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Addendum to the Regulatory Impact Analysis for the Final Criteria for Municipal Solid Waste Landfills

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Prepared for

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I. Introduction

Background

The December 1990 Regulatory Impact Analysis (RIA) was prepared to evaluate the U.S. Environmental Protection Agency's (EPA's) revisions to Subtitle D criteria for municipal solid waste landfills (MSWLFs). This addendum supplements the RIA. These regulations are a major rule-making according to Executive Order 12291 (aggregate compliance costs are greater than $100 million per year); therefore, an RIA is required as part of this rule-making. The analysis in the RIA evaluates the hybrid approach (referred to in the RIA as the final rule) relative to four regulatory alternatives in terms of costs, economic impacts, impacts on small entities, health risk, and resource damage and discusses the overall rationale for the Agency's final choice. The RIA also includes a Regulatory Flexibility Analysis (RFA) that assesses impacts to small entities.

This analysis represents EPA's best efforts to quantify the costs, economic impacts, and benefits (health risk and resource damage) of the regulatory options. It should be noted, however, that as in any analysis, the results are necessarily based upon incomplete data and on simplified assumptions. A discussion of limitations of the analyses is included in the RIA.

Introduction

After the analysis for the December 1990 RIA was completed and the document prepared, several changes were made to the regulatory analysis. These changes affect costs, economic impacts, risks, and resource damage because they

- Reflect a modified baseline (i.e., take into account additional requirements already in place as a result of state landfill regulations)
- Reflect changes in the analyses to better represent flexibility incorporated in the final rule language
- Exempt certain small landfills from compliance with the provisions of the regulatory options

Because changes to the baseline and the final rule occurred after the RIA was completed, EPA did not revise all of the analysis found in the complete RIA. Instead, this document summarizes the principal changes in the baseline and final rule that affect costs and benefits,

the approach taken to incorporate these changes into the cost, economic impact, risk, and resource damage analyses, and the results of the revised analyses. The final rule and the limited rule option (ground-water monitoring, corrective action, and location standards -- Alternative 4 in the RIA) have received the most scrutiny; these two options are the focus of this addendum.

The most significant change in the cost and benefit estimates resulted from an expanded review of current state landfill regulations. Landfill owner/operators are already obligated to comply with state standards so, to the extent that revised federal criteria for landfills duplicate existing state requirements, the federal criteria would impose no additional cost. Similarly, any benefits resulting from these existing state requirements are considered part of the baseline and are not attributed to the federal criteria. In the RIA, only a limited number of state requirements were included in the baseline of state requirements. EPA has since examined these regulations in more detail and expanded the characterization of baseline practices.

A second change in the analysis resulted from changes in the modeling assumptions to reflect flexibility incorporated into the final rule language, but not modeled in the RIA. RIA assumptions that were changed relate to the cost of conforming with "best engineering practices" in landfill construction, assumed cover requirements for existing landfills, use of alternative points of compliance (POCs) for landfills, and the frequency of ground-water monitoring.

Third, the final rule provides for an exemption from the requirements for small landfills in approved states meeting certain criteria (e.g., low rainfall or seasonal interruptions in operation). These exemptions were not reflected in the RIA cost estimates, but are included in this addendum.

Chapter II of the addendum summarizes the changes in the methodology for the cost and risk analyses. The revised cost results are presented in Chapter III, economic impact results in Chapter IV, risk and resource damage results in Chapter V, and other benefits in Chapter VI.

II. Revised Assumptions

Incremental costs and benefits estimated in the RIA have been changed to reflect current state requirements that overlap with the revised federal criteria, additional flexibility in the implementation of the rule, and exemptions for small landfills that were not modeled in the RIA. This chapter briefly reviews the relevant assumptions made in the RIA and describes the new methodology that was used to produce the results summarized in Chapters III through V.

Credits for State Requirements

Cost Analysis

Assumptions in the RIA

Research conducted by EPA in 1987 indicated that many states already had requirements for ground-water monitoring and containment systems. As described in the RIA, these requirements were factored into the cost and economic impact analysis; they were not considered in the risk and resource damage assessment. Based on 1987 data, the RIA assumed credit for ground-water monitoring capital costs for landfills in 24 states (2,702 units) and for at least a portion of containment system costs in 22 states.

1991 Revised Assumptions for the Addendum

In the spring of 1991, EPA expanded the scope of the review of state requirements to include a broader range of regulatory requirements and state regulations that had been promulgated since 1987. While the 1987 analysis only included synthetic liner and ground-water monitoring requirements, the 1991 review addressed all containment systems (including synthetic liners, clay liners, composite liners, and leachate collection systems), covers, ground-water monitoring, and corrective action. Credit was given for these additional requirements in the results presented in this addendum. For the purposes of this analysis, state regulations were categorized into a simple framework to develop assumptions about costs. This analysis should not be used as an authoritative or comprehensive source on state landfill regulations.

The rationale for providing credits is relatively simple. If the federal criteria overlap with current state landfill requirements (i.e., require similar actions) no incremental cost is attributable to the federal criteria. Since landfills must already comply with state regulations the federal criteria will only affect the landfill to the extent that the federal requirements are more stringent. The approach EPA adopted is to identify relevant state requirements and only attribute to the federal rule incremental costs beyond state requirements.

To model costs, design requirements for individual landfills were determined using the Subtitle D Risk Model. If, based on the performance standard criteria and model results, a landfill is assigned to a synthetic liner design under the final rule and state regulations already require the liner, then the cost of the liner is not counted in total compliance costs. These cost credits are, of course, integrated with the credits already provided to landfill in the RIA. The cost modeling approach proceeds state-by-state and identifies all landfills incurring the cost for a requirement already in state regulations. The cost of state requirements is subtracted from the total compliance cost, and the remaining costs are aggregated to estimate revised national cost totals. A description of each of the state requirement categories is provided below.

Containment Systems

The review of state containment system requirements addressed clay liners, synthetic liners, composite (synthetic plus clay) liners, and leachate collection systems (LCS). For the purposes of this analysis, the three liner designs analyzed were assumed to be equivalent in cost and performance to similar designs modeled in the RIA. For example, state requirements for clay liners were assumed to be equivalent to the clay liner modeled in the RIA (two feet of recompacted clay with a permeability of 10^{-7}).

The results of the state review are summarized in Table II-1. EPA assumed that 33 states (containing 4,626 landfills) require a clay liner, 29 states (containing 3,413 landfills) require a synthetic liner, and 19 states (containing 1,766 landfills) require composite liners. However, not all of the landfills in these states were required under the final rule to have these designs. The actual credit provided for individual landfills depended on the design to which the landfill was assigned in the RIA. For units assigned to a synthetic liners, for example, if the state already required a synthetic liner or composite liner, no additional cost was attributed to the federal criteria. If the state required only a clay liner, the federal criteria would impose only the difference in cost between the clay liner and a synthetic liner. In the case of composite liner requirements, landfills in states with composite liner credits incurred no additional cost from the federal rule. If the state mandated either a synthetic or clay liner, the landfill received credit for the less expensive of the two (assuming the landfill owner would comply with the less expensive state requirement); the federal criteria would then impose additional costs on the landfill for the remaining composite liner components.

