	2-4	2-4	2-4	2-4
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Funeral homes						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Physicians' offices						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Dentists' offices and clinics						
Output decrease (%)	0	0	0	0	0	0
Employment loss	1	1	1	1	1	1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Outpatient care						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Freestanding blood banks						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Fire and rescue operations						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Correctional facilities						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0

Table 6B
Industry-wide Output, Employment, and Revenue Impacts: Existing Sources
Scenario B: Switching With Waste Segregation

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals						
Output decrease (%)	0	0	0-0.01	0-0.01	0-0.01	0-0.01
Employment loss	0-166	0-179	0-195	0-198	0-199	0-202
Revenue increase or (decrease) (%)	0.01	0.01	0.01	0.01	0.01	0.01
Nursing homes						
Output decrease (%)	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01	0.01
Employment loss	61-124	66-134	72-146	73-148	73-149	75-151
Revenue increase or (decrease) (%)	0-0.01	0-0.1	0-0.01	0-0.01	0-0.01	0-0.01
Laboratories:						
Commercial research						
Output decrease (%)	0.03-0.05	0.04-0.05	0.04-0.05	0.04-0.05	0.04-0.05	0.04-0.06
Employment loss	54-72	58-78	64-85	65-86	65-86	66-88
Revenue increase or (decrease) (%)	(0.01)-0	(0.01)-0	(0.01)-0	(0.01)-0	(0.01)-0	(0.01)-0
Medical/dental						
Output decrease (%)	0	0	0	0	0	0
Employment loss	2-4	2-4	2-4	2-4	2-4	2-4
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Funeral homes						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Physicians' offices						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Dentists' offices and clinics						
Output decrease (%)	0	0	0	0	0	0
Employment loss	1	1	1	1	1	1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Outpatient care						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Freestanding blood banks						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Fire and rescue operations						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Correctional facilities						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0

Table 6C
Industry-wide Output, Employment, and Revenue Impacts: Existing Sources
Scenario C: Switching With No Waste Segregation

Industry	Regulatory Option					
	One	Two	Three	Four	Five	Six
Hospitals						
Output decrease (%)	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01	0-0.01
Employment loss	0-255	0-378	0-395	0-400	0-410	0-415
Revenue increase or (decrease) (%)	0.01-0.02	0.02-0.03	0.02-0.03	0.02-0.03	0.02-0.03	0.02-0.03
Nursing homes						
Output decrease (%)	0.01	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02
Employment loss	94-191	139-283	146-296	148-300	151-307	153-310
Revenue increase or (decrease) (%)	0.01	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02
Laboratories:						
Commercial research						
Output decrease (%)	0.05-0.07	0.08-0.10	0.08-0.11	0.08-0.11	0.08-0.11	0.09-0.11
Employment loss	83-111	124-165	129-172	131-174	134-178	136-180
Revenue increase or (decrease) (%)	(0.02)-0	(0.03)-0	(0.03)-0	(0.03)-0	(0.03)-0	(0.03)-0
Medical/dental						
Output decrease (%)	0	0	0	0	0	0
Employment loss	2-4	2-4	2-4	2-4	2-4	2-4
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Funeral homes						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Physicians' offices						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Dentists' offices and clinics						
Output decrease (%)	0	0	0	0	0	0
Employment loss	1	1	1	1	1	1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Outpatient care						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0-1	0-1	0-1	0-1	0-1	0-1
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Freestanding blood banks						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Fire and rescue operations						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0
Correctional facilities						
Output decrease (%)	0	0	0	0	0	0
Employment loss	0	0	0	0	0	0
Revenue increase or (decrease) (%)	0	0	0	0	0	0

The impact of the market price increase on industry-wide employment, assuming that employment is proportional to output (i.e., fixed labor to output ratio), is also presented in Tables 6A through 6C. These impacts are presented in terms of estimated employment losses. As a percent of the baseline (see Table 4), the employment losses are considered small. (In fact, by definition, the percent decrease in employment is equal to the percent decrease in output, which has already been seen to be insignificant.) At the most (regulatory option six) under scenario A, the number of employees would decline by up to 660 at hospitals, 494 at nursing homes, and 287 at research labs (all other industries have minuscule or undetectable impacts). However, because switching is likely to occur, the impacts are more likely to fall between those shown under scenarios B and C. At the most (regulatory option six) under scenario C, the number of employees would decline by up to 415 at hospitals, 310 at nursing homes, and 180 at research labs. At the most (regulatory option six) under scenario B, the number of employees would decline by up to 202 at hospitals, 151 at nursing homes, and 180 at research labs.

