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Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) Regulatory Impact Analysis for Promulgated Air Emission Standards for Tanks, Surface Impoundments, and Containers

Office of Air Quality Planning and Standards
Clean Air
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Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) Regulatory Impact Analysis for Promulgated Organic Air Emission Standards for Tanks, Surface Impoundments, and Containers

Emission Standards Division

U.S. ENVIRONMENTAL PROTECTION AGENCY

Office of Air and Radiation

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PREFACE

This document constitutes the Final Regulatory Impact Analysis (RIA) for the Hazardous Waste Treatment, Storage, and Disposal Facilities; Organic Air Emission Standards for Tanks, Surface Impoundments, and Containers under Section 3004 (n) of the Resource Conservation and Recovery Act (RCRA). The document is composed of two parts: (1) an addendum consisting of revised chapters to the 1989 RIA; and (2) an appendix containing the 1989 RIA. The addendum consists of rewritten chapters that discuss revised analyses of control options considered for the final standards. The highlight of this addendum is a completely revamped Benefit-Cost assessment (Chapter VII).

I. SUMMARY OF THE REGULATION

A. ALTERNATIVES EXAMINED

Five control options were selected for consideration of standards. These five control options, labeled as **A**, **B**, **C**, **D**, and **E**, are summarized in Table III-1. In terms of complying with the Resource Conservation and Recovery Act (RCRA), options **A** and **B** were considered as providing the equivalent level of human health and environmental protection in terms of maximum individual risk (MIR) and reduction of annual cancer incidence.

When no control options achieve acceptable levels of protection, EPA's approach historically has considered cost under RCRA only among options that are equivalently protective. Option **B** would be less expensive for the treatment, storage and disposal facility (TSDF) industry to implement than option **A** because fewer units would be required to be equipped with and operate organic emission controls. Because option **B** would be less expensive, EPA selected option **B** as the basis for the final standard.

For further information on the rationale for the selection of the proposed standard, the reader is referred to **Section V** of the Preamble.

B. CONTROL COSTS AND COST-EFFECTIVENESS ANALYSIS

The EPA gave notice at proposal that consideration of new results from revision to the national impacts analysis could lead to selection of any one of the five control options considered at proposal or possibly other control options (56 FR 33516). Since proposal, the EPA has revised the national impacts model to incorporate new information obtained by the EPA. New impact results were obtained using the revised national impacts model. Based on the new impact results, the EPA expanded the control options considered for the final rule. A series of preliminary runs was performed using the revised national impacts model for the original five control options ultimately selected for evaluation at proposal plus an additional nine control options.

New waste data were compiled from two nationwide surveys conducted in 1987, as well as an updated Industry Studies Data Base and other sources. The costs were reviewed and revised. As a result of the review, estimates of baseline emissions and control costs have been revised directionally downward.

Based on cost-effective principles, dominant control options were identified for the selection of the final rule for promulgation. In essence, those options that provide the best health improvement at least cost are dominant. Table I-1 summarizes the capital and annualized cost of five control options for the selection of the standard for the final rule.

TABLE I-1. COMPARISON OF NATIONWIDE COSTS OF APPLYING CONTROLS FOR CONTROL OPTIONS FOR TSDF AIR RULE PHASE II

Control Option[1]	Action Level[2]	Nationwide Capital Costs[3,4] (million $)	Nationwide Annual Costs[3,4] (million $)
Option A	0 ppmw	520	190
Option B	100 ppmw	290	110
Option C	500 ppmw	240	90
Option D	1,500 ppmw	200	80
Option E	3,000 ppmw	140	60

NOTES:

(1) Option C is the proposed regulation.

(2) Units for Action Level are parts per million by weight (ppmw).

(3) December 1986 dollars.

(4) Cost values presented in table are rounded to nearest $10 million increment.

C. ECONOMIC IMPACT ANALYSIS

In the 1989 draft Regulatory Impact Analysis (RIA), it was stated that some 834 facilities represented those that would incur the greatest portion of costs and thus were analyzed for the economic effects. If the findings of the analysis for these 834 facilities could be couched in terms of negligible impacts, then it seemed reasonable to extend the findings to the regulated community of sources as well. That conclusion seems to hold in 1989 and still does now.

Scaling the costs for the revised control options, the most stringent option or control option **A**, would cost $ 190 million and approximate 1 percent of current hazardous waste management costs for all but 3 sectors, and not exceed 2 percent in those sectors. Those 3 sectors are industrial chemicals (organic and inorganic); plastics and fibers; and assorted chemical products. In the commercial hazardous waste management sector, the price of the service supplied to generators of hazardous waste increases by less than one-tenth, or well less than one-half of one percent; this price increase induces a minimal decrease in the quantity of off-site hazardous waste management demanded. Facility closures and employment dislocations are minimal.

D. REGULATORY FLEXIBILITY ACT ANALYSIS

A revised analysis of the costs for control option **B** estimates $ 7 million annually for tanks and containers. The revised estimate is approximately 50 percent of the estimate for the proposed rule (control option **C**), as reported in the August 1989 preliminary screening analysis. On a cost-effectiveness basis, the controls are $ 200 per Mg of emission reduction for 90-day containers and $ 400 to $ 500 per Mg of emission reduction for tanks. In contrast, controls for control option **B** for TSDF cost approximately $ 1000 per Mg. If control cost-effectiveness can serve as a proxy for impacts, then controls for 90-day tanks and containers do not produce a significant burden on small quantity generators.

E. BENEFIT-COST ASSESSMENT

Based on an illustrative benefit-cost assessment which uses allocative efficiency arguments, the findings are as follows:

- Regardless of the mortality risk reduction coefficient used, from an allocative efficiency perspective, organic emission reductions should be at least as great as those associated with option **E**. Even with the lower valuation coefficient and incomplete coverage of benefits, positive partial net benefits are maximized at option **E**.

- Using the higher valuation coefficient for mortality risk reduction, positive partial net benefits are maximized at option **D**. Given a range of some breadth (i.e., mortality risk reduction benefits from $510 to $800 per Mg), reductions at least to option **D** may be warranted on allocative efficiency grounds.