Table II-1

Analysis Assumptions Regarding State Containment System Requirements for Municipal Landfills

(Assumed universe of 6,034 landfills)

	Liner Systems			
State	Clay	Synthetic	Composite	Leachate Collection Systems
Alaska	■	■	■	■
Alabama	■	■		■
Arkansas	■	■	■	■
Arizona	■	■	■	■
California	■			■
Colorado	■	■	■	■
Delaware	■	■	■	■
Florida	■	■	■	■
Georgia		■		■
Iowa	■			■
Indiana	■			■
Kentucky	■	■	■	■
Louisiana	■	■	■	■
Maryland	■	■	■	■
Maine	■	■		■
Michigan	■	■		■
Minnesota	■	■		■
Missouri	■	■		■
Mississipi	■	■		■
Montana	■			■
Nebraska				■
New Jersey	■	■	■	■
New York	■	■	■	■
Ohio	■	■		■
Oklahoma	■	■	■	■
Oregon				■
Pennsylvania	■	■	■	■
South Dakota	■	■		■
Tennessee	■	■	■	■
Texas	■	■		■

Table II-1
(Continued)

Analysis Assumptions Regarding State Containment System Requirements for Municipal Landfills

(Assumed universe of 6,034 landfills)

State	Liner Systems: Clay	Liner Systems: Synthetic	Liner Systems: Composite	Leachate Collection Systems
Virginia	■	■	■	■
Vermont	■	■	■	■
Washington	■	■	■	■
Wisconsin	■			■
West Virginia	■	■	■	■
Wyoming	■	■		■
Total States	33	29	19	36
Total Number of Landfills	4,626	3,413	1,766	5,017

All state landfill liner requirements were assumed to include leachate collection requirements as well. Thus, no additional costs were assigned for leachate collection systems in 36 states (containing 5,017 landfills).

Cover Systems

The cover systems modeled in the RIA are either a vegetative cover or a synthetic cover. The status of state requirements for covers is summarized in Table II-2. For new units, EPA assumed that 21 states (containing 1,900 landfills) either require synthetic covers explicitly for new landfills or have a performance standard which, when coupled with the state's liner requirements, effectively require a synthetic cover. For existing units, however, EPA assumed only 6 states (containing 489 landfills) require synthetic covers. Again, only landfills assigned to synthetic covers in the RIA modeling received credit for the state requirements.

Ground-Water Monitoring and Corrective Action

EPA assigned credit for ground-water monitoring and corrective action differently for existing landfills and for new landfills. EPA assumed that new landfills in 39 states (containing 5,149 units) are subject to state ground-water monitoring requirements (Table II-3). As a result, the federal criteria would not impose additional costs on these landfills for ground-water monitoring wells or for hydrogeologic studies of the site to determine well placement and other background data. However, since the sampling requirements in the final rule are relatively comprehensive, EPA assumed that no state receives credit for the sampling costs. The total cost of ground-water monitoring equals sampling costs for all landfills and also well and study costs for landfills in the 11 "non-credit" states.

Ground-water monitoring requirements for existing landfills were less clear in these 39 states. Because many of these regulations are relatively new, EPA assumed that only half of the existing landfills in these states would have wells in place and would not incur costs for wells and studies. The remaining existing landfills would incur full costs as a result of the ground-water monitoring requirements. As with the new units, EPA assumed all existing landfills will bear the full cost of the sampling requirements.

Twenty-three of the states with ground-water monitoring requirements also require some type of corrective action for releases from municipal landfills. Given uncertainty over the state requirements (i.e., the stringency of state requirements and the types of constituents that must be controlled), only partial (50 percent) credit was given toward corrective action costs for new landfills that trigger corrective action in these states. These corrective action requirements also extend to existing landfills in these same sates, but due to limited ground-water monitoring and other uncertainties, EPA assumed that the credit would be lower than that provided to new units. Only existing landfills in states that were already monitoring

Table II-2

Analysis Assumptions Regarding State Cover System Requirements for Municipal Landfills

(Assumed universe of 6,034 landfills)

State	New Units[1]	Existing Units
Alaska	■	
Arkansas	■	
Arizona	■	
Colorado	■	
Delaware	■	■
Florida	■	
Kentucky	■	
Louisiana	■	
Maryland	■	■
Maine	■	■
Minnesota	■	■
Missouri	■	■
New Jersey	■	
New York	■	
Oklahoma	■	
Pennsylvania	■	■
Tennessee	■	
Virginia	■	
Vermont	■	
Washington	■	
West Virginia	■	
Total States	21	6
Total Number of Landfills	1,900	489

[1] States with existing unit requirements have an explicit synthetic cover requirement for all landfills. The other states require synthetic covers through a performance standard.

Table II-3

Analysis Assumptions Regarding State Ground-Water Monitoring and Corrective Action Requirements for Municipal Landfills

(Assumed universe of 6,034 landfills)

State	Ground-Water Monitoring[1]	Corrective Action[2]
Alaska	■	■
Alabama	■	
California	■	
Colorado	■	■
Connecticut	■	■
Delaware	■	■
Florida	■	
Georgia	■	■
Iowa	■	■
Idaho	■	■
Indiana	■	■
Kentucky	■	
Louisiana	■	■
Maryland	■	
Maine	■	■
Michigan	■	■
Minnesota	■	■
Missouri	■	■
Mississippi	■	
North Carolina	■	

[1] Credit is provided for ground-water monitoring wells and hydrogeologic studies only. All new landfills receive the credit. Only half of the existing landfills in these states receive credit; within each state, the existing landfills that receive credit were chosen randomly.

[2] New landfills in these states receive credit for half of their corrective action costs. Existing landfills that received credit for ground-water monitoring receive credit for 25 percent of their corrective action costs. No other credit is provided.

Table II-3
(Continued)

Analysis Assumptions Regarding State Ground-Water Monitoring and Corrective Action Requirements for Municipal Landfills

(Assumed universe of 6,034 landfills)

	Ground-Water Monitoring[1]	Corrective Action[2]
New Hampshire	■	
New Jersey	■	
New Mexico	■	■
New York	■	■
Ohio	■	■
Oklahoma	■	■
Oregon	■	
Pennsylvania	■	
Rhode Island	■	■
South Carolina	■	
South Dakota	■	
Tennessee	■	
Texas	■	
Virginia	■	■
Vermont	■	■
Washington	■	■
Wisconsin	■	■
West Virginia	■	■
Wyoming	■	
Total States	39	23
Total Number of Landfills	5,149	3,175

groundwater were assumed eligible to receive credit toward corrective action costs. Further, EPA assumed that existing landfills that triggered corrective action would receive credit for only 25 percent of their corrective action costs.

Risk and Resource Damage Analysis

Baseline

In the RIA, baseline risk and resource damage were simulated under the assumption that new landfills were unlined, had vegetative covers, and that none performed corrective action. To revise the RIA results to account for compliance with state requirements in the baseline, our basic approach was to use the results of the 1991 state review to determine how many landfills are in states that require more advanced designs or corrective action, and to recalculate risk and resource damage with the appropriate state requirements in place.