The employment impacts in Tables 6A through 6C do not attempt to quantify some positive employment impacts expected to occur as a result of the 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 will change in response to the market price increase. It will increase if demand is relatively inelastic (i.e., $-1 < e < 0$) and decrease if demand is relatively elastic (i.e., $e < -1$). For example, if demand is relatively inelastic, the percent decrease in output in response to a price increase will be less than the percent price increase. Since revenue is the product of price and output, a less-than-proportionate decrease in output implies an increase in revenue. The following equation can be used to measure the impact on revenue of the market price increase (and resultant output decrease):

$$\Delta \text{ Revenue} = \text{Baseline Revenue} * [\% \Delta P + \% \Delta Q + (\% \Delta P * \% \Delta Q)]$$

Revenue impacts (percent increase or, in parentheses, percent decrease) are also presented in Tables 6A through 6C. Revenue decreases only for commercial research labs in the case of the maximum elasticity ($e = -1.33$; see Table 4). In all other cases, revenue increases because demand is relatively inelastic or does not change because demand is unitary-elastic ($e = -1$). Regardless, all impacts are small and are not considered significant.

C. Model Facility Analysis

Facility-specific impacts were also estimated for the affected industries. These impacts were calculated by employing the concept of the model facility. This technique allows an analysis to be

Table 7
Model Facility Definitions

Facility	Definition	MWI Assignment
Large Hospital	400 beds	Large MWI
Medium Hospital	140 beds	Medium MWI
Small Hospital	40 beds	Small MWI
Nursing Home	150 employees	Small MWI
Commercial Research Laboratory	200 employees	Medium MWI

N/A - not available

prepared on a more detailed level by defining key parameters to describe “typical” facilities in the affected industries. The EIA prepared for the proposed rule used cost estimates provided on a model combustor (i.e., MWI) basis to estimate economic impacts for model facilities. The model facility concept not only had to incorporate model MWI 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 MWIs 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 MWI parameters already incorporated into the model facility concept. Therefore, this document no longer needs to employ the “linking” scheme used to assign model MWIs to model facilities in the earlier EIA. The model facilities defined in the cost analysis are presented in Table 7. Note that hospitals are defined in terms of number of beds while nursing homes and commercial research laboratories are defined in terms of number of employees. Note also that commercial incineration facilities are not included in the table. This is because an exception to the model facility approach is made for commercial MWIs. Instead, facility-specific impacts are calculated for each of the 59 facilities operating the 79 commercial MWIs in the MWI inventory. (Costs and impacts for commercial MWIs will be presented in the tables that follow as ranges representing all 59 of the commercial MWI facilities in the inventory.)

1. Model MWI Costs

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

For all MWIs other than commercial MWIs and small, rural, remote MWIs (defined as more than 50 miles away from an SMSA and burning less than 2,000 pounds of medical waste per year), scenario A is an unlikely representation of facility-specific impacts for a couple of reasons. First, the assumption that some currently operated MWIs will not be replaced by alternative technologies is unrealistic. The regulation will impose additional costs on MWIs and, therefore, will make alternative technologies more attractive – from a cost perspective – in comparison. Second, the model facility analysis under scenario A examines the cost of imposing emission control costs on “uncontrolled” MWIs in the baseline. Many currently operated MWIs already have some emission control equipment installed. The costs of meeting any of the regulatory options would not be from a baseline of “no controls” for these facilities. Therefore, scenario A represents only the extreme case of MWIs having no emission controls in the baseline. Scenario A, on the other hand, is the only scenario that applies to commercial MWIs and small, rural, remote MWIs because they are assumed to not be able to switch to an alternative technology.

Table 8
Control Costs for Model MWIs: Existing Sources
Scenario A: No Switching

Model MWI	Regulatory Option					
	One	Two	Three	Four	Five	Six
Small Urban Annualized cost Capital cost	\$ 20,325 \$ 59,234	\$ 71,202 \$ 238,838	\$ 71,202 \$ 238,838	\$ 77,802 \$ 264,338	\$ 77,802 \$ 264,338	\$ 87,802 \$ 312,738
Small Rural, not remote or ≥ 2,000 lbs./week Annualized cost Capital cost	\$ 20,325 \$ 59,234	\$ 71,202 \$ 238,838	\$ 71,202 \$ 238,838	\$ 77,802 \$ 264,338	\$ 77,802 \$ 264,338	\$ 87,802 \$ 312,738
Small Rural, remote and < 2,000 lbs./week Annualized cost Capital cost	\$ 20,325 \$ 59,234	\$ 20,325 \$ 59,234	\$ 71,202 \$ 238,838	\$ 77,802 \$ 264,338	\$ 77,802 \$ 264,338	\$ 87,802 \$ 312,738
Medium ¹ Annualized cost Capital cost	\$ 87,494 \$ 253,086	\$ 87,494 \$ 253,086	\$ 87,494 \$ 253,086	\$ 87,494 \$ 253,086	\$ 98,794 \$ 305,186	\$ 98,794 \$ 305,186
Large on-site Annualized cost Capital cost	\$ 152,494 \$ 399,886	\$ 152,494 \$ 399,886	\$ 152,494 \$ 399,886	\$ 152,494 \$ 399,886	\$ 152,494 \$ 399,886	\$ 152,494 \$ 399,886
Commercial Annualized cost Capital cost	\$ 0-227,536 \$ 0-640,574	\$ 0-227,536 \$ 0-640,574	\$ 0-227,536 \$ 0-640,574	\$ 0-227,536 \$ 0-640,574	\$ 0-227,536 \$ 0-640,574	\$ 0-227,536 \$ 0-640,574

¹Under regulatory option one, assumes conservatively that the units are not downsized to small (to meet the less-stringent good combustion control requirement for small MWIs). Rather, the moderate efficiency wet scrubber requirement for medium MWIs is met.