On occasion, the application of benefit-cost analysis focuses almost entirely on the relationship between incremental benefits (quantified or inferred) and incremental costs. What is lost in such applications is the difference the selected option choice may make in the resulting potential net benefits. To determine this difference, a sensitivity analysis of the net benefits has been prepared to identify the conditions under which each of the considered options would be optimal and calculates the resulting net benefits. Instead of arbitrarily assigning a credit to organic emission reduction, the analyses presumes several scenarios in which the point at which incremental benefits equals incremental costs provides a value that may be used only for comparing candidate control options. Two findings emerge:

- First, the difference in net benefits between the optimal option and the others is not great in a relative sense. The potential loss in net benefits from not choosing the optimal option ranges from approximately zero to 10 percent.

- Second, the range of relative differences in net benefits is reduced by half when the considered options are limited to **D**, **C**, and **B**. Under those circumstances, the range of potential loss is from approximately zero to 5 percent of the net benefits for the optimal option.

II. THE NEED FOR AND CONSEQUENCES OF REGULATORY ACTION

A. LEGISLATIVE REQUIREMENTS AFFECTING THE REGULATION OF AIR EMISSIONS FROM TREATMENT, STORAGE, AND DISPOSAL FACILITIES FOR HAZARDOUS WASTES

Section 3004(n) of the 1984 Hazardous and Solid Waste Amendments to the RCRA requires standards for the monitoring and control of air emissions from hazardous waste TSDF as necessary to protect human health and the environment.

B. THE NATURE OF THE AIR EMISSIONS PROBLEM

Hazardous waste facilities emit approximately 12 percent of all organic emissions from stationary nationwide. Organic emissions contribute to tropospheric ozone formation, a significant national problem for which EPA is assiduously pursuing significant controls. Organic emissions from TSDF may also contain a variety of toxins such as carbon tetrachloride, acrylonitrile, and methylene chloride. Accordingly, air emission regulations have been developed for numerous source categories at TSDF, including tanks, containers, certain surface impoundments, and fixation processes. Control of ozone precursors and reduction of the toxicity potential of organic emissions are the goals of these standards.

C. THE NEED FOR REGULATORY ACTION

In the absence of government regulation, market systems have failed to deal effectively with air emissions from TSDF for hazardous waste because these facilities do not internalize damages caused by their emissions. For an individual facility, emissions are unusable byproducts which can be disposed at no cost to the facility by release into the atmosphere. Unfortunately, once in the atmosphere, emissions impose costs upon others in society.

The fact that the owner of the facility does not bear the full costs of his or her action leads to a divergence between private costs and social costs. This divergence indicates a failure of the unregulated market. The result is inefficiency or a disproportionate allocation of society's resources: the polluting activity, i.e., the release of organic emissions at the hazardous waste facility, occurs at too high a level in comparison to the optimal situation in which the polluter bears all of the costs.

A variety of market and extra-market mechanisms are available to correct that situation. Some of the market mechanisms are briefly described in Chapter III of this RIA. This section discusses extra-market mechanisms.

In addition to government regulation, extra-market mechanisms included negotiations or

litigation under tort and common law. In theory, the latter approaches might result in payments to persons to compensate for the damages which they incur.

Such resolutions may not occur, however, and a need for government regulation would continue. Two major obstacles block the correction by the private market of pollution-based inefficiencies and inequities. The first is high transaction costs when millions of persons are affected by thousands of polluters. Transaction costs of compensating those adversely affected by TSDF emissions arise and accumulate to a substantial amount because their current and future injury must be appraised, the injury must be apportioned to each TSDF, and damage suits or negotiations must be conducted. In an unregulated market, each owner of a TSDF and each affected person would have to litigate or negotiate. The transaction costs would be so high as to probably exceed the benefits of reduced air emissions. Therefore, another mechanism is desirable for solving the air pollution problem caused by emissions from TSDF.

The second obstacle discouraging resolution by the private sector is due to the public good nature of pollution reduction. That is, after emissions have been reduced, the benefits of reduction can be enjoyed by additional persons at no additional cost. This results in the classic "free rider" problem. Thus everyone would have an incentive to be the last to contribute resources to litigation or negotiation, thinking that he or she would freely benefit from the efforts of others. Again, a need arises for an alternative approach to reducing air emissions.

III. ALTERNATIVES EXAMINED

A. INTRODUCTION

This section briefly presents potential alternatives of regulating air emissions from TSDF. The outline for the section is adopted from Executive Order 12291 which requires that at a minimum the following alternatives be examined:

- no regulation;
- regulation beyond the scope of present legislation;
- market-oriented alternatives; and
- alternative control options.

Although Executive Order 12291 requires that all alternatives be examined, only the most promising ones need to be analyzed in detail.

B. NO REGULATION

Section 3004(n) of RCRA was added to the Act under the Hazardous and Solid Waste Amendments of 1984 to require the Administrator of EPA to promulgate regulations for monitoring and control of air emissions from TSDF of hazardous wastes management activities as may be necessary to protect human health and environment.

C. REGULATIONS BEYOND THE SCOPE OF PRESENT LEGISLATION

Other regulatory approaches include: (1) regulation under the Clean Air Act, particularly Sections 110 for criteria air pollutants, 111 for new source performance standards, and 112 for national emission standards for hazardous air pollutants; and (2) and some individual state hazardous wastes management programs. From an administrative point of view, the regulatory and implementation processes of RCRA for permitting TSDF were already in place and made regulating air emissions more expeditious for this source category.

Potentially, air emissions from TSDF are precursors to tropospheric ozone, and, to some degree, particulate matter which are regulated under Sections 109 and 110 of the Clean Air Act. Under these regulations, states have the responsibility to attain National Ambient Air Quality Standards for ozone. However, the implementation program process (i. e., SIP process) for attaining ozone air quality standards and state hazardous waste management programs may not be sufficient to provide full health protection from potential risks posed by certain individual chemical constituents, as air contaminants, of known toxicity to humans.

D. MARKET-ORIENTED APPROACHES

There are several market-oriented approaches which can be considered as alternatives to regulate air emissions from TSDF. These include pollution charges, marketable permits, and subsidies and are briefly described below.

