The attached Economic Assessment has been slightly revised to reflect a calculation error. These changes were made in section 4.7.

FINAL REPORT

Economic Assessment of the Association of Battery Recyclers Proposed Rule

Prepared for:

U.S. Environmental Protection Agency,
Office of Solid Waste and Emergency Response
Economics, Methods and Risk Analysis Division
401 M Street S.W.
Washington, D.C. 20460

Prepared by:

DPRA Incorporated
332 Minnesota Street, Suite E-1500
St. Paul, Minnesota 55101

June 27, 2003

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

Appendix A	Co-Proposal Option for the Regulatory Modification to the Definition of Solid Waste for the Association of Battery Recyclers Notice of Proposed Rulemaking
Appendix B	Review of Recycled Waste Quantities by Manufacturing Industries
Appendix C	Limitation on Use of Reclaimed Product
Appendix D	Memorandum: Recoverable Waste Type Analysis for the Economic Assessment of the Association of Battery Recyclers Proposed Rulemaking
Appendix E	Memorandum: Analysis of Market Changes between 1997 and 1999
Appendix F	State Hazardous Waste Generation Taxes and Fees
Appendices G through V	Example Cost Calculations
Appendix W	Methodology for Estimating Residual Generation and Management
Appendix X	Analysis of Metals Containing and Organic Liquid Disposal Quantities

1.0 EXECUTIVE SUMMARY

Under the current Resource Conservation and Recovery Act (RCRA) regulations, secondary materials (i.e., materials that are neither classified as virgin materials nor primary materials) may be solid wastes and also hazardous wastes when recycled depending on the type of material (e.g., sludge, spent material, or byproduct) and the type of recycling (e.g., burning for energy recovery, use constituting disposal, and reclamation). Currently, the Environmental Protection Agency (EPA) is revising these regulations to respond to concerns articulated in the U.S. D.C. Circuit Court of Appeals decisions concerning the Agency's legal authority to regulate certain secondary materials being recycled under RCRA. The most recent in a series of D.C. Circuit decisions addressing RCRA jurisdiction over secondary materials being recycled is *Association of Battery Recyclers, Inc., et al., Petitioners vs. U.S. Environmental Protection Agency* No. 98-1368, April 21, 2000 (ABR). The Court held in ABR that EPA could not regulate secondary materials from the mineral processing industry under RCRA that are stored on land for any period of time. The Court reasoned that EPA had not demonstrated that such materials are "discarded" within the statutory meaning of the term. The Court vacated the regulatory language in 40 CFR 261.4(a)(17) that established RCRA jurisdiction over these materials. Finally, the Court expressed displeasure that EPA had again classified materials as "solid wastes" for its Subtitle C regulatory program that were not discarded, but rather "destined for reuse or recycling in a continuous process by the generating industry itself."

EPA is revising its definition of solid waste regulations in response to the series of D.C. Circuit opinions. These revised regulations will change how certain secondary materials (i.e., spent materials, listed sludges and listed byproducts) being recycled are classified under the Subtitle C regulatory program. In response to these regulatory changes, some RCRA regulated entities who currently recycle secondary materials will realize cost savings from the change. Other RCRA regulated entities who currently land dispose, incinerate, or recover energy from hazardous waste will be induced to recycle their waste to obtain lower material management costs resulting from the change in regulatory jurisdiction.

Executive Order No. 12866 requires that regulatory agencies determine whether a new regulation constitutes a significant regulatory action. The Agency is proposing to exclude from RCRA jurisdiction, all hazardous secondary materials recycled in a continuous process within the generating industry. This extends to both recycling done on site as well as recycling completed off site from the generating facility when the off-site facility is in the same generating industry as the facility that generated the material. The estimated costs and potential economic impacts of this proposal to exclude recovered materials if reclaimed on site or off site within the same Industry Group (i.e., 4-digit North American Industry Classification System (NAICS)) indicate this action is not a significant regulatory action as defined by the Executive Order. The action will result in a potential savings to generators of $178 million annually and will have an decreased annual effect on the economy of $100 million or more. The rule does not have an adverse affect on the economy, a sector of the economy, productivity, competition, jobs, the environment, health or public safety.

No action is not considered to be a desirable option. The D.C. Circuit decisions allow waste generators to argue that some of the Subtitle C recycling rules exceed EPA's jurisdiction by classifying materials that have not been "discarded" as "wastes." Defendants in enforcement actions brought by EPA as well as actions brought by authorized States and citizens could raise these arguments. EPA might not be a party in some of these suits and, thus, might not be able to present its views. EPA prefers to address these issues in a national rulemaking rather than on an ad hoc, case-by-case basis. The main regulatory option considered by the Agency in order to conform with the Court's decision is to exclude wastes that are reclaimed either on site or at an off site facility within the same Industry Group from RCRA jurisdiction.

Currently under RCRA, spent materials, listed sludges, and listed by-products are solid wastes if reclaimed (40 CFR 261.2(a)(3)), while, sludges and by-products exhibiting a characteristic of hazardous waste are not solid wastes. The proposed regulation would exclude the former group of materials from the definition of solid waste if they are reclaimed on site or off site within the same industry group (4-digit NAICS code).

A total of 1,749 plants recovering approximately 1,570,000 tons either on site or within the same Industry Group may benefit from the exclusion from RCRA jurisdiction. Metals recovery, solvents recovery, and other recovery account for 678,000 tons, 280,000, and 613,000 tons, respectively. The plant counts and quantities will be higher if small quantity generators are included.

Excluding metal, solvent, and other wastes that are reclaimed on site or within the same Industry Group from the Definition of Solid Waste will make it more economical for generators and within- industry off-site reclaimers to recover the values from these wastes. Savings to generators are expected to result from several factors. First, generators will benefit from reduced manifesting, pre-transport, and record keeping and reporting requirements under 40 CFR Part 262 of RCRA. Second, given that the excluded quantities are no longer considered hazardous if recovered, the generator status of the facility may switch from being a large quantity generator to a small or conditionally exempt small quantity generator. Small and conditionally exempt small quantity generators have fewer administrative requirements than large quantity generators under Part 262 of RCRA. Finally, if wastes are no longer considered a listed hazardous waste if reclaimed either on site or within the same Industry Group, residuals from the recovery processes may no longer be hazardous under the "Derived-from Rule." The management of these residuals may shift from Subtitle C to Subtitle D disposal if they do not test characteristically hazardous. In addition, with the wastes no longer being defined as hazardous waste if recovered, generators (firms) may no longer need to pay hazardous waste generation taxes and fees. Reductions in hazardous waste taxes and fees are not social cost savings, but, a reduction in transfer costs to States. Reductions in taxes and fees may influence the individual firm's waste management decisions (e.g., reclamation) and are included when appropriate in the analysis. Table 1-1 presents the cost savings and costs for generators recovering wastes on and off site. Total cost savings are estimated to be $178 million per year. For facilities recovering waste on site and within the same industry group, total cost savings are estimated to be approximately $34 million per year ($27 million for on-site recovery facilities and $7 million for facilities recovering within the same industry group). Approximately $63 million per year in additional cost savings are included for generators who currently recover wastes off site outside their industry group now finding it more economical to construct on-site recovery facilities post rule. A break-even cost estimate was conducted to determine if it was economically feasible for these generators to recover their waste on site. In addition, approximately $80 million per year in additional cost savings are included for generators who currently dispose five selected waste types now finding it more economical to construct on-site recovery facilities post rule. A break-even cost estimate was conducted to determine if it was economically feasible for these generators to recover their waste on site

For reclaimers, savings are expected to result from no longer needing to renew their RCRA container storage and tank storage permits. The number of within- industry off-site reclaimers impacted by the proposed regulations has not been determined. The estimated savings from not renewing RCRA permits ranges from $14,953 to $29,906 every 10 years for metal reclaiming facilities. For facilities reclaiming solvents or acids, the estimated savings ranges from $14,786 to $29,573 every 10 years. This barrier will no longer exist for those generators making the decision to reclaim wastes on site.

Annualized cost savings for affected facilities vary greatly depending upon the amount of waste recycled and whether the amount recycled represents 100 percent of their total waste. In cases where the waste recycled is equivalent to all waste generated, the total savings is greater because of the elimination of nearly all administrative costs associated with RCRA regulations. Because of these variations impacts were examined for average facilities in terms of sales volumes and cost savings. Cost reductions as a percent of total sales were no more than 0.1 percent for the major industries examined. Impacts in terms of profitability increases were estimated to range from approximately 0.2 to over 2.9 percent.

Additionally, increased reclamation of metal, solvent and other waste will result in a net benefit to both society and the environment. Some of the expected potential benefits include lessening the future burden on landfill capacity; conserving scarce metal resources which provides environmental benefits in terms of energy savings, reduced volumes of waste, reduced disturbances to land, and reduced pollution; and lessening the dependance of the United States on foreign metal supplies and increasing recovery of strategic metals such as chromium.

The total estimated recovered metal value is $590 million. Plants affected by this rulemaking reported recovering 597,000 tons of metal-bearing waste. Assuming that these wastes contain 20 percent recoverable metals valued at an average of $4,770 per ton (the average price for copper, chromium, and nickel), the estimated metal value for total recovery is nearly $569 million per year. This proposed rule encourages these plants to continue recovering these metals and maintaining these benefits. Additionally facilities will be encouraged to recycle additional wastes as a result of the rule. As a proxy for this effect it was assumed that facilities that reported recovering wastes in 1997 but not in 1999 would resume recycling as a result of the rule. Based on this scenario over 3,000 tons of metal bearing waste would be recovered, with an expected value of approximately $2.9 million per year. In addition, facilities that dispose three waste types (48,235 tons of emission control dust - K061, 19,108 tons of metal-containing liquids from the printed circuit board industry, and 10,869 tons of spent catalyst from the petroleum refining industry - K171/K172) were estimated to find it more economical to switch to on-site recovery post rule and be of sufficient quality for recovery. In the analysis, it is assumed that recovered emission control dust wastes contain 15 percent recoverable zinc at $643 per ton of zinc, metal-containing liquids contain 0.02 percent copper at $1,397 per ton of copper, and spent catalysts contain five percent molybdenum at $23,940 per ton of molybdenum. The estimated metal value from these disposed wastes is $17.7 million. This proposed rule may encourage these new benefits.

The total estimated recovered solvent value is $290 million. The rule will affect the current recovery of approximately 268,000 tons of solvent waste valued at over $277 million. Further the rule will encourage additional recycling. As described above, a proxy for this effect is the assumption that facilities that reported recovering wastes in 1997 but not in 1999 would resume recycling as a result of the rule. The incremental recovery of solvent given this assumption is nearly 12,000 tons of solvent with a total value of almost $13 million per year.

The total estimated recovered acid and fluoride value is $122 million. The rule will affect the current recovery of approximately 270,000 tons of acid wastes valued at $60 million. Further the rule will encourage additional recycling. As described above, a proxy for this effect is the assumption that facilities that reported recovering wastes in 1997 but not in 1999 would resume recycling as a result of the rule. The incremental recovery of acid given this assumption is nearly 17,000 tons of acids, with a total value of almost $3.7 million per year. In addition, facilities that disposed two waste types (71,698 tons of spent aluminum potliner, K088, and 254,109 tons of spent pickle liquor from the steel works industry) were estimated to find it more economical to switch to on-site recovery post rule and be of sufficient quality for recovery. In the analysis, it is assumed that these recovered spent aluminum potliner wastes contain two percent recoverable fluoride at $1,240 per ton and the spent pickle liquor contains 74 percent recoverable acids at $298 per ton. The estimated metal value from these disposed wastes is $57.8 million. This proposed rule may encourage these new benefits.

Table 1-1. Estimated Incremental Costs for Generators Reclaiming Wastes On Site, Reclaiming Wastes Off Site Within Industry Group, Shifting from Off-Site Reclamation Outside Industry Group to On Site Reclamation, and Shifting from Disposal to On-Site Reclamation by Cost Item (2002$/year)	
Cost Item	**Estimated Incremental Costs**
On-Site Reclamation	
Waste Reclamation and Residual Management	($1,222,000)
Waste Characterization Testing	($3,729,000)
Manifesting	($575,000)
Loading	$153,000
Salvage Revenue	($16,898,000)
Hazardous Materials Training	($3,392,000)
Manifest Training	($521,000)
BRS/General Administrative Duties	($615,000)
One-Time Contingency Planning	($1,018,000)
One-Time Notification of Exclusion	$704,000
On-site Reclamation Subtotal	**($27,113,000)**

Table 1-1. Estimated Incremental Costs for Generators Reclaiming Wastes On Site, Reclaiming Wastes Off Site Within Industry Group, Shifting from Off-Site Reclamation Outside Industry Group to On Site Reclamation, and Shifting from Disposal to On-Site Reclamation by Cost Item (2002$/year)	
Cost Item	**Estimated Incremental Costs**
Off-Site Reclamation Within Industry Group	
Waste Reclamation and Residual Management	($931,000)
Waste Characterization Testing	($418,000)
Manifesting	($114,000)
Loading	$328,000
Recovery Transportation	($1,274,000)
Salvage Revenue	($4,439,000)
Hazardous Materials Training	($426,000)
Manifest Training	($76,000)
BRS/General Administrative Duties	($79,000)
One-Time Contingency Planning	($124,000)
One-Time Notification of Exclusion	$188,000
Off-site Reclamation Within Industry Group Subtotal	**($7,365,000)**

Table 1-1. Estimated Incremental Costs for Generators Reclaiming Wastes On Site, Reclaiming Wastes Off Site Within Industry Group, Shifting from Off-Site Reclamation Outside Industry Group to On Site Reclamation, and Shifting from Disposal to On-Site Reclamation by Cost Item (2002$/year)	
Cost Item	**Estimated Incremental Costs**
Shifting from Off-Site Reclamation Outside Industry Group to On-Site Reclamation	
Waste Reclamation and Residual Management	($43,422,000)
Waste Characterization Testing	($15,265,000)
Manifesting	($2,352,000)
Loading	$1,077,000
Recovery Transportation	($2,003,000)
Salvage Revenue	$0
Hazardous Materials Training	($728,000)
Manifest Training	($132,000)
BRS/General Administrative Duties	($139,000)
One-Time Contingency Planning	($209,000)
One-Time Notification of Exclusion	$90,000
Shifting from Off-Site Reclamation Outside Industry Group to On-Site Reclamation Subtotal	**($63,083,000)**

Table 1-1. Estimated Incremental Costs for Generators Reclaiming Wastes On Site, Reclaiming Wastes Off Site Within Industry Group, Shifting from Off-Site Reclamation Outside Industry Group to On Site Reclamation, and Shifting from Disposal to On-Site Reclamation by Cost Item (2002$/year)	
Cost Item	**Estimated Incremental Costs**
Shifting from Disposal to On-Site Reclamation	
Waste Disposal, Reclamation and Residual Management	$18,080,500
Waste Characterization Testing	($22,893,000)
Manifesting	($3,527,000)
Loading	$1,762,000
Recovery Transportation	$0
Salvage Revenue	($73,026,000)
Hazardous Materials Training	($385,000)
Manifest Training	($41,000)
BRS/General Administrative Duties	($66,000)
One-Time Contingency Planning	($142,000)
One-Time Notification of Exclusion	$135,000
Shifting from Disposal to On-Site Reclamation Subtotal	**($80,102,500)**
Total Incremental Costs	**($177,663,500)**

Table 1-1. Estimated Incremental Costs for Generators Reclaiming Wastes On Site, Reclaiming Wastes Off Site Within Industry Group, Shifting from Off-Site Reclamation Outside Industry Group to On Site Reclamation, and Shifting from Disposal to On-Site Reclamation by Cost Item (2002$/year)	
Cost Item	**Estimated Incremental Costs**
Estimated Reduction in State Government Program Rents from Reduced Hazardous Waste Tax Collection for Each Category of Generators (2002$/year)	
On-site Reclamation	($2,118,000)
Off-site Reclamation Within Industry Group	($32,000)
Off-Site Reclamation Outside Industry Group Switching to On-Site Reclamation	($172,000)
Off-Site Disposal Switching to On-Site Reclamation	($4,651,000)
Total State Tax Costs	($6,973,000)
Note: Numbers in parentheses, "( )", represent negative costs that reflect revenues or cost savings.	

2.0 INTRODUCTION

Under the current Resource Conservation and Recovery Act (RCRA) regulations, secondary materials (i.e., materials that are neither classified as virgin materials nor primary materials) may be solid wastes and also hazardous wastes when recycled depending on the type of material (e.g., sludge, spent material, or byproduct) and the type of recycling (e.g., burning for energy recovery, use constituting disposal, and reclamation). Currently, the Environmental Protection Agency (EPA) is revising these regulations to respond to concerns articulated in a series of decisions by the U.S. D.C. Circuit Court of Appeals concerning the Agency's legal authority to regulate, as hazardous wastes, certain secondary materials being recycled under RCRA. The most recent D.C. Circuit decision addressing RCRA jurisdiction over secondary materials being recycled is *Association of Battery Recyclers, Inc., et al., Petitioners vs. U.S. Environmental Protection Agency* No. 98-1368, April 21, 2000 (ABR). The Court held in ABR that EPA could not regulate secondary materials from the mineral processing industry under RCRA that are stored on land for any period of time. The Court reasoned that EPA had not demonstrated that such materials were"discarded" within the statutory meaning of the term. The Court vacated the regulatory language in 40 CFR 261.4(a)(17) that established RCRA jurisdiction over these materials. Finally, the Court expressed displeasure that EPA had again classified materials as "solid wastes" for its Subtitle C regulatory program that were not discarded, but rather "destined for reuse or recycling in a continuous process by the generating industry itself."

EPA is revising its definition of solid waste regulations in response to the series of D.C. Circuit opinions. These revised regulations will change how certain secondary materials (i.e., spent materials, listed sludges and listed byproducts) being recycled are classified under the Subtitle C regulatory program. In response to these regulatory changes, some RCRA regulated entities who currently recycle secondary materials will realize cost savings from the regulatory change. Other RCRA regulated entities who currently land dispose, incinerate, or recover energy from hazardous waste will be induced to recycle their waste to obtain lower material management costs resulting from the change in RCRA regulation.

The Agency is proposing to exclude from RCRA jurisdiction, all hazardous secondary materials recycled in a continuous process within the generating industry. This extends to both recycling done onsite as well as recycling completed off-site from the generating facility when the off-site facility is in the same generating industry as the facility that generated the material. This economic assessment presents a cost and economic impact analysis corresponding to the rule to exclude metal, solvent, and other wastes (e.g., acid) from the Definition of Solid Waste if reclaimed on site or within the same Industry Group (4-digit NAICS code). The expected effect of this regulatory modification include conformity with the D.C. Circuit Court opinion and increased reclamation of values from metal, solvent and other wastes on site or within the same Industry Group.

Executive Order No. 12866 (58 FR 51735, October 4, 1993) requires that regulatory agencies determine whether a new regulation constitutes a significant regulatory action. A significant regulatory action is defined as an action likely to result in a rule that may:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in Executive Order 12866.

This analysis is designed to address the first and third factors listed above. To accomplish this, EPA estimated the costs and potential economic impacts of this regulatory modification on generators of metal, solvent and other wastes recovered either on site and off site within the same industry group; generators who will find it more economical to recover these wastes on site instead of at facilities outside their industry group; generators who will determining it more economical to recover these wastes on site instead of primarily off site disposal; and State hazardous waste program budgets from reduced rents collected through taxes and fees to determine if it is a significant regulatory action as defined by the Executive Order.

2.1 Purpose

Metal-bearing, solvent, and other (e.g., acids and waste oils) wastes are currently being reclaimed for their values. The purpose of this rule is to revise the Definition of Solid Waste regulations in response to a series of decisions by the U.S. D.C. Circuit Court of Appeals addressing the Agency's legal authority to regulate secondary materials being recycled under RCRA. This economic assessment evaluates the costs and benefits of relieving particular regulatory burdens on generators and within-industry off-site reclaimers of these wastes. EPA is proposing to allow metal-bearing, solvent and other types of waste that are reclaimed either on site or off site within the same Industry Group (4-digit NAICS code) be excluded from the Definition of Solid Waste under RCRA.

This analysis estimates how generators reclaiming their waste and within- industry off-site reclaimers may economically benefit from the regulatory modification. Estimates of the cost effects of the regulation were determined on both a model-plant and industry-wide basis.

2.2 Scope of Study

The scope of the study is an assessment of the potential impacts that will be borne by the industries that recover metal, solvent and other types of waste either on site or off site within the same industry group (4-digit NAICS code).

Data from the 1999 and 1997 Biennial Reporting System (BRS) databases were used to complete this analysis. A total of 1,749 plants recovering approximately 1,408,000 tons either on site or within the same Industry Group may benefit from the exclusion from RCRA jurisdiction. These totals include plants that recovered wastes off site outside their Industry Group where it was determined it was economically feasible to construct an on-site recovery facility. The total also includes five waste types currently disposed where it was determined it is economically feasible to constuct an on-site recovery facility and the waste itself was of sufficient quality for recovery.

Industries most heavily impacted by this proposed rule include basic chemical manufacturing (NAICS 3251), nonferrous metal (except aluminum) production and processing (NAICS 3314), steel product manufacturing from purchased steel (NAICS 3312), pharmaceutical and medicine manufacturing (NAICS 3254), paint, coating, and adhesive manufacturing (NAICS 3255), sawmills and wood preservation (NAICS 3211).

It should be noted that small quantity generators (SQGs, i.e., generators who generated less than 1,000 kilograms of hazardous waste in a calendar month) are not required to complete a Biennial Report. Therefore, the BRS data used in this analysis under represents the total number of plants, affected by the rule.

The main regulatory option will allow generators of metal, solvent, and other types of waste being reclaimed either on site or off site within the same industry group to be excluded from the Definition of a Solid Waste and RCRA jurisdiction. The Main Option is the subject of the main report. Other regulatory options considered are presented in Appendix A, B and C.