Table 9
Annual Costs of Switching for Model MWIs¹
Scenarios B and C

Model MWI	Scenario B - Switching With Waste Segregation	Scenario C - Switching Without Waste Segregation
Small		
Urban	\$5,260	\$19,200
Rural ²	\$7,400	\$31,200
Medium		
Urban	\$19,944	\$72,800
Rural	\$28,058	\$118,300
Large		
Urban	\$ 93,584	\$341,600
Rural	\$131,658	\$555,100

¹ Switching costs do not vary by regulatory option.

² Does not apply to facilities that are remote (i.e., more than 50 miles from an SMSA) and burn less than 2,000 pounds of medical waste per week. Such facilities are assumed to generally not have switching opportunities.

Table 10
Annual Costs for Model Facilities Not Operating On-site MWIs: Existing Sources

Industry/Model Facility	Medical Waste Per Facility (tons)	Incremental Annual Cost Per Facility	
		Low ¹	High ²
Hospitals			
<50 Beds	9.75	\$123	\$490
50-99 Beds	17.10	\$216	\$859
100-299 Beds	52.08	\$657	\$2,616
300+ Beds	167.28	\$2,111	\$8,404
Nursing Homes			
0-19 Employees			
Tax-paying	0.14	\$2	\$7
Tax-exempt	0.17	\$2	\$9
20-99 Employees			
Tax-paying	1.14	\$14	\$57
Tax-exempt	1.04	\$13	\$52
100+ Employees			
Tax-exempt	2.70	\$34	\$135
Tax-paying	3.44	\$43	\$173
Commercial Research Laboratories			
Tax-paying			
0-19 Employees	0.28	\$4	\$14
20-99 Employees	2.19	\$28	\$110
100+ Employees	24.50	\$309	\$1,231
Tax-exempt	7.28	\$92	\$366
Outpatient Care Clinics			
Physicians' clinics (amb. care)			
Tax-paying	2.26	\$29	\$113
Tax-exempt	4.19	\$53	\$210
Freestanding kidney dialysis facilities			
Tax-paying	1.62	\$20	\$81
Tax-exempt	2.31	\$29	\$116
Physicians' Offices	0.18	\$2	\$9
Dentists' Offices and Clinics			
Offices	0.08	\$1	\$4
Clinics			
Tax-paying	0.14	\$2	\$7
Tax-exempt	0.19	\$2	\$10
Medical & Dental Laboratories			
Medical	1.63	\$21	\$82
Dental	0.51	\$6	\$26
Freestanding Blood Banks	22.48	\$284	\$1,129
Funeral Homes	0.04	\$1	\$2
Fire & Rescue	0.05	\$1	\$3
Corrections			
Federal Government	1.64	\$21	\$82
State Government	1.70	\$21	\$85
Local Government	0.34	\$4	\$17

1 Based on \$0.006 per pound, the average annualized control cost for all commercial MWIs.

2 Based on \$0.025 per pound, the annualized control cost for a large model commercial MWI that is uncontrolled in the baseline.

Table 11
MWI Operators: Model Facilities
(Year = 1993)

Industry/Model Facility	Employment¹	Annual Revenue/Budget²
Short-term hospitals, excluding psychiatric:		
Federal government		
Small	393	\$18.7
Medium	674	\$43.2
Large	1,738	\$117.0
State government		
Small	133	\$8.7
Medium	617	\$41.3
Large	2,753	\$207.3
Local government		
Small	112	\$5.6
Medium	432	\$27.1
Large	1,987	\$155.0
Not-for-profit		
Small	139	\$8.3
Medium	522	\$36.8
Large	1,725	\$134.6
For-profit		
Small	112	\$7.3
Medium	399	\$34.7
Large	1,156	\$106.7
Psychiatric hospitals, short-term and long-term		
Small	87	\$5.3
Medium	259	\$15.1
Large	719	\$32.6
Nursing homes		
Tax-paying	150	\$4.9
Tax-exempt	150	\$4.8
Commercial research laboratories		
Tax-paying	200	\$21.2
Tax-exempt	200	\$21.2
Commercial incineration facilities	N/A	\$0.5-8.7

1 For hospitals, full-time-equivalent

2 Millions of dollars

N/A - not available

Table 12
Hospitals: Financial/Economic Inputs
(Year = 1993)