Implementing this approach rigorously would have involved simulating risk and resource damage for every type and combination of liner and cover systems that states require. For the purposes of this analysis, we took a more simplified approach. To account for compliance with state liner and cover system requirements in the baseline, we matched the various state-required designs with one of the three designs that had already been simulated for the RIA: (1) no liner/vegetative cover; (2) no liner/synthetic cover; and (3) composite liner with LCS/synthetic cover. Our assignment of state requirements to the three available designs is shown in Table II-4:

Table II-4

Assumptions for Assigning Liner and Cover Designs to Reflect State Requirements in the Baseline

State Requirement		Design Assignment for Risk and Resource Damage Estimate
Liner	Cover	
None	None	No liner / vegetative cover
Clay	None	No liner / vegetative cover
Synthetic or Composite	None	Composite liner / synthetic cover
Synthetic or Composite	Synthetic	Composite liner / synthetic cover

The decision rules for making these assignments reflect the following conclusions:

- Clay liners are much less effective at controlling releases than synthetic membranes. In dry regions, clay liners may increase the time of travel of leachate from the waste to the underlying aquifer by several years, but are not likely to significantly reduce the rate at which leachate is released once the liner becomes saturated. In wetter regions, the time delay is much shorter, and the reduction in leachate release rates is likely to be significant only in regions with very high net infiltration rates. Synthetic membranes are much less permeable than clay liners and drastically reduce releases for as long as they are intact. Given the choice between assigning landfills with clay liners to the unlined design versus the composite liner, we believe that the unlined design reflects clay liner performance more accurately.

- State leachate collection system requirements were not an important factor in assigning landfills to one of the three designs. Of the 36 states requiring LCSs, 29 also require synthetic or composite liners. Two states require LCSs but do not require liners, and five states require LCSs and only clay liners. Because the efficiency of the LCS depends to a great extent on the permeability of the underlying layer, and synthetic membranes are much less permeable than in-situ soils or typical clay liners, we believe landfills with LCSs overlying natural soils or clay liners behave more like unlined landfills than composite-lined landfills.

- All landfills in states requiring synthetic or composite liners were assigned to the composite liner/synthetic cover design, regardless of the cover requirement. Of the 29 states requiring synthetic or composite liners, only 7 have no cover requirements. We do not believe that many landfills would actually be designed this way, given the potential "bathtubbing" effect associated with landfills whose liners are less permeable than their covers.

As discussed above, some states also require ground-water monitoring and corrective action in the baseline. For the cost analysis, credit was given toward corrective action costs for only 50 percent of the new landfills that trigger corrective action in the 23 states with corrective action requirements. For the risk and resource damage analysis, we assumed that only half of the landfills in these 23 states that exceed MCLs would be assigned corrective action in the baseline. As in the RIA, we assumed that landfills with the composite/synthetic design would never trigger corrective action because the containment systems would remain intact until the end of the post-closure care period, when ground-water monitoring would cease.

Using these decision rules, about 56 percent of landfills were assigned the composite liner/synthetic cover in the baseline, and about 44 percent were assumed to have no liners and

only vegetative covers. About 4 percent of landfills were assumed to have corrective action in the baseline, all of which have the unlined/vegetative cover design.[1]

Final Rule

To revise the RIA risk and resource damage estimates for the final rule, we started with the design assignments under the revised baseline. If a landfill met the MCL-based performance standard with the state-required design in place, it retained that design under the final rule. If the state-required design was not sufficient to meet the performance standard, we assigned a more stringent design. Because landfills that trigger corrective action in the baseline do not meet the MCL-based performance standard with the unlined/vegetative cover design, we assigned them to more stringent designs under the final rule. (As in the RIA, the most stringent design assigned to any landfill was the composite/synthetic design.)

Using these criteria, the design assignments for landfills under the final rule were assumed to be as follows:

Table II-5

Revised Design Assignments for New Landfills: Final Rule
(Assumes Compliance with Baseline State Requirements)[2]

Final Rule Design	Percent of Landfills
No liner / vegetative cover	29 %
No liner / synthetic cover	<1 %
Composite or synthetic liner / synthetic cover	71 %
-- Due to state requirements	--- 56 %
-- Due to final rule	--- 15 %
	100 %

[1]This split among designs is not exactly the same as that used for the cost analysis, but the differences are very small and do not significantly affect either the risk or cost results.

[2]These design assignments are based on a 10-meter point of compliance.

As shown on the table, 29 percent of landfills were assigned to the unlined/vegetative cover design under the final rule. About 0.3 percent of landfills were assigned to the unlined/synthetic cover design, and 71 percent to the composite/synthetic design (56 percent due to baseline state requirements and 15 percent due to the final rule). No new landfills were assumed to trigger corrective action under the final rule.

Limited Rule Option

We adopted a similar approach for estimating risk and resource damage for the limited option. If the state-required baseline design was not sufficient to meet the performance standard, we assumed that the landfill would trigger corrective action. Using these criteria, 56 percent of landfills were assumed to have the composite liner/synthetic cover design due to state requirements and the remaining 44 percent have no liners and only vegetative covers. About 12 percent of all landfills trigger corrective action (4 percent due to state requirements and 8 percent due to the limited option), all of which have the unlined/vegetative cover design.[3]

Table II-6

Revised Design Assignments for New Landfills: Limited Option
(Assumes Compliance with Baseline State Requirements)[4]

Limited Option Design	Percent of Landfills
No liner, vegetative cover, no corrective action	32 %
No liner, vegetative cover, corrective action	12 %
-- Due to state requirements	--- 4 %
-- Due to limited option rule	--- 8 %
Composite liner, synthetic cover (all due to state requirements)	56 %
	100 %

[3]The Subtitle D Risk Model indicates that if all landfills are unlined and have vegetative covers, between 30 and 35 percent of unlined landfills trigger corrective action. When landfills are assumed to be in compliance with state liner requirements, the proportion of landfills that trigger corrective decreases to about 12 percent.

[4]These design assignments are based on a 10-meter point of compliance.

Modeling Flexibility in the Final Rule

Cost Analysis

Since the RIA was completed, we have refined our modeling assumptions to better capture some of the flexibility provided to states in the rule's language. These assumptions relate to indirect capital expenses at baseline landfills, assumed cover requirements for existing landfills, the point of compliance, and the frequency of ground-water monitoring.

In the RIA, the baseline landfill (from which incremental costs were measured) was assumed to be designed and operated in accordance with best engineering practices. Despite this, we had assumed that landfills would incur additional costs under the final rule for higher engineering fees, inspection, and testing of the unlined/vegetative landfill design. Given existing state requirements and the language of the rule, this cost is more appropriately considered as part of the baseline, rather than attributable to the federal criteria.

Existing landfills were assigned to either synthetic covers or vegetative covers in the RIA, depending on the level of net precipitation at the landfill site. If net precipitation was positive, we assumed that a synthetic cover would be necessary to comply with the performance standard. Given the current language of the rule which requires the cover to be less permeable than the liner, and the widespread practice of using graded soil covers (at least) on existing landfills, we determined that the assignment to synthetic liners was excessive and not stipulated by the final rule. Since most existing landfills are either unlined or have soil liners, a soil and vegetative cover would likely meet the final rule criteria. Therefore, the revised costs exclude synthetic covers at existing facilities.

The final rule provides flexibility to states in determining the point of compliance (POC) for the performance standard. The flexibility regarding alternative POCs is discussed for the 1988 proposal in the RIA. Briefly, an approved state can set the POC where the MCL-based performance standard must be met. The POC can be set at the edge of the landfill (the 10-meter distance is used in the RIA as the proxy for this POC), or at a point no more than 150 meters from the edge of the landfill provided that the POC is still on the municipal solid waste landfill owner's property. To bound the analysis, we used an alternative POC 150 meters downgradient from the edge of the landfill and estimated costs and benefits using the alternative POC. Given the greater distance, slightly fewer landfills are assigned to the more stringent designs under the performance standard. As a result, costs decrease somewhat. Because of uncertainty over which landfills would be able to use an alternative POC, for the development of a best estimate we assumed that half of all landfills would use a 10-meter POC and half would use a 150-meter POC.