Appendix A presents a Co-Proposal Option. Under the Co-Proposal Option hazardous wastes will be excluded from RCRA jurisdiction if the hazardous wastes shipped off site for recovery are transferred within the same industry group (4-digit NAICS code) and the recovery facility does not recover wastes from other (multiple) industry groups. For example if a primary lead smelter receives refractory brick for recovery from other mineral processing industries and lead acid batteries from another industry they would not be granted the exclusion from RCRA. If the primary lead smelter elects to no longer receive the lead acid batteries for recovery they would be granted the exclusion given that all transfers would now be within the same industry.

Appendix B presents the Manufacturing Sector Option. Under this option only reclaimed wastes in the manufacturing sector (NAICS codes 31 through 33) will be granted the exclusion from the Definition of Solid Waste.

Appendix C presents the Restricted Product Use Option. Under this option the recovery material has to be the primary good (i.e., main product) manufactured by that industry to be granted the exclusion from the Definition of Solid Waste.

2.3 Organization of Report

The remainder of this report is divided into seven sections. Section 3 presents the analytical methodology, data collection methodology, and limitations of the analysis. Section 4 presents the total hazardous waste generation and reclamation practices impacted by the proposed rule. Section 5 presents the cost impact analysis of the proposed regulation. Section 6 documents the economic impacts. Section 7 summarizes the potential qualitative benefits of the regulation. Section 8 presents the references used in the analysis.

3.0 METHODOLOGY AND LIMITATIONS

3.1 Analytical Methodology

This economic assessment follows the guidelines spelled out in the Office of Management and Budget, "Economic Analysis of Federal Regulations Under Executive Order 12866," January 11, 1996. The economic assessment identifies and assesses the costs of the baseline and alternative approach. An estimate of the incremental cost or benefit (cost savings) of the proposed rule is determined based on production cost estimates at a seven percent real discount rate. Finally, an evaluation of the distribution of costs and benefits across populations and industry groups is presented.

3.1.1 Baseline

The baseline is the assessment of the way the world looks absent the proposed regulation.[1] Baseline in this economic assessment is a measure of current reclamation practices and associated administrative burdens under RCRA by generators of hazardous waste. Baseline reclamation practices were determined in this assessment using data reported by large quantity generators of hazardous waste in EPA's 1999 and 1997 Biennial Report databases.

3.1.2 Alternative Approach

The alternative approach (i.e., Main Option) in this assessment, as discussed previously, responds to a series of judicial decisions. **The post-regulatory alternative is to regulate only hazardous secondary materials recycled in a continuous process within the generating industry**. This economic assessment evaluates the costs and benefits of relieving particular regulatory burdens on generators and within-industry off-site reclaimers of these wastes if they are no longer regulated under RCRA Subtitle C if reclaimed. EPA is proposing to allow metal-bearing, solvent and other types of waste that are reclaimed either on site or off site within the same Industry Group (4-digit NAICS code) to be excluded from the Definition of Solid Waste under RCRA Subtitle C. Other alternative approaches considered are presented in Appendix A, B and C.

3.1.3 Cost and Benefit Estimates

Costs are measured as the opportunity cost of the resources used or the benefits forgone or gained as a result of the regulatory action. Opportunity costs include, but are not limited to, private-sector compliance costs and government administrative costs. Opportunity costs also include losses in consumers' or producers' surpluses, discomfort or inconvenience, and loss of time.[2] This economic assessment does not calculate losses in consumers' or producers' surpluses, discomfort or

---

[1] Office of Management and Budget, "Economic Analysis of Federal Regulations under Executive Order 12866," January 11, 1996.

[2] Ibid.

inconvenience. It does estimate reductions in private-sector compliance costs and gains in time from fewer administrative compliance costs.

All costs calculated are incremental. They represent the changes in costs that would occur if the regulatory option is implemented compared to the baseline. Future costs that would be incurred even if the regulation is not promulgated, as well as costs that already have been incurred (sunk costs), are not part of the incremental costs.[3]

Goods and services are valued at their market prices in this economic assessment. Increases or decreases in health and safety risks have not been evaluated to estimate the cost or benefits of these goods that are indirectly traded in markets.

Constant-dollar costs and benefits are discounted to present value to determine overall net benefits of the proposed rule. Benefits and costs are estimated in real dollars (i.e., corrected for inflation). This economic assessment follows the basic guidance on discount rates for regulatory analyses provided in OMB Circular A-94. The seven percent discount rate specified in the guidance approximates the opportunity cost of capital, which is the before-tax rate of return to incremental private investment. This discount rate reflects the rates of return on low yielding forms of capital, such as housing, as well as the higher rates of return yielded by corporate capital.[4]

3.1.4 Distributional Effects

The distributional effects describes the net effects of the regulatory alternative across the population and economy.[5] In this economic assessment certain industrial groups may receive more benefits than other groups because they reclaim more waste. In addition, larger businesses may achieve more benefits than smaller businesses from economies of scale allowing more on-site reclamation and exclusions from the Definition of Solid Waste. Finally, certain states charge hazardous waste generation taxes and fees (i.e., transfer payments). With the proposed regulation to exclude wastes that are reclaimed from the Definition of Solid Waste, these wastes are no longer defined as hazardous waste and thus may not incur a hazardous waste generation tax or fee. As a result, there may be state geographic distributional effects on generators through reduced transfer payments. At the same time, certain state government hazardous waste programs may have reductions in program revenues from collected taxes and fees. Transfer payments are not treated as social costs when estimating the total costs and benefits of the proposed rule because they reflect redistribution of income/wealth and not the social value of a good or service (i.e., resource). State taxes and fees are included in the economic impact analysis.

---

[3] Ibid.

[4] Ibid.

[5] Ibid.

3.2 Data Collection Methodology

3.2.1 Data Source

The U.S. EPA 1999 and 1997 Hazardous Waste Report census of large quantity generators (LQGs) of hazardous waste and RCRA-permitted treatment, storage, and disposal facilities (TSDs) were used to compile a database of all hazardous wastes generated that have the potential to become excluded from RCRA Subtitle C jurisdiction under the proposed rulemaking if the waste is reclaimed. The Hazardous Waste Report is also referred to as the Biennial Report because LQGs of hazardous waste and all TSDs are required to report their hazardous waste generation and management practices every two years. The 1999 and 1997 Biennial Reports were used instead of the 2001 Biennial Report because the 2001 database has yet to be developed.

3.2.2 Methodology for Identifying Within Industry Group (Same 4-Digit NAICS Code) Recovery Management Quantities

The following steps were taken to develop a data sets of same NAICS code hazardous waste recovery in the United States and recovery in other countries:

1. *Initial Data Downloaded from Databases:* 1999 data for all hazardous wastes generated by LQGs and managed on site or off site in metal recovery (M011-M019), solvent recovery (M021-M029), and other recovery (M031-M039) system types were included in the initial database. Metals recovery includes high temperature metals recovery, retorting, secondary smelting, and other metals recovery (e.g., ion exchange, reverse osmosis, and acid leaching). Solvents recovery includes fractionation/distillation, thin film evaporation, solvent extraction, and other solvent recovery. Other recovery includes acid regeneration and other recovery (e.g., waste oil recovery and nonsolvent organics recovery).

   Similar data were downloaded for the 1997 database; however, only those records that reclaimed metal, solvent, or other values in 1997, but, not in 1999 were kept. These facilities may switch back to reclamation given the more favorable economic conditions produced by the proposed regulation given they have reclaimed these wastes in the past.

2. *Exclusion of Origin Code 4 Records from Analysis:* The data were then sorted and all waste streams originating from a transfer location, origin code 4, were eliminated and not included in the database to be used for the rule making to avoid double-counting waste quantities. The definition of origin code 4 is "the hazardous waste received from off site and not recycled or treated on site" (1999 Hazardous Waste Report Forms and Instructions, pg. 13). Tables 3-1 and 3-2 present the total number of records and total on-site and off-site management quantity changes when origin code 4 waste streams were removed from the database. The number of records included in the database went from 18,917 to 14,509 with the exclusion of the origin code 4 records for the 1999 data and from 5,094 to 4,728 for the 1997 data. The total generation quantity does not change because these records reflect wastes

that were received from off site and NOT generated by the facility. The instructions for the 1999 Biennial Report form related to origin code 4 records are not to report the waste being generated. They are only required to report how the waste is managed. Therefore, the on-site and off-site recovery management quantities changed when origin code 4 records were removed.

With the exclusion of origin code 4 records, the on-site recovery management quantity went from approximately 5.5 million tons to 1.9 million tons in the 1999 data and reduced by approximately 1,600 tons in the 1997 data.

Six (6) records accounted for 3.6 million tons of the on-site management quantity reduction in 1999. These records were examined to determine if any reporting or data entry error may have caused these wastes to be erroneously reported as origin code 4 wastes. Of the six origin code 4 records reviewed, 99.9% of the reduction is attributed to one record. The record (EPA ID VA1210020730) indicates 392,745.29 tons of "DNT contaminated wastewater" was generated. Managed totals were reported as 3,589,180 tons by system type M011 (metals recovery) and 392,745.3 tons by system type M081 (biological treatment). In comparison to 1997 BRS Data, the generated total appears correct. However, the M011 system type appears to have been entered in error. Also, the origin code should have been reported as 1, as the waste is managed on site. Of the remaining five records, four records appeared to have erroneous on-site managed totals duplicating reported shipped totals. The erroneous on-site managed totals were removed. The remaining waste stream appears to have been mislabeled as origin code 4 instead of 1, based on comparison to 1997 BRS data and reported managed totals. Adjusting origin code 4 records in the data provides a better data set from which do conduct the economic analysis for this rulemaking.

TABLE 3-1

Summary of 1999 Total Hazardous Waste Metal Recovery, Solvent Recovery and Other Recovery Generation and Management Quantities (Tons)

	Database Including Origin Code 4			Database Excluding Origin Code 4		
Total number of records (waste streams)	18,917			14,511		
Total generation quantity of all records	4,596,678			4,596,678		
On-site recovery management quantity of all records	5,520,660			1,928,745		
Off-site recovery management quantity of all records*	System 1	System 2	System 3	System 1	System 2	System 3
	1,069,065	126,568	34,383	975,763	119,393	34,335

TABLE 3-1

Summary of 1999 Total Hazardous Waste Metal Recovery, Solvent Recovery and Other Recovery Generation and Management Quantities (Tons)

	Database Including Origin Code 4	Database Excluding Origin Code 4

Data Source: 1999 Biennial Report
Origin Code 4: The hazardous waste received from off site and not recycled or treated on site.
Limitation: Only includes quantities generated by large quantity generators.
* Generators can report multiple off-site system types (e.g., System 1, System 2, System 3) used for each waste if needed. A close estimate of the total off-site recovery management quantity is the sum of the three systems.

TABLE 3-2

Summary of 1997 Total Hazardous Waste Metal Recovery, Solvent Recovery and Other Recovery Generation and Management Quantities (Tons)

	Database Including Origin Code 4			Database Excluding Origin Code 4		
Total number of records (waste streams)	5,094			4,728		
Total generation quantity of all records	555,514			555,514		
On-site recovery management quantity of all records	130,705			129,101		
Off-site recovery management quantity of all records*	System 1	System 2	System 3	System 1	System 2	System 3
	146,779	10,591	748	141,360	10,578	748

Data Source: 1997 Biennial Report
Origin Code 4: The hazardous waste received from off site and not recycled or treated on site.
Limitation: Only includes quantities generated by large quantity generators.
* Generators can report multiple off-site system types (e.g., System 1, System 2, System 3) used for each waste if needed. A close estimate of the total off-site recovery management quantity is the sum of the three systems.

3. *Identification of Statistical Outliers for QA/QC:* Following the removal of all appropriate origin code 4 records, an analysis of statistical outliers was conducted on the reported total waste generation, on-site recovery management quantities, and off-site recovery management quantities. Up to six different off-site management locations may have been reported for one waste. The statistical analysis only was conducted on the first three reported off-site

management locations given they comprised nearly all of the reported off site recovery management quantity.

For each generation and management quantity data item (i.e., total generation, on-site management, off-site management system 1, off-site management system 2, and off-site management system 3) the sum, mean, and standard deviation were computed. In a "normal" distribution of the data, two standard deviations above and below the mean quantity capture and account for 95% of the total quantity. The generation and management distributions are not normal, but skewed to the right. However, those records with reported generation or management quantities greater than two standard deviations above the mean were still identified as statistical 'outliers' and subject to QA/QC in this analysis. A 1999 data record was identified as an outlier for the total generation quantity if it exceeded 28,981 tons. On-site management outliers have reported quantities greater than 47,741 tons. Similarly, off-site management system 1, system 2, and system 3 outliers have reported quantities greater than 1,656 tons, 2,067 tons, and 2,397 tons, respectively.

Table 3-3 presents the number of records identified as outliers and the percentage of the total quantity these records represented. In 1999, the 17 total generation outlier records account for 62% of the total generation quantity. The five on-site management outlier records account for 64% of the total on-site management quantity. For the off-site management records there are overlap between management system 1, 2, and 3 quantities exceeding the second standard deviation quantity which explains why 97 records are identified as offsite outliers, while 106 records are indicated in the Table 3-3. Of the total quantity managed off-site, 65% of the total off-site quantity is represented by the outlier records.

For the 1997 data a more abbreviated QA/QC was conducted. All records with total estimated incremental costs between pre- and post-rule exceeding $500,000 were reviewed. A total of 15 records were reviewed.

TABLE 3-3

Identification of 1999 Hazardous Waste Metal Recovery, Solvent Recovery and Other Recovery Generation and Management Outlier Records and Quantities (Tons)

Location/Type of Generation	Total Generation	On-site Management	Off-site Management		
			System 1	System 2	System 3
# Outlier Records Identified	17	5	86	15	5
Sum of Outlier Records Quantity	2,841,423	1,234,293	616,909	85,796	26,769
Sum of All Records Quantity (no origin code 4)	4,596,678	1,928,745	975,762	119,393	34,335
Outlier Quantity as Percentage of Total Quantity	62%	64%	63%	72%	78%
			65% (total for all Off-site Management)		

Data Source: 1999 Biennial Report
Outlier Identification: Included records that are over two standard deviations above the mean.
Note: Analysis excludes records with origin code equal 4 ("the hazardous waste received from off site and not recycled or treated on site")
Limitation: Only includes quantities generated by large quantity generators.

4. *QA/QC of Identified Statistical Outliers:* the outlier records were evaluated for the issues identified below:

- Is there mass balance between the total generation quantity and the quantities managed on and off site?
- Is the reported unit of measure consistent with other waste streams reported in 1999 and in the 1997 Biennial Report?
- For off-site management quantities, did the facility receiving the waste report a similar quantity?
- Did the facility report generating or managing a similar quantity and type of waste in 1999 and in the 1997 Biennial Report?
- Did the facility report a different origin codes in 1999 and in the 1997 Biennial Report?
- Did the facility report a different (non-recovery) system type codes in 1999 and in the 1997 Biennial Report?
- Is the waste stream the result of a new remediation activity or one-time generation activity?

If the reported generation and management quantities were not grossly different (i.e., within a factor of two), the reported quantities were not modified. Tables 3-4 and 3-5 present the records that were modified as a result of DPRA's analysis.

A summary of the QA/QC issues and modifications are as follows:

- Shipping Disconnect - A valid receiver (i.e., facility showing receipt of any wastes streams) did not report a similar waste stream as reported shipped by the facility. No similar waste stream was reported in 1997. The modification involved removal of the waste stream from the database.

- Mass Balance Issues - Reported generation differs from reported on-site management/shipping totals. Two situations arose from the mass imbalance.

> 1.) The generation total exceeded a single management/shipping total by a factor greater than two. Form WR volumes and 1997 BRS data were reviewed for comparing management/shipping totals. Appropriate generation/on-site management/shipping totals were modified.
>
> 2.) On-site management and shipping totals were being double-counted. That is, the on-site management and shipping totals were identical, and the total was double the reported generated total. Removal of one of the totals (management or shipping) was determined based on review of 1999 BRS WR data, comparison to 1997 BRS data, determination if the facility has a TDR permit, and comparison to other waste streams generated at the facility.

- Leachate Contaminated Groundwater Reported as Generated - As explained in the special instructions section of the 1999 BRS instructions for ground water contaminated by leachate: "Groundwater contaminated by RCRA hazardous waste is not considered a solid waste and is, therefore, not classified as a hazardous waste." The quantity should not be reported in the generation total. However, management of the waste must be reported. As such, a managed or shipped total must be reported for contaminated ground water. Waste streams with reported generated totals of contaminated ground water were modified (i.e., generated totals were deleted). In addition, one facility, CAD981653553, reported 774,546 tons of solvent waste (contaminated groundwater) being recovered on-site. This one facility (quantity) skewed the on-site recovery profile across NAICS codes accounting for 40 percent of the total on-site quantity. Since it is unlikely to be impacted in a negative way by the proposed rule, it has been excluded from the data analysis. The associated SIC code was 9223, correctional institutions, and the current solvents recovery method is by fractionation/distillation.

- Origin - Waste streams with reported management/generation totals but with an origin code of 4 were reviewed and modified. Two issues were identified from these facilities.

1.) The reported origin code appeared accurate. This determination was based on a lack of a treatment, disposal, or recycling (TDR) permit, no generation quantity reported, and other waste streams at the facility were reported with origin code 4. The waste streams were modified by removing the on-site managed total and retaining the shipped total.

2.) The reported origin code appeared inaccurate. This determination was based on a reported quantity in the generation total when origin code 4 is an indicator that the waste was not generated on site and comparisons with 1997 BRS data and other reported facility waste streams. These waste streams were modified by changing the origin code to 1.

- Unit of Measure - For one facility the unit of measure (UOM) was modified from short tons to pounds. This modification is based on the UOM reported in 1997 BRS and the totals reported by the facility receiving the waste for management.

- System Code - One facility system code was modified from M021 to M121. The modification was based on 1997 BRS data for the waste stream. The waste stream was effectively removed as the system code is outside the scope of the proposed rule.

For the QA/QC of the 1997 BRS data, six facilities were contacted directly to verify their 1997 data, with four responses. Based on the information received, all six facilities were removed. Two facilities were removed as the reported waste stream is no longer generated. One facility currently sells the formerly reported waste stream. One facility indicated the process is a "closed loop" system, negating any reporting requirements. No information was available for the current process solvent use as the process was reported to have changed. One facility is assumed to be closed. The final facility was removed based on the other facility discussions, generally indicating large metal/solvent/acid recycling facilities that did not report similar wastes generated in 1999 have discontinued or switched the generation process.

TABLE 3-4

Modified 1999 BRS Facility Waste Streams

EPA ID Number	Comments	GM Form Page
Shipping Disconnect		
CAT080033681	Receiver not showing as received; No similar '97 waste stream. Removed waste stream due to lack of correlating data to its generation.	11
IND000717959	Receiver not showing waste received. No similar '97 waste stream. Removed waste stream due to lack of correlating data to its generation.	6
TXD055330997	Mass balanced. No comparable 1997 BRS data. Receiver did not report this waste as received. Cannot determine if UOM error. Removed waste stream due to lack of correlating data to its generation.	8

TABLE 3-4

Modified 1999 BRS Facility Waste Streams

EPA ID Number	Comments	GM Form Page
Mass Balance		
MID047153077	Mass not balanced. 1997 BRS data reported similar generation total to 1999 BRS data. Modified onsite managed total to match generated total.	2
TXD008092793	Mass not balanced. No comparison of 1997 BRS data to 1999 BRS data. Management of waste limited to one type (M032). Increased managed total to match generated total.	6
CTR000004457	Mass not balanced. Shipped total similar to 1997 BRS data. Generated value approx 13.2 times greater than '99 shipment total and approx. 21 times greater than '97 generated total. 1999 BRS data did not include WR for shipped waste. Modified generated total to equal shipped total.	1
VA1210020730	DNT Contaminated Wastewater. Generation did not equal managed total. Origin for waste stream is 4, whereas same waste stream in 1997 BRS Data was 1. 1997 BRS data generated and managed total was 806,853 tons and managed onsite by M081. Assumed generated total is correct and managed onsite by M081. Removed second reported managed (M011) quantity. Modified Origin from 4 to 1.	20
MID980615298	Mass not balanced. Management and shipments equal to each other (334 tons M029), 1997 BRS data showed similar waste streams were generated and shipped. 1999 BRS data had receivers for similar wastes. Removed onsite management total listed with system type M061. As this modification did not effect the population scope, no change to the totals was required.	9
OHD004206264	Mass not balanced. Facility does not have a TDR permit. Generated total matches shipped total. 1997 BRS data reported similar waste streams, without managed totals. 1999 BRS data managed total system type is M031. Removed managed total, effectively removing this record from scope of project.	1
Leachate Contaminated Groundwater		
MID047153077	Groundwater remediation waste. Mass balanced. Management total comparable to 1997 BRS data. No generated total in 1997 BRS data due to leachate exclusion. Generation total removed due to leachate exclusion (management total retained).	1
CAD981653553[2]	Remediation derived waste. Not reported as generated due to "Leachate Generation" rule (not considered a solid waste). Managed total is required and was reported. Removed record from scope of project.	10
Origin		

TABLE 3-4

Modified 1999 BRS Facility Waste Streams

EPA ID Number	Comments	GM Form Page
NYD013277454	Mass not balanced. Origin 4 stated. No generation reported. Managed quantity equal to shipped quantity. 1997 BRS data showed similar waste stream shipped only. Facility is not permitted for treatment. Removed reported onsite managed (M029) quantity.	4
NYD048148175	Mass not balanced. No generated total. Managed total equals shipped total. No 1997 BRS waste stream comparable for facility. All facility waste streams are reported as origin 4 and shipped off-site. Facility is not permitted for treatment. Removed onsite managed (M012) total.	13
NYD077444263	Mass not balanced. Origin 4 stated. No generated total reported. Managed total equal to shipped total. All facility waste streams are reported as origin 4. Facility is not permitted for treatment. No 1997 BRS waste stream comparable for facility. Removed onsite managed (M012) total.	55
CAD008252405	Mass not balanced. Shipped total equals generated total. 1997 BRS data indicated origin 4 waste stream with no onsite generation with a similar mass shipped to 1999 BRS Data. Removed reported onsite managed (M022) quantity	7
TX5360310283	Mass balanced. Origin 4 stated. Managed total reported, no shipped total. Other site waste streams were origin 1. No 1997 BRS waste stream comparable for facility. Modified waste stream by using managed total as generated total and changed origin from 4 to 1.	4
Unit of Measure		
PAD004338091	Mass balanced. UOM in 1997 BRS data was lbs (not tons). Shipped and managed by M077, with similar received total. Modified UOM for generated and managed to lbs.	1
System Code		
KYD006371314	Mass not balanced. 1997 BRS data reported similar generated total, though management was by M121, not M021 as reported in 1999 BRS. Modified system type code from M021 to M121, essentially removing the management and generation total from the analysis.	11

TABLE 3-5 Modified 1997 BRS Facility Waste Streams		
EPA ID Number	**Comments**	**GM Form Page**
IAD065218737	Facility reports the waste stream is currently sold. The waste stream is classified as a revenue source and not a solid waste. Treatment or recovery of the waste stream onsite is not likely in the foreseeable future.	6
IND006050967	One process generating the waste was removed. Further review by the facility indicated the recovery process is a "closed loop"system. Therefore, reporting of the waste stream is not required. No information regarding the quantity of the solvent used/recycled was available.	26, 30, 35, 43, 44
MAD001016302	No response.	22, 23
NHD058537960	The reported waste solvent has been removed from the process.	14, 23
OKD074274333	Contact information was not current. No phone number was found for the business. Assumed business is closed.	3, 15
WAD980833099	The reported solvent has been removed from the process along with an equipment upgrade. The solvent is no longer necessary.	7, 13

5. *Remove Records Already Excluded Under Definition of Solid Waste:* Waste streams for industry groups with current exclusions from the Definition of Solid Waste were removed from the database. Wastes where oil was recovered was excluded for SICs 1311, 1321, 1381, 1382, 1389, 2911, 4612, 4613, 4922, 4923, 4789, 5171, and 5172 (40 CFR 261.4(a)(12)(ii)).