Charges

This policy would involve a charge, or tax, being set on each unit of pollutants emitted. Firms would then choose the amount of abatement, in the form of hazardous waste reduction or actual air emissions, including the pollution charge. Emissions are reduced until the marginal cost of abatement is equal to the charge on emissions. The regulatory agency would have to set the level of charge in a manner that would result in the desired level of emissions, or conceivably health protection. Given the fact that the health and environmental impacts are multifaceted (i.e., toxicity and ozone health related), it would be very difficult to assess the appropriate charges. Presently, hazardous wastes generators in the chemical manufacturing and petroleum refining industries are assessed charges based on the amount of wastes generated, under SARA Title III, to pay for the clean-up of present and future Superfund sites. These charges should provide incentive to reduce the amount of wastes generated. However, it is difficult to predict the relationship between air emissions and the amount of wastes generated because the distribution and processing of hazardous wastes from the point of origin to its final disposition alters the character of the wastes.

Permits

A permit system would allow a TSDF to purchase a permit in order to emit a specified amount of a pollutant over a specified period of time at a specified location. This is very similar to the actual permit process administered under RCRA, Section 3005. A fixed number of permits could be issued and auctioned off to the highest bidders. Alternatively, the permits can be distributed among the sources, who could trade these permits or acquire firms that have successfully obtained permits to operate an incinerator or another type of treatment facility under RCRA. Under the present system (RCRA), trading is limited to acquiring <u>regulated</u> facilities with operating permits. To use a marketable permit in its purest form (i.e., without any environmental regulation) as the sole incentive to reduce air emissions would be effective only if the emissions were homogeneous in character. Such is not the situation with TSDF emissions.

Subsidies

A subsidy system pays sources for each unit of pollution that they do not emit. This can take the form of direct payments or tax credits. Subsidies and charges are similar in that both increase the opportunity cost of pollution, the former by causing each source of emissions to entail forgoing the subsidy which could be received if it were not emitting pollutants. Thus, the subsidy is similar to a charge, except in two respects:

- Administratively, there is the problem of determining the actual emissions of each source, as was discussed above. There must be a determination of what level and character of emissions were in the absence of the subsidy. For example, many wastes streams rich in organic content are processed for recovery of valuable chemicals (e.g., chlorinated solvents). The same chemicals in aqueous wastes streams (high in water content) would not be economical for such recycling. These determinations are difficult and may depend upon individual waste sampling, provided by the waste generators, who may have the incentive to misrepresent the nature of their wastes to the administrative agent for carrying out the subsidy system.

- The long-run effects of subsidies may be quite different than for permits or charges, since the former increase profit levels for waste generating industries and the latter decrease them. In the hazardous wastes management industry, the subsidies accruing to recyclers of wastes help in minimizing wastes disposal and air emissions associated with that practice. Subsidies, other than those presently offered by the marketplace would probably encourage more waste generation and hence, increase air emissions.

E. REGULATORY ALTERNATIVES WITHIN THE SCOPE OF PRESENT LEGISLATION (RCRA)

As indicated earlier, Section 3004(n) of RCRA requires regulations for the monitoring and control of air emissions from TSDF to protect human health and the environment. The regulatory analysis that was conducted took into account reduction of risk of mortality as measured by a facility-specific composite risk factor modeled for several potencies of individual chemical constituents, and explicitly recognized other effects associated with organic emissions and transformation products (tropospheric ozone and particulate matter).

Many emission control strategies are available to reduce organic emissions from TSDF. In fact, due to the variations in waste streams, emission sources, and control options, potential control strategies number in the thousands. With further analysis, it is possible to identify inferior control strategies. Many potential control strategies are inferior because at least one other strategy would achieve the same organic emission reduction (or reduction in cancer incidence) but at a lower cost or, for the same cost, provide a higher reduction. Chapter IV of the 1989 Draft RIA discusses the Least-Cost Model used to identify the dominant control strategies to reduce organic emissions from TSDF.

Five control options were selected for consideration of standards. These five control options, labeled as **A**, **B**, **C**, **D**, and **E**, are summarized in Table III-1. For all control options, tanks, containers, and surface impoundments must have suppression controls (e.g., covers). In addition, controls vented to control devices (e.g., carbon adsorbers) must be installed if certain combination of action level, waste vapor pressure, and handling capacity criteria are met. Control options **B**, **C**, **D**, and **E** are all the same except for the volatile organic concentration

action level. For control option **A**, the action level is 0; that is, controls are required on all organic waste streams managed in tanks with capacity greater than 20,000 gallons and organic vapor pressure greater than 0.75 pounds per square inch absolute (psia), or 40,000 gallon, if organic waste vapor pressure is greater than 4.0 psia. For control options **B**, **C**, **D**, and **E**, the concentration action levels are 100 parts per million by weight (ppmw), 500 ppmw, 1500 ppmw, and 3000 ppmw.

F. RATIONALE FOR THE PROPOSED REGULATION

In terms of complying with the RCRA, options **A** and **B** were considered as providing the equivalent level of human health and environmental protection in terms of MIR and reduction of annual cancer incidence. Options **C**, **D**, and **E** are estimated to provide less protection in terms of MIR and annual cancer incidence. Options **A**, **B**, **C**, and **D**, provide approximately the same level of nationwide emission reduction, while option **E** provides somewhat less than the others, but within the same general range. The estimated MIR is an order-of-magnitude higher for options **C**, **D**, and **E** (2×10^{-2} for option **C**, 3×10^{-2} for options **D** and **E**) compared to options **A** and **B** (4×10^{-3}). However, none of the options is estimated to reduce MIR to the target risk levels for other promulgated RCRA standards, which have been in the range of 1×10^{-4} to 1×10^{-6}. Therefore, EPA concluded that options **A** and **B** are equally protective of human health and the environment, and are more protective than options **C**, **D**, or **E**. The impacts for the control options and baseline and summarized in Table III-2.

When no control options achieve acceptable levels of protection, EPA's approach historically has considered cost under RCRA only among options that are equivalently protective. Option **B** would be less expensive for the TSDF industry to implement than option **A** because fewer units would be required to be equipped with and operate organic emission controls.