	Industry Totals			Average Per Facility		
	Number of Facilities	Number of Beds	Employment ¹	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						
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						
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

¹Full-time equivalent

Table 13
Other MWI Operators: Financial/Economic Inputs
(Year = 1993)

Other MWI Operators	Average Employment 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

N/A - not available

Incremental annual costs for off-site generators are presented in Table 10. The costs reflect two alternative estimates of the increase in the cost of off-site incineration. The low estimate is 0.63 cents per pound, the average annualized control cost for all commercial MWIs. The high estimate derives from an uncontrolled large model commercial MWI estimated to have annualized control costs of \$193,694 and to burn 7,711,000 pounds of medical waste annually. Dividing cost by throughput yields a cost of 2.51 cents per pound. The use of low and high cost estimates allows for the consideration of uncertainty in the actual incremental cost that off-site generators will face.

2. Financial and Economic Inputs

Model information for facilities that operate on-site MWIs (i.e., MWI operators) is presented in Table 11. The information derives from the financial and economic input data in Tables 12 and 13. Interpolation was used to assign employment and revenue to the model hospitals of bed sizes 40 (small), 140 (medium), and 400 (large), and to assign revenue to the model nursing homes with 150 employees and model research labs with 200 employees. For example, in Table 12 it is seen that the average number of beds at a Federal government hospital is 34.8 in the 25-49 beds category and 66.2 in the 50-99 beds category. The model small hospital has 40 beds, however. Interpolating between average revenue of \$16.5 million for a Federal hospital with 34.8 beds and \$29.6 million for a Federal hospital with 66.2 beds, revenue of \$18.7 million for the model small hospital, shown in Table 11, is obtained.

3. Model Facility Impacts

The facility-specific price increase is defined as the price increase necessary for an individual facility to fully recover control costs. It is calculated as the ratio of model facility annualized control costs to annual revenue. This provides an indication of the impact of the regulation on “typical” facilities in each industry. This calculation is then compared to the market price increase (i.e., the average industry-wide price increase). To the extent that an industry is competitive, individual firms are constrained to institute price increases that do not significantly exceed the market price increase. For all but commercial MWIs, the analysis assumes that the facility-specific price increase may not be achievable if it exceeds the market price increase by more than one percentage point. For commercial MWIs, it is assumed that the facility-specific price increase may not be achievable if it exceeds the market price increase by more than two percentage points. More pricing latitude is given to commercial MWI operators for two reasons: 1) commercial incineration is not subject to the same institutional pricing constraints as the health care sector, and 2) commercial incineration fees could actually get a boost from the regulation as a result of switching from on-site incineration and an increase in the demand for commercial incineration services.

The price increases necessary for model facilities to recover annualized control costs under scenario A, no switching, are shown in Table 14A. For all but commercial incineration facilities, these price increases are considered achievable if they do not exceed the market price increase (see Table 5A) by more than one percentage point. Where the difference is more than one percentage point (e.g., small urban local government hospitals under regulatory options two

Table 14A
Price Impacts for Model Facilities Operating On-site MWIs: Existing Sources
Scenario A: No Switching

Model Facility	Annualized Control Costs as a Percent of Revenue/Budget					
	Regu- latory Option 1	Regu- latory Option 2	Regu- latory Option 3	Regu- latory Option 4	Regu- latory Option 5	Regu- latory Option 6
Short-term hospitals, excluding psychiatric:						
Federal government						
Small						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.11	0.38	0.38	0.42	0.42	0.47
Rural, remote and $<2,000$ lbs./week	0.11	0.11	0.38	0.42	0.42	0.47
Medium	0.20	0.20	0.20	0.20	0.23	0.23
Large	0.13	0.13	0.13	0.13	0.13	0.13
State government						
Small						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.23	0.82	0.82	0.89	0.89	1.01
Rural, remote and $<2,000$ lbs./week	0.23	0.23	0.82	0.89	0.89	1.01
Medium	0.21	0.21	0.21	0.21	0.24	0.24
Large	0.07	0.07	0.07	0.07	0.07	0.07
Local government						
Small						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.36	1.27	1.27	1.39	1.39	1.57
Rural, remote and $<2,000$ lbs./week	0.36	0.36	1.27	1.39	1.39	1.57
Medium	0.32	0.32	0.32	0.32	0.36	0.36
Large	0.10	0.10	0.10	0.10	0.10	0.10
Not-for-profit						
Small						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.25	0.86	0.86	0.94	0.94	1.06
Rural, remote and $<2,000$ lbs./week	0.25	0.25	0.86	0.94	0.94	1.06
Medium	0.24	0.24	0.24	0.24	0.27	0.27
Large	0.11	0.11	0.11	0.11	0.11	0.11
For-profit						
Small						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.28	0.97	0.97	1.06	1.06	1.20
Rural, remote and $<2,000$ lbs./week	0.28	0.28	0.97	1.06	1.06	1.20
Medium	0.25	0.25	0.25	0.25	0.28	0.28
Large	0.14	0.14	0.14	0.14	0.14	0.14
Psychiatric hospitals, short-term and long-term						
Small						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.38	1.34	1.34	1.46	1.46	1.65
Rural, remote and $<2,000$ lbs./week	0.38	0.38	1.34	1.46	1.46	1.65
Medium	0.58	0.58	0.58	0.58	0.66	0.66
Large	0.47	0.47	0.47	0.47	0.47	0.47
Nursing homes						
Tax-paying						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.41	1.45	1.45	1.59	1.59	1.79
Rural, remote and $<2,000$ lbs./week	0.41	0.41	1.45	1.59	1.59	1.79
Tax-exempt						
Urban and rural, not remote or $\geq 2,000$ lbs./week	0.42	1.49	1.49	1.62	1.62	1.83
Rural, remote and $<2,000$ lbs./week	0.42	0.42	1.49	1.62	1.62	1.83
Commercial research labs						
Tax-paying	0.41	0.41	0.41	0.47	0.47	0.47
Tax-exempt	0.41	0.41	0.41	0.47	0.47	0.47
Commercial incineration facilities*	0-18.36	0-18.36	0-18.36	0-18.36	0-20.69	0-20.69