By-products exhibiting a characteristic of hazardous waste are not solid wastes when reclaimed (40 CFR 261.2(c)(3)), therefore are excluded from RCRA. Wastes with the words "solder" or "dross" in their waste description, that are within the following physical and chemical characteristics of inorganic solids:

- Other "dry" ash, slag, or thermal residue (Form Code B304);
- Metal scale, filings, or scrap (Form Code B307); or
- Other waste inorganic solids (Form Code B319);

and are within the hazardous waste characteristic of lead (EPA Code D008) were removed from the database since lead solder dross is a by-product of the smelting process.

Sludges exhibiting a characteristic of hazardous waste are not solid wastes when reclaimed (40 CFR 261.2(c)(3)), therefore are excluded from RCRA. Spent carbon organic solid wastes (Form Code B404) within the source codes for "Remediation Derived Waste" (A61-A69) and "Pollution Control or Waste Treatment Processes" (A71-A89) were removed from the database, since wastes generated from pollution control devices are defined under RCRA as "sludge".

Tables 3-6 and 3-7 present the new generation and management totals as a result of the QA/QC conducted on the origin code 4 records and outlier records and removal of records already excluded under the Definition of Solid Waste. The 1999 total generation quantity (4.2 million tons) reported for these records does not equal the sum of the on-site management quantity (0.8 million tons) and off-site management quantities (1.0 million tons) because the remaining quantity is managed in non-recovery system types (e.g., incineration and landfill). This also is true for the 1997 data.

TABLE 3-6

Summary of Modified 1999 Total Hazardous Waste Metal Recovery, Solvent Recovery and Other Recovery Generation and Management Quantities (Tons)

	Database Including Origin Code 4			Database Excluding Origin Code 4, Outliers, and Currently Excluded Industry Groups		
Total number of records (waste streams)	18,917			14,117		
Total generation quantity of all records	4,596,678			4,233,621		
On-site recovery management quantity of all records	5,520,660			818,374		
Off-site recovery management quantity of all records*	System 1	System 2	System 3	System 1	System 2	System 3
	1,069,065	126,568	34,383	892,997	114,970	34,331

Data Source: 1999 Biennial Report
Origin Code 4: The hazardous waste received from off site and not recycled or treated on site.
Limitation: Only includes quantities generated by large quantity generators.
* Generators can report multiple off-site system types (e.g., System 1, System 2, System 3) used for each waste if needed. A close estimate of the total off-site recovery management quantity is the sum of the three systems.

TABLE 3-7

Summary of Modified 1997 Total Hazardous Waste Metal Recovery, Solvent Recovery and Other Recovery Generation and Management Quantities (Tons)

	Database Including Origin Code 4	Database Excluding Origin Code 4, Outliers, and Currently Excluded Industry Groups
Total number of records (waste streams)	5,094	4,660

TABLE 3-7 **Summary of Modified 1997 Total Hazardous Waste Metal Recovery, Solvent Recovery and Other Recovery Generation and Management Quantities (Tons)**						
Total generation quantity of all records	555,514			**451,667**		
On-site recovery management quantity of all records	130,705			27,544		
Off-site recovery management quantity of all records*	System 1	System 2	System 3	**System 1**	**System 2**	**System 3**
	146,779	10,591	748	**139,631**	**9,690**	**748**

Data Source: 1997 Biennial Report
Origin Code 4: The hazardous waste received from off site and not recycled or treated on site.
Limitation: Only includes quantities generated by large quantity generators.
* Generators can report multiple off-site system types (e.g., System 1, System 2, System 3) used for each waste if needed. A close estimate of the total off-site recovery management quantity is the sum of the three systems.

6. *Main Option - Only Include Off-site Transfers Within the Same Industry Group (4-Digit NAICS):* In the Association of Battery Recyclers (ABR) Decision, the Court said that EPA overreached its authority by regulating mineral processing materials that were not "discarded" by being "disposed of, thrown away or abandoned, but rather were "destined for beneficial reuse or recycling in a continuous process by the generating industry itself." EPA is proposing to revise its Subtitle C regulations by generally giving up control over materials reclaimed within the generating industry as solid wastes. Consequently, the Agency needs to establish, among other things, a definition for "generating industry."

The Agency's preference is to use existing, well-defined, widely used industry classification system as the basis for identifying "industries" for this rule. The North American Industry Classification System (NAICS), which was developed by the Department of Commerce as an update of the Standard Industrial Classification (SIC) system appears to be an appropriate choice.

The Standard Industrial Classification (SIC) was originally developed in the 1930's to classify industries by activities and to promote the comparability of establishment data. Over the years, the SIC codes were revised periodically to reflect the changes in the economy. It was last updated in 1987 when approximately 20 new service industries were added to the SIC and a few new industries were added to manufacturing to reflect technological changes occurring in that sector.[6]

[6] Warski, Kristine. *SIC vs. NAICS: Understanding the Difference*, Miller Brooks Inc.

Since 1987, world economies have rapidly changed, bringing SIC codes under much criticism. A major change in the system was needed; thus the creation of NAICS (North American Industrial Classification System).

NAICS industries can be identified by as much as a 6-digit code, in contrast to the 4-digit SIC code. This allows for additional detail and flexibility in designating sub-sectors as new sub-industries emerge. The International NAICS agreement fixes only the first 5 digits of the code. The sixth digit, where used, identifies subdivisions of NAICS industries that accommodate user needs in individual countries. Thus, 6-digit US codes may vary from counterparts in Canada or Mexico, but at the 5-digit level, they are standardized.[7]

The nomenclature of the groupings within the system is different in NAICS. NAICS calls the highest level of aggregation in the system a sector; the SIC referred to this grouping as a division. Other changes have been made to the nomenclature as shown in Table 3-8.[8]

Table 3-8. NAICS vs. SIC: Structure and Nomenclature 1/

NAICS			SIC		
Structure	**Definition**	**Number**	**Structure**	**Definition**	**Number**
2-digit	Sector	18	Letter	Division	8
3-digit	Subsector	87	2-digit	Major Group	67
4-digit	Industry Group	290	3-digit	Industry Group	360
5-digit	NAICS Industry	654	4-digit	Industry	1303
6-digit	National	1086	N/A	N/A	N/A

1/ The agricultural and public administration industries were excluded from this tally.

Source: U.S. Department of Commerce, US Census Bureau, *Development of NAICS,* http://www.census.gov/epcd/www/naicsdev.htm.

The Agency has selected the 4-digit NAICS to define the same "generating industry" (i.e., industry group). The BRS 4-digit SIC data were cross-walked into the 4-digit NAICS codes. Waste streams that are not transferred off site within the same 4-digit NAICS were eliminated from the database because they are not impacted by the proposed regulation. The resulting on-site and off-site recovery quantities for the 1999 and 1997 list of large quantity generators are

7 Ibid.

8 U.S. Department of Commerce, US Census Bureau, *Development of NAICS,* http://www.census.gov/epcd/www/naicsdev.htm.

presented in the Table 3-9 below. The plant counts and recovered quantities listed below will be higher if small quantity generators are included. The Biennial Report database does not include small quantity generators.

Table 3-9. Summary of Within Industry Group Affected Plants and Recovery Management Quantities		
	No. of Plants	**Recovered Quantity (tons)**
1999 On-site Recovery Management	849	818,348
1997 On-site Recovery Management	253	27,544
1999 Off-site Recovery Management Within Industry Group	249	59,436
1997 Off-site Recovery Management Within industry Group	46	4,505
Total*	**1,374**	**909,833**

* Some plants are included in multiple rows above because they report conducting both on-site and off-site recovery within the same 4-digit NAICS. A total of 21 1999 plants and two 1997 plants conduct recovery both on and off site. The total number of plants is 1,397 - 23 = 1,374.

3.2.3 Methodology for Identifying Outside Industry Group Recovery Management Quantities

Generators who recover values from wastes at off-site recyclers outside their industry group (4-digit NAICS code) may additionally benefit from the rule because they may now choose to construct an on-site recycling unit given a RCRA storage permit and other RCRA administrative activities are no longer required. Large facilities may recover large enough volumes to construct an on site recovery unit. Groups of facilities within the same industry group may achieve economies of scale. These facilities under baseline were not willing to permit a captive facility. Post-rule they may be willing.

This data set was developed by starting with the list of generators recovering metal, solvent, and acid wastes off site developed in Step 5 of the previous section (Table 3-6). This time the list of facilities transferring wastes off site within the same industry group (4-digit NAICS code) are removed from the list as opposed to last time in Step 6 above they were kept. Because of project resource constraints the analysis was limited to the 4-digit NAICS codes recovering the most quantity off site assuming they are most likely to achieve economies of scale. These eleven NAICS codes are identified in Table 3-10 with their recovery quantities. They account of 77 percent of the quantity currently recovered off site outside the same industry group. A break-even cost analysis was conducted on this data set to determine which facilities may cost-effectively construct on-site recovery systems post rule.

Table 3-10. Summary of Outside Industry Group POTENTIALLY Affected Number of Plants and Off-site Recovery Management Quantities		
4-Digit NAICS Code	**No. of Plants**	**Recovered Quantity (tons)**
3312 Steel Product Manufacturing	119	471,434
3344 Semiconductor and Other Electronic Component Manufacturing	382	56,589
3252 Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing	99	32,446
3359 Other Electrical Equipment and Component Manufacturing	67	32,543
3314 Non-Ferrous Metal (except Aluminum) Production and Processing	83	29,046
3241 Petroleum and Coal Products Manufacturing	112	28,547
3328 Coating, Engraving, Heat Treating and Allied Activities	417	25,069
3255 Paint, Coating and Adhesive manufacturing	156	23,181
3251 Basic Chemical Manufacturing	227	22,515
3362 Motor Vehicle Body and Trailer Manufacturing	74	18,069
3254 Pharmaceutical and Medicine Manufacturing	111	15,447
Subtotal (included in analysis)	**1847***	**754,886**
Other NAICS	4351	221,447
Totals	**6177****	**976,333**

* Some plants are included in multiple rows above because they report having multiple NAICS codes. Eight plants are counted in two of the above NAICS codes, and one plant is counted in six of the above NAICS codes, for a total of 13 instances of plants being included in multiple rows. The total number of plants is 1,860 - 13 = 1,847.

** Some plants are included in both the subtotal and other NAICS plant count because they report having multiple NAICS codes. 21 plants recover hazardous waste in both the specified NAICS codes and the remaining NAICS codes. The total number of plants is 6,198 - 21 = 6,177.

3.2.4 Methodology for Identifying Disposed Management Quantities that Potentially May Be Recovered On Site

A firm may decide to reclaim wastes previously disposed (e.g., landfilled or energy recovery) because of favorable economics under the proposed regulation. Because of limited budget resources an analysis was conducted identifying the primary waste types being recovered in 1999. It is assumed that these waste types have a higher potential for recovery. Based on the waste types identified, a data set of these wastes types being disposed (i.e., land disposed or thermally destroyed) was developed to limit the scope of the analysis. The facilities disposing these waste may potentially recover them on site post rule if economically feasible.

Given budget resource constraints, the identification of recoverable waste types was limited to those SIC codes that reported recovering more than 30,000 tons either on site or off site in 1999. Appendix D presents a memorandum of the initial analysis. Subsequent review of the information presented in Appendix D determined that some facilities were reporting characteristic by-products (e.g., lead slag and dross) as hazardous waste. Table 3-11 presents a listing of the waste types, industries (SIC codes), and waste forms included in the analysis.

Table 3-11. List of Waste Types Analyzed for Potential On-Site Recovery

Waste Types	SIC Codes	Waste Forms
Organic Liquids (from Industrial Organic Chemicals, Paints and Allied Products, Pharmaceutical Preparations, and Plastics Materials and Resins Industries)	2869, 2851, 2834, 2821	Liquid Form Codes (B101-B119, B201-B219)
Emission Control Dust (from Steel Works Industry)	3312	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)
Metal-Containing Liquids (from Printed Circuit Board Industry)	3672	Liquid Form Codes (B101-B119, B201-B219)
Electroplating Wastewater Treatment Sludges (from Printed Circuit Board Industry)	3672	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)
Spent Carbon (from Industrial Organic Chemicals and Petroleum Refining Industries)	2869, 2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)
Spent Catalyst (from Petroleum Refining Industry)	2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)
Spent Aluminum Potliner (from Aluminum Industry)	3334	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)

Spent Pickle Liquor (from Steel Works Industry)	3312	Liquid Form Codes (B101-B119, B201-B219)

Table 3-12 presents a summary of the disposed management quantities that potentially may be recovered, indicating step-by-step changes in the quantities as a QA/QC analysis was conducted on the initial data sets. A summary of the QA/QC steps is as follows:

1 - Facilities reporting wastes in 1997 as recovered and 1999 as disposed were removed from the analysis to avoid double-counting waste quantities included in the 1997 on-site and off-site recovery quantities in Table 3-9.

2 - Facilities reporting wastes with Origin Code 4, "the hazardous waste was received from off site and was not recycled or treated on site," are not supposed to report the waste as generated (i.e., zero quantity generated). This explains why the generation quantity total does not change when the records are removed. These records were removed because the generator did not generate the waste. Incremental costs for management of this waste are associated with the original generator.

3 - Certain wastes reported with Origin Code 5, "the hazardous waste was a residual from the on site treatment, disposal, or recycling of a previously existing hazardous waste," were excluded because values from these wastes are not likely recoverable.

4 - Wastes generated from processes (e.g., those generated from remediation or one-time activities) are not continuous waste streams that would supply a continuous feedstock for an on-site recovery facility. Values from these wastes are not likely recoverable.

5 - Waste descriptions were analyzed to ensure only the appropriate waste streams were being kept in the analysis for each set of data. Waste streams (e.g., "debris") that did not meet the criteria for each data set were removed from the analysis.

6 - Waste streams that were missing one or more of the following codes: SIC Code, Origin Code, Source Code, or Form Code, were analyzed to determine if, had they not been missing the codes, they may have been removed in previous QA/QC steps. The additional analysis primarily involved the waste stream's EPA Hazardous Waste Codes.

7 - Waste streams with unusually large quantities were evaluated to determine if they were wastewater and the waste quality was sufficient for recovery.

8 - All on-site deep-well injection quantities for spent pickle liquors were removed because on-site recovery is not more economical than deep-well injection.

9 - Any outliers (waste streams with generation quantities greater than two standard deviations above the mean and an order of magnitude greater than the average) were removed as statistical outliers so they would not skew the results.

A break-even cost analysis was conducted on this data set to determine which facilities may cost-effectively construct on-site recovery systems post rule.

Table 3-12. QA/QC Of Disposed Quantities That Potentially May Be Recovered*																
	Organic Liquids from Industrial Organic Chemicals, Paints & Allied Products, Pharmaceutical Preparations, & Plastics Materials & Resins Industries (SICs 2869, 2851, 2834, 2821 and liquid form codes)		**K061 - Emission Control Dust from Steel Works Industry (SIC 3312 and solid & sludge form codes)**		**Metal-Containing Liquids from Printed Circuit Board Industry (SIC 3672 and liquid form codes)**		**F006 - Electroplating Wastewater Treatment Sludges from Printed Circuit Board Industry (SIC 3672 and solid & sludge form codes)**		**Spent Carbon from Industrial Organic Chemicals and Petroleum Refining Industries (SICs 2869, 2911 and solid & sludge form codes)**		**K171 & K172 - Spent Catalyst from Petroleum Refining Industry (SIC 2911 and solid & sludge form codes)**		**K088 - Spent Aluminum Potliner from Aluminum Industry (SIC 3334 and solid & sludge form codes)**		**K062 - Spent Pickle Liquor from Steel Works Industry (SIC 3312 and liquid form codes)**	
QA/QC Steps	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Qty. (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**
Initial Query	6,063	6,214,217	52	406,080	779	3,189,148	193	9,305	185	23,813	118	20,254	47	76,591	50	5,609,212
Remove 97/99 EPA ID Matches [1]	6,045	6,213,453	52	406,080	779	3,189,148	193	9,305	182	23,804	118	20,254	47	76,591	50	5,609,212
Remove Origin Code 4 [2]	5,973	6,213,453	52	406,080	779	3,189,148	193	9,305	175	23,804	116	20,254	46	76,591	50	5,609,212
Remove Origin Code 5 [3]	---	---	50	364,374	773	3,188,220	---	---	---	---	116	20,254	---	---	---	---
Remove Non-Process Wastes [4]	5,768	6,166,802	43	359,835	768	3,186,928	182	9,061	145	23,804	110	19,545	39	75,080	48	5,592,972
Remove "Odd Wastes" [5]	5,712	6,166,457	36	359,569	768	3,186,928	158	8,944	132	3,227	107	19,543	34	74,178	48	5,592,972
Remove wastes with "Missing Code Issues" [6]	---	---	33	359,546	768	3,186,928	158	8,944	132	3,227	107	19,543	31	74,081	48	5,592,972

Table 3-12. QA/QC Of Disposed Quantities That Potentially May Be Recovered*

	Organic Liquids from Industrial Organic Chemicals, Paints & Allied Products, Pharmaceutical Preparations, & Plastics Materials & Resins Industries (SICs 2869, 2851, 2834, 2821 and liquid form codes)		K061 - Emission Control Dust from Steel Works Industry (SIC 3312 and solid & sludge form codes)		Metal-Containing Liquids from Printed Circuit Board Industry (SIC 3672 and liquid form codes)		F006 - Electroplating Wastewater Treatment Sludges from Printed Circuit Board Industry (SIC 3672 and solid & sludge form codes)		Spent Carbon from Industrial Organic Chemicals and Petroleum Refining Industries (SICs 2869, 2911 and solid & sludge form codes)		K171 & K172 - Spent Catalyst from Petroleum Refining Industry (SIC 2911 and solid & sludge form codes)		K088 - Spent Aluminum Potliner from Aluminum Industry (SIC 3334 and solid & sludge form codes)		K062 - Spent Pickle Liquor from Steel Works Industry (SIC 3312 and liquid form codes)	
QA/QC Steps	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Qty. (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**	**Number Waste Streams**	**Quantity (tons)**
Removal of large waste streams not of sufficient quality for recovery [7]	5,707	1,134,200	33	359,546	767	896,171	158	8,944	132	3,227	107	19,543	31	74,081	47	1,025,472
Remove deep-well injection quantities for spent pickle liquors [8]	5,707	1,134,200	33	359,546	767	896,171	158	8,944	132	3,227	107	19,543	31	74,081	44	837,566
Remove statistical outliers [9]	4,839**	412,091 **	31	347,767 ***	746	554,701	154	6,998	125	2,448	99	11,278	31	74,081	41	192,259
FINAL NUMBERS	**4,839**	**412,091**	**31**	**347,767**	**746**	**554,701**	**154**	**6,998**	**125**	**2,448**	**99**	**11,278**	**31**	**74,081**	**41**	**192,259**

Table 3-12. QA/QC Of Disposed Quantities That Potentially May Be Recovered*

	Organic Liquids from Industrial Organic Chemicals, Paints & Allied Products, Pharmaceutical Preparations, & Plastics Materials & Resins Industries (SICs 2869, 2851, 2834, 2821 and liquid form codes)		K061 - Emission Control Dust from Steel Works Industry (SIC 3312 and solid & sludge form codes)		Metal-Containing Liquids from Printed Circuit Board Industry (SIC 3672 and liquid form codes)		F006 - Electroplating Wastewater Treatment Sludges from Printed Circuit Board Industry (SIC 3672 and solid & sludge form codes)		Spent Carbon from Industrial Organic Chemicals and Petroleum Refining Industries (SICs 2869, 2911 and solid & sludge form codes)		K171 & K172 - Spent Catalyst from Petroleum Refining Industry (SIC 2911 and solid & sludge form codes)		K088 - Spent Aluminum Potliner from Aluminum Industry (SIC 3334 and solid & sludge form codes)		K062 - Spent Pickle Liquor from Steel Works Industry (SIC 3312 and liquid form codes)	
QA/QC Steps	Number Waste Streams	Quantity (tons)	Number Waste Streams	Qty. (tons)	Number Waste Streams	Quantity (tons)	Number Waste Streams	Quantity (tons)	Number Waste Streams	Quantity (tons)	Number Waste Streams	Quantity (tons)	Number Waste Streams	Quantity (tons)	Number Waste Streams	Quantity (tons)

[1] Facilities reporting wastes in 1997 as recovered and 1999 as disposed were removed from the analysis to avoid double-counting waste quantities included in the 1997 on-site and off-site recovery quantities in Table 3-9.
[2] Facilities reporting wastes with Origin Code 4, “the hazardous waste was received from off site and was not recycled or treated on site,” are not supposed to report the waste as generated (i.e., zero quantity generated). This explains why the generation quantity total does not change when the records are removed. These records were removed because the generator did not generate the waste. Incremental costs for management of this waste are associated with the original generator.
[3] Certain wastes reported with Origin Code 5, “the hazardous waste was a residual from the on site treatment, disposal, or recycling of a previously existing hazardous waste,” were excluded because values from these wastes are not likely recoverable.
[4] Wastes generated from processes (e.g., those generated from remediation or one-time activities) are not continuous waste streams that would supply a continuous feedstock for an on-site recovery facility. Values from these wastes are not likely recoverable.
[5] Waste descriptions were analyzed to ensure only the appropriate waste streams were being kept in the analysis for each set of data. Waste streams (e.g., “debris”) that did not meet the criteria for each data set were removed from the analysis.
[6] Waste streams that were missing one or more of the following codes: SIC Code, Origin Code, Source Code, or Form Code, were analyzed to determine if, had they not been missing the codes, they may have been removed in previous QA/QC steps. The additional analysis primarily involved the waste stream’s EPA Hazardous Waste Codes.
[7] Waste descriptions were analyzed for unusually large waste streams to ensure the waste quality is sufficient for recovery.
[8] All on-site deep-well injection quantities for spent pickle liquors were removed because on-site recovery is not more economical than deep-well injection.
[9] Any outliers (waste streams with generation quantities greater than two standard deviations above the mean and an order of magnitude greater than the average) were removed as statistical outliers so they would not skew the results.
* Quantities reflect generation quantities and not management quantities. Quantities presented in Chapter 4 are management quantities.
** Onsite disposal quantities were removed from this analysis. Onsite disposal of organic liquids is incineration, which requires a large capital expenditure. For the purposes of this analysis, it is assumed facilities disposing onsite will not change to a recovery process.
*** Only offsite quantities were considered in this analysis.