New waste data were compiled from two nationwide surveys conducted in 1987, as well as an updated Industry Studies Data Base and other sources. The costs were reviewed and revised. As a result of the review, estimates of baseline emissions and control costs have been revised directionally downward. and operate organic emission controls. Because option **B** would be less expensive, EPA selected option **B** as the basis for the final standard.

For further information on the rationale for the selection of the proposed standard, the reader is referred to **Section V** of the Preamble.

TABLE III-1. SUMMARY OF CONTROL OPTIONS FOR TSDF RCRA AIR RULES PHASE II

Control Option	Action Level[1]	Quiescent[2] Tank <20,000 gal	Quiescent[2] Tank ≥20,000 gal	Non-quiescent Tank	Quiescent[2] Surface Impoundment	Non-quiescent Surface Impoundment	Container
Option **A**	0 ppmw	S	S or S/C[3]	S/C	S/C	S/C	S
Option **B**	100 ppmw	S	S or S/C[3]	S/C	S	S/C	S
Option **C**	500 ppmw	S	S or S/C[3]	S/C	S	S/C	S
Option **D**	1,500 ppmw	S	S or S/C[3]	S/C	S	S/C	S
Option **E**	3,000 ppmw	S	S or S/C[3]	S/C	S	S/C	S

CODE:

S = Suppression controls (e.g., covers)

S/C = Suppression controls vented to control device

NOTES:

(1) Action level is the volatile organic concentration of the waste managed in the unit as determined at the point of waste generation.

(2) "Quiescent " unit is a waste management unit in which the waste is neither intentionally aerated, agitated, nor treated by a process that generates or uses heat.

(3) Type of controls required depends on organic vapor pressure of waste managed in tank. If tank capacity < 40,000 gal. and waste organic vapor pressure < 4.0 psia; then suppression controls only required. If tank capacity ≥ 40,000 gal. and waste organic vapor pressure < 0.75 psia; then suppression controls only required.

TABLE III-2. NATIONWIDE IMPACTS OF ACTION LEVEL OPTIONS

Action Level Option	Maximum Individual Risk	Cancer Incidence per year	Organic Emissions (1000 Mg/yr)	Capital Investment Cost (million $)	Annual Cost (million $)
A	4×10^{-3}	2	30	520	190
B*	4×10^{-3}	2	41	290	110
C**	2×10^{-2}	5	48	240	90
D	3×10^{-2}	5	51	200	80
E	3×10^{-2}	9	80	140	60
Baseline	3×10^{-2}	48	1,011	N/A	N/A

NOTES:

N/A = Not applicable.

* Option **B** is the recommended basis for the final standards.

** Option **C** was the basis for the proposed standards.

IV. CONTROL COST AND COST-EFFECTIVENESS ANALYSES

BACKGROUND

Chapter IV of the draft RIA presents a lengthy discussion on the Least Cost Model (LCM) and the process of selection of the five control options for the proposed rule. The following discussion summarizes the results and conclusions of the cost-effectiveness analysis.

> "Some 2,718 distinct control strategies examined in the draft RIA. This number represents some 144 combinations of control options for 6 different waste management processes for each of 19 different concentration levels. The processes examined were:
>
> - container storage,
> - quiescent tanks,
> - quiescent impoundments,
> - aerated tanks and impoundments,
> - fixation processes, and
> - drum and truck loading.
>
> In this modeling exercise, the no-controls category is repeated 19 times. Replacing it with a single strategy (baseline level of controls but no additional control) gives a total of 2,718 potential control strategies. (Mathematically, 144 combinations time 19 yields 2736 possible control options.)
>
> The dominant strategies were identified as those strategies that were least cost both for emission reductions and incidence reduction. The calculations of cost use a 10% real discount rate; sensitivity analyses indicated that the dominance did not change in response to variations in the discount rate.
>
> Of 2,718 control strategies, approximately 100 are dominant under both the emissions and incidence criteria. Thus the Least-Cost Model successfully reduces the number of strategies that should be examined in more detail. However, many of these dominant strategies produced similar cost-effective characteristics that they appeared clustered together in groups. Thus the 100 dominant options were reduced to a select group of four dominant options plus the baseline for a regulatory analysis of five options."

The Least Cost Analysis Model was not used in the analysis of options for final standard selection. Rather, the national impacts model[1] was used to develop the national costs and impacts for the process of selecting the five control options for the final rule. Both the LCM and the national impacts model were used as complementary analytical tools to develop the five control options at proposal.

DISCUSSION

The EPA gave notice at proposal that consideration of new results from revision to the national impacts analysis could lead to selection of any one of the five control options considered at proposal or possibly other control options (56 FR 33516). Since proposal EPA has revised the national impacts model to incorporate new information obtained by EPA. New impact results were obtained using the revised national impacts model. Based on the new impact results, EPA decided to expand the control options considered for the final rule. A series of preliminary runs was performed using the revised national impacts model for the original five control options ultimately selected for evaluation at proposal plus an additional nine control options. The following discussion briefly describes the analytical process of winnowing down the field of fourteen control options to four dominant control options plus the control option presented for the proposed rule.

New waste data were compiled from two nationwide surveys conducted in 1987, as well as an updated Industry Studies Data Base and other sources. The costs were reviewed and revised. As a result of the review, estimates of baseline emissions and control costs have been revised directionally downward. More detailed information can be found in the Docket[2]. Control options 2 (with action levels of 500 ppmw, 1500 ppmw, and 3000 ppmw) and 3 (with an action level of 500 ppmw) in the proposal were modified and expanded to fine tune concentration action levels. Table IV-1 presents the emission reduction and incidence reductions for the expanded group of potential options. For comparison purposes, the Table presents the emissions and incidence levels of the pre-control baseline and revised estimates of emissions and incidence levels for the action levels that were retained from the Proposed Rule.

Table IV-2 presents the capital and annualized costs for the same group of potential options as those listed in Table IV-1. Like Table IV-1, Table IV-2 provides an useful comparison of cost and impact measures since proposal. The primary reasons for the lower costs in the RIA Addendum are the following:

- a significant number of surface impoundments have been converted to tanks, which result in less surface area for generating emissions, as well as reduction in scale for sizing control equipment (less costs);

- the quantity of wastes fixated has been reduced significantly, for which controls were very expensive; and

- pollution prevention practices toward generation of hazardous waste have resulted in reduction of total wastes quantities stored and treated, thus resulting in lower air emissions.