The final difference between the RIA estimates and these revised results is a lower cost of ground-water monitoring brought on by less frequent sampling. The RIA assumed

that all landfills sampled groundwater twice each year from each well at the facility. In order to ease compliance costs and economic impacts, EPA has provided flexibility for this requirement and the RIA assumption of semi-annual monitoring has been changed as well. The revised cost estimates reflect only annual monitoring during the active life and the post-closure care period for both the final rule and the limited approach.

Risk and Resource Damage Analysis

As discussed above, the cost analysis was revised to capture flexibility in the final rule, but only the compliance point affects the risk and resource damage results for new landfills. For the cost analysis, we assumed that half of all landfills would use a 10-meter POC and half would use a 150-meter POC. For the risk and resource damage analysis, we used the simplifying assumption that landfills with no downgradient wells within one mile (46 percent of all landfills) would use the 150-meter POC, while those with downgradient wells within one mile (54 percent of all landfills) would use the 10-meter POC.

Because pollutant concentrations in ground water may decrease with increasing distance from the landfill, increasing the POC from 10 to 150 meters could result in less stringent designs for some landfills under the performance standard. This phenomenon is not reflected in the design assignments shown in Tables II-5 and II-6, nor did we rigorously assess the effects of extending the compliance point on risk or resource damage. From a risk perspective, extending the compliance point at landfills that have no drinking water wells -- and therefore no exposure -- has no effect on estimated risk; these landfills have no risk either in the baseline or under any of the regulatory alternatives considered. From a resource damage standpoint, relaxing the design requirements at landfills without drinking water wells would have decreased option value slightly. However, because option value resource damage comprises only a small portion of total resource damage (about ten percent), the reduction in total resource damage would have been negligible.

Exemptions from the Federal Criteria

Cost Analysis

The final rule contains an exemption for small communities that meet particular criteria. These are designed to mitigate compliance cost burdens and service interruptions for small landfills in remote or arid areas. For the purpose of capturing this exemption in the cost analysis, EPA assumed that all landfills 20 TPD or smaller and that receive 25 inches or less precipitation annually would be exempt from the regulatory requirements. This assumption exempts 1,028 landfills or about 17 percent of all landfills. This analysis may overestimate the number of landfills receiving the exemption since there are additional criteria

to qualify for this exemption in the final rule (e.g. no practicable waste management alternative).

Risk and Resource Damage Analysis

In the risk and resource damage analysis, landfills are characterized differently than for the cost analysis. For example, precipitation is measured in terms of net infiltration rates rather than precipitation rates. To define the exemption for selected small landfills, we assumed that the smallest landfills (the 10 TPD category) in the lowest net infiltration rate category (0.25 inches per year) would be exempt, (This exempts 21 percent of landfills, compared to 17 percent in the cost analysis). As it turns out, these landfills never exceed MCLs at the compliance point in the modeling. Even without the exemption, the final rule would not have imposed designs that are more stringent than the baseline, and corrective action would not have been triggered under the limited approach. Therefore, exempting these landfills from the final rule and/or the limited option rule does not change our assessment of the risk and resource damage effects of these regulatory options.

III. Revised Cost Results

All of the changes in assumptions since the RIA have reduced the estimated compliance costs for the regulatory options. Before presenting the new results and showing how the new assumptions changed the costs, we will review the national cost estimates from the RIA. The previous cost estimates are described in detail in Chapter VII of the December 1990 RIA.

The cost estimates were based on the Subtitle D Cost Model, developed for the RIA in 1987. The model is an engineering cost model that provides the specifications for a baseline municipal waste landfill to which the user can add hundreds of additional components. The model computes the year-by-year costs of designing, constructing, operating, and closing a landfill, given the design and operating parameters specified by the user. Analysis of the baseline costs and regulatory costs for landfills of various sizes and designs can be found in Chapter VII of the RIA.

National Costs in the RIA

The national cost estimates were presented as a range in the RIA to reflect

- Flexibility in the length of the post-closure care period that would be required
- Uncertainty over the trend toward larger, regional landfills that replace fewer, small facilities
- Uncertainty over future reduction in waste disposal resulting from source reduction, expanded recycling, and expanded use of combustion as a disposal option

The upper end of the range of costs was defined by a scenario in which all landfills were required to have 40 years of post-closure care, no additional regionalization occurred, and the future volume of waste discarded in landfills stayed constant (i.e., diversion of waste through recycling and other alternatives increased at the same rate as total generation). The annualized combined cost for the final rule was $1,040 million. The same cost under the limited option rule (Alternative 4 in the RIA) was $755 million per year.

We also developed a scenario for compliance costs in the future, assuming that all landfills had 10 years of post-closure care instead of 40 and that regionalization and shifts

away from disposal and toward combustion, recycling, and source reduction would continue. The methodology behind the projected regionalization and expanded waste diversion are described in Chapter IV of the RIA.

Under this lower bound scenario, annualized combined costs were about 40 percent lower than the upper bound estimates. This scenario was based on an assumed population of landfills that would remain in operation after 20 years of regionalization occurred. Also, the quantity of municipal solid waste placed in landfills was assumed to decline by the end of this 20-year period reflecting the effect of additional source reduction, recycling, and reliance on combustion. In the lower bound, the annualized combined cost for the final rule was estimated at $620 million and the annualized combined cost for the limited option was $447 million (see Table VII-36 in the RIA).

A most likely estimate was not reported in the RIA, but has been developed by EPA since the RIA was completed. It is very difficult to determine where in this range the true cost of the options would fall. This most likely, or "best" estimate was designed to provide a point estimate of costs, taking into account the likelihood of future regionalization and the extent to which landfills would continue to close and consolidate. This is only an estimate, however; the actual cost could fall anywhere in the range presented. The most likely annual cost estimates for the final rule and limited option rule RIA costs were $700 million and $510 million respectively.

The best estimate assumes that a portion of the regionalization would occur. The simulation described in Chapter IV of the RIA indicated that virtually all small landfills could save more money on disposal in larger facilities than they would pay in higher transportation costs. After 20 years, the projected population of landfills would decrease from the 6,034 that were active in 1986 to approximately 1,800 based on economic decisions. Of course, regional landfills might not always be available to every community that wants to use one. Siting difficulties, transportation restrictions, or a community's desire to keep the landfill under its own control would all work to slow the spread of regionalization.

For the purposes of this analysis, EPA estimates that approximately 3,000 municipal landfills would still be active in 20 years, rather than the 1,800 originally projected. The most likely estimate reflects this projection. The shift in the number of landfills also affects the distribution of landfills across size categories. Table III-1 summarizes the distribution of landfills across seven size categories before and after the projected regionalization.