3.3 Limitations of Analysis

This analysis does not capture all of the variables that may affect a generator's decision to reclaim or landfill these types of wastes. A generator's decision also may be affected by factors such as the presence of multiple metals, solvents, or other waste types in one waste stream; total content of metal, solvent and other values; technical feasibility of recovering available metals, solvents, etc.. Limitations of the analysis include the following:

- The presence of multiple metals or other values in a waste may impact both the marketability and feasibility of reclamation. While the waste may contain recoverable levels of each metal/value present, within- industry off-site reclaimers tend to prefer co-mingled wastes to be segregated to avoid having to separate the metals (values) again into a mono-metal or bi-metal sludge.[9] In certain instances, within- industry off-site reclaimers face higher costs to handle impurities (metals/values considered not to be of value by the within- industry off-site reclaimer) in excess of a specified concentration.[10]

- The type and percent concentration of metals or other values present in the waste may impact the cost for within- industry off-site reclaimers to manage the waste. The cost of reclamation is influenced by the market price the recyclers can obtain for the values they recover. Variations in future prices for recovered values are not evaluated in the analysis.

- The proximity of businesses to a landfill is likely to continue to heavily influence off site transfers within the same Industry Group due to the savings associated with the reduced transportation costs.

- The cost estimates for landfill management are overstated, particularly for smaller generators, because other forms of hazardous waste are generated in facility operations. These wastes may be shipped with the reclaimable waste to the landfill in the same truck if the wastes are compatible, resulting in lower per-unit transportation costs due to a generator's ability to take advantage of economies of scale and avoid incurring the minimum landfill charge on multiple loads.

- Reclamation costs are overstated, particularly for small generators, because transporters may stop at two or more facilities creating fuller loads, thereby reducing per-unit transportation costs. Economies of scale may be achieved that exceed the minimum recycling processing charge.

- There may exist instances where facilities improve the quality of their waste streams with potential recoverable values to improve the quality of the waste for reclamation and allow them to

---

[9] Borst, Paul A., U.S. EPA, Office of Solid Waste, Economic, Methods and Risk Analysis Division, "Recycling of Wastewater Treatment Sludges from Electroplating Operations," F006, 18th AESF/EPA Pollution Prevention and Control Conference, January 27-29, 1997, p. 179.

[10] Lamancusa, James P.,P.E.,CEF, "Strategies at a Decorative Chromium Electroplating Facility: On-line vs. Off-line Recycling," Plating and Surface Finishing, April 1995, p.48.

accumulate more economic quantities for reclamation. This study does not address these possible benefits.

4.0 BASELINE METAL, SOLVENT AND OTHER RECOVERY MANAGEMENT

4.1 On-site Recovery Quantity in 1999

A total of 818,000 tons of hazardous waste were recovered on site by 849 plants within 94 NAICS codes in 1999. Eleven NAICS codes each recovered greater than 10,000 tons (1.2% of the total on-site recovery quantity) in 1999 in on-site recovery practices. These 11 NAICS codes each recovered more than 10,000 tons on site account for 68 percent of the total quantity recovered. Metals recovery, solvents recovery, and other recovery account for 409,000 tons, 160,000 tons, and 250,000 tons of the total, respectively. Table 4-1 presents the quantity of hazardous waste managed on site by NAICS code and recovery management type for the top 11 NAICS codes.

NAICS 3251, basic chemical manufacturing, recovered 200,000 tons (24.4 percent) of the total on-site recovery quantity. Most of this quantity was managed by other recovery (acid and nonsolvent organic recovery) and metals recovery.

NAICS 3314, nonferrous metal (except aluminum) production and processing, recovered 116,000 tons (14.1 percent) of the total on-site recovery quantity. Nearly all of this quantity was managed by metals recovery.

NAICS 3312, steel product manufacturing from purchased steel, recovered 47,000 tons (5.8 percent) of the total on-site recovery quantity. Nearly all of this quantity was managed by other recovery (acid regeneration).

The last eight NAICS codes listed in Table 4-1 recover more than 10,000 tons onsite in 1999. The remaining NAICS codes that each recover less than 10,000 tons on-site in 1999 account for 72,000 tons (8.8 percent) of the total on-site recovery quantity.

No SIC codes (that could be mapped into NAICS codes) were reported by facilities recovering 190,000 (23.2 percent) of the total on-site recovery quantity.

TABLE 4-1
1999 ONSITE RECOVERY MANAGEMENT BY NAICS CODE (TONS)

NAICS Code	METALS RECOVERY					Total Metals Recovery	SOLVENTS RECOVERY					Total Solvents Recovery	OTHER RECOVERY			Total Other Recovery	TOTALS		
	M011	M012	M013	M014	M019		M021	M022	M023	M024	M029		M031	M032	M039		Quantity	%	Cumul. %
3251	1,336	853		70,699	643	73,531	25,967		16	1,273		27,257		76,856	21,984	98,840	199,627	24.394	24.394
3314	9		114,864	374	51	115,297						0		338		338	115,636	14.130	38.524
3312						0	94					94	47,132			47,132	47,226	5.771	44.295
3254						0	31,337		4,241	4		35,583				0	35,583	4.348	48.643
3255	0			9,296		9,297	11,851	11,020	17	700	16	23,604			38	38	32,939	4.025	52.668
3211						0						0		32,273	99	32,373	32,373	3.956	56.624
3344				24,767	4	24,771	441					441	2			2	25,214	3.081	59.705
3252	158			755		913	1,897	437	13	72		2,420	10,731	10,014		20,744	24,077	2.942	62.647
3328				557		557	2,657	1,168	1			3,826	96	15,111		15,207	19,591	2.394	65.041
3399				9,265	242	9,506	383		96	22		502	3,401			3,401	13,409	1.639	66.680
3253						0						0	1,209	8,913		10,122	10,122	1.237	67.917
Others	355	6	653	9,091	4,372	14,477	27,143	4,071	7,725	2,228	754	41,922	5,281	10,448	261	15,989	72,387	8.846	76.762
No Code				160,662	304	160,965	21,423	1,430	182	1,435	1	24,472	551	1,548	2,627	4,727	190,164	23.238	100.000
TOTAL	1,858	859	115,516	285,466	5,615	409,315	123,194	18,126	12,292	5,735	771	160,119	68,403	155,501	25,010	248,914	818,348	100.000	—

Metals Recovery
- M011 High temperature metals recovery
- M012 Retorting
- M013 Secondary smelting
- M014 Other metals recovery for reuse: e.g., ion exchange, reverse osmosis, acid leaching
- M019 Metals recovery - type unknown

Solvents Recovery
- M021 Fractionation/distillation
- M022 Thin film evaporation
- M023 Solvent extraction
- M024 Other solvent recovery
- M029 Solvents recovery - type unknown

Other Recovery
- M031 Acid regeneration
- M032 Other recovery: e.g., waste oil recovery, nonsolvent organics recovery
- M039 Other recovery - type unknown

4.2 Off-site Recovery Quantity Transferred Within Same Industry Group (4-Digit NAICS Code) in 1999

The proposed regulation will allow an exclusion from RCRA Subtitle C jurisdiction if the hazardous wastes shipped off site for recovery are transferred within the same industry group. The Biennial Report data were analyzed for off-site shipments within the same 4-digit NAICS codes. These off-site recovery quantities are a subset of the total quantity of hazardous waste shipped off site for recovery.

A total of 59,000 tons of hazardous waste were recovered off site in 1999 within the same industry group by 249 plants within 30 NAICS codes. Nine NAICS codes recovered greater than 300 tons each (0.5% of the total off-site recovery quantity) in off-site recovery practices within the same 4-digit NAICS code. These nine NAICS codes account for 96 percent of the total quantity recovered off site. Metals recovery, solvents recovery, and other recovery account for 19,000 tons, 36,000 tons, and 5,000 tons of the total, respectively. Table 4-2 presents the quantity of hazardous waste managed off site by NAICS code and recovery management type for all NAICS codes.

NAICS 3254, pharmaceutical and medicine manufacturing, recovered 14,600 tons (24.5 percent) of the total off-site recovery quantity. Nearly all of this quantity was managed by solvent recovery.

NAICS 3251, basic chemical manufacturing, recovered 13,700 tons (23.1 percent) of the total off-site recovery quantity. Most of this quantity was managed by solvents recovery.

NAICS 5419, other professional, scientific, and technical services, recovered 10,600 tons (17.9 percent) of the total off-site recovery quantity. Nearly all of this quantity was managed by solvent recovery.

NAICS 3314, nonferrous metal (except aluminum) production and processing, recovered 7,700 tons (13.0 percent) of the total off-site recovery quantity. Nearly all of this quantity was managed by metals recovery.

NAICS 3312, steel product manufacturing from purchased steel, recovered 6,700 tons (11.3 percent) of the total off-site recovery quantity. All of this quantity was managed by metals recovery.

NAICS 3252, resin, synthetic rubber, and artificial synthetic fibers and filaments, recovered 2,400 tons (4.1 percent) of the total off-site recovery quantity. All of this quantity was managed by other recovery (nonsolvent organics recovery).

The remaining 24 NAICS codes that recover less than 2,400 tons off-site in 1999 account for 2,600 tons (4.4 percent) of the total on-site recovery quantity.

TABLE 4-2

1999 OFFSITE RECOVERY WITHIN SAME INDUSTRY GROUP (4-DIGIT NAICS CODE) (TONS)

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS		
Code	M011	M012	M013	M014	M019	Recovery	M021	M022	M023	M024	M029	Recovery	M031	M032	M039	Recovery	Quantity	%	Cumul. %
3254	65			16	6	87	14,467				1	14,468				0	14,555	24.489	24.489
3251	43	235		2,095	273	2,646	8,690	2	0		20	8,713		2,243	129	2,372	13,731	23.101	47.590
5419		0			2	2	7,212	3,410				10,622				0	10,625	17.875	65.466
3314	41	163	7,267	18	246	7,735	2					2		0		0	7,737	13.018	78.483
3312	6,734					6,734						0				0	6,734	11.330	89.813
3252						0						0	2,429			2,429	2,429	4.087	93.900
3363					0	0	688					688				0	688	1.157	95.058
6113				16	398	414	1					1			0	0	415	0.699	95.756
3241						0						0		312		312	312	0.525	96.281
3326	210				87	297						0				0	297	0.499	96.780
3344	8		5	225	31	270					1	1				0	271	0.456	97.237
8129				35	144	180						0				0	180	0.302	97.539
3359			158		0	158						0				0	158	0.266	97.805
4219		91		0	6	97						0				0	97	0.163	97.968
5622		1				1	5					5		90	0	90	96	0.162	98.130
3372	0					0	29	3				32				0	32	0.053	98.184
3255		1		0	0	1	15				7	22				0	24	0.040	98.223
4226						0		15				15				0	15	0.025	98.248
3328	2		0	2	7	11						0				0	11	0.018	98.267
3231	1				9	10						0		0		0	10	0.018	98.284
9241						0	0		1			1	1			1	2	0.004	98.288
3321						0	2					2				0	2	0.003	98.291
9281	1				1	2						0				0	2	0.003	98.294
5414						0	1					1				0	1	0.001	98.295
3333					1	1						0				0	1	0.001	98.296

TABLE 4-2

1999 OFFSITE RECOVERY WITHIN SAME INDUSTRY GROUP (4-DIGIT NAICS CODE) (TONS)

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS		
Code	M011	M012	M013	M014	M019	Recovery	M021	M022	M023	M024	M029	Recovery	M031	M032	M039	Recovery	Quantity	%	Cumul. %
3259						0	0					0				0	0	0.001	98.296
3399	0					0						0				0	0	0.001	98.297
3222		0				0						0				0	0	0.000	98.297
3325						0	0					0				0	0	0.000	98.298
2122					0	0						0				0	0	0.000	98.298
No Code						0		1,012				1,012				0	1,012	1.702	100.000
TOTALS	**7,106**	**491**	**7,431**	**2,408**	**1,212**	**18,647**	**31,112**	**4,442**	**2**	**0**	**29**	**35,585**	**2,430**	**2,645**	**129**	**5,205**	**59,436**	**100.000**	**—**

SYSTEM TYPE CODES:

Metals Recovery

M011 High temperature metals recovery

M012 Retorting

M013 Secondary smelting

M014 Other metals recovery for reuse: e.g., ion exchange, reverse osmosis, acid leaching

M019 Metals recovery - type unknown

Solvents Recovery

M021 Fractionation/distillation

M022 Thin film evaporation

M023 Solvent extraction

M024 Other solvent recovery

M029 Solvents recovery - type unknown

Other Recovery

M031 Acid regeneration

M032 Other recovery: e.g., waste oil recovery, nonsolvent organics recovery

M039 Other recovery - type unknown

4.3 Export Recovery Quantity in 1999

A total of 125,000 tons of hazardous waste generated by 80 plants were recovered off site in 1999 in a foreign country. NAICS code data were unavailable to determine if the transfers (exports) occurred within the same industry groups (4-digit NAICS) and subject to the exclusion of the proposed regulation. Mexico received 90,000 tons, Canada 11,000 tons, and Germany, France, Korea, Belgium and Sweden less than 1,000 tons (Table 4-3). For approximately 21,000 tons recovered outside the United States, the foreign country is not specified.

NAICS 3312, steel product manufacturing and purchased steel, recovered approximately 91,000 tons of the total export recovery quantity. All of this quantity was managed by metals recovery.

TABLE 4-3

1999 EXPORTS BY NAICS CODE (TONS)

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS			
Code	**M011**	**M012**	**M013**	**M014**	**M019**	**Recovery**	**M021**	**M022**	**M023**	**M024**	**M029**	**Recovery**	**M031**	**M032**	**M039**	**Recovery**	**Quantity**	**%**	**Cumulative %**	**# Plants**
CANADA																				
3359			3,363	5		3,368						0				0	3,368	29.362	29.362	2
3333			1,936			1,936	179					179				0	2,115	18.438	47.800	2
5622			1,865			1,865						0				0	1,865	16.262	64.062	1
3315			887	134		1,020						0				0	1,020	8.896	72.957	2
5419						0						0		949		949	949	8.273	81.230	1
3254						0	720					720				0	720	6.278	87.508	1
3314			576			576						0				0	576	5.022	92.530	3
3251			70			70	316					316				0	386	3.365	95.895	3
3222						0		147				147				0	147	1.284	97.180	1
3241						0						0		70	72	143	143	1.243	98.423	2
4226					79	79						0				0	79	0.688	99.111	1
3321	61					61						0				0	61	0.530	99.641	1
3351						0	16					16				0	16	0.138	99.779	1
9281	0				11	11						0				0	11	0.098	99.877	6
4219	9					9						0				0	9	0.077	99.954	1
3255						0			4			4				0	4	0.034	99.988	1
no code	0	0		0	0	0	0				0	0		1		1	1	0.012	100.000	9
9999		0				0						0				0	0	0.000	100.000	1
Subtotal	**70**	**0**	**8,697**	**139**	**90**	**8,996**	**1,231**	**147**	**4**	**0**	**0**	**1,383**	**0**	**1,020**	**72**	**1,092**	**11,471**	**100.000**	**---**	**39**
BELGIUM																				
5622			62			62						0				0	62	100.000	100.000	1
FRANCE																				
4219			622			622						0				0	622	90.187	90.187	1
5419					68	68						0				0	68	9.813	100.000	1
Subtotal	**0**	**0**	**622**	**0**	**68**	**689**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**689**	**100.000**	**---**	**2**

TABLE 4-3

1999 EXPORTS BY NAICS CODE (TONS)

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS			
Code	**M011**	**M012**	**M013**	**M014**	**M019**	**Recovery**	**M021**	**M022**	**M023**	**M024**	**M029**	**Recovery**	**M031**	**M032**	**M039**	**Recovery**	**Quantity**	**%**	**Cumulative %**	**# Plants**
GERMANY																				
3314	820					820						0				0	820	100.000	100.000	1
KOREA																				
4219			102			102						0				0	102	100.000	100.000	1
MEXICO																				
3312	77,935					77,935						0				0	77,935	86.164	86.164	10
no code	10,825					10,825						0				0	10,825	11.968	98.132	2
2211						0						0			1,690	1,690	1,690	1.868	100.000	1
Subtotal	**88,760**	**0**	**0**	**0**	**0**	**88,760**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,690**	**1,690**	**90,450**	**100.000**	**---**	**13**
SWEDEN																				
3359	41					41											41	100.000	100.000	1
OTHER FOREIGN COUNTRIES (COUNTRY UNSPECIFIED)																				
3312	13,016					0						0				0	13,016	60.671	60.671	2
3399						0						0			5,352	5,352	5,352	24.946	85.618	1
3344	674		676			1,350						0				0	1,350	6.291	91.909	3
9281					549	549						0				0	549	2.559	94.468	1
3254						0					544	544				0	544	2.536	97.004	1
4883					0	0						0			212	212	212	0.986	97.990	1
3314				191		191						0				0	191	0.892	98.882	1
3328	1			18	75	94						0				0	94	0.440	99.322	4
3359			76			76						0				0	76	0.355	99.677	2
3342	68					68						0				0	68	0.318	99.995	1
3364						0						0			0	0	0	0.002	99.998	1
2211			0			0						0				0	0	0.001	99.999	2
5133				0		0						0				0	0	0.001	100.000	1
3333			0			0						0				0	0	0.000	100.000	1
Subtotal	**13,759**	**0**	**753**	**210**	**624**	**15,346**	**0**	**0**	**0**	**0**	**544**	**544**	**0**	**0**	**5,564**	**5,564**	**21,453**	**100.000**	**---**	**22**

TABLE 4-3

1999 EXPORTS BY NAICS CODE (TONS)

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS			
Code	M011	M012	M013	M014	M019	Recovery	M021	M022	M023	M024	M029	Recovery	M031	M032	M039	Recovery	Quantity	%	Cumulative %	# Plants
TOTAL	**103,450**	**0**	**10,235**	**348**	**782**	**114,815**	**1,231**	**147**	**4**	**0**	**544**	**1,927**	**0**	**1,020**	**7,326**	**8,346**	**125,088**	**---**	**---**	**80**

SYSTEM TYPE CODES:

Metals Recovery
- M011 High temperature metals recovery
- M012 Retorting
- M013 Secondary smelting
- M014 Other metals recovery for reuse: e.g., ion exchange, reverse osmosis, acid leaching
- M019 Metals recovery - type unknown

Solvents Recovery
- M021 Fractionation/distillation
- M022 Thin film evaporation
- M023 Solvent extraction
- M024 Other solvent recovery
- M029 Solvents recovery - type unknown

Other Recovery
- M031 Acid regeneration
- M032 Other recovery: e.g., waste oil recovery, nonsolvent organics recovery
- M039 Other recovery - type unknown

4.4 Potential Additional Recovery Quantity from 1997

If hazardous wastes are excluded from RCRA Subtitle C jurisdiction if recovered, additional facilities may determine that recovering their waste is more economical than treatment or disposal. As a rough proxy of the additional hazardous waste quantity that may be recovered, the quantity of waste reported recovered in 1997 but not in 1999 was determined. 1997 Biennial Report data were used to identify the plants that recovered hazardous wastes in 1997. This list of plants was compared with the 1999 list of plants discussed above. If the EPA identification number was not found in the 1999 list it is assumed they now treat or dispose their waste. It is assumed these quantities again may be recovered under the proposed regulation. Some of the limitations with this assumption is that the plant may have closed, discontinued the process generating the waste, or modified the process such that the waste was no longer generated, or the waste was a one-time generation event (e.g., spill cleanup or remediation activity) in 1999.

Approximately 28,000 tons were recovered on site in 1997 but not in 1999 by 253 plants within 69 NAICS codes. Six NAICS codes each recovered greater than 1,000 tons in 1997 on site but not in 1999 (at least 3.8% of the total on-site recovery quantity). These six NAICS codes account for 63 percent of the total quantity recovered on site in 1997 but not in 1999. Metals recovery, solvents recovery, and other recovery account for 3,000 tons, 8,000 tons, and 16,000 tons of the total, respectively. Table 4-4 presents the quantity of hazardous waste managed on site by NAICS code and recovery management type for all NAICS codes recovering more than 100 tons (0.4 percent).