The capital costs are in 1986 dollars; and, the annualized costs have an imputed discount rate of 10 percent in real rate terms in the annualized costs. These are the same assumptions used for the benefits assessment in Chapter VII. The reader is encouraged to refer to the Background Information Document[3] for more detailed discussion on the procedures of estimation of capital and annualized costs.

Based on cost-effective principles, dominant control options were identified for the selection of the final rule for promulgation. Basically, those options that provide the best health improvement at least cost are dominant. All fourteen control options were examined by comparing total annualized costs using annual emission reductions and annual incidence reductions independently as surrogates for health improvements. Figure IV-1 illustrates graphically the process of identification of the least cost envelope of the dominant control options. Note that only 4 control options identified with the action level in Figure IV-1 (solid triangle) are dominant control options. These are identified as the control options with action levels of 3000 ppmw, 1500 ppmw, 100 ppmw, and 0 ppmw. Control option **C** with the action level of 500 ppmw is not a dominant control option, but is retained as it represents the proposed option. Previous analyses had indicated that control option **C** was a dominant control option.

Table IV-3 summarizes the capital and annualized cost of five control options for the selection of the standard for the final rule. The information in Table IV-3 represents the descriptive information for the benefit-cost assessment presented in Chapter VII.

FIGURE IV-1. CANCER INCIDENCE REDUCTIONS VS COST

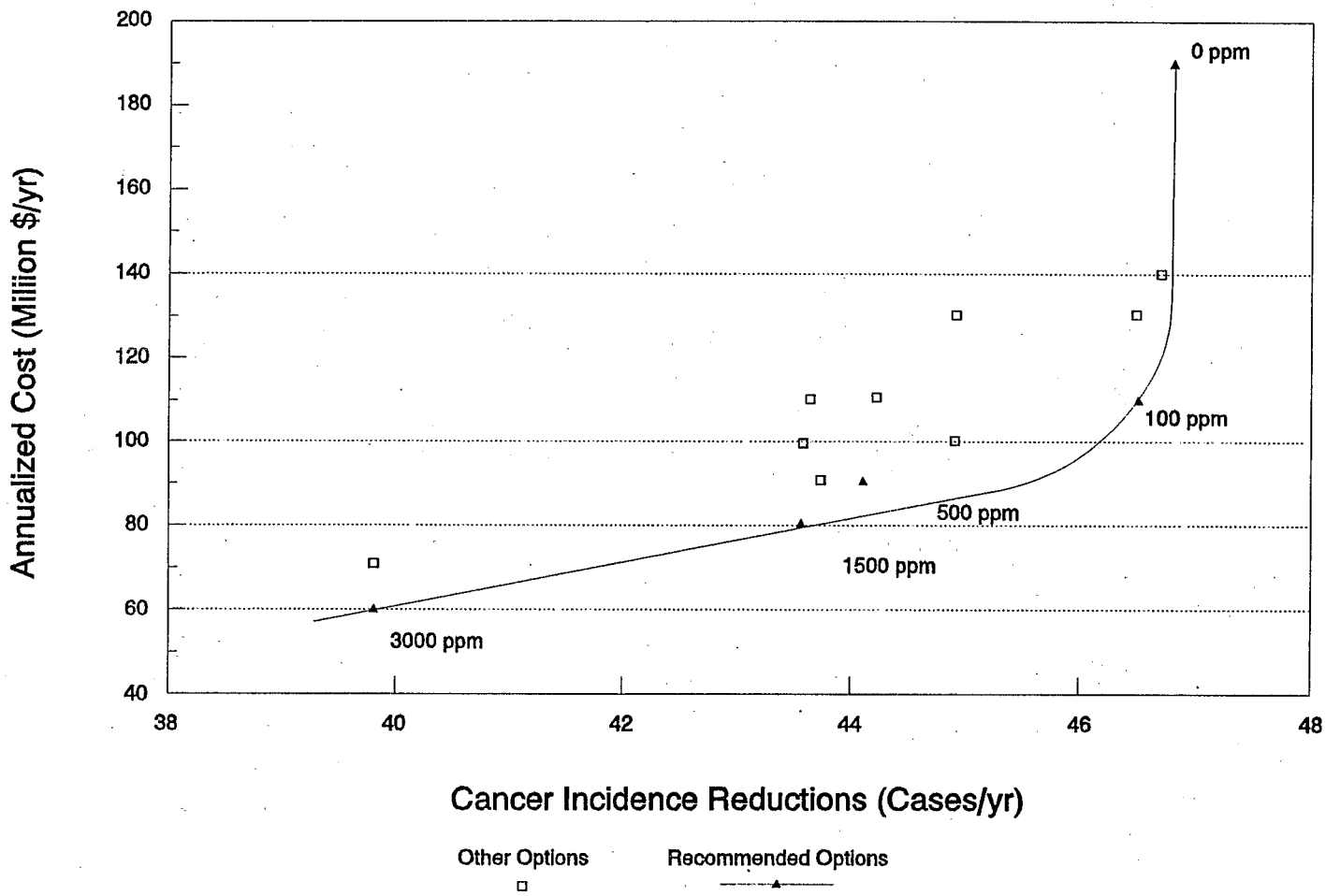

TABLE IV-1. POTENTIAL CONTROL OPTIONS FOR TSDF AIR RULE PHASE II

CONTROL OPTION	*ACTION LEVEL (ppmw)*	*ORGANIC EMISSIONS (1000 Mg/yr) PROPOSED*	*ORGANIC EMISSIONS (1000 Mg/yr) REVISED*	*CANCER INCIDENCE (Cases/yr) PROPOSED*	*CANCER INCIDENCE (Cases/yr) REVISED*
Baseline		1800	1011	140	48.0
3	3000		90		8.2
2	3000	180	79	16	8.2
3	1500		51		4.4
2	1500	140	41	14	4.4
3	1000		49		4.3
2	1000		38		4.3
3	500	130	48	8	3.9
2	500	96	37	6	3.8
3	200		42		3.2
2	200		31		3.1
3	100		41		1.5
3	0		41		1.5
2	100		30		1.3
2	0	93	30	6	1.2