* This is the range of impacts for all 59 facilities operating commercial MWIs. Only three facilities have cost to revenue/budget ratios exceeding the industry average of 4.6%.

Table 14B
Price Impacts of Switching for Model Facilities Operating On-site MWIs: Existing Sources - Scenarios B and C

Model Facility	Annual Switching Costs as a Percent of Revenue/Budget	
	Scenario B - Switching With Waste Segregation	Scenario C - Switching Without Waste Segregation
Short-term hospitals, excluding psychiatric:		
Federal government	0.03	0.10
Small - Urban	0.04	0.17
Rural ¹	0.05	0.17
Medium - Urban	0.06	0.27
Rural	0.08	0.29
Large - Urban	0.11	0.47
Rural		
State government		
Small - Urban	0.06	0.22
Rural ¹	0.08	0.36
Medium - Urban	0.05	0.18
Rural	0.07	0.29
Large - Urban	0.05	0.16
Rural	0.06	0.27
Local government		
Small - Urban	0.09	0.34
Rural ¹	0.13	0.56
Medium - Urban	0.07	0.27
Rural	0.10	0.44
Large - Urban	0.06	0.22
Rural	0.08	0.36
Not-for-profit		
Small - Urban	0.06	0.23
Rural ¹	0.09	0.38
Medium - Urban	0.05	0.20
Rural	0.08	0.32
Large - Urban	0.07	0.25
Rural	0.10	0.41
For-profit		
Small - Urban	0.07	0.26
Rural ¹	0.10	0.43
Medium - Urban	0.06	0.21
Rural	0.08	0.34
Large - Urban	0.09	0.32
Rural	0.12	0.52
Psychiatric hospitals, short-term and long-term		
Small - Urban	0.10	0.36
Rural ¹	0.14	0.59
Medium - Urban	0.13	0.48
Rural	0.19	0.78
Large - Urban	0.29	1.05
Rural	0.40	1.70
Nursing homes: Tax-paying - Urban	0.11	0.39
Rural ¹	0.15	0.64
Tax-exempt- Urban	0.11	0.40
Rural ¹	0.15	0.65
Commercial research labs: Tax-paying - Urban	0.09	0.34
Rural	0.13	0.56
Tax-exempt - Urban	0.09	0.34
Rural	0.13	0.56

¹Does not apply to facilities that are remote (i.e., more than 50 miles from an SMSA) and burn less than 2,000 pounds of medical waste per week.

through six), Table 14B shows that the price increase necessary to recover annual switching costs, whether under Scenario B or Scenario C, is achievable, in no case exceeding the market price increase (see Tables 5B and 5C) by more than one percentage point. It can therefore be concluded that where switching to an alternative method of medical waste disposal (e.g., off-site incineration) is an option, the regulation does not have any significant price impacts. (The lower price impacts in Table 14B compared to Table 14A also suggest – as is already incorporated into scenarios B and C – that many facilities may find switching cost-attractive regardless of whether the price impacts of installing controls are significant.)

Not all facilities have switching as an option, however. Recall that switching is assumed to not be possible for up to 114 small rural MWIs that are located more than 50 miles away from an SMSA (“remote”) and that burn less than 2,000 pounds of medical waste per week. Price impacts for these facilities are distinguished in Table 14A. A comparison with Table 5A reveals that the facility-specific price increase never exceeds the market price increase by more than one percentage point under regulatory options one and two. Therefore, none of these MWIs are significantly impacted under regulatory options one and two.