NAICS 3326, spring and wire product manufacturing, recovered 6,500 tons (23.6 percent) of the total on-site recovery quantity. All of this quantity was managed by other recovery (spent acid with metals).

NAICS 3211, sawmills and wood preservation, recovered 5,700 tons (20.9 percent) of the 1997 total on-site recovery quantity. All of this quantity was managed by other recovery.

NAICS 3253, pesticide, fertilizer, and other agricultural chemical manufacturing, recovered 1,400 tons (5.0 percent) of the 1997 total on-site recovery quantity. All of this quantity was managed by other recovery.

NAICS 3252, resin, synthetic rubber, and artificial synthetic fibers and filaments manufacturing, recovered 1,300 tons (4.7 percent) of the 1997 total on-site recovery quantity. All of this quantity was managed by solvents recovery.

The remaining NAICS codes that recovered less than 1,300 tons on-site in 1997 account for 9,700 tons (35.1 percent) of the 1997 total on-site recovery quantity.

No SIC codes (that could be mapped into NAICS codes) were reported by facilities recovering 3,000 (10.8 percent) of the 1997 total on-site recovery quantity.

Approximately 4,500 tons were recovered off site in 1997 but not in 1999 within the same Industry Group (4-digit NAICS) by 46 plants within 17 NAICS codes. Two NAICS codes recovered greater than 1,000 tons in 1997 off site but not in 1999. Metals recovery, solvents recovery, and other recovery account for 200 tons, 4,000 tons, and 200 tons of the total, respectively. Table 4-5 presents the quantity of hazardous waste managed off site by NAICS code and recovery management type.

NAICS 5419, other professional, scientific, and technical services, recovered 2,600 tons (58.2 percent) of the 1997 total off-site recovery quantity. Nearly all of this quantity was managed by solvents recovery.

NAICS 3251, basic chemical manufacturing, recovered 1,500 tons (33.3 percent) of the 1997 total off-site recovery quantity. Nearly all of this quantity was managed by solvents recovery.

The remaining NAICS codes that recovered less than 1,500 tons off-site in 1997 account for 380 tons (8.5 percent) of the 1997 total off-site recovery quantity.

TABLE 4-4
WASTE QUANTITIES ASSUMED TO SHIFT TO ONSITE RECOVERY (WASTES WERE RECOVERED ONSITE IN 1997 BUT NOT RECOVERED IN 1999) BY NAICS CODE (TONS)

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS		
Code	M011	M012	M013	M014	M019	Recovery	M021	M022	M023	M024	M029	Recovery	M031	M032	M039	Recovery	Quantity	%	Cumul. %
3326						0						0	6,497			6,497	6,497	23.588	23.588
3211						0						0		2,585	3,168	5,753	5,753	20.886	44.474
3253						0						0			1,368	1,368	1,368	4.966	49.440
3252						0	1,181			124		1,305				0	1,305	4.738	54.177
3231				2		2	1,242		8	6		1,256				0	1,258	4.569	58.746
3344				279	60	340	274				422	696			14	14	1,050	3.812	62.559
3261						0	468	198			55	721				0	721	2.619	65.178
3222						0	530	36	105			671				0	671	2.436	67.614
3314			120	3		123	22				9	31			408	408	561	2.038	69.652
3255						0	347		121	3	34	505				0	505	1.833	71.485
3333						0	29	450				479				0	479	1.738	73.224
3312	318					318						0	63			63	381	1.385	74.608
3251	67	127		6		200	52					52	100	5	0	105	357	1.297	75.905
3372						0	177					177			172	172	349	1.266	77.171
3328			0			0	2					2		343		343	346	1.254	78.426
3133						0	251			5		257				0	257	0.931	79.357
3259						0	213					213			42	42	255	0.927	80.284
3351						0						0	245			245	245	0.888	81.173
3329				17		17	210					210				0	226	0.822	81.994
3363						0	194					194				0	194	0.704	82.699
4229						0			173			173				0	173	0.629	83.327
3399				0		0	163					163	2			2	165	0.597	83.925
3339						0	133				1	134				0	134	0.485	84.410
3219						0	127					127				0	127	0.461	84.872

TABLE 4-4
WASTE QUANTITIES ASSUMED TO SHIFT TO ONSITE RECOVERY (WASTES WERE RECOVERED ONSITE IN 1997 BUT NOT RECOVERED IN 1999) BY NAICS CODE (TONS)

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS		
Code	M011	M012	M013	M014	M019	Recovery	M021	M022	M023	M024	M029	Recovery	M031	M032	M039	Recovery	Quantity	%	Cumul. %
Others	0	1	66	86	61	215	705	159	22	4	1	890	0	82	16	98	1,203	4.368	89.240
No Code				13	1,551	1,564	191					191		29	1,180	1,208	2,964	10.760	100.000
TOTALS	**385**	**128**	**186**	**406**	**1,673**	**2,778**	**6,510**	**843**	**429**	**142**	**523**	**8,448**	**6,906**	**3,043**	**6,368**	**16,318**	**27,544**	**100.000**	**—**

SYSTEM TYPE CODES:

Metals Recovery

- M011 High temperature metals recovery
- M012 Retorting
- M013 Secondary smelting
- M014 Other metals recovery for reuse: e.g., ion exchange, reverse osmosis, acid leaching
- M019 Metals recovery - type unknown

Solvents Recovery

- M021 Fractionation/distillation
- M022 Thin film evaporation
- M023 Solvent extraction
- M024 Other solvent recovery
- M029 Solvents recovery - type unknown

Other Recovery

- M031 Acid regeneration
- M032 Other recovery: e.g., waste oil recovery, nonsolvent organics recovery
- M039 Other recovery - type unknown

TABLE 4-5

WASTE QUANTITIES RECOVERED OFFSITE IN 1997 BUT NOT RECOVERED IN 1999 - BY NAICS CODE (TONS))

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS		
Code	M011	M012	M013	M014	M019	Recovery	M021	M022	M023	M024	M029	Recovery	M031	M032	M039	Recovery	Quantity	%	Cumul. %
5419					14	14	2,610					2,610				0	2,624	58.240	58.240
3251	2	18		95	0	116	1,233				15	1,248		1	134	135	1,499	33.266	91.506
5622						0		128				128	1			1	128	2.847	94.353
3312						0						0	94			94	94	2.087	96.440
3314	75			0		75						0				0	75	1.672	98.111
3259						0	46					46				0	46	1.010	99.122
5417						0	0					0			15	15	15	0.338	99.460
3231				13		13						0				0	13	0.294	99.753
4219		8				8						0				0	8	0.174	99.927
3328	2					2						0				0	2	0.045	99.971
3254				1		1						0				0	1	0.012	99.984
3342				0		0						0				0	0	0.007	99.990
3222						0						0		0		0	0	0.005	99.995
3371				0		0						0				0	0	0.001	99.996
9999					0	0						0				0	0	0.000	99.996
2122					0	0						0				0	0	0.000	99.996
3372						0						0	0			0	0	0.000	99.996
No Code						0						0			0	0	0	0.004	100.000
TOTALS	**79**	**26**	**0**	**110**	**14**	**229**	**3,888**	**128**	**0**	**0**	**15**	**4,031**	**95**	**1**	**149**	**245**	**4,505**	**100.000**	**—**

SYSTEM TYPE CODES:

Metals Recovery	Solvents Recovery	Other Recovery
M011 High temperature metals recovery	M021 Fractionation/distillation	M031 Acid regeneration

TABLE 4-5

WASTE QUANTITIES RECOVERED OFFSITE IN 1997 BUT NOT RECOVERED IN 1999 - BY NAICS CODE (TONS))

NAICS	METALS RECOVERY					Total Metals	SOLVENTS RECOVERY					Total Solvents	OTHER RECOVERY			Total Other	TOTALS		
Code	M011	M012	M013	M014	M019	Recovery	M021	M022	M023	M024	M029	Recovery	M031	M032	M039	Recovery	Quantity	%	Cumul. %

M012 Retorting

M013 Secondary smelting

M014 Other metals recovery for reuse: e.g., ion exchange, reverse osmosis, acid leaching

M019 Metals recovery - type unknown

M022 Thin film evaporation

M023 Solvent extraction

M024 Other solvent recovery

M029 Solvents recovery - type unknown

M032 Other recovery: e.g., waste oil recovery, nonsolvent organics recovery

M039 Other recovery - type unknown

4.5 Off-Site Recovery Quantity Transferred Outside Industry Group in 1999 (Selected NAICS Codes) with On-Site Recovery Potential

The proposed regulation will allow an exclusion from RCRA Subtitle C jurisdiction if the hazardous wastes currently shipped off site for recovery are recovered on site. This regulation may induce facilities to construct on-site recovery facilities to gain the exclusion. The regulation will eliminate the economic barrier of applying for a RCRA permit to store waste at the generating facility for longer than 90 days. The Biennial Report data were analyzed for off-site shipments outside the same industry group (i.e., not within the same 4-digit NAICS code). These off-site recovery quantities are a subset of the total quantity of hazardous waste shipped off site for recovery.

A total of 755,000 tons of hazardous waste within eleven selected 4-digit NAICS codes were not transferred within the same industry group in 1999, and have the potential for onsite recovery. One NAICS code recovered greater than 470,000 tons (62% of the potential on-site recovery quantity). Metals recovery, solvents recovery, and other recovery account for 583,000 tons, 102,000 tons, and 70,000 tons of the total, respectively. Table 4-6 presents the quantity of hazardous waste with on-site recovery potential by NAICS code and recovery management type for 11 selected NAICS codes.

NAICS 3312, steel product manufacturing from purchased steel, recovered 470,000 tons (62.5 percent) of the potential on-site recovery quantity. Most of this quantity was managed by metals recovery.

NAICS 3344, , recovered 57,000 tons (7.5 percent) of the potential on-site recovery quantity. Most of this quantity was managed by metals recovery.

NAICS 3252, resin, synthetic rubber, and artificial synthetic fibers and filaments, recovered 33,000 tons (4.3 percent) of the potential on-site recovery quantity. Most of this quantity was managed by solvents recovery.

NAICS 3359, , recovered 33,000 tons (4.3 percent) of the potential on-site recovery quantity. Nearly all of this quantity was managed by metals recovery.

The remaining seven NAICS codes that recovered less than 30,000 tons off-site in 1999 account for 162,000 tons (21.4 percent) of the potential on-site recovery quantity.

TABLE 4-6 1999 OFF-SITE RECOVERY QUANTITY TRANSFERRED OUTSIDE INDUSTRY GROUP (FOR SELECTED NAICS CODES) WITH ON-SITE RECOVERY POTENTIAL (TONS)										
NAICS CODE	METALS RECOVERY		SOLVENTS RECOVERY		OTHER RECOVERY		TOTALS			
	# Waste Streams	Quantity (tons)	# Waste Streams	Quantity (tons)	# Waste Streams	Quantity (tons)	# Waste Streams*	Quantity (tons)	%	Cumul. %
3312	157	452,950	70	348	6	18,136	205	471,434	62.451	62.451
3344	980	48,639	138	2,159	143	5,792	1,151	56,589	7.496	69.947
3252	80	5,133	87	26,811	12	722	166	32,666	4.327	74.275
3359	163	32,333	38	139	11	72	195	32,543	4.311	78.586
3314	69	9,963	61	535	23	18,548	145	29,046	3.848	82.434
3241	127	8,540	54	284	130	19,723	287	28,547	3.782	86.215
3328	778	23,306	140	629	70	1,139	906	25,075	3.322	89.537
3255	58	94	167	22,764	19	66	227	22,924	3.037	92.574
3251	176	2,311	196	14,969	82	5,180	431	22,460	2.975	95.549
3362	40	54	107	17,883	11	130	145	18,067	2.393	97.942
3254	131	117	289	15,258	14	158	420	15,533	2.058	100.000
TOTALS	**2,759**	**583,440**	**1,347**	**101,778**	**521**	**69,667**	**4,278**	**754,885**	**100.000**	—

* The total number of waste streams is not equal to the sum of the number of waste streams for the three recovery types, since portions of each waste stream may be recovered by different method. The numbers in the total number of waste streams column represent the total number of unique waste streams.

4.6 Disposal Quantity in 1999 with On-Site Recovery Potential (Selected Waste Types and SIC Codes)

The proposed regulation will allow an exclusion from RCRA Subtitle C jurisdiction if the hazardous wastes currently land-disposed are recovered on site. This regulation may induce facilities to construct on-site recovery facilities to gain the exclusion. The regulation will eliminate the economic barrier of applying for a RCRA permit to operate the facility. The Biennial Report data were analyzed for disposal of eight selected waste types with a higher potential for recovery.

4.6.1 Off-Site Disposal

A total of 696,000 tons of hazardous waste within selected waste types and SIC codes, and with on-site recovery potential, were disposed off site in 1999 by 1,758 plants (1,585 unique plants). Two waste types disposed greater than 210,000 tons each (30.2% of the total off-site disposal quantity) in off-site disposal practices. These two waste types account for 71 percent of the total disposal quantity with on-site recovery potential. Incineration, energy recovery and fuel blending, aqueous inorganic treatment, aqueous organic and inorganic treatment, stabilization, and disposal are the primary disposal methods. These disposal methods account for 66,000 tons, 159,000 tons, 90,000 tons, 67,000 tons, 151,000 tons, and 100,000 tons of the total, respectively. Table 4-7 presents the quantity of hazardous waste disposed off site by waste type and disposal management type for selected waste types and SIC codes.

Organic Liquids from Industrial Organic Chemicals, Paints and Allied Products, Pharmaceutical Preparations, and Plastics Materials and Resins Industries (SICs 2869, 2851, 2834, 2821 and liquid form codes) disposed 220,000 tons (31.6 percent) of the total off-site disposal quantity. Most of this quantity was managed by incineration and energy recovery and fuel blending.

K061 - Emission Control Dust from Steel Works Industry (SIC 3312 and solid & sludge form codes) disposed 273,000 tons (39.2 percent) of the total off-site disposal quantity. Over half of this quantity was managed by stabilization.

Metal-Containing Liquids from Printed Circuit Board Industry (SIC 3672 and liquid form codes) disposed 22,000 tons (3.1 percent) of the total off-site disposal quantity. Most of this quantity was managed by aqueous inorganic treatment.

F006 - Electroplating Wastewater Treatment Sludges from Printed Circuit Board Industry (SIC 3672 and solid & sludge form codes) disposed 7,000 tons (1.0 percent) of the total off-site disposal quantity. Most of this quantity was managed by sludge treatment, other treatment, and transfer facility storage.

Spent Carbon from Industrial Organic Chemicals and Petroleum Refining Industries (SICs 2869, 2911 and solid & sludge form codes) disposed 2,000 tons (0.4 percent) of the total off-site disposal quantity. Most of this quantity was managed by incineration and other treatment.

K171 & K172 - Spent Catalyst from Petroleum Refining Industry (SIC 2911 and solid & sludge form codes) disposed 11,000 tons (1.6 percent) of the total off-site disposal quantity. Most of this quantity was managed by incineration, and other treatment.

K088 - Spent Aluminum Potliner from Aluminum Industry (SIC 3334 and solid & sludge form codes) disposed 73,000 tons (10.4 percent) of the total off-site disposal quantity. Most of this quantity was managed by incineration, aqueous inorganic treatment, other treatment, and disposal.

K062 - Spent Pickle Liquor from Steel Works Industry (SIC 3312 and liquid form codes) disposed 88,000 tons (12.7 percent) of the total off-site disposal quantity. Most of this quantity was managed by aqueous inorganic treatment and disposal.

4.6.2 On-Site Disposal

A total of 315,000 tons of hazardous waste within selected waste types and SIC codes, and with on-site recovery potential, were disposed on site in 1999 by 86 plants. Two waste types account for 100 percent of the total disposal quantity with on-site recovery potential. Aqueous inorganic treatment, other treatment, and disposal are the primary disposal methods. These disposal methods account for 35,000 tons, 88,000 tons, and 191,000 tons of the total, respectively. Table 4-8 presents the quantity of hazardous waste disposed on site by waste type and disposal management type for selected waste types and SIC codes.

Metal-Containing Liquids from Printed Circuit Board Industry (SIC 3672 and liquid form codes) disposed 134,000 tons (42.6 percent) of the total on-site disposal quantity. Most of this quantity was managed by disposal.

K062 - Spent Pickle Liquor from Steel Works Industry (SIC 3312 and liquid form codes) disposed 181,000 tons (57.5 percent) of the total on-site disposal quantity. Most of this quantity was managed by other treatment and disposal.

TABLE 4-7

1999 OFF-SITE DISPOSAL QUANTITY WITH ON-SITE RECOVERY POTENTIAL (SELECTED WASTE TYPES AND SIC CODES)

Selected Waste Types and SIC Codes	Incineration (M041-M049)		Energy Recovery and Fuel Blending (M051-M061)		Aqueous Inorganic Treatment (M071-M079)		Aqueous Organic Treatment (M081-M089)		Aqueous Organic and Inorganic Treatment (M091-M099)		Sludge Treatment (M101-M109)		Stabilization (M111-M119)		Other Treatment (M121-M129)		Disposal (M131-M137)		Transfer Facility Storage (M141)		No System Type Code		TOTAL QUANTITY
	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	
Organic Liquids from Industrial Organic Chemicals, Paints and Allied Products, Pharmaceutical Preparations, and Plastics Materials and Resins Industries (SICs 2869, 2851, 2834, 2821 and liquid form codes)	1,681	44,221	2,481	158,048	3	19	14	2,350	12	834	1	2	17	430	241	1,882	29	2,210	1,331	9,603	11	331	**219,930**
K061 - Emission Control Dust from Steel Works Industry (SIC 3312 and solid & sludge form codes)	0	0	0	0	0	0	0	0	7	62,536	0	0	22	141,447	2	2,365	12	50,816	0	0	4	16,044	**273,208**
Metal-Containing Liquids from Printed Circuit Board Industry (SIC 3672 and liquid form codes)	17	106	13	290	183	14,808	1	23	9	1,911	2	19	23	1,446	44	815	4	24	189	2,301	6	119	**21,862**
F006 - Electroplating Wastewater Treatment Sludges from Printed Circuit Board Industry (SIC 3672 and solid & sludge form codes)	8	369	3	141	13	738	0	0	0	0	18	874	29	769	33	1,509	9	165	63	2,512	1	18	**7,095**
Spent Carbon from Industrial Organic Chemicals and Petroleum Refining Industries (SICs 2869, 2911 and solid & sludge form codes)	65	743	17	419	0	0	3	65	0	0	1	2	1	0	16	836	4	131	35	205	2	54	**2,455**

TABLE 4-7

1999 OFF-SITE DISPOSAL QUANTITY WITH ON-SITE RECOVERY POTENTIAL (SELECTED WASTE TYPES AND SIC CODES)

Selected Waste Types and SIC Codes	Incineration (M041-M049)		Energy Recovery and Fuel Blending (M051-M061)		Aqueous Inorganic Treatment (M071-M079)		Aqueous Organic Treatment (M081-M089)		Aqueous Organic and Inorganic Treatment (M091-M099)		Sludge Treatment (M101-M109)		Stabilization (M111-M119)		Other Treatment (M121-M129)		Disposal (M131-M137)		Transfer Facility Storage (M141)		No System Type Code		TOTAL QUANTITY
	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	
K171 & K172 - Spent Catalyst from Petroleum Refining Industry (SIC 2911 and solid & sludge form codes)	40	2,616	3	34	2	18	0	0	1	42	0	0	9	748	37	5,146	12	407	15	787	7	1,118	**10,916**
K088 - Spent Aluminum Potliner from Aluminum Industry (SIC 3334 and solid & sludge form codes)	9	18,222	0	0	2	9,873	0	0	3	1,934	0	0	5	4,957	2	9,024	16	25,369	1	3,168	0	0	**72,547**
K062 - Spent Pickle Liquor from Steel Works Industry (SIC 3312 and liquid form codes)	0	0	0	0	24	64,622	0	0	2	21	0	0	5	1,499	3	1,257	7	20,646	2	54	0	0	**88,099**
TOTALS	**1,820**	**66,277**	**2,517**	**158,932**	**227**	**90,078**	**18**	**2,438**	**34**	**67,278**	**22**	**897**	**111**	**151,296**	**378**	**22,834**	**93**	**99,768**	**1,636**	**18,630**	**31**	**17,684**	**696,112**

TABLE 4-8

1999 ON-SITE DISPOSAL QUANTITY WITH ON-SITE RECOVERY POTENTIAL (SELECTED WASTE TYPES AND SIC CODES)

Selected Waste Types and SIC Codes	Aqueous Inorganic Treatment (M071-M079)		Aqueous Organic Treatment (M081-M089)		Aqueous Organic and Inorganic Treatment (M091-M099)		Sludge Treatment (M101-M109)		Other Treatment (M121-M129)		Disposal (M131-M137)		TOTAL QUANTITY
	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	# Waste Streams	Quantity	
Metal-Containing Liquids from Printed Circuit Board Industry (SIC 3672 and liquid form codes)	187	23,918	7	28	2	304	1	334	23	3,081	95	105,846	**133,511**
K062 - Spent Pickle Liquor from Steel Works Industry (SIC 3312 and liquid form codes)	4	11,571	0	0	0	0	0	0	1	84,798	4	84,802	**181,171**
TOTALS	**191**	**35,489**	**7**	**28**	**2**	**304**	**1**	**334**	**24**	**87,879**	**99**	**190,648**	**314,682**

4.7 Summary of Management Data

A total of 849 plants (large quantity generators) within 94 NAICS codes recovered 818,000 tons of hazardous waste on site in 1999. Metals recovery, solvents recovery, and other recovery account for 409,000 tons, 160,000 tons, and 250,000 tons of the total, respectively. Eleven NAICS codes each recovered more than 10,000 tons on site in 1999 and account for 68 percent of the total quantity recovered. The industries receiving the highest potential cost savings as a result of the rule are basic chemical manufacturing, nonferrous metal (except aluminum) production and processing, and steel product manufacturing from purchased steel.