TABLE IV-2. COSTS FOR POTENTIAL CONTROL OPTIONS FOR TSDF AIR RULE PHASE II

CONTROL OPTION	*ACTION LEVEL (ppmw)*	*CAPITAL COST (Million $) PROPOSED*	*CAPITAL COST (Million $) REVISED*	*ANNUALIZED COSTS (Million $/Yr) PROPOSED*	*ANNUALIZED COSTS (Million $/Yr) REVISED*
3	3000		140		60
2	3000	520	170	210	70
3	1500		200		80
3	1000		230		90
3	500	960	240	360	90
2	1500	690	240	290	100
3	100		270		110
2	1000		290		110
2	500	1700	290	710	110
3	0		380		130
2	200		350		130
2	100		370		140
2	0	2100	520	930	190

TABLE IV-3. COMPARISON OF NATIONWIDE COSTS OF APPLYING CONTROLS FOR CONTROL OPTIONS FOR TSDF AIR RULE PHASE II

Control Option[1]	Action Level	Nationwide Capital Costs[2,3] (million $)	Nationwide Annual Costs[2,3] (million $)
Option A	0 ppmw	520	190
Option B	100 ppmw	290	110
Option C	500 ppmw	240	90
Option D	1,500 ppmw	200	80
Option E	3,000 ppmw	140	60

NOTES:

(1) Option C is the proposed regulation.

(2) December 1986 dollars.

(3) Cost values presented in table are rounded to nearest $10 million increment.

REFERENCES

1. National Impacts Model.
2. Responses to Comments on Chapter 4, *Impact Analysis Methodology*, of the Background Information Document.
3. Cost Chapter, *Background Information Document*,

CHAPTER V. REVISED ECONOMIC IMPACT ANALYSIS

The revised economic impact analysis is an extension of the analysis performed for the August 1989 Draft RIA. Chapter VI of the RIA presents a lengthy discussion on the industry profile, as well as methodology used to estimate price and quantity adjustments, employment effects, and facility closures for the TSDF air regulation. The reader is advised to refer to this document for an understanding of the economic analysis. The following conclusions of the earlier analysis were as follows:

> "The analysis of the most stringent option, option 1, which has a 0 ppmw action level and the highest compliance cost, provides a benchmark for judging the severity of the economic effects of regulating air emissions from TSDF. In the absence of market adjustments, the model projects compliance costs (annualized capital and operating costs) of $892 million per year for the 834 affected facilities. Those costs are less than 6% of current hazardous waste management costs for all but three sectors and do not exceed 12% in any sector. Price and quantity adjustments for the goods and services produced by hazardous waste generators are negligible because hazardous waste management costs are a very small portion of production costs; when allowing for those market changes, compliance costs are $888 million. In the commercial hazardous waste management sector, the price of the service supplied to generators of hazardous waste increases by less than one-half of one percent; this price increase induces a minimal decrease in the quantity of off-site hazardous waste management demanded. Facility closures and employment dislocations are minimal."

Some comments should be noted concerning the coverage of facilities (834) mentioned above and the known population of 2300 TSDF, which represents processing (treatment) facilities and storage facilities, including many storage-only facilities. Once again, Chapter VI from the August 1989 RIA is quoted as follows:

> "For the economic analysis, the 834 directly affected facilities in the 20 generator sectors and 1 commercial hazardous waste management sector were analyzed. The 1,098 storage-only facilities were excluded from detailed economic analysis because they represent less than 4 percent of the total compliance cost of all TSDF and less than 3 percent of the quantity of hazardous waste managed by all the TSDF."

The 834 facilities represented those that would incur the greatest portion of costs and thus were analyzed for the economic effects. If the findings of the analysis for these 834 facilities could be couched in terms of negligible impacts, then it seemed reasonable to extend the findings to the regulated community of sources as well. That conclusion seems to hold in 1989 and still does now.

Scaling the costs for the revised control options, the most stringent option or control option **A**, same as control option 1 cited above, would cost $ 190 million and approximate 1 percent of current hazardous wastes management costs for all but 3 sectors and do not exceed 2 percent in those sectors. Those 3 sectors are industrial chemicals (organic and inorganic);

plastics and fibers; and assorted chemical products. In the commercial hazardous waste management sector, the price of the service supplied to generators of hazardous waste increases by less than one-tenth, or well less than one-half of one percent; this price increase induces a minimal decrease in the quantity of off-site hazardous waste management demanded. Facility closures and employment dislocations are minimal.

CHAPTER VI. REVISED REGULATORY FLEXIBILITY ANALYSIS

The revised Regulatory Flexibility Analysis (RFA) addresses two issues raised during the public comment period for the proposed rule. First, the revised RFA reflects changes in the costs and impacts, as a result of updating the hazardous waste data base. Second, the revised RFA addresses concerns raised in the public comment concerning disproportionate impacts incurred by small entities in the population of accumulators and small quantity generators.

As background, the Regulatory Flexibility Act requires Federal agencies to analyze the effects of their regulations on small entities and to involve these entities more actively in developing and reviewing regulations.[1] "Small entities" here includes small businesses, small governmental jurisdictions, and small organizations. The purpose of the Regulatory Flexibility Act is to minimize any significantly adverse effects of environmental regulations on small entities. The methodology for the revised RFA is based on Agency guidelines preceding the April 1992 Agency guidelines for conducting regulatory flexibility analyses. The revised RFA extends the methodology presented in Chapter VI of the 1989 Draft RIA and Chapter VIII in the Background Information Document.[2]

A "significant economic impact" is said to occur whenever any of the following criteria are satisfied:

- Annual compliance costs (including annualized capital, operating, and reporting costs) increase as a percent of total costs of production for small entities for the relevant process or product by more than 5 percent.

- Compliance costs as a percent of sales for small entities are at least 10 percent higher than compliance costs as a percent of sales for large entities.

- Capital costs of compliance represent a significant portion of capital available to small entities, considering internal cash flow plus external financing capabilities.