Table III-1

Number and Percentage of Landfills by Size Category
Before and After Regionalization

Size Range (Tons/Day)	Unregionalized Number (6,034)	Percentage	Regionalized Number (3,000)	Percentage
< 17.5	3,100	51	1,200	40
17.5 - 50	1,000	17	420	14
50 - 125	790	13	290	10
125 - 275	440	7.3	310	10
275 - 563	330	5.5	350	12
563 - 1,125	190	3.1	240	8.0
> 1,125	160	2.6	180	6.1

The most likely estimate also assumes that half of all landfills will provide post-closure care for 40 years and half for 10 years. Similarly, half of all landfills will operate assuming their POC for design and corrective action is 10 meters from the landfill and half will have a 150-meter POC. Finally, EPA assumes that source reduction, recycling, and combustion will reduce the total quantity of municipal solid waste landfilled by 1 percent per year. The approach for computing the most likely estimate will be used for the revised cost results presented later in the chapter. The assumptions associated with the most-likely estimate are summarized below.

Most Likely Estimate

- 50-50 split between 10- and 40-year post-closure care period
- 50-50 split between 10-meter and 150-meter POC
- Some regionalization (universe of 3,000 landfills after 20 years)
- 20 percent additional waste diversion over 20 years (1 percent decrease per year)

Revised National Costs

Taking into account the changes since the RIA was completed, the national costs for both regulatory options have declined by more than 50 percent. For the final rule, the range

of annualized combined costs (shown in Table III-2) is between $300 million and $490 million with a most likely estimate of $330 million. The drop in costs was even larger for the limited option rule which has a range of $160 million to $270 million and a most likely estimate of $180 million per year.[5]

Table III-2

Summary of Revised Annualized Combined Costs
Annual Costs 20 Years After the Effective Date

(dollars in millions)

	Final Rule	Limited Option Rule
Range of Costs	$300 - $490	$160 - $270
Best Estimate	$330	$180

The most likely estimate combines the assumptions as follows: the landfills are evenly split across the post-closure care and POC options, a universe of 3,000 landfills is projected for 20 years after the effective date, and 20 percent of the waste currently disposed is diverted through source reduction, recycling, and combustion.

The most likely annualized combined costs for the final rule decreased by 53 percent and the costs for the limited approach fell 64 percent compared to the RIA estimates. These significant changes resulted primarily from EPA's analysis of current state landfill regulations and the resulting change in the costs attributable to the federal criteria. As a rough estimate, factoring in additional state requirements accounted for about half of the reduction in cost for the final rule and over three-quarters of the reduction in cost for the limited option. The other assumptions regarding flexibility and exemptions for small landfills account for the remaining decrease.

[5] Only two of the five options analyzed in the RIA are addressed here. The most expensive option, the Subtitle C option described in the RIA, would still be significantly more expensive than these options. Given state credits, the most likely estimate for the annualized combined cost would still be over $1.3 billion.

Table III-3 shows the components of cost for the two options. These costs assume 40 years of post-closure care, no regionalization, and a constant waste generation rate since 1986. This upper-bound scenario was chosen for reporting purposes only and the cost estimates have been rounded to simplify the discussion. The table indicates that liner and leachate collection system requirements account for the largest portion of final rule costs, 40 percent of the total; ground-water monitoring is the next most expensive component of costs adding another 27 percent to the cost. The limited option rule is nearly evenly split between ground-water monitoring and corrective action costs.

Table III-3

Components of Final Rule and Limited Option Rule Cost
Annual Upper Bound Cost Scenario Only

Cost Component	Final Rule Percent	Limited Option Percent
Ground-water Monitoring	27 %	48 %
Synthetic Covers	17 %	0 %
Liners/LCS	40 %	0 %
Corrective Action	8 %	52 %
Other Costs	8 %	0 %
Total Cost	100 %	100 %

IV. Revised Economic Impact Results

The revised costs summarized in Chapter III have also changed the results of the economic impact assessment described in Chapters V and VIII of the RIA. In general, the incorporation of existing state requirements into the baseline costs decreases the severity of the economic impacts just as it decreased the incremental costs. It is important to emphasize that the economic impacts computed here reflect only the incremental burden on communities and households resulting from the various federal regulatory options. To the extent that state requirements are already in place, local governments are already bearing those increased burdens.

The economic impact results were computed based on the most likely estimates of incremental costs presented in Chapter III. For example, these results reflect the expected impact of regionalization on incremental costs and impacts. As such, the results simulate impacts in the future after the waste management system has adjusted to new costs.

This chapter briefly summarizes the measures of economic impact (described in more detail in Chapter V of the RIA), presents the results, and analyzes major differences between these results and those in the RIA.

Measures of Economic Impact

The impact analysis focuses on communities and on individual households. The measure of community impact is incremental annualized cost as a percentage of total annual community expenditures (CPE). This measure illustrates how expensive the regulations would be relative to communities' current operating budgets. We established a significant impacts threshold at 1 percent of current expenditures.

The other two impact measures focus on households in the community: cost per household (CPH) which spreads the incremental costs over all of the households in the community, and cost as a percentage of median household income (CPMHI) which is a more appropriate assessment of the impact of the regulations on households. CPMHI is computed as the CPH divided by the median household income for the community. A threshold of $220 per household was used to indicate significant impacts for CPH and the CPMHI threshold was 1 percent.

Results

The most likely annualized cost estimates for the final rule and the limited option rule are $330 million and $180 million respectively; these costs will not impose significant impacts on over 98 percent of the communities served by municipal landfills. The summary of results shown in Table IV-1 indicates that the significant impact threshold is exceeded only for the CPE measure and then only for 1.4 percent of all jurisdictions (396 jurisdictions out of 29,017 jurisdictions under the final rule and 402 under the limited approach). No significant impacts on households are projected for either option. These results include the exemption for landfills 20 TPD or smaller located in dry climates.

Table IV-1

Economic Impacts: Cost as a Percentage of Expenditures for the Final Rule and Limited Option Rule

Based on Most Likely Costs After Regionalization

Regulatory Option	Minimum CPE	Median CPE	Maximum CPE	Number of Jurisdictions With CPE > 1%	Percentage With CPE > 1%
Final Rule	0.0%	0.20%	3.1%	396	1.4%
Limited Option Rule	0.0%	0.11%	2.6%	402	1.4%

The communities with significant impacts account for a very small share of total jurisdictions providing landfill services. The communities facing significant impacts are typically small, about 90 percent have fewer than 5,000 people, and the landfills serving the communities are small as well, over 80 percent are smaller than 17 TPD. The maximum CPE under the final rule occurs in communities of between 1,000 and 5,000 people served by landfills smaller than 17 TPD that were assigned to the uniform design. The maximum CPE under the limited option occurs in the same situation, only the landfills were assigned to corrective action, not the uniform design.

No jurisdictions exceed the household significant impact thresholds. Table IV-2 summarizes the impact estimates for the two options for cost per household. The median CPH is less than $10 for both options and the CPH averaged across all households in the United States is $4.10 for the final rule and $2.30 for the limited approach. The maximum is $62 for the final rule and $52 for the limited approach; only 13 communities have CPH greater than $50 under either option.

Since no communities exceed the significant impact threshold for CPH of $220 per household, we used a more moderate impact threshold of $100 per household for reporting purposes only. However, even with the more moderate CPH threshold, no jurisdictions exceed the $100 CPH level.

Table IV-2

Economic Impacts: Cost per Household for the Final Rule and Limited Option Rule

Based on Most Likely Costs After Regionalization

Regulatory Option	Minimum CPH	Average CPH*	Median CPH	Maximum CPH	Number of Jurisdictions With CPH > $100
Final Rule	$0.20	$4.10	$6.10	$62	0
Limited Option Rule	$0.12	$2.30	$3.30	$52	0

* National most likely cost divided by national number of households.