A total of 249 plants (large quantity generators) within 30 NAICS codes recovered 59,000 tons off site in 1999 within the same industry group (4-digit NAICS code). Metals recovery, solvents recovery, and other recovery account for 19,000 tons, 36,000 tons, and 5,000 tons of the total, respectively. Nine NAICS codes each recovered more than 300 tons off site in 1999 within the same Industry Group (4-digit NAICS code) and account for 96 percent of the total quantity recovered off site. The industries receiving the highest potential cost savings from including transfers off site within the same Industry Group are pharmaceutical and medicine manufacturing, basic chemical manufacturing, other professional, scientific, and technical services, nonferrous metal (except aluminum) production and processing, steel product manufacturing from purchased steel, and resin, synthetic rubber, and artificial synthetic fibers and filaments.

Based on 1997 BRS data indicating the waste had been recovered previously, an additional 28,000 tons may be recovered on-site by 253 plants because of better economics under the proposed rule. Metals recovery, solvents recovery, and other recovery account for 3,000 tons, 8,000 tons, and 16,000 tons of the total, respectively. Also, an additional 4,500 tons identified may be recovered off site by 46 plants because of better economics if transferred within the same Industry Group. Metals recovery, solvents recovery, and other recovery account for 200 tons, 4,000 tons, and 200 tons of the total, respectively.

In addition, if it is economically feasible to construct on-site recovery facilities, part of a population of 6,177 plants recovering approximately 976,000 tons off site outside the same industry group may receive benefits from the proposed rule. A break-even cost analysis was conducted on wastes recovered by eleven NAICS codes. These eleven NAICS codes comprise 1,847 plants and 755,000 tons of the above totals. Metal recovery, solvent recovery, and other recovery within the selected NAICS codes account for 583,000 tons, 102,000, and 70,000 tons, respectively. Based on a break-even cost analysis, 142 of the 1,847 plants representing 257,000 of the 755,000 tons (168,695 tons for metals recovery, 72,040 tons for solvent recovery, and 15,952 tons for other recovery) may construct on-site recovery facilities.

Finally, if it is economically feasible to construct on-site recovery facilities, part of a population of 1,758 plants (1,585 unique plants) disposing approximately 696,000 tons off site may receive benefits from the proposed rule. A break-even cost analysis was conducted on the eight waste types from selected SIC codes included in the analysis (results presented in Table 5-21). Based on the break-even cost analysis, 681 of the 1,758 plants (some plants are double-counted because they disposed more than one of the eight waste types) representing 415,000 of the 696,000 tons may construct on-site recovery facilities. However, a significant limitation is that it is unknown if all eight of these wastes are of sufficient quality for recovery. Five of the eight wastes types have been identified as likely having sufficient constituent mix/concentration quality for recovery. Emission control dust (K061) from the steel works industry has a past history of being recovered for zinc values prior to the delisting of the significantly cheaper Envirosource stabilization technology. Most of the metal-containing liquids from the printed circuit board industry were reported being disposed either on-site or off-site by chemical precipitation and included in this group of waste. Upon further inspection of the Biennial Report data, the copper-containing sludge precipitated from this treatment process often goes on to metals recovery. This waste is of sufficient quality for recovery. Spent aluminum potliner (K088) from the aluminum industry has a proven technology for recovering fluoride values. The Vortec technology has been implemented at least at two sites and licensing agreements can be arranged for construction at other sites. The Vortec technology meets universal treatment standards for potliner waste. Spent catalyst (K171/K172) from the petroleum refining industry is believed to be recoverable based on communications with reclaimers. Spent pickle liquor (K062) from the steel works industry also is believed to have sufficient quality for recovery of acid values. The remaining three wastes are not assumed to be of sufficient quality for recovery in this analysis. Based on the break-even analysis for the five waste types of sufficient quality for recovery, 183 out of 331 plants representing 222,000 of the 467,000 tons may construct on-site recovery facilities. Incineration, aqueous treatment, stabilization, and disposal account for 21,000 tons, 156,000 tons, 150,000 tons, and 97,000 tons, respectively. In addition, part of a population of 86 plants disposing approximately 315,000 tons on site may receive benefits from the proposed rule. A break-even cost analysis was conducted on the two waste types from selected SIC codes included in the analysis (results presented in Table 5-22). Based on the break-even cost analysis, 27 of the 86 plants representing 181,000 of the 315,000 tons may construct on-site recovery facilities. Aqueous inorganic treatment, other treatment, and disposal account for 35,000 tons, 88,000 tons, and 191,000 tons, respectively.

For the wastes that already are being recovered or were being recovered in 1997 and five waste types being disposed with high recovery potential (discussed in Section 5), the total number of plants affected is estimated to be 1,749. These plants recover approximately 1,570,000 tons either on site or within the same industry group and may benefit from the exclusion from RCRA jurisdiction.

5.0 COST IMPACT ANALYSIS

5.1 Types of Cost Savings

The proposed rule will create cost savings. First, given an exclusion from the Definition of Solid Waste, the generator no longer needs to comply with manifest, pre-transport, and recordkeeping and reporting requirements under 40 CFR Part 262 of RCRA for those wastes. Second, given that the excluded quantities are no longer considered hazardous if recovered, the generator status of the facility may switch from being a large quantity generator to a small or conditionally exempt small quantity generator. Small and conditionally exempt small quantity generators have fewer administrative requirements than large quantity generators under Part 262 of RCRA. Finally, if wastes are no longer listed as hazardous if recovered either on site or off site within the same industry group (4-digit NAICS), residuals from the recovery processes may no longer be hazardous under the "Derived-from Rule." The management of these residuals may shift from Subtitle C to Subtitle D disposal if they do not test characteristically hazardous. In addition, with the wastes no longer being defined as hazardous waste if recovered, generators may no longer need to pay hazardous waste generation taxes and fees. Reductions in hazardous waste taxes and fees are not social cost savings, but, reductions in transfer costs. However, these reductions may influence a firms's decision to reclaim it's wastes.

5.2 Baseline Cost Components

The baseline management practices for recovered wastes were identified using the 1999 Biennial Report. For facilities recovering wastes <u>on site in 1999</u>, the primary metals, solvents, and other recovery practices are high temperature metals recovery/secondary smelting, fractionation/ distillation, and acid regeneration used to represent all "other recovery practices", respectively. Residuals from these recovery practices that are derived from a listed waste or have a hazardous characteristic are managed as hazardous. High temperature metals recovery/secondary smelting, fractionation/distillation, and acid regeneration residuals are assumed to be managed by hazardous waste landfill disposal with stabilization, energy recovery, and chemical precipitation with off-site stabilization and landfill disposal of precipitates and sewer discharge of neutralized wastewater, respectively, in this economic assessment.

For facilities recovering wastes <u>off site within the industry group in 1999</u>, the primary metals, solvents, and other recovery practices are high temperature metals recovery/secondary smelting, fractionation/distillation, and acid regeneration, respectively. Residuals from these management practices that are derived from a listed waste or have a hazardous characteristic are managed as hazardous. High temperature metals recovery/secondary smelting, fractionation/distillation, and acid regeneration residuals are assumed to be managed by hazardous waste landfill disposal with stabilization, energy recovery, and chemical precipitation with off-site stabilization and landfill disposal of precipitates and sewer discharge of neutralized wastewater, respectively.

If hazardous wastes are excluded from RCRA Subtitle C jurisdiction if recovered additional facilities may determine that recovering their waste is more economical than treatment or disposal. Three groups of waste are evaluated for their potential new recovery practices. The first group of plants are those that reported a quantity of waste recovered in 1997 but not in 1999. 1997 Biennial Report data were used to identify the plants that recovered hazardous wastes in 1997. Based on an analysis of market price changes between 1997 and 1999, it is assumed that <u>100 percent</u> of the 1997 waste streams which went to recycling (but did not in 1999) would again be sent to recycling as a result of the change in regulatory status for these wastes (see Appendix E). Some of the limitations with this assumption is that the plant may have closed, discontinued the process generating the waste, modified the process such that the waste was no longer generated, or the waste was a one-time generation event (e.g., spill cleanup or remediation activity). For facilities that recovered wastes <u>on site or off site in 1997</u>, the assumed baseline management practices in 1999 for metal-bearing, solvent and acidic wastes are off-site commercial hazardous waste landfill, off-site energy recovery, and on-site neutralization, respectively. Residuals from these management practices are minimal or non-hazardous. Off-site landfill residual (leachate) management costs would be included in the commercial landfill price. Off-site energy recovery residual management costs would be included in the commercial energy recovery (e.g., cement kiln) price. Acid neutralization residuals would be discharged to a POTW which has a relatively small cost.

The second group of plants are those that <u>recovered wastes off site outside their industry group in 1999</u>. If economically feasible, some of these plants may construct on-site recovery facilities to recover metal, solvent and acid values from their wastes. The primary (baseline) off-site metals, solvents, and other recovery practices are high temperature metals recovery/secondary smelting, fractionation/distillation, and acid regeneration, respectively. Residuals from these management practices that are derived from a listed waste or have a hazardous characteristic are managed as hazardous. High temperature metals recovery/secondary smelting, fractionation/distillation, and acid regeneration residuals are assumed to be managed by hazardous waste landfill disposal with stabilization, energy recovery, and chemical precipitation with off-site stabilization and landfill disposal of precipitates and sewer discharge of neutralized wastewater, respectively. A break-even cost analysis was conducted to determine which plants would construct on-site recovery facilities.

The third group of plants are those that <u>disposed wastes on site or off site in 1999.</u> If economically feasible, some of these plants may construct on-site recovery facilities to recover metal, solvent and acid values from their wastes. Table 5-1 presents the specific waste types that were evaluated and their respective baseline management practices and residual management practices. A break-even cost analysis was conducted to determine which plants would construct on-site recovery facilities.

Table 5-1. Baseline Management Practices for List of Disposed Waste Types Analyzed for Potential On-Site Recovery			
Waste Types	**SIC Codes**	**Waste Forms**	**Baseline Management (Residual Management)**
Organic Liquids (from Industrial Organic Chemicals, Paints and Allied Products, Pharmaceutical Preparations, and Plastics Materials and Resins Industries)	2869 2851 2834 2821	Liquid Form Codes (B101-B119, B201-B219)	Off-site Fuel Blending
Emission Control Dust (from Steel Works Industry)	3312	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	Off-site Stabilization and Subtitle D Landfill (Envirosource delisting technology)
Metal-Containing Liquids (from Printed Circuit Board Industry)	3672	Liquid Form Codes (B101-B119, B201-B219)	On-site or Off-site Chemical Precipitation
Electroplating Wastewater Treatment Sludges (from Printed Circuit Board Industry)	3672	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	Off-site Stabilization and Landfill
Spent Carbon (from Industrial Organic Chemicals and Petroleum Refining Industries)	2869 2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	Off-site Incineration or Carbon Regeneration[1]
Spent Catalyst (from Petroleum Refining Industry)	2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	Off-site Stabilization and Landfill
Spent Aluminum Potliner (from Aluminum Industry)	3334	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	Off-site Incineration
Spent Pickle Liquor (from Steel Works Industry)	3312	Liquid Form Codes (B101-B119, B201-B219)	On-site or Off-site Chemical Precipitation

Table 5-1. Baseline Management Practices for List of Disposed Waste Types Analyzed for Potential On-Site Recovery			
Waste Types	**SIC Codes**	**Waste Forms**	**Baseline Management (Residual Management)**
[1] Facilities reporting Other Treatment (M125) waste stream management in the 1999 BRS were assumed to use off site regeneration of carbon as the disposal method. All other facilities were assumed to use incineration as the baseline management method.			

Current RCRA administrative requirements for the baseline large quantity generators (LQGs) identified through the Biennial Report System are listed in Table 5-2. A summary of potential cost impacts for each administrative requirement, pre- and post-rule, are included in the table from any changes in generator status that may result from the exclusion from the Definition of Solid Waste.

In addition, transfer costs may be reduced with the reduction in hazardous waste generation taxes and fees paid by generators who reclaim their wastes. These costs do not count as social cost savings because they are a redistribution (transfer) of wealth. However, they do influence a generators's (firm's) decision to reclaim their waste. See Appendix F for an analysis of current state hazardous waste generator taxes and fees.

Table 5-2. RCRA Administrative Requirements for Generators

RCRA Generator Requirement	Generator Status			Cost Impacts
	LQG (> 13.2 tons/yr)	SQG (1.3 - 13.2 tons/yr)	CESQG (< 1.3 tons/yr)	
EPA ID Number	Required	Required	Not required	Assumed no cost savings because generators already have incurred costs for obtaining EPA ID number.
RCRA Personnel Training	Required (40 CFR 262.34)	Basic training required (40 CFR 262.34)	Not required	Cost savings incurred if generator becomes a small or conditionally exempt small quantity generator with exclusion from the Definition of Solid Waste.

Table 5-2. RCRA Administrative Requirements for Generators				
RCRA Generator Requirement	**Generator Status**			**Cost Impacts**
	LQG (> 13.2 tons/yr)	**SQG (1.3 - 13.2 tons/yr)**	**CESQG (< 1.3 tons/yr)**	
Recordkeeping	Required for manifests, exception report, and biennial report.	Required for manifests and exception reports.	Not required	Cost savings incurred if recovered waste not defined as a hazardous waste or if generator becomes a small or conditionally exempt small quantity generator with exclusion from the Definition of Solid Waste.
Exception Report	Required within 45 days of hazardous waste being accepted by initial transporter	Required within 60 days of hazardous waste being accepted by initial transporter	Not Required	Cost savings incurred if generator becomes a small or conditionally exempt small quantity generator with exclusion from the Definition of Solid Waste.
Biennial Report	Required	Not required	Not required	Cost savings incurred if generator becomes a small or conditionally exempt small quantity generator with exclusion from the Definition of Solid Waste.
Accumulation Time Limits	90 days	180 days [or 270 days if transported more than 200 miles]	None	Cost savings incurred if generator becomes a small or conditionally exempt small quantity generator with exclusion from the Definition of Solid Waste.
Storage Requirements for Accumulated Hazardous Waste	Full compliance with management of containers or tanks	Basic requirements with technical standards for containers or tanks	None	Assumed no cost savings if generator status changes because facilities already have incurred costs.

Table 5-2. RCRA Administrative Requirements for Generators				
RCRA Generator Requirement	Generator Status			Cost Impacts
	LQG (> 13.2 tons/yr)	SQG (1.3 - 13.2 tons/yr)	CESQG (< 1.3 tons/yr)	
Use Manifests	Required	Required, unless the waste is reclaimed under a contractual agreement	Not required	Cost savings incurred if recovered waste not defined as a hazardous waste or if generator becomes a small (with contract agreement) or conditionally exempt small quantity generator with exclusion from the Definition of Solid Waste.
Contingency Plan	Required	Not required	Not required	Cost savings incurred if generator becomes a conditionally exempt small quantity generator with exclusion from the Definition of Solid Waste.
LQG = Large quantity generator SQG = Small quantity generator CESQG = Conditionally exempt small quantity generator				

5.3 Post-Regulatory Cost Components

Under post-regulatory conditions, facilities that recovered wastes on-site and off-site (within the same industry group) for the 1999 site list have the same recovery management practices as those for the baseline scenario, however, residual management may change. If wastes are no longer "listed" as hazardous if they are recovered either on site or off site within the same industry group (4-digit NAICS), residuals from the recovery processes will no longer be hazardous under the "Derived-from Rule"unless they exhibit a hazardous characteristic. For high temperature metals recovery/secondary smelting, hazardous residual management is assumed to be disposed in a Subtitle C landfill with stabilization. The management of these residuals will shift from Subtitle C to Subtitle D landfill if they do not test characteristically hazardous. Non-hazardous residual management is assumed to be Subtitle D landfilling. For fractionation/distillation, hazardous and non-hazardous residual management is assumed to be fuel blending. For acid regeneration, hazardous residual management is assumed to be chemical precipitation. The management of these residuals will shift from Subtitle C to Subtitle D disposal if they do not test characteristically hazardous. Non-hazardous residual management is assumed to be sewer discharge to a local publically owned treatment works (POTW). It is assumed as a rough approximation that 5 percent, 15 percent, and 25 percent of the residual quantity is nonhazardous post rule, for secondary smelting, distillation, and acid regeneration, respectively. These percentages are based on an analysis of the frequency and quantity of wastes currently classified as characteristic only waste (i.e., single or multiple D-code wastes) entering on-site recovery processes in 1999. These percentages reflect the portion of the waste entering recovery processes that are not characteristically hazardous (i.e., single or multiple D-code wastes), but, listed hazardous waste which will become nonhazardous post rule.

For facilities that recovered wastes on site and off site in 1997 but not in 1999, the post-regulatory management practices for metal-bearing, solvent and acidic wastes are high temperature metals recovery/secondary smelting, fractionation/distillation, and acid regeneration, respectively, based on recovery practices reported in 1997. The residual management assumptions are the same as those presented above.

For facilities that recovered wastes off-site outside their industry group in 1999, the post-regulatory recovery management practices for metal-bearing, solvent and acidic wastes are ON-SITE high temperature metals recovery/secondary smelting, fractionation/distillation, and acid regeneration, respectively, if economically feasible. A break-even cost analysis was conducted to determine which plants would construct on-site recovery facilities. Otherwise there is no change from the baseline management practice. The residual management assumptions are the same as those presented above for on-site recovery systems.

For facilities of selected waste types that disposed wastes off-site in 1999, the post-regulatory ON-SITE recovery management practices and residual management practices are presented in Table 5-3, if economically feasible. A break-even cost analysis was conducted to determine which plants would construct on-site recovery facilities. If it is not economically feasible to construct an on-site recovery system there is no change from the baseline management practice.

Table 5-3. Post-Regulatory Management Practices for List of Disposed Waste Types Analyzed for Potential On-Site Recovery			
Waste Types	**SIC Codes**	**Waste Forms**	**Post-Regulatory Management (Residual Management)**
Organic Liquids (from Industrial Organic Chemicals, Paints and Allied Products, Pharmaceutical Preparations, and Plastics Materials and Resins Industries)	2869 2851 2834 2821	Liquid Form Codes (B101-B119, B201-B219)	On-site Fractionation/ Distillation
Emission Control Dust (from Steel Works Industry)	3312	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	On-site Smelting
Metal-Containing Liquids (from Printed Circuit Board Industry)	3672	Liquid Form Codes (B101-B119, B201-B219)	On-site Ion Exchange
Electroplating Wastewater Treatment Sludges (from Printed Circuit Board Industry)	3672	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	On-site Smelting
Spent Carbon (from Industrial Organic Chemicals and Petroleum Refining Industries)	2869 2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	On-site Carbon Regeneration: "Roasting"
Spent Catalyst (from Petroleum Refining Industry)	2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	On-site Smelting
Spent Aluminum Potliner (from Aluminum Industry)	3334	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	On-site Fluoride Recovery using Vortec technology
Spent Pickle Liquor (from Steel Works Industry)	3312	Liquid Form Codes (B101-B119, B201-B219)	On-site Acid Regeneration

Potential cost savings from changes in RCRA administrative requirements because of reduced manifest, recordkeeping, and generator status (i.e., SQG and CESQG) requirements are listed in Table 5-2.

An additional one-time costs will be incurred by each generator for completing a notification of RCRA exclusion for their waste.

There is a distributional affect on transfer costs. If wastes are no longer "listed" as hazardous if they are recovered either on site or off site within the same Industry Group (4-digit NAICS), state hazardous waste generation taxes and fees may no longer apply. These reductions in costs are not social cost savings but do impact a generator's decision to reclaim its wastes. State hazardous waste taxes and fees are presented in Appendix F.

5.4 Annualization Methodology of Before-Tax Compliance Costs

Under Executive Order 12866, EPA must determine whether a regulation constitutes a "significant regulatory action." One of the criteria for defining a significant regulatory action, as defined under the Executive Order, is if the rule has an annual effect on the economy of $100 million or more. To determine whether the proposed exclusion from the Definition of Solid Waste is a significant regulatory action under this criteria, all costs are annualized on a before-tax basis assuming a seven percent real discount rate. The savings attributable to corporate tax deductions or depreciation on capital expenditures for equipment are not considered in calculating before-tax costs.

A plant-specific annualized before-tax cost analysis was conducted for each plant affected by the proposed rulemaking. Annual before-tax baseline, compliance, and incremental compliance costs were estimated for each plant. Before-tax incremental compliance costs were used because they represent a resource or social cost of the rulemaking, measured before any business expense tax deductions that are available to affected companies. In reformulating the social costs of compliance, a discount rate (real rate of return) of seven percent was used, assuming either a 10-year or 14-year borrowing period.

The following formula was used to determine the before-tax annualized costs:

Annual Before-Tax Costs = (Capital Costs)(CRF_n)+ (Annual O&M Costs)

Where: CRF_n = Capital recovery factor (i.e., the amount of each future annuity payment required to accumulate a given present value) based on a 7 percent real rate of return (i) and a 10-year borrowing period (n) as follows:

$$\frac{(1+i)^n(i)}{(1+i)^n-1} = \begin{array}{ll} 0.14238 & \text{when } n = 10 \\ 0.11435 & \text{when } n = 14 \end{array}$$

Costs for contingency planning, initial waste characterization, and the notification of exclusion are one-time costs. These costs will be incurred the first year, but not subsequent years.

5.5 Example Cost Calculations

Using the waste quantity/recovery technology inputs, unit costs, and annualized cost functions described in the following subsections, cost impacts/savings were calculated on a per plant basis. All the plant-specific cost impact/savings calculations are summed over all plants identified as potentially impacted by the proposed rule to determine the total cost impact/savings from the rule. Cost determinants are the plant's quantity of hazardous waste recovered on site or off site within the same Industry Group (4-digit NAICS code), recovery management method, and the total quantity of hazardous waste generated to determine RCRA administrative requirements that vary depending on generator status (i.e., large, small, or conditionally exempt).