- The requirements of the regulation are likely to result in closures of small entities.

Chapter VI of the August 1989 draft RIA summarized the results of the RFA for TSDF as follows:

> "The compliance cost increases as a percent of total costs of production for small businesses are less than 3.6 percent for all small businesses. The compliance costs as a percent of sales for small businesses are less than 2 percent. The estimated ratio of compliance costs to total sales for the 16 small businesses is 0.28 percent. For the

larger businesses, the estimated ratio of total compliance costs to total sales is 0.26 percent. The compliance costs as a percent of sales for small businesses are less than 10 percent higher than the compliance costs as a percent of sales for large businesses.

The capital costs as a percent of sales for small businesses are less than 2 percent. Because the compliance capital costs represent a small portion of the total amount of sales, it is reasonable to conclude that the capital costs of compliance represent an insignificant portion of the capital available to small businesses."

The RIA did not address the impacts on small quantity generators and accumulators, who may be impacted by the promulgated rule for 90-day tanks and accumulators. Note the quote from Chapter VI, "...the regulation of TSDF affects the hazardous waste generators who supply on-site waste management services (captive facilities), and the suppliers of commercial hazardous waste management services (commercial facilities)."

A preliminary regulatory flexibility screening analysis of cost impacts was prepared in late August 1989 for the proposed rule for the 90-day tanks and containers.[3] This analysis relied on a 1987 survey of hazardous waste generators conducted by the Research Triangle Institute.[4] The results are summarized as follows. Additional control costs, for control option **C**, of $14 million annually for tanks, containers, and equipment leaks for the 90-day accumulators would result in price increase of 7.2 percent for waste management services for 20 2-digit SIC sectors. The key finding was that adverse effects on any facility were unlikely. It should be noted that the report cited that waste management services constituted a minor percent of the total cost of production of materials in generating facilities for all the sectors studied. Consequently, the increase in waste management service cost as a percent of total cost for the 2 digit SIC industries is small.

A revised analysis of the costs for control option reveals an estimate of $ 7 million annually for tanks and containers for control option **B**. The revised estimate is approximately 50 percent of the estimate for the proposed rule (control option **C**), as reported in the August 1989 preliminary screening analysis. On a cost-effectiveness basis, the controls are $ 200 per Mg of emission reduction for 90-day containers and $ 400 to $ 500 per Mg of emission reduction for tanks. In contrast, controls for control option **B** for TSDF cost approximately $ 1000 per Mg. If control cost-effectiveness can serve as a proxy for impacts, then controls for 90-day tanks and containers do not produce a significant burden on small quantity generators.

REFERENCES

1. This chapter is based on § 8.3.6, "Small Business Effects," in *Hazardous Waste TSDF--Background Information for Proposed RCRA Air Emission Standards*.

2. See Reference 1.

3. *Preliminary estimates of the Economic Impacts of Emission Controls on 90-Day Tanks and Containers: Hazardous Waste Generating Industries,* By Research Triangle Institute. Prepared for the U. S. Environmental Protection Agency, August 31, 1989.

4. Research Triangle Institute. National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities. Prepared for U.S. Environmental Protection Agency, Office of Solid Waste. Research Triangle Park, NC, 1987.

CHAPTER VII. REVISED BENEFIT-COST ASSESSMENT

The revised benefit-cost analysis reflects changes in the costs and emission reductions since proposal of the Section 3004 (n) rule and extends the illustrative analysis in the August 1989 Draft RIA.

The concept of allocative efficiency is illustrated in Figure VII-1. There, the level of organic emission reductions which maximizes positive net benefits is identified. Consequently, a simplified concept of allocative efficiency would say that society is best off with the Q* level of organic emission reductions from TSDF. That level occurs where the incremental costs and benefits between options are equivalent to one another and where incremental costs are increasing. However, it is not possible to fully implement such an analysis for TSDF because data exist to monetize but one category of potential benefits. Later in this Chapter, an attempt is made to illustrate this concept with a sensitivity analysis.

Table VII-1, which is a revision of Table VII-1 of the August 1989 Draft RIA, presents the cost, emission reductions, cancer incidence reductions, and total mortality risk reduction benefits for the 5 control options under consideration for the promulgated rule. The willingness-to-pay for small reductions in mortality risk has been estimated to range from $ 1.60 to $ 8.50 annually for a 1.0×10^{-6} reduction in mortality risk. These are values based on a paper by Fisher et al, "The Value of Reducing Risks of Death: A Note on New Evidence".[1] The costs for the control options are based upon both engineering controls, without market adjustments, and upon Chapter 7 of *Hazardous Waste TSDF--Background Information for Proposed RCRA Air Emission Standards*.[2] The costs, emission reductions, and mortality risk reductions are all the same as incorporated in the preamble for the final rulemaking.[3]

The partial net benefits presented in this Table, as well as the costs and benefits, are measured from baseline emissions and cancer incidence. Because the coverage of benefits is incomplete from an ozone perspective, this table cannot be used to identify the optimal control level in an allocative efficiency sense. To reflect some of the uncertainty in the analysis, the Table reflects a range of values for the mortality risk reduction benefits.

Table VII-2 presents the incremental assessment of benefits and costs underlying Table VII-1. The estimates presented for incremental costs and incremental benefits for each control option are on a $ per Mg basis for that option relative to the contiguous option with the lower health protection. Examination of the both Tables yields the following findings.

- Regardless of the mortality risk reduction coefficient used, from an allocative efficiency perspective, benefits associated with organic emission reductions should be at least as great as those associated with option E. Even with the lower valuation coefficient and incomplete coverage of benefits, positive partial net benefits are maximized at option E.

- Using the higher valuation coefficient for mortality risk reduction, positive partial net benefits are maximized at option **D**. Given a range of some breadth (i.e., mortality risk reduction benefits from $510 to $800 per Mg), reductions at least to option **D** may be warranted on allocative efficiency grounds.