Finally, the CPMHI is well below the threshold level for both options. Table IV-3 indicates that the maximum CPMHI for the final rule is 0.33 percent and for the limited option it is 0.32 percent, compared to a significant impact threshold of 1 percent.

Table IV-3

Economic Impacts: CPH as a Percentage of Median Household Income for the Final Rule and Limited Option Rule

Based on Most Likely Costs After Regionalization

Regulatory Option	Minimum CPMHI	Median CPMHI	Maximum CPMHI	Number of Jurisdictions With CPMHI > 1%
Final Rule	0.0%	0.026%	0.33%	0
Limited Option Rule	0.0%	0.015%	0.32%	0

Regulatory Flexibility Analysis

The RIA contains analysis of the incidence of significant impacts on small communities. In Chapter VIII of the RIA, we summarized the indicators of impacts (the same as those described above for economic impacts) and the definition of small entities. Small communities dominate the affected population with nearly 86 percent of all jurisdictions containing 10,000 or fewer people, and nearly 77 percent of all jurisdictions containing 5,000 or fewer people.

Since the impact thresholds were exceeded only for CPE, we have summarized this measure for small jurisdictions below. As indicated earlier, smaller communities are somewhat more likely to incur these significant impacts. Table IV-4 indicates, however, that the difference between the incidence of impacts in all jurisdictions versus small ones is quite similar. Using the final rule as an example, 1.4 percent of all jurisdictions face significant impacts; similarly, for communities smaller than 10,000, 1.4 percent incur significant impacts; and for communities smaller than 5,000, 1.6 percent incur significant impacts. There is some difference confirming that small communities do incur greater burdens, but the differential

between small and large communities is relatively slight. Further, only a few hundred communities will incur these impacts.

There is a large reduction in the number of significantly impacted small communities from those presented in the RIA. This reduction is a result of the change in assumption regarding the frequency of ground-water monitoring (from semi-annual in the RIA to annual in this addendum). This assumption reflects the flexibility offered to approved states in the rule. If states require more frequent monitoring, the number of significantly impacted small communities increases.

Table IV - 4

Jurisdictions Incurring Significant Impacts
By Size of Community: Final Rule and Limited Option Rule

	All Jurisdictions	Population < 10,000	Population < 5,000	Population < 1,000
Total Jurisdictions	29,017	24,883	22,205	13,211
Final Rule: CPE > 1%	396 (1.4%)	355 (1.4%)	355 (1.6%)	201 (1.5%)
Ltd Opt: CPE > 1%	402 (1.4%)	393 (1.6%)	356 (1.6%)	181 (1.4%)

V. Revised Risk And Resource Damage Results

The changes in the modeling and the regulatory options since the RIA was completed have reduced estimated risk and resource damage for the baseline and regulatory options. This chapter discusses human health risk first and then resource damage for the baseline, the final rule, and the limited option rule. For both risk and resource damage, a summary of the results presented in the RIA precedes our presentation of the revised results. A full discussion of the RIA results can be found in Chapter IX of the RIA. We have also added a section on the frequency of ground-water contamination at landfills.

Health Risk

Health Risk in the RIA

In the RIA, we did not account for any state requirements when computing risk or resource damage. In the baseline, all landfills were assumed to be unlined and to have vegetative covers. The baseline maximum exposed individual (MEI) risk (i.e., risk to a person exposed at the closest well) ranged from zero to about 10^{-4}. About 60 percent of the landfills posed no risk, 54 percent because there were no downgradient wells within one mile and 6 percent because constituents did not reach the nearest well during the modeling period. About 17 percent of landfills posed risk greater than 10^{-6}. The estimated number of cancer cases over the 300-year modeling period, summed for 6,034 facilities, was 23.1. The results presented in the RIA showed that the final rule and limited approach reduced the number of cancer cases by approximately the same amount, 16 cases.

Revised Health Risk

The RIA risk and resource damage results were based on a universe of 6,034 landfills. The number and size distribution of landfills are changing due to regionalization (i.e., construction of larger landfills serving many communities). Although regionalization was addressed in the cost analysis presented in the RIA, it was not taken into account in the risk and resource damage analysis. In this addendum, we present risk and resource damage results using the best estimate of regionalization (3,000 landfills with the following size distribution: 53.5 percent in the 10 TPD category, 35.4 percent in the 175 TPD category, and 11.1 percent in the 750 TPD category). The results also reflect current state requirements as described in Chapter II.

Assuming a universe of 3,000 landfills in compliance with state requirements, the total number of cancer cases in the baseline is 5.7 over 300 years.

Table V-1 summarizes the revised risk results for the baseline, final rule, and limited option for the regionalized universe of 3,000 landfills. The revised number of cancer cases for the final rule is equal to the revised number of cases for the limited option — both have 3.3 cases over 300 years. These are lower than predicted in the RIA.

Table V-1

Revised Risk Reduction
With State Requirements and Regionalization
(3,000 MSWLFs)

Regulatory Scenario	Total Cases In Modeling Period	Cancer Cases Avoided	Percentage Decrease
Baseline	5.7	---	---
Final Rule	3.3	2.4	42.1 %
Limited Option	3.3	2.4	42.1 %

The effectiveness of both regulatory options is also lower than predicted in the RIA. Using the regionalized universe of 3,000 landfills, the number of cancer cases avoided under the final rule and the limited approach drops to 2.4 cancer cases over 300 years. The percentage decrease in risk is 42 percent, lower than the 68 to 70 percent reduction predicted in the RIA.

The final rule now results in 0.8 percent of landfills having risks exceeding 10^{-5}. About 10.4 percent of landfills have moderate risk (i.e., between 10^{-6} and 10^{-5}), and about 19.9 percent of landfills have low risk (i.e., between 10^{-8} and 10^{-6}).

The limited option rule results in 1.3 percent of landfills with risks exceeding 10^{-5}. About 9.4 percent of landfills have moderate risk (i.e., between 10^{-6} and 10^{-5}), and about 19.7 percent of landfills have low risk (i.e., between 10^{-8} and 10^{-6}).

Analysis of Changes in Risk from the RIA

Incorporating existing state regulations into the baseline results in a significant decrease in the estimated number of cancer cases. This is simply because landfills with more protective designs pose lower human health risks. The number of cancer cases also decreases when we incorporate regionalization into the baseline; this is because there are fewer landfills (3,000 as opposed to 6,034).[6]

The decrease in risk reduction for the final rule and limited option can be attributed primarily to the assumption regarding the effectiveness of state regulations in controlling baseline risk, particularly at the higher risk landfills. In the revised baseline, over half of the landfills are assumed to have the composite/synthetic design; because nothing more stringent is imposed by either the final rule or the limited approach, there is no potential for additional risk reduction at these landfills. State regulations also reduce baseline risk for the approximately 4 percent of landfills that trigger corrective action in the baseline.

As discussed in the methodology section, the reduction in effectiveness of the regulatory options is in no way attributable to the new exemption for small landfills in dry climates. Because in EPA's modeling these landfills never exceed MCLs at the compliance point, neither the final rule nor the limited option would have imposed more stringent designs or corrective action on these landfills.