Example cost calculations are presented for the following six plant categories: 1) plants that recovered hazardous waste on site in 1999, 2) plants that recovered hazardous waste on site in 1997 but not in 1999, 3) plants that recovered waste off site in 1999 within the same industry group, 4) plants that recovered waste off site in 1997 within the same industry group, 5) plants that recovered waste off site in other industry groups, and 6) plants that disposed potentially recoverable wastes on-site or of–site in 1999. The type of waste being recovered (metal-bearing, solvent, or acid), the year the waste was recovered and the location (on- or off-site) determined the cost calculation methodology. Table 5-4 references the appendices at the end of this analysis that present an example calculation demonstrating how the costs were calculated for each plant for that plant category and waste type. Given resource constraints, example cost calculations are not presented in the appendices for all the waste types within the off-site recovery in other industry group plant category and on-site and off-site disposal plant category where a break-even cost analysis was conducted to determine economic feasibility for constructing an on-site recovery system. Four examples are presented demonstrating how the break-even cost-analysis calculations were conducted

Table 5-4. Example Cost Calculation Reference List by Plant Category

Plant Category	Waste Type	Baseline (Pre-Rule) Management	Post-Rule Management	No. of Plants*	Quantity (tons)	Example Cost Calculation Reference
On-site Recovery						
1999 On-site Recovery Plants	metal-bearing waste	On-site Metal Recovery	On-site Metal Recovery	175	409,315	Appendix G
	spent solvents	On-site Solvent Recovery	On-site Solvent Recovery	640	160,139	Appendix H

Table 5-4. Example Cost Calculation Reference List by Plant Category						
Plant Category	**Waste Type**	**Baseline (Pre-Rule) Management**	**Post-Rule Management**	**No. of Plants***	**Quantity (tons)**	**Example Cost Calculation Reference**
	spent acid	On-site Acid (Other) Recovery	On-site Acid (Other) Recovery	74	249,904	Appendix I
1997 On-site Recovery Plants	metal-bearing waste	Off-site Hazardous Landfill	On-site Metal Recovery	33	2,854	Appendix J
	spent solvent	Off-site Energy Recovery	On-site Solvent Recovery	189	8,451	Appendix K
	spent acid	On-site Acid Neutralization	On-site Acid (Other) Recovery	34	16,312	Appendix L
Off-site Recovery Within Industry Group (4-Digit NAICS Code)						
1999 Off-site Recovery Plants Within Industry Group	metal-bearing waste	Off-site Metal Recovery	Off-site Metal Recovery	160	25,618	Appendix M
	spent solvent	Off-site Solvent Recovery	Off-site Solvent Recovery	76	28,635	Appendix N
	spent acid	Off-site Acid (Other) Recovery	Off-site Acid (Other) Recovery	22	5,183	Appendix O
1997 Off-site Recovery Plants Within Industry Group	metal-bearing waste	Off-site Hazardous Landfill	Off-site Metal Recovery	27	229	Appendix P
	spent solvent	Off-site Energy Recovery	Off-site Solvent Recovery	10	4,031	Appendix Q
	spent acid	On-site Acid Neutralization	Off-site Acid (Other) Recovery	9	245	Appendix R

Table 5-4. Example Cost Calculation Reference List by Plant Category						
Plant Category	**Waste Type**	**Baseline (Pre-Rule) Management**	**Post-Rule Management**	**No. of Plants***	**Quantity (tons)**	**Example Cost Calculation Reference**
Shifting from Off-site Recovery Outside Industry Group to On-site Recovery						
1999 Off-Site Recovery Plants Outside Industry Group	metal-bearing waste	Off-site Metals Recovery	On-site Metals Recovery	1,244	583,440	Did not prepare an example cost calculation.
	spent solvent	Off-site Energy Recovery	On-Site Energy Recovery	763	101,778	Appendix S
	spent acid	Off-site Acid (Other) Recovery	On-Site Acid Recovery	276	69,667	Appendix T
Shifting from Disposal to On-site Recovery						
1999 On-Site or Off-Site Disposal Plants	K061 - electric arc furnace dust	Off-site Stabilization and Subtitle D Landfill (Envirosource delisting technology)	On-site Smelting	30	273,208	Appendix U
	Metal-Containing Liquids (from Printed Circuit Board Industry)	On-site or Off-site Chemical Precipitation	On-site Ion Exchange Metals Recovery using MR3 System technology	252	155,354	Did not prepare an example cost calculation.
	Spent Catalyst (from Petroleum Refining Industry)	Off-site Stabilization and Landfill	On-site Smelting	75	11,001	Did not prepare an example cost calculation.
	K088 - spent aluminum potliner	Off-site Incineration	On-site Fluoride Recovery using Vortec technology	21	72,547	Appendix V

Table 5-4. Example Cost Calculation Reference List by Plant Category						
Plant Category	**Waste Type**	**Baseline (Pre-Rule) Management**	**Post-Rule Management**	**No. of Plants***	**Quantity (tons)**	**Example Cost Calculation Reference**
	K062 - spent pickle liquor	On-site or Off-site Chemical Precipitation	On-site Acid Regeneration	35	269,329	Did not prepare an example cost calculation.
* Some plants are counted more than once because they recover a combination of metal, solvent and/or other wastes.						

5.6 Unit Cost and Cost Function Estimates

Metal Recycling (Secondary Smelting) Costs

<u>Offsite Metal Recovery</u>

Recycling cost estimates were taken from a previous Agency rulemaking titled *Regulatory Impact Analysis of the Final Rule for a 180-Day Accumulation Time for F006 Wastewater Treatment Sludges*, November 10, 1999 (F006 180-Day Accumulation Rule). In that analysis recycling costs for recovering metals from F006 wastewater treatment sludges were estimated from 1993 cost data provided in Exhibit 7-1 of Cushnie, George C., CAI Engineering, "Pollution Prevention and Control Technology for Plating Operations," prepared for NCMS/NAMF. Table 5-5 presents the estimate from the above report for the metal recycling/recovery unit costs being paid by F006 sludge generators. Transportation costs were subtracted from the estimated recycling costs. 1997 unit transportation prices reported in Environmental Cost Handling Options and Solutions (ECHOS), <u>Environmental Remediation Cost Data-Unit Price</u>, 4th Annual Edition, published by R.S. Means and Delta Technologies Group, Inc., 1998, were used to estimate transportation costs in that analysis. Differences in average unit recycling costs in Table 5-5 are the result of variability in the amount various recyclers charge generators. A major factor contributing to the differences in recycling costs is metal content (i.e., concentration and type of metals present in the waste). The generally lower costs for the small facilities that recover metals may be due to the fact that these facilities tend to generate single-metal wastes which are more amenable to recycling.

No minimum charge is assumed for transfers of bulk shipments within the same Industry Group (4-digit NAICS). It is assumed that transfers are typically occurring within the same parent company and that they would not charge a minimum fee, unlike a commercial metal recovery facility. Normally, one would assume that a commercial off-site facility will have a minimum charge for accepting small quantities of waste for recovery.

In the F006 180-Day Accumulation Rule report, an average unit recycling cost of $0.20/lb was assumed as an upper-end typical price charged by a metals recovery facility based on the 1993 data provided in Cushnie. One recycler that was contacted provided an average 1998 price of approximately $0.10/lb. For that analysis, impacts are evaluated based on average recycling prices ranging from $0.10/lb to $0.20/lb ($200/ton to $400/ton).[11] In some cases, when the metal value is very high, the charges can be somewhat lower.[12] Minimum charges are at least sometimes avoided when the recycler actually picks up the F006 directly from the generator.[13]

Residuals generation from metals recovery were estimated using 1999 BRS data. Waste streams at selected recovery facilities were reviewed by comments, disposal system type, and origin to determine the likely waste streams generated from the recovery operations. Approximately 32 percent of the metals recovery mass was identified as residuals in the 1999 BRS data (see Appendix W). The hazardous fraction of the residuals were determined by reviewing the waste codes for the waste streams reporting metals reclamation. Waste streams reporting characteristic codes were assumed to have residuals that would be characteristically hazardous waste. For metals recovery, approximately 95 percent of the residual waste volume and frequency of waste streams are estimated to be characteristically hazardous with the remaining 5 percent containing listed hazardous wastes which will become nonhazardous post rule.

For purposes of this rule making, a unit cost of $316 per ton (2002$) was assumed for commercial metals recovery. This unit cost was used as a proxy to estimate the unit cost to recover metals onsite for those who conducted the practice on-site in 1997, assuming a 15% profit factor (i.e., direct cost to recover waste is $268 per ton in 2002 dollars). The commercial unit cost is assumed to include all capital and annual expenditures necessary for the metals recovery system. It is assumed that these facilities already have invested a significant amount of capital into recovery units that exist on site (but were not used in 1999). Metal salvage value was considered separate from the recovery unit cost.

---

[11] The estimates of average recycling costs were confirmed by industry contacts (Jarvis, 1999, Personal Communication, Eritech, North Carolina; Anonymous, 1999, Personal Communication, Sun-Glo Pating, Florida).

[12] Shields, 1999, Personal Communication, American Nickeloid, Illinois.

[13] Jarvis, 1999, Personal Communication, Eritech, North Carolina; and Anonymous, 1999, Personal Communication, Dearborn Brass, Texas.

Table 5-5. Estimated F006 Off-site Metals Recycling Costs (1993$)					
Generator Type	**No. of Data Points**	**Transport**		**Recycling**	
		Average Unit Cost ($/lb) (+/- st. dev.)	**Minimum Median Maximum Unit Cost ($/lb)**	**Average Unit Cost ($/lb) (+/- st. dev.)**	**Minimum Median Maximum Unit Cost ($/lb)**
Small LQG - small shipment (< 13.2 t/yr)*	31	0.49 +/-0.50	0.11 0.27 2.07	0.02 +/-0.56	-1.77 0.07 0.76
Small LQG - large shipment (13.2 - < 60 t/yr)	36	0.11 +/-0.08	0.02 0.08 0.39	0.20 +/-0.21	-0.14 0.18 1.04
Large LQG (60 t/yr or greater)	20	0.06 +/-0.05	0.02 0.02 0.16	0.17 +/-0.15	0.01 0.14 0.61
Total	87	0.15 +/-0.18	0.02 0.09 1.04	0.22 +/-0.27	-0.74 0.18 0.9

* Assumes all facilities are LQGs and ship four times per year. This data may include SQGs which ship at a maximum of 2 times per year. If these facilities are SQGs, the average transport unit cost is $0.25/lb (+/-0.25) and average recycling unit cost is $0.26/lb (+/-0.36).

Assumptions:

Step 1: Used 1993 cost data provided in Exhibit 7-1 of Cushnie, George C., CAI Engineering, "Pollution Prevention and Control Technology for Plating Operations," prepared for NCMS/NAMF.

Step 2: Eliminated seven data records from Cushnie that do not provide either shipping distance, quantity shipped, or unit cost. Based on inspection, four records eliminated as statistical outliers.

Step 3: Assumed the following distances:
Category < 500 miles = 250 miles,
Category 500 to 1,000 miles = 750 miles,
Category 1,000 to 1,500 miles = 1,250 miles,
Category 1,500 to 2,000 miles = 1,750 miles, and
Category 2,000 to 2,500 miles = 2,250 miles.

Step 4: Assumed LQG and 90-day storage if > 26,400 lbs generated annually.

Step 5: Assumed a full shipment size of 15 tons based upon EPA’s Common Sense Initiative report.

Step 6: Assumed minimum of 4 shipments/year (i.e., 90-day storage limit) for LQGs.

Step 7: Used 1998 ECHOS transportation unit price estimates ($/mile) for van trailer transportation of hazardous waste. Assume transportation prices have not changed significantly since 1993 given that increased labor costs are likely being balanced by historically low fuel costs.

Step 8: Used 1998 ECHOS minimum charge for van trailer transportation of small hazardous waste loads of $732.33 per shipment as a minimum cost. Assumed $2.64/each supersack for loading on to the truck. Assumed transportation prices have not changed significantly since 1993 given that increased labor costs are likely being balanced by historically low fuel costs.

Recovery from Metals Containing Liquids

For recovery of metals from metals containing liquids, cost for an ion exchange process for MR3 Systems Inc.[14] recovery process was estimated (Table 5-6). Company literature provided capital and operation costs of $4 million and $2 million, respectively, for a 50,000 ton per year facility. The data was scaled using a 0.54 factor for capital and 0.7 factor for operation and maintenance. Capital costs were annualized over 14 years at 7 percent using a capital recovery factor (CRF) of 0.11435.

Table 5-6. Estimated On-site Metal Recovery Costs for Metal Containing Liquids (2002$)

Cost Element	Annual Expenditure ($/ton)
Capital Expenditure (Annualized)[1]	$1,095* (Recovered Waste Quantity)^0.54
Operation and Maintenance	$1,027*(Recovered Waste Quantity)^0.70

[1] Annualized over 14 years at 7 percent interest rate using a CRF of 0.11435.

Primary Electric Arc Furnace Dust Metals Recovery and Stabilization Technologies

In 1980, the United States Environmental Protection Agency (EPA) classified emission control dust and sludge from the primary production of steel in electric arc furnaces as listed hazardous waste K061 (40 CFR 261.32), due to the fact that it contains toxic levels of metals such as zinc, iron, lead, cadmium and chromium. Currently, the EPA requires that electric arc furnace (EAF) dust be disposed of by one of two approved methods: high temperature metals recovery (HTMR) or stabilization.

HTMR – Horsehead Resources Development Co.: Horsehead Resource Development Co. recycles 330,000 tons of EAF dust per year with a process known as High Temperature Metals Recovery (HTMR), using a Waelz reduction kiln. The Waelz kiln process is used to enrich the EAF dust to a product with greater than 45% zinc. The zinc oxide material is mixed with reducing agents, such as lime and coke, and heated in the kiln to a point where zinc vapor is formed. The zinc fumes are then carried off with the offgases and collected in dustbags to be sold. Horsehead operates Waelz reduction kilns in Palmerton, PA; Calumet, IL; and Rockwood, TN. In 1988, the EPA stated that this process is the best-demonstrated control technology for treating EAF dust.

Stabilization - Envirosource Technologies: Envirosource describes its stabilization technology on its website as follows: “Super Detox® is a technologically advanced stabilization process which involves a series of complex chemical and physical reactions including oxidation/reduction; metals insolubilization; silicate polymerization and substitution; pozzolonic bonding and solidification which chemically change

[14] MR3 Systems Inc., http://www.mr3systems.com

the metals to their least soluble state and physically immobilize them. The stabilized material, which meets the regulatory standards and exhibits low permeability and high strength properties, can then be treated as a non-hazardous material. This patented process, which was developed specifically to treat EAF dust by Bethlehem Steel Corporation, has been perfected and extensively tested by Envirosource during ten years of research and commercial application. The first Super Detox plant was installed eight years ago at Northwestern Steel and Wire Co. in Sterling, Illinois. In June of 1995, the EPA granted a unique multi-site delisting for Super Detox. The EPA delisting validates the environmental soundness of the technology and marks the recognition by the regulators of the need for alternatives to HTMR processes such as the Waelz Kiln."

HTMR Technologies **for Electric Arc Furnace Dust Metals Recovery**

Several companies are currently developing or provide HTMR technologies for recovering metals from EAF dust, through laboratory and pilot plant tests. The following paragraphs provide brief descriptions of some of these technologies:

Midrex Direct Reduction Corporation/Kobe Steel, Ltd.: Midrex's FASTMET process converts steel mill wastes and/or iron ore fines into metallic direct-reduced iron (DRI) in a rotary hearth furnace (RHF) using carbon as the reductant. The DRI can be hot briquetted, discharged as hot DRI into transfer containers, cooled if cold DRI is required, or directly charged to a melter for the production of FASTIRON. Midrex's process for the production of FASTIRON is called FASTMELT. In the FASTMELT process, zinc recovery can be accomplished by designing the RHF in a way that minimizes the amount of iron being carried over to the offgas system. The offgas can then be sent through a baghouse, where high zinc content dust (70-90%) is produced for sale to zinc processors. The first commercial FASTMET plant was constructed, commissioned and turned over to the client for commercial operation at Nippon Steel's Hirohata Works in Himeji, Hyogo Prefecture, Japan in 2000.

Nucor: Nucor is the nation's largest EAF-steel producer, and according to Nucor's vice president of technology, "[Nucor has] gone with two different processes [for EAF-dust recycling] because there is no process that has really stepped up and demonstrated itself as being clearly the choice for recycling or recovering the constituents in arc-furnace dust". The two EAF-dust recycling processes that Nucor has employed are currently in the evaluation and comparison stage. Inorganic Recycling Corp has been contracted to recycle 25,000 tons of dust annually at Nucor's flat-rolled mill in Hickman, AR. The dust is melted with other ingredients to create ceramic grit that is sold to distributors as a sandblasting abrasive. Nucor has contracted AllMet Technologies to recycle 30,000 tons of dust annually at its Nucor-Yamato structurals mill in Blytheville, AR. AllMet blends dust and mill scale to increase the iron content. This mix is briquetted with carbon and fed to a rotary-hearth furnace (RHF), where zinc, lead and cadmium are oxidized and fumed off. Final products include prime western zinc and chloride that can be sold as flux materials to secondary-aluminum processors.

AmeriSteel: AmeriSteel's dust processing facility in Jackson, TN produces DRI and recycles the zinc oxide. At the plant, the EAF dust is blended with coal and put into an RHF, where the crude zinc oxide is separated from the iron. The zinc oxide is captured in a baghouse to be sold, and the remaining iron-rich material goes to the mill's melt shop, where it accounts for 1-1½ percent of the charge.

Phoenix Environmental Ltd.: Phoenix Environmental Ltd.'s process will convert byproducts from steel and bearing manufacturing, such as EAF dust, metal grindings and scale, into magnetite. The magnetite will be sold as a raw material to manufacturers of blasting media, shingle granules, pigments and colorants for paint and concrete, and filler additives for plastic. During the process, the byproducts will be melted in a reactor with an oxygen-enriched atmosphere, and the resulting molten iron oxide will become magnetite. The facility will also recover zinc and lead for resale. Phoenix Environmental Ltd. plans to build a byproduct recycling plant at Timken Co,'s Faircrest steel plant in Canton, OH.

Frame Engineering Co./Richland Moulded Brick: Richland Moulded Brick in Mansfield, OH began making bricks from EAF dust in early 1998, and can currently recycle 12,000 tons of EAF dust annually. Steel mills are currently paying Richland an average of $100/ton to take their EAF dust. At the plant, the dust and coke are mixed with water, and the mixture is poured into wooden molds. The mixture is then heated for at least 3 days at 1900ºF. Twenty percent of the mixture is driven off as volatile compounds, including zinc, lead, and cadmium. The remaining 80% of the mixture is left for brick. The zinc and lead are recovered and sold to zinc processors. The process typically produces 2,000 tons of zinc oxide annually.

Kawasaki Steel Corp of Japan – Chiba Works Pilot Plant: At Kawasaki Steel Corp's Chiba Works pilot plant, a 5-meter tall dust-recycling furnace is used. Coke is loaded through the top of the furnace, and oxygen is blown into the furnace through upper and lower tuyeres. The oxygen combusts in the burning coke to form two ultra-high-heating zones. A dust-injection blower, which is alongside the upper tuyere, sends the EAF dust to the upper heating zone where the dust is superheated at 3000ºC and melted instantly. The molten dust filters down through the layers of burning coke and drops into the lower heating zone for compensative heating. As it travels between heating zones, the molten dust – which is now molten zinc oxide – separates into zinc vapor, molten iron, and molten slag. The molten iron and slag sink to the bottom of the furnace, where the molten iron is then tapped through a skimmer. During this time, the zinc gas and the exhaust gas rise to the top of the furnace. A wet-type gas recovery system near the top of the furnace captures the zinc vapor.

HIsmelt Corporation: The HIsmelt process smelts iron ore and coal in a water-cooled refractory lined vertical vessel. The resulting hot metal is then used as feed stock for Electric Arc Furnaces or Blast Furnaces. The technology has been implemented at several USA and Australian facilities at production rates of 0.5 to 1.5 million tons per annum. The smelter has been proven effective for accepting a range of iron feed stock including high phosphorus iron ore fines and steel plant wastes (reverts). Steel plant wastes include blast furnace sludges, millscale, and casthouse dust. The HIsmelt process consists of injecting ground ferrous material and coal into a molten iron bath by a nitrogen carrier gas. The contact with the iron bath drives off the carbon (as carbon monoxide) and hydrogen. The carbon monoxide and hydrogen is post combusted with oxygen by an oxygen enriched hot air blast (1200 C). The heated metal is continuously tapped from the hearth; the slag is batch tapped[1].

No additional handling of reverts was required for use in the HIsmelt process. For reverts containing lead and zinc (which include EAF dust), the majority of the zinc and lead partitioned into the dust collected from the process. The dust could be recycled into the smelt reduction vessel to concentrate zinc to a saleable product. No information regarding the direct applicability of the concentration of zinc dust was documented and was only proposed as a potential additional commercial option.

Ion Exchange Technology for Electric Arc Furnace Dust Metals Recovery

At least one company has been identified that is currently developing an ion exchange technology that can recover metals from EAF dust.

MR3 Systems Inc.: MR3 Systems Inc. has developed a specialty ion-exchange media to remove metals from an aqueous solution. Other companies (such as US Filter) also provide ion exchange media suitable for reclaiming metals from an aqueous solution; however, MR3 Systems Inc. was the only manufacture, which included a method for bringing metal bearing solids into an aqueous state to pass through the ion exchange media. The separated metals are processed individual into a saleable product (e.g., zinc sulfate [ZnSO4.H2] for fertilizer). MR3 Systems Inc. have conducted benchtop tests for the recovery of zinc from electric arc furnace dust (K061) and operated two metal recovery facilities. A zinc recovery facility from zinc ash was operated in Butte, Montana, facility (now closed) and an ongoing project at the Grace Gold Mine Complex in Empire, Colorado. The technology is also being used to process metal wastes generated from the electroplating, metal finishing, and printed circuit board industries[2].

[1] Bates, Peter and Coad, Andrew, “HIsmelt, The Future in Ironmaking Technology”, 4th European Coke & Ironmaking Congress, Paris, June 2000. http://www.hismelt.com
[2] “MR3 Systems Announces Execution of Land Lease for MR3 Taiwan Metals Processing Plant – Reports On Empire Gold Project Progress” SEMISEEKNEWS, January 28, 2003, http://www.semiseeknews.com/press_release4465.htm

Selected Electric Arc Furnace Dust Metals Recovery Technology

The HIsmelt technology was used to represent the current technology commercially available to recover metals from EAF (K061) wastes. Other HTMR technologies, while potentially applicable, were limited by their current stage of the process development and availability of published cost examples. The HIsmelt technology has published costs for several US and abroad facilities. Though the HIsmelt technology is not specific to the recovery of metal from EAF and was developed as a more cost effective means of smelting iron ore, the technology does lend itself to the recovery of metals from EAF. As developed for large-scale iron fabrication, the cost economics for the facilities are generally for larger-scale facilities. Future technologies in development as discussed above may mature to a level and be feasible for smaller scale generators, with improved cost economies and size requirements.