As a general principle, the application of benefit-cost analysis focuses almost entirely on the relationship between incremental benefits (quantified or inferred) and incremental costs. In the example above, the value of organic emission reductions was assigned an arbitrary value of zero. Instead of arbitrarily assigning a credit to organic emission reduction, the analyses presumes several scenarios in which the point at which incremental benefits equals incremental costs provides a value that may be used only for comparing candidate control options. A sensitivity analysis of the net benefits between options has been prepared to identify the conditions under which each of the considered options would be optimal.

For example, for option **A** to be optimal, the incremental benefits would have to be $7300/Mg of organic emission reduction. Assuming incremental benefits are constant, total benefits are calculated and subtracted from total costs to yield net benefits for each option. The difference that option choice makes in the resulting net benefits can then be observed. The results are presented in Table VII-3. Two findings emerge:

- First, the difference in net benefits between the optimal option and the others is not great in a relative sense. The potential loss in net benefits from not choosing the optimal option ranges from approximately zero to 10 percent.

- Second, the range of relative differences in net benefits is reduced by half when the considered options are limited to **D**, **C**, and **B**. Under those circumstances, the range of potential loss is from approximately zero to 5 percent of the net benefits for the optimal option.

TABLE VII-1. SUMMARY OF ESTIMATED MORTALITY RISK REDUCTION BENEFITS, COSTS AND PARTIAL[1] NET BENEFITS FOR CONTROL OPTIONS

Control Option	*Reduced Organic Emissions (1000 Mg/yr)*	*Reduced Cancer Incidence (Cases/yr)*	*Benefits [2] ($ Mill/yr)*		*Costs ($ Mill/yr)*	*Net Benefits [2] ($ Mill/yr)*	
			low	*high*		*low*	*high*
Option **A**	981	46.8	75	398	190	-115	208
Option **B**	970	46.5	74	395	110	-36	285
Option **C**	963	44.1	71	375	90	-19	285
Option **D**	960	43.6	70	371	80	-10	291
Option **E**	921	39.8	64	338	60	4	278

NOTES:

(Assume $ 0 per Mg for Organic Emission Reduction Credit)

1 Net benefits are partial because other human health benefits such as morbidity risk reduction and reductions in risk to materials, crops, etc. are omitted.

2 Range of benefits based on Risk Reduction @ $ 1.60 per 10^{-6} reduction in mortality risk for "low" and @ $ 8.50 per 10^{-6} reduction in mortality risk for "high".

TABLE VII-2. ICREMENTAL COSTS AND MORTALITY RISK REDUCTION BENEFITS

Control Option	*Incremental Cost ($/Mg)*	*Mortality Risk Reduction Benefits*		
		Lower Bound ($/Mg) [1]	*Mean Estimate ($/Mg)* [2]	*Higher Bound ($/Mg)* [3]
Option **A**	7300 (**B** to **A**)	40	120	230
Option **B**	2900 (**C** to **B**)	550	1509	2900
Option **B** [4]	3000 (**D** to **B**)	500	1300	2500
Option **C**	3300 (**D** to **C**)	300	700	1400
Option **D**	510 (**E** to **D**)	160	420	800
Option **E**	65 (Baseline to **E**)	65	190	370

NOTES:

1 Lower bound represents a willingness to pay of $1.60 for a 1.0×10^{-6} reduction in mortality risk.

2 Mean estimate represents a willingness to pay of $4.40 for a 1.0×10^{-6} reduction in mortality risk.

3 Upper bound represents a willingness to pay of $8.50 for a 1.0×10^{-6} reduction in mortality risk.

4 The increment between Options **B** and **D** is shown because these are consecutive options for the promulgation analysis. The Option **C** was evaluated for promulgation because it was the Option proposed, although it is not considered an efficient alternative based on the analysis for promulgation.

TABLE VII-3. TOTAL NET BENEFITS IF INCREMENTAL BENEFITS EQUAL INCREMENTAL COSTS FOR VARIOUS CONTROL OPTIONS (BILLIONS OF DOLLARS)

Control Option	*SCENARIO*[1]				
	$510 per Mg	*$ 2900 per Mg*	*$ 3000 per Mg*	*$ 3300 per Mg*	*$ 7300 per Mg*
Option **A**	$ 0.31 Billion	$ 2.7 Billion	$ 2.8 Billion	$ 3.0 Billion	$ 7.0 Billion
Option **B**	0.38	2.7	2.8	3.1	7.0
Option **C**	0.40	2.7	2.8	3.1	6.9
Option **D**	0.41	2.7	2.8	3.1	6.9
Option **E**	0.41	2.6	2.7	3.0	6.7

1 A Scenario represents the incremental cost for a specific control option relative to another control option for the following comparisons of interest:

$510 per Mg -> Option **D** relative to Option **E**
$2900 per Mg -> Option **B** relative to Option **C**
$3000 per Mg -> Option **B** relative to Option **D**
$3300 per Mg -> Option **C** relative to Option **D**
$7300 per Mg -> Option **A** relative to Option **B**

REFERENCES

1. Fisher, Ann; Chestnut, Lorraine; and Violette, Daniel; "The Value of Reducing Risks of Death: A Note on New Evidence", *Journal of Policy Analysis and Management*, Vol.8, No. 1. January 1989.

2. U.S. Environmental Protection Agency, *Hazardous Waste TSDF--Background Information for Proposed RCRA Air Emission Standards Volume I-Chapters*, Office of Air Quality Planning and Standards, September 1989 Draft.

3. U.S. Environmental Protection Agency, *Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) Organic Air Emission Standards*, Draft Preamble for Final Rulemaking, Office of Air and Radiation, (Date to be Appended)

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16. ABSTRACT

Standards for the control of organic air emissions from hazardous waste treatment, storage, and disposal facilities (TSDF) are promulgated under the authority of Section 3004(n) of the Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA). Also promulgated is a new test method for determining the organic vapor pressure of waste, Reference Method 25E. The final rules establish organic air emission control requirements for tanks, surface impoundments, and certain containers in which hazardous waste is placed. This document presents the costs and impacts associated with the final standard, and the basis for the selection of the controls.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Action Level, Air Pollution, Benefit, Container, Control Device, Hazardous Waste, Impact, Inspection, Miscellaneous Unit, Monitoring, Reporting, Recordkeeping, Surface Impoundment, TSDF, Tank, Volatile Organic	Air Pollution control	13B

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