Under regulatory options three through six, on the other hand, the facility-specific price increase exceeds the market price increase by more than one percentage point for these up to 114 small, rural, remote MWIs in the following instances: local government hospitals under regulatory options three through six, not-for-profit hospitals under regulatory option six, for-profit hospitals under regulatory options four through six, psychiatric hospitals under regulatory options three through six, and both tax-paying and tax-exempt nursing homes under regulatory options three through six. In the original EIA, the ratio of annualized control costs to before-tax net income – indicating the percent reduction in before-tax net income if control costs are fully absorbed – was calculated. Repeating this calculation for the above cases of small rural MWIs (using earnings data updated to 1993), impacts ranging from 15.95 percent for for-profit hospitals under regulatory options four and five to 52.33 percent for tax-exempt nursing homes under regulatory option six were found. All of these impacts can be considered significant. In the long run, some of these facilities might have to shut down, or at least terminate their operations that generate medical waste (which might be tantamount to shutting down).

Therefore, under regulatory options three through six, some of the up to 114 small rural MWIs that are located more than 50 miles away from an SMSA and burn less than 2,000 pounds of medical waste per week – and are therefore assumed to not be able to switch to an alternative medical waste disposal method – are significantly impacted. The exact number is not known, but other than knowing that it could be up to 114, it can also be concluded that the number would increase as the control requirements increase in stringency from regulatory option three to regulatory option six.

Switching may also not be an option for commercial MWIs. (While commercial autoclaving can treat medical waste, it may not be a viable switching option for all commercial MWI operators.) Table 14A shows that the facility-specific price impact for commercial MWIs ranges from 0 to

18.36 percent under regulatory options one through four and from 0 to 20.69 percent under regulatory options five and six. These ranges reflect the varying levels of baseline control among the 59 facilities operating the 79 commercial MWIs in the MWI inventory. While some of the 79 commercial MWIs already meet the requirements of the EG and therefore have no control costs, others are “uncontrolled” in the baseline and therefore have relatively high control costs. However, only three commercial MWI facilities – out of the total of 59 – have price impacts exceeding the market price increase (2.62 percent under regulatory options one through four, 2.63 percent under regulatory options five and six) by more than two percentage points (i.e., above 4.6%). All of these facilities are completely uncontrolled in the baseline. One has a price impact of 9.58 percent under all six regulatory options, another has a price impact of 11.13 percent under all six regulatory options, and the third has a price impact of 18.36 percent under regulatory options one through four and 20.69 percent under regulatory options five and six.

These price impacts deviate significantly from the market price increase and therefore may not be achievable. Current excess capacity in the commercial incineration industry further suggests that they may not be achievable. The impacts on these three commercial MWI facilities of absorbing all or a portion of control costs cannot be estimated due to a lack of information on baseline profitability. However, in all three cases, judging from the magnitude of control costs in relation to revenue, the impact of absorbing any significant portion of control costs is liable to be prohibitive. In all three cases, therefore, closure may result if switching to an alternative commercial treatment technology (e.g., autoclaving) is not possible.

There are a couple of mitigating factors. First, one benefit that commercial MWI operators will derive from the regulation will be an increase in demand for their service. Table 14B presents impact information under the assumption that some facilities with on-site MWIs will choose to switch to a lower-cost alternative for medical waste treatment and disposal rather than install emission control equipment to meet the requirements of the regulation. In many cases this lower-cost option will be commercial incineration. As a result, the demand for commercial incineration should increase as a result of the regulation. Lack of relevant financial data prevents quantification of the economic effects of this increase in demand. However, it should be recognized that increased revenues from the increase in demand could make it a little easier for uncontrolled commercial MWI facilities to absorb their control costs.

Second, it is possible that because they are uncontrolled, the three significantly impacted commercial MWI facilities currently enjoy a cost advantage over their competitors. If so, the control costs would not necessarily make these facilities unviable, but rather would eliminate their current excess profits and would “level the playing field.”

Price impacts for model facilities that do not operate an MWI (off-site generators) are shown in Table 15. These facilities represent the vast majority of medical waste generators. All impacts are very small and are not considered significant.

Table 15
Price Impacts for Model Facilities Not Operating On-site MWIs: Existing Sources

Industry/Model Facility	Incremental Annual Cost as a Percent of Revenue/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
Tax-exempt	0	0
100+ Employees		
Tax-exempt	0	0
Tax-paying	0	0
Commercial Research Laboratories		
Tax-paying		
0-19 Employees	0	0
20-99 Employees	0	0
100+ Employees	0	0
Tax-exempt	0	0
Outpatient Care		
Physicians' clinics (amb. care)		
Tax-paying	0	0
Tax-exempt	0	0
Freestanding kidney dialysis facilities		
Tax-paying	0	0
Tax-exempt	0	0.01
Physician' Offices	0	0
Dentists' Offices and Clinics		
Offices	0	0
Clinics		
Tax-paying	0	0
Tax-exempt	0	0
Medical & Dental Laboratories		
Medical	0	0.01
Dental	0	0.01
Freestanding Blood Banks	0	0.02
Funeral Homes	0	0
Fire & Rescue	0	0
Corrections		
Federal government	0	0
State government	0	0
Local government	0	0

1 Based on \$0.006 per pound, the average annualized control cost for all commercial MWIs.

2 Based on \$0.025 per pound, the annualized control cost for a large model commercial MWI that is uncontrolled in the baseline.