Resource Damage

Resource Damage in the RIA

In the RIA, baseline resource damage at landfills ranged from $0 to more than $4 million. (All results were expressed as present values.) The RIA reported that 71 percent of landfills had resource damage, with only 31 percent of landfills having resource damage exceeding $200,000. About 13 percent of landfills had resource damage in excess of $1 million. The total resource damage for both use and option value, summing across 6,034 landfills, was about $2.6 billion. The results presented in the RIA indicated that all regulatory options reduced resource damage from baseline levels (a reduction of $1.7 billion

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[6]Comparing the revised baseline risks with and without regionalization shows that the risk distribution actually shifts towards the higher risk range with regionalization. This is because the larger landfills comprise a larger portion of the universe under the regionalization scenario. Because regionalization results in far fewer landfills, however, the number of people exposed is lower and therefore the number of cancer cases is lower.

or 67 percent for the final rule; and a reduction of $970 million or 38 percent for the limited approach).

Revised Resource Damage

Because of the assumptions adopted since the RIA was completed (i.e., compliance with state credits, regionalized universe of 3,000 landfills), estimated resource damage in the baseline decreases from the $2.6 billion reported in the RIA to $560 million.

Table V-2 summarizes the new results for the baseline, final rule, and limited option for the regionalized universe of 3,000 landfills. Total resource damage decreases to $290 million under the final rule. The resource damage avoided under the final rule is now $270 million (48 percent reduction from the baseline). Total resource damage decreases to $440 million for the limited option. The resource damage avoided under the limited approach is now $120 million (22 percent reduction).

Table V-2

Revised Resource Damage Reduction
With State Requirements and Regionalization
(3,000 MSWLFs; Present Value)

Regulatory Scenario	Total Resource Damage	Resource Damage Avoided	Percentage Decrease
Baseline	$560	----	----
Final Rule	$290	$270	48 %
Limited Option	$440	$120	22 %

The revised results for the final rule show that 1.0 percent of landfills have resource damage exceeding $1 million. About 87 percent of landfills have resource damages below $200,000. The revised results for the limited option show that 3.3 percent of landfills have resource damage exceeding $1 million. The share of landfills with resource damages below $200,000 is 83 percent.

Analysis of Changes in Resource Damage Reduction from the RIA

As with risk, incorporating existing state regulations into the baseline results in a significant decrease in total resource damage for both the baseline and regulatory options. Again, this is because more landfills have more protective designs as a result of state requirements, and landfills with more protective designs have lower resource damage. Regionalization reduces total resource damage even further because there are fewer landfills.

The decrease in the effectiveness of the final rule and limited option rule can be attributed to the effectiveness of state regulations in controlling baseline resource damage. For landfills with the composite/synthetic design in the baseline, nothing more stringent is required by the regulatory options, so there is no potential for additional resource damage reduction. State regulations also reduce baseline resource damage very effectively for the approximately 4 percent of landfills that trigger corrective action in the baseline.

As discussed in the methodology section, the reduction in effectiveness of the regulatory options is in no way attributable to the new exemption for small landfills in dry climates. Because in EPA's modeling these landfills never exceed MCLs at the compliance point, neither the final rule nor the limited option would have imposed more stringent designs or corrective action on these landfills.

Ground-Water Contamination

The RIA and addendum measure the impacts of ground-water contamination in terms of human health risks and drinking water supply replacement costs. Both of these measures depend largely on the presence of drinking water wells near the landfill. If there are no downgradient drinking water wells, people are not exposed to ground-water contamination and there is no current risk.

In Figure V-1, we compare the cumulative frequency of average baseline risk (for a regionalized universe of 3,000 landfills in compliance with state requirements) (1) at the assumed exposure well distribution, and (2) at a hypothetical well 10 meters from each landfill. Figure V-1 reveals that the well distance distribution has a profound effect on baseline risk:

- While about 2.2 percent of landfills have risks exceeding 10^{-5} assuming the actual well distribution, about 19.1 percent exceed this risk level at the 10-meter well.

- About 12.2 percent of landfills have risks higher than 10^{-6} assuming the actual well distribution, compared to about 52.6 percent at the 10-meter well.

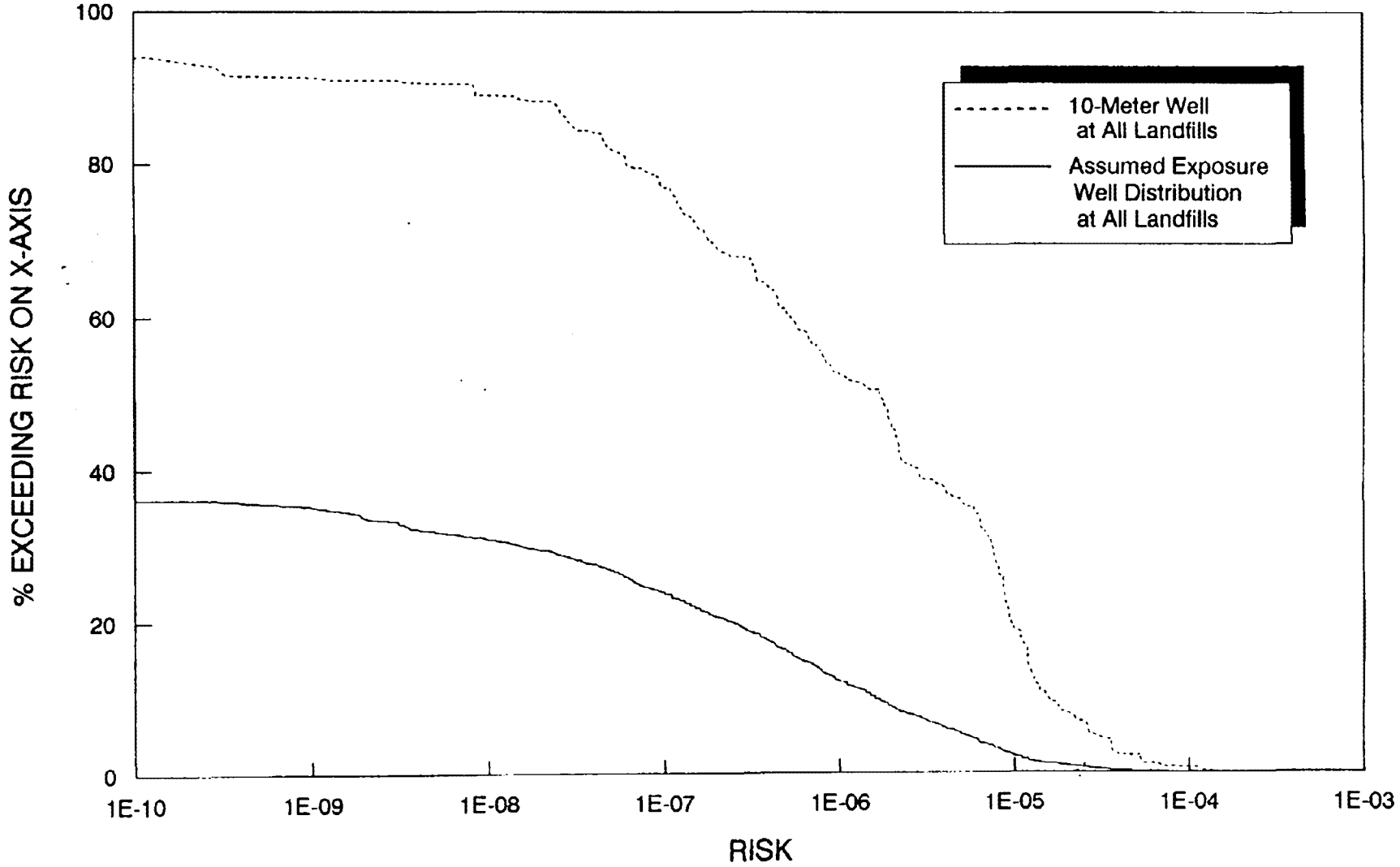
Therefore, although only one out of eight landfills pose MEI risks greater than 10^{-6} at existing wells, ground water near the waste management boundary is being contaminated at levels high enough to pose risks greater than 10^{-6} at over half of all landfills.

The resource damage results also show a high frequency of occurrence of ground-water contamination at landfills. The percentage of landfills with resource damage in the baseline (assuming a regionalized universe of 3,000 landfills in compliance with state requirements) is 62.6. This means that nearly two out of three landfills would be expected to pollute ground water above drinking water MCLs, taste and odor thresholds, or 10^{-6} risk levels.

FIGURE V-1

CUMULATIVE FREQUENCY OF AVERAGE RISK IN BASELINE

3,000 LANDFILLS IN COMPLIANCE WITH STATE REQUIREMENTS



VI. Additional Benefits

In addition to the risk and resource damage analyses, EPA believe there may be several additional benefits which could accrue to the regulatory options. The Agency believes all benefits, quantified and unquantified, should be considered when comparing various rule options.

Increased Public Confidence

EPA believes that providing federal criteria which prevent ground-water contamination above drinking water standards will increase public confidence in landfills. Furthermore, EPA believes that with an increase in public confidence, local officials will find it somewhat easier to site new landfills. This increased confidence will translate, for a portion of new landfills, into fewer sites needing costly, detailed site evaluation, and therefore less time will be necessary to complete the siting process. Through its reliance on protecting groundwater, the final rule will provide these benefits. The benefits of expediting siting could translate into a potential savings to local municipalities of up to $84 million per year.[7] EPA does not expect that the limited approach, which allows contamination to occur, will result in similar benefits in this area.

Protection of Property Value

Property value studies of households located near waste sites indicate that property values can be adversely affected when ground-water contamination is discovered.[8] The studies reviewed by EPA varied in methodology and complexity, types of factors studied, and types of waste sites considered. However, the majority found property value reductions for households located within three to four miles of the waste sties; the reductions ranged from an average of $300 to $15,000 per household. The extent of property value loss depends on a variety of factors including proximity to the site and initial property value. Further, it is

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[7] For an explanation of the methodology for the estimate, see June 14, 1991 draft letter from Don Clay to James B. MacRae, Jr. This letter can be found in the docket to the final criteria.

[8] Ibid.

difficult to separate the effect of ground-water contamination from other disamenities (e.g. noise or appearance) when considering property value changes. While EPA has not conducted a specific property value study regarding municipal landfills, EPA believes these studies indicated that property value loss is a very real effect from landfill contamination of groundwater.

The final rule will prevent ground water contamination. Thus, the potential benefits (avoided property value loss) of the final rule could fall within this range of $300 to $15,000 per household near landfills which would otherwise contaminate groundwater above drinking water standards. Because the limited option allows contamination to occur, significant benefits in this area would not accrue to this option.

Existence and Bequest Values

Literature on natural resource economics also indicates that people place a value on and are willing to pay for protecting resources even if they neither live near the resources nor plan to use them in their lifetime. This value is motivated by several beliefs, including the conservation ethic, and is reflected in public support for programs to protect groundwater, despite water replacement alternatives. This value is often referred to as existence value. In addition, the literature describes a second value people place on knowing they are passing pristine resources onto future generations, often referred to as a "bequest value."

EPA has not traditionally quantified these benefits in RIAs for past RCRA regulations. However, existence and bequest values are receiving increasing attention within the economic community. EPA believes that the existence value and bequest value benefits under the final rule (which protects ground-water resources) may be substantial. The limited approach will accrue these benefits only to the extent that corrective action is conducted upon discovery of contamination, and is successful at returning a contaminated aquifer to drinking water standards.

Encouraging Responsible Waste Management Practices

Improved waste management practices may also result from the revised criteria. First, there is concern about minimizing intergenerational inequities -- reducing the need for future generations to pay for costly cleanup of closed landfills (i.e., ensuring that today's generations pay for today's waste disposal). Second, there is an increasing emphasis on alternative waste management practices such as resource conservation through source reduction and recycling. EPA believes that the final rule, through its recognition of the true cost of safe waste disposal, will reduce financial burdens on future generations and encourage source reduction and recycling.

VII. Net Benefits

This chapter compares estimated costs and benefits for a hypothetical set of new landfills as described in Chapter X of the RIA. This comparison also illustrates the difficulty of interpreting these estimates because only some of the benefits are quantifiable.

Summary of Benefits

Benefits that were quantified are described in Chapter V and include risk reduction and resource damage reduction; the unquantified benefits described in Chapter VI include increased public confidence, protection of property value, existence and bequest values, and encouragement of resposible waste management practices. A summary of these benefit estimates is shown in Table VII-1:

Table VII-1

Summary of Benefits
With State Requirements and Regionalization

(3,000 MSWLFs)

Regulatory Scenario	Risk Reduction (Cases Avoided)	Resource Damage (Present Value Avoided)	Other Benefits (see Chapter VI)
Final Rule	2.4	$270 million	?
Limited Option	2.4	$120 million	?

Assuming a universe of 3,000 landfills in compliance with state requirements, the number of cancer cases avoided from the baseline for both the final rule and limited option rule is the same, about 2.4 cases avoided over 300 years. The revised resource damage avoided under the final rule is now $270 million, and under the limited option rule, the resource damage avoided is $120 million. As described in the RIA, these quantified benefit estimates are not additive; they are alternative measures of benefits that focus on different effects. Finally, the

unquantified benefits should be added to either human health risk or resource damage benefits to compute total benefits.

Net Benefits

Human Health Risk

Table VII-2 presents the incremental number of cases avoided (cases under the baseline minus cases under the final rule and limited option rule) and the incremental present value cost for each of the regulatory options for one set of new landfills. The incremental present value cost estimates include state requirements, regionalization, and the small community exemption.

Table VII-2

Comparison of Costs and Cases Avoided

(One Set of New Landfills; 300-Year Period)

Regulatory Scenario	Risk Reduction (Cases Avoided)	Incremental Cost (Present Value)
Final Rule	2.4	$5,770 million
Limited Option	2.4	$2,670 million

Resource Damage

Table VII-3 compares the quantified benefits using resource damage with the costs for the two regulatory options. The calculation of resource damage reduction reflects one set of new landfills as does the cost; the incremental present value cost estimates include state requirements, regionalization, and the small community exemption.

Table VII-3

Comparison of Costs and Resource Damage Avoided

(One Set of New Landfills; 300-Year Period)

Regulatory Scenario	Resource Damage Reduction (Present Value)	Incremental Cost (Present Value)
Final Rule	$270 million	$5,770 million
Limited Option	$120 million	$2,670 million

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

This analysis represents EPA's best efforts to quantify the costs, economic imapacts and benefits (health risk and resource damage) of the regulatory options. It should be noted, however, that as in any analysis, the results are necessarily based upon incomplete data and on simplified assumptions. A discussion of limitations of the analyses is included in the RIA.

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