This economic impact analysis has examined industries that are directly impacted by the regulation, namely industries that generate or treat medical waste. Secondary impacts such as those on air pollution device vendors and MWI vendors were not evaluated due to data limitations. However, it can be said that air pollution device vendors are expected to experience an increase in demand for their products due to the regulation. The regulation is also expected to increase the demand for commercial MWI services. Due to economies of scale, however, there is likely to be a demand shift from smaller incinerators to larger incinerators. Therefore, vendors of small MWIs may be adversely affected by the regulation. Lack of data on the above effects prevents quantification of economic impacts on these secondary sectors.

V. Small Entity Impacts

In accordance with the Regulatory Flexibility Act of 1980 and its amendment in 1996 by the Small Business Regulatory Enforcement Fairness Act (SBREFA), it is necessary to determine if the EG will have a “significant impact on a substantial number of small entities.”⁴ As demonstrated below, the EG are determined not to have a significant economic impact on a substantial number of small entities under any regulatory option.

Three types of small “entities” are impacted by the regulation: small businesses, small nonprofit organizations, and small governmental jurisdictions. Examples of impacted businesses include for-profit hospitals and tax-paying nursing homes. Examples of impacted nonprofit organizations include not-for-profit hospitals and, in many cases, tax-exempt nursing homes. Examples of impacted governmental jurisdictions include those (e.g., municipalities, counties, states) that operate hospitals and probably some tax-exempt nursing homes.

The EG will impact most facilities that generate medical waste – not only MWI operators, but also facilities that send their medical waste off-site to be incinerated. MWI operators are directly impacted by having to meet the control requirements of the regulation while “off-site generators” face the likelihood of higher fees for commercial incineration. Off-site generators represent the vast majority of facilities impacted by the regulation. While perhaps half of all hospitals operate on-site MWIs, the great majority of nursing homes and research labs do not. Moreover, the following industries were defined to exist exclusively of facilities that do not operate on-site MWIs: medical and dental labs, outpatient care, physicians’ offices, dentists’ offices and clinics, blood banks, funeral homes, fire and rescue operations, and correctional facilities. Table 15 shows that economic impacts on facilities that have to pay more for commercial incineration are insignificant. The increase in fees could be recovered with a price increase of, at the most, only 0.02 percent (freestanding blood banks).

It remains, therefore, to look at MWI operators. Four industries have been defined as including MWI operators: hospitals, nursing homes, research labs, and commercial incineration. The U.S. Small Business Administration (SBA) definition of a small business for hospitals, nursing homes,

and commercial MWI operators is \$5 million or less in annual revenue averaged over the past three years. For research labs, the SBA definition is 500 employees or fewer.⁵ A nonprofit organization is considered “small” if it is “independently owned and operated and not dominant in its field.” A governmental jurisdiction is considered “small” if its population is 50,000 or less.⁶

It has been seen in this revised EIA that – due to the widespread opportunity to switch to an alternative method of medical waste treatment and disposal – the economic impacts of the EG on MWI operators of all sizes are generally not significant. In general, the cost of controls or the cost of switching can be recovered with a price increase that does not significantly exceed the market price increase. This holds for small businesses, small nonprofit organizations, and, by implication, small governmental jurisdictions (if a government facility is not significantly impacted, it can be assumed that the jurisdiction is not significantly impacted).

There are two exceptions. Significant economic impacts were found 1) under all six regulatory options for three commercial MWI facilities, and 2) under regulatory options three through six for some of the up to 114 small, rural, remote MWIs (defined as located more than 50 miles away from an SMSA and burning less than 2,000 pounds of medical waste-per week) that are assumed to not have switching opportunities.

The significant impacts found in the EIA for three commercial MWI facilities were represented by price increases of 9.6 percent, 11.1 percent, and 18.4 percent under regulatory options one through four (against a market price increase of 2.62%), and 9.6 percent, 11.1 percent, and 20.7 percent, respectively, under regulatory options five and six (against a market price increase of 2.63%). Estimating revenue for commercial MWIs by assigning, conservatively, a rate of 24 cents per pound to throughput, only one of the significantly impacted facilities – the facility requiring an 11.1 percent price increase – is found to be affiliated with an entity (e.g., firm, governmental jurisdiction) with medical waste incineration revenues of \$5 million or less. Therefore, at the most, only one of the significantly impacted commercial MWI operators is “small.” This is not considered a “substantial number.” (Note: An examination of the commercial MWIs in the MWI inventory suggests that of the 79, 51 are operated by 10 entities with medical waste incineration revenues of more than \$5 million. The other 28 MWIs are operated by 22 entities that are potentially “small.” However, as explained above, at the most only one of these 22 potentially small entities is “significantly impacted.”)

The EIA also found significant economic impacts in some cases under regulatory options three through six for the up to 114 rural MWIs that are more than 50 miles away from an SMSA and burn less than 2,000 pounds of medical waste per week. However, not all of these 114 MWIs are significantly impacted. Moreover, at least some, and possibly a majority, are neither operated by a small business or nonprofit organization nor under the jurisdiction of a small government.

To wit, the small intermittent MWI for which significant impacts were found was assigned to hospitals with 40 beds and nursing homes with 150 employees. Table 11 showed that hospitals with 40 beds have average revenue ranging from \$5.3 million (psychiatric hospitals) to \$18.7

million (Federal hospitals). This exceeds the threshold for a small hospital, \$5.0 million, suggesting that most hospitals operating a small MWI are not “small.” Average revenue for nursing homes in Table 11 is \$4.8-4.9 million, just below the \$5.0 million small-business cutoff. Many nursing homes operating a small MWI – perhaps close to half – are therefore not “small.” Furthermore, the majority of MWIs are not operated by a public, or government, facility, suggesting that fewer than half of the up to 114 small, rural, remote MWIs are under the jurisdiction of a small government. It is therefore concluded that at the most half, or 57, of the 114 small, rural, remote MWIs are potentially significantly impacted under regulatory options three through six and are either operated by a small business or nonprofit organization or are under the jurisdiction of a small government.

This number, up to 57, is not seen as “substantial,” however. This is because it is small in relation to the total number of small entities impacted by the regulation. The exact number of impacted small businesses and nonprofit organizations is not known. Recall, however, that most facilities generating medical waste – not only MWI operators, but also facilities sending their waste off-site to be incinerated – are impacted by the regulation.

In Table 12, 660 hospitals are in bed-size categories with average revenue per facility of \$5 million or less. More than half of these 660 hospitals are likely to be “small,” with revenue under \$5 million. The number of “small” nursing homes is more overwhelming. Though not shown in Table 13, there are 4,515 tax-paying nursing homes with 100+ employees (average revenue = \$4.8 million), 6,781 tax-paying nursing homes with 20-99 employees (avg. rev. = \$1.8 million), 1,896 tax-exempt nursing homes with 20-99 employees (avg. rev. = \$1.6 million), 2,440 tax-paying nursing homes with 0-19 employees (avg. rev. = \$0.3 million), and 1,926 tax-exempt nursing homes with 0-19 employees (avg. rev. = \$0.3 million). Clearly, the number of significantly impacted small businesses and nonprofit organizations is small in relation to the total number that are impacted, both for hospitals and nursing homes.

The exact number of impacted small governmental jurisdictions is also not known. Consider, however, that most townships and municipalities are “small.” in 1986, the 16,691 townships in the U.S. had an average population of 3,119 and the 19,200 municipalities had an average population of 7,805, both significantly below the population threshold for a small governmental jurisdiction, 50,000. In addition, many counties are small: in 1986, the 3,042 counties in the U.S. had an average population of 71,465.

No doubt many – perhaps several thousand – small townships, municipalities, and counties are impacted by the regulation because one or more medical waste generators who either operate an on-site MWI or send their waste off-site to be incinerated are under their jurisdiction. Such medical waste generators would have to be public, or government, facilities. Table 12 identifies 1,314 local government hospitals in the U.S. (in addition, 19 of the psychiatric hospitals are local-government). Many of these “local government” jurisdictions may be small. More significantly, there were 29,840 public fire departments in the U.S. in 1987. Many, if not most, are operated by small governmental jurisdictions, particularly municipalities, considering that municipalities

accounted for 75 percent of public spending on fire and rescue in 1986. Further, some of the counties and municipalities that operate the 3,304 local jails in the U.S. (1990) are certain to be “small.”

With perhaps several thousand small governmental jurisdictions impacted by the regulation, the number that are significantly impacted – up to 57 – is not seen as substantial.

Finally, it should be noted that in one important sense, the EG have differential impacts that actually favor small entities. MWIs tend to be located at large facilities as opposed to small facilities. (It takes certain economies of scale to be able to justify operating an on-site MWI.) Tables 14A and 14B show that the price increase necessary for MWI operators to recover control costs or switching costs ranges up to 1.83 percent (tax-exempt nursing homes; scenario A, no switching; regulatory option six). In contrast, Table 15 shows that impacts on the generally smaller facilities that send their medical waste off-site to be incinerated are minimal. The estimated increase in the cost of off-site incineration, 0.6-2.5 cents per pound, could be recovered with a price increase of, at the most, only 0.02 percent (freestanding blood banks).

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