The ion exchange system produced by MR3 Systems was not utilized as an EAF recovery method, though the process is less expensive than the HTMR process reviewed. The ion exchange technology is not a method currently approved under Universal Treatment Standards by EPA for treatment of EAF. Limited information regarding the suspension/leaching of solids into an aqueous form is publicly available. Traditional use of an ion exchange system is for wastes already in aqueous form. Though the MR3 system was not used in this analysis, future development of the system may enable broader us of the ion exchange systems for EAF. An ion exchange system would have the advantages of smaller space requirements, unit expandability, limited or no residuals, and automated systems.

Metal-Containing Solids

For construction of on-site metal recovery systems for solid wastes containing metals (e.g., EAF), a smelting process used in steel manufacturing was used as a proxy. The smelting process assumed is described as HIsmelt[3], a process developed as an lower cost alternative to a traditional blast furnace. Air permitting costs were added to construction and operation and maintenance costs. An air permit is assumed to be renewed every 5 years at a estimated cost of $68,876[4] (2002$); therefore, the application costs were capitalized over five years using a capital recovery factor of 0.24389 assuming a 7 percent interest rate. Additional air monitoring costs for compliance with the permit are estimated at 10% of the original permit application cost ($6,888 per year) (see Table 5-7 for cost equations).

---

[3]Bates, Peter, and Muir, Adrian, Hismelt-Low Cost Iron Making", Gorham Conference June 2000, Commercializing New Hot Metal Process - Beyond the Blast Furnace, http://www.hismelt.com

[4]Toon, John, "The Cost of Cleaning the Air: Study Shows Permit Application Costs Lower Than Expected – With Key Benefits to Industry", Georgia Tech Research News, September 21, 1999.

Table 5-7. Estimated On-site Metal Recovery Costs (2002$)	
Cost Element [1]	**Annual Expenditure ($/ton)[3]**
Capital Expenditure (Annualized)[2]	$6,744* (Recovered Waste Quantity)^0.59 + $16,798
Operation and Maintenance	$1,934*(Recovered Waste Quantity)^0.78 + $6,888

[1] Costs inflated from 1999 dollars to 2002 dollars.
[2] Annualized over 14 years at 7 percent interest rate using a capital recovery factor (CRF) of 0.11435.
[3] Includes air permit expenditures.

Solvent Recovery (Distillation) Costs

Solvent recycling costs estimates were taken from a U.S. Army Corp of Engineers Public Works Technical Bulletin 200-01-04, dated August 31, 1999 (USACE Tech Bulletin). The systems reviewed were batch distillation with vacuum systems. Two system capacities, 15 gallons and 55 gallons, are estimated. The capital costs for batch systems including timers, thermal controls, and transfer pumps, are $13,283 and $25,468, respectively. A one time installation cost is estimated on a per system basis of $583. Annual costs include annual labor of 2 hours per batch, power use, water use, and materials. Each system was assumed to run from 2 to 5 batches per week, with a through-put of 3.3 to 120 tons of solvent recoverable waste per year. Larger systems are composed of multiple batch units in 15 and 55 gallon increments. Smaller systems would be composed of a 15 gallon batch unit, with fewer batches per year.

Capital costs were annualized using a 10-year life for the equipment at a 7 percent real rate of return. Costs are assumed to be the same for recovery at off-site ("sister") facilities owned by the same company within the same industry group.

Residuals generation from solvent recovery were estimated using 1999 BRS data. Waste streams at selected recovery facilities were reviewed by comments, disposal system type, and origin to determine the likely waste streams generated from the recovery operations. Approximately 33 percent of the solvents recovery mass was identified as residuals in the 1999 BRS data (see Appendix W). The hazardous fraction of the residuals were determined by reviewing the waste codes for the waste streams reporting solvent reclamation. Waste streams reporting characteristic codes were assumed to have residuals that would be characteristically hazardous waste. For solvent recovery, approximately 85 percent of the residual waste volume is estimated to be characteristically hazardous with the remaining 15 percent containing listed hazardous wastes which will become nonhazardous post rule.

Air permitting costs were added to construction and operation and maintenance costs. An air permit is assumed to be renewed every 5 years at a estimated cost of $68,876[5] (2002$); therefore, the application costs were capitalized using a capital recovery factor of 0.24389 using a 7 percent interest rate. Additional air monitoring costs for compliance with the permit are estimated at 10% of the original permit application cost ($6,888 per year).

Commercial off-site solvent recovery costs were developed using U.S. Army Corp of Engineers Public Works Technical Bulletin 200-01-04, dated August 31, 1999 (USACE Tech Bulletin). Recovery costs include handling and transportation of the solvent waste stream. The estimate is a service contract with one recovery facility for annual management of 1,000 gallons at a cost of $4.23 per gallon.

Table 5-8. Estimated Solvent Distillation On-site Recovery Costs (2002$)

Cost Element [1]	Annual Expenditure ($/ton)[3]
Capital Expenditure (Annualized)[2]	$44.62* (Recovered Waste Quantity) + $18,456
Operation and Maintenance	$5,519*(Recovered Waste Quantity)^0.45 + $6,888

[1] Costs inflated from 1999 dollars to 2002 dollars.
[2] Annualized over 10 years at 7 percent interest rate using a capital recovery factor (CRF) of 0.14238.
[3] Includes air permit expenditures.

Acid Regeneration

Estimates of on-site acid recovery system costs were taken from the Pilot of the Pollution Prevention Technology Application Analysis Template Utilizing Acid Recovery System prepared by Zero Discharge Technologies, Inc for the USEPA - New England, dated October 1999. A capital cost of roughly $17,500 to $31,800 for recovery systems sized at 20 and 65 gallons per day (gpd) were utilized for this estimate. A factor of 1.5 was assumed to cover installation and startup costs for the systems. An annual expenditure of $639 for operation and $1,418 for repair and maintenance was estimated per system, respectively. Each system was assumed to operate with a through-put of 25 to 160 tons of acid recoverable waste per year. Larger systems are composed of multiple units in 20 and 65 gallon increments. Smaller systems would be composed of a 20 gallon unit, with reduced operational period.

[5]Toon, John, “The Cost of Cleaning the Air: Study Shows Permit Application Costs Lower Than Expected – With Key Benefits to Industry”, GeorgiaTech Research News, September 21, 1999.

Capital costs were annualized using a 10-year life for the equipment at a 7 percent real rate of return. Costs are assumed to be the same for recovery at off-site ("sister") facilities owned by the same company within the same industry group.

Residuals generation from acid regeneration were estimated using 1999 BRS data. Waste streams at selected recovery facilities were reviewed by comments, disposal system type, and origin to determine the likely waste streams generated from the recovery operations. Approximately 26 percent of the acid regeneration mass was identified as residuals in the 1999 BRS data. The hazardous fraction of the residuals were determined by reviewing the waste codes for the waste streams reporting solvent reclamation. Waste streams reporting characteristic codes were assumed to have residuals that would be characteristically hazardous waste. For acid regeneration, approximately 75 percent of the residual waste volume is estimated to be characteristically hazardous with the remaining 25 percent containing listed hazardous waste subsequently becoming nonhazardous post rule.

Commercial off-site acid recovery costs were estimated using Pilot of the Pollution Prevention Technology Application Analysis Template Utilizing Acid Recovery System prepared by Zero Discharge Technologies, Inc for the USEPA - New England, dated October 1999. Commercial off-site acid recovery was estimated using the system capital cost and operation and maintenance costs curves with an additional 30 percent for commercial profit. A range of facility sizes for off-site recovery facilities was estimated using 1999 BRS data. Acid recovery facilities were identified using the offsite EPA ID (receiver) of waste streams with the reported management system of acid recovery (M031). The average acid recovery facility size used is 250 tons per year. A facility size of 250 tons per year is estimated to have an unit acid recovery cost of $170 per ton. Unit costs for facilities sized above 250 tons per year begin to reach asymptotic limits, with a minimum unit cost for acid recovery of approximately $154 tons per year. Commercial off-site recovery unit costs do not include transportation and handling.

Table 5-9. Estimated Acid Regeneration On-site Recovery Costs (2002$)

Cost Element [1]	Annual Expenditure ($/ton)
Capital Expenditure (Annualized)[2]	$79.50* (Recovered Waste Quantity) + $1,804
Operation and Maintenance	$29.07* (Recovered Waste Quantity) + $1,320

[1] Costs inflated from 1999 dollars to 2002 dollars.

[2] Annualized over 10 years at 7 percent interest rate using a CRF of 0.14238.

Landfill Costs

2000 unit costs reported in Environmental Cost Handling Operations and Solutions (ECHOS), Environmental Remediation Cost Data-Unit Price, 4th Annual Edition, published by R.S. Means and Delta Technologies Group, Inc., 2001 were used to estimate Subtitle C and Subtitle D commercial landfill disposal costs. The cost reported in ECHOS was $304 per ton for bulk hazardous waste with stabilization. These costs were inflated to 2002 dollars ($320 per ton) for this estimate. Non hazardous disposal was reported as $111 per ton in bulk quantities. The January 2002 Landfill Cost Data from the Hazardous Waste Resource Center reports an average cost of $159 per ton for bulk hazardous waste disposal with treatment at a commercial landfill.[6] Earl Finnder of U.S. Filter estimated that electroplaters pay approximately $260 to $300 per ton for Subtitle C landfill disposal.[7] The ECHOS unit cost was used as an average disposal cost for hazardous waste. The ECHOS disposal cost for Hazardous and non hazardous wastes is presented as a 30 city average of major cities across the United States. The landfill disposal costs assumed under baseline are presented below. ECHOS also lists the following minimum charge for bulk shipments to commercial landfill with stabilization of $2,246. No minimum charge is assumed for the disposal of waste in Subtitle D landfills as there is no regulation of non-hazardous waste storage times; therefore, each non-hazardous waste load will be a full 18-ton load.

Electric arc furnace emission control dust (EAF) - K061 waste is disposed by at an Envirosource using a stabilization technology called Super Detox®. The technology is further described above under the Metal Recycling (Secondary Smelting) Costs heading. Estimates for disposal of EAF range from $100 to $175[8] to $150 to $200[9] per ton. A mid point ($150 per ton) was selected for the disposal cost and inflated to 2002 dollars ($153.42 per ton) from 1999 dollars for this estimate.

Table 5-10. Subtitle C and D Landfill Unit Costs (2002$)

Cost Element [1]	**($/ton)**
Subtitle C Landfill with Stabilization	$320/ton $2,246 minimum charge
Subtitle D Landfill	$111/ton
ECD Disposal (Super Detox®)	$153.42/ton

[1] Costs inflated from 1999 dollars to 2002 dollars.

Acid Neutralization Costs

---

[6] Based on a survey of landfill prices conducted between October 2001 and January 2002.

[7] Telephone communication with Mr. Earl Finnder, U.S. Filter, October 2001.

[8] Bagsarian, Tom Ed. “Cashing in on steelmaking byproducts”, New Steel March 1999, http://www.newsteel.com/features/NS9903f2.htm

[9] MR3 Systems Inc., http://www.mr3systems.com

Acid neutralization costs were developed from the Remedial Action Cost Engineering and Requirements (RACER) cost estimating software; costs in this software are based on the 2001 Environmental Cost Handling Options and Solutions (ECHOS) cost database. Systems estimated ranged from 10 to 50 gallons per minute (gpm), with a throughput of 5,890 to 29,430 tons per year. Capital costs ranged from $42,700 to $110,500, with annual operation costs ranging from $28,700 to $83,600 per year. No residual was assumed to be generated; all wastewater is disposed into the wastewater sewer to the POTW.

Capital costs were annualized using a 10-year life for the equipment at a 7 percent real rate of return.

Table 5-11. Estimated On-site Acid Neutralization Costs (2002$)

	Annual Expenditure ($/ton)
Capital Expenditure (Annualized)[1]	$0.41*(Waste Stream Quantity) + $3,233
Operation and Maintenance	$2.85*(Waste Stream Quantity + $15,600

[1] Annualized over 10 years at 7 percent interest rate using a CRF of 0.14238.

Unit costs for commercial off-site acid disposal unit cost were estimated using RACER cost estimating software. RACER lists costs for disposing of liquid wastes ranging from $1.50 to $3.50 per gallon ($2002). A unit cost of $1.50 per gallon was used for commercial off-site disposal. For loads less than 60 percent full, an added charge of 15 percent of the unit cost was added ($1.50 * 1.15 = $1.73 per gallon) to account for minimum charges.

Loading/Handling

Cost for loading/handling waste streams and residuals disposed off-site were estimated based on costs reported in RACER 2002. Three waste/residual streams are assumed; solids, sludges, and liquids. Solids, such as electric arc furnace dust, can be loaded with front end loaders into rolloff bins. Sludges, such as solvent recovery distillation bottoms, are contained in 55 gallon drums for handling. Liquids, such as acid recovery residuals, condensed acids with other impurities, are pumpable and stored in tanks and containers prior to loading into a tanker truck. Solid waste, sludge waste, and liquid waste unit costs are estimated to be $2.57 per ton, $26.23 per ton, and $40.94 per ton, respectively.

Transportation Costs

Hazardous waste transportation costs (excluding manifesting costs which are estimated separately) were estimated based on unit costs reported in ECHOS 2001 and RACER cost estimating software for van trailers and tanker trucks (Table 5-12). Costs are based on distance and maximum truck load size of 18 tons for van trailers and 5,000 gallons for tanker trucks.[10] A minimum of four loads per year is assumed based on the maximum accumulation period of 90 days for hazardous waste landfill disposal and 180 days for product recovery based on accumulation time regulations. Otherwise, the number of loads per year is calculated by dividing the total annual generation quantity by the assumed maximum truck load size of 18 tons. The ECHOS minimum shipment fee of $714 is used to determine transportation unit costs below 200 miles for hazardous waste. For example, the transportation cost for shipping waste 100 miles is calculated by dividing the minimum shipment fee by 100 miles ($714/100 miles = $7.14/mile). Transportation costs are presented below. Tables 5-13A and 5-13B presents how shipping distances vary when shipping to Subtitle C landfills (338 mile average) compared to product recovery facilities (521 mile average). The distances presented reflect estimates for shipments of F006 wastes from the EPA draft report, *Evaluation of Cost and Economic Impacts of F006 Recycling Rulemaking Options* from December 2001 for landfill and metals recovery facilities were utilized as a proxy for the transportation distances within the same Industry Group (4-digit NAICS code) and residual disposal.

Non-hazardous waste transportation costs (excluding manifesting costs) also were estimated based on bulk hazardous waste transportation cost reported in ECHOS 2001. Costs are based on distance and maximum load size of 18 tons. Due to the relatively close transportation distances estimated for Subtitle D landfills, a unit cost of $2.16 per mile ($0.12 per ton-mile) was used. The transportation cost is estimated to be less than the hazardous transportation unit cost due to the regularly scheduled, full 18-ton, bulk non-hazardous waste shipments. For non hazardous waste and post rule product recovery, no minimum number of loads is assumed. The number of shipments per year is calculated by dividing the total annual generation quantity by the assumed maximum truck load size of 18 tons.

Table 5-12. Transportation Unit Costs (2002$)

Cost Element	Baseline	
	Van Trailer	Tanker Truck
Loading/Unloading	$2.50/ton	$40.94/ton
Hazardous Waste Minimum Charge	$713/shipment	$1,032/shipment
Hazardous Waste Shipping		
200-299 miles	$2.60/mile	$3.69/mile
300-399 miles	$2.36/mile	$3.19/mile
400-499 miles	$2.15/mile	$3.26/mile
500-599 miles	$2.05/mile	$3.35/mile
600-699 miles	$2.01/mile	$3.15/mile
700-799 miles	$1.94/mile	$3.08/mile
800-899 miles	$1.94/mile	$3.05/mile
900-999 miles	$1.94/mile	$3.02/mile

[10] EPA's Common Sense Initiative Report indicates a 15 tons per truck load size and ECHOS 2001 indicates a maximum truck load size of 18 tons. RACER indicates a tanker truck capacity of 5,000 gallons.

Table 5-12. Transportation Unit Costs (2002$)		
Cost Element	**Baseline**	
1,000+ miles	$1.90/mile	$2.99/mile
Non-Hazardous Waste	$2.16/mile	POTW discharge

Weighted transportation costs are presented in Tables 5-13A and 5-13B. The weighted average transportation unit cost to Subtitle C landfill is $3.73/mile and the weighted average distance is 338 miles. The weighted average transportation unit cost to a recovery facility is $6.20/mile and the weighted average distance is 521 miles. The assumed average transportation unit cost to a Subtitle D landfill is $2.16/mile and an average distance of 50 miles. The assumed average transportation unit cost to a fuel blending facility is $2.94/mile and an average distance of 577 miles. The assumed average transportation unit cost to an acid recovery/acid neutralization is $3.50/mile and an average distance of 405 miles. The assumed average transportation unit cost to a catalyst recovery facility is $3.73/mile and an average distance of 338 miles. The assumed average transportation unit cost to an incinerator is $3.73/mile and an average distance of 1,000 miles. The estimates for metals recovery distances from facilities identified in the EPA, Evaluation of Cost and Economic Impacts of F006 Recycling Rulemaking Options from December 2001 were used to model product recovery and Subtitle C landfill distances.

Transportation distances for fuel blending, and acid recovery/acid neutralization were determined after review of 1999 BRS data of facilities shipping the wastes and the receiving facilities. A distribution for shipping was generated using potential transportation ranges of 250, 350, 450, 550, 650, 750, 850, 950, and 1050 miles. For waste streams with facilities tending to ship within the state, the transportation distribution was skewed to the 250 and 350 mile ranges. For waste streams with facilities tending to ship outside the state, the transportation distribution was skewed to distances between 450 and 650 miles. A average distance of 1,000 miles for incineration managed waste streams was estimated due to the limited number of facilities available providing the service. Based on a review of the 1999 BRS data, no incineration managed waste streams were shipped within the state.

Table 5-13A. Weighted Average Transportation Unit Costs to Subtitle C Landfills for SIC 3471 Generators (2002$)

Percentile (%)	Distance to Landfill or Stabilization for Top 95 Percent of Waste Shipped (miles, n = 75)	Average Distance per 10th Percentile (miles)	Weighted Distance to Subtitle C Landfill (miles)	Unit Price ($/mile)	Weighted Unit Price ($/mile)
0	38	---	---	---	---
10	129	83.5	8.35	$8.55	$0.855

Table 5-13A. Weighted Average Transportation Unit Costs to Subtitle C Landfills for SIC 3471 Generators (2002$)					
Percentile (%)	**Distance to Landfill or Stabilization for Top 95 Percent of Waste Shipped (miles, n = 75)**	**Average Distance per 10th Percentile (miles)**	**Weighted Distance to Subtitle C Landfill (miles)**	**Unit Price ($/mile)**	**Weighted Unit Price ($/mile)**
20	147	138	13.8	$5.17	$0.517
30	166	156.5	15.65	$4.56	$0.456
40	175	170.5	17.05	$4.19	$0.419
50	234	204.5	20.45	$2.60	$0.260
60	283	258.5	25.85	$2.60	$0.260
70	348	315.5	31.55	$2.36	$0.236
80	434	391	39.1	$2.36	$0.236
90	636	535	53.5	$2.05	$0.205
100	1627	1,131.5	113.15	$1.90	$0.190
Total			338.45		$3.63 ($3.73)[1]

[1] Costs inflated from 2000 dollars to 2002 dollars.

Table 5-13B. Weighted Average Transportation Unit Costs to Metals Recovery (Secondary Smelting) for SIC 3471 Generators[1] (2002$)					
Percentile (%)	**Distance to Metals Recovery Facilities for Top 95 Percent of Waste Shipped (miles, n = 51)**	**Average Distance per 10th Percentile (miles)**	**Weighted Distance to Metals Recovery (miles)**	**Unit Price ($/mile)**	**Weighted Unit Price ($/mile)**
0	7	---	---	---	---
10	32	19.5	1.95	$36.62	$3.662
20	193	112.5	11.25	$6.35	$0.635
30	231	212	21.2	$2.60	$0.260
40	329	280	28.0	$2.60	$0.260
50	372	350.5	35.05	$2.36	$0.236
60	481	427	42.7	$2.15	$0.215
70	567	524	52.4	$2.05	$0.205
80	846	706.5	70.65	$1.94	$0.194
90	1,253	1,049.5	104.95	$1.90	$0.190
100	1,802	1,527.5	152.75	$1.90	$0.190
Total			520.9		$6.05 ($6.20)[2]

[1] These values were used as a proxy for same Industry Group (4-digit NAICS) product recovery distances and transportation unit costs.
[2] Costs inflated from 2000 dollars to 2002 dollars.

Manifesting Costs

In general, under the current hazardous waste regulations, wastes are tracked through the use of a hazardous waste manifest which accompanies each waste shipment. Manifesting costs were obtained from the *Hazardous Waste Manifest Cost Benefit Analysis*, prepared by Logistics Management Institute in October 2000. Costs were inflated to 2002 dollars. The manifesting cost incurred by the generator per manifest was determined to be $89.31 for small quantity generators and $136.91 for large quantity generators. An average cost of $113.11 ($116.05 inflated to 2002$) per manifest was assumed to be incurred by the generator. The transporter is assumed to incur $117.35 ($120.40

inflated to 2002$) in manifesting costs per shipment. The transporter and generator costs were combined to estimate a total manifesting cost per shipment of $236 (2002$).

Costs also have been estimated for shipping papers under a reclamation agreement. Costs to prepare, carry, and retain shipping papers were obtained from the *Hazardous Waste Manifest Cost Benefit Analysis*. The cost for the generator to complete the shipping papers for each load is estimated to be $26.50, based on assumed effort of 0.5 hours by a technical staff member at $53 per hour. The cost for the generator to maintain a copy of the reclamation agreement is $2.70 per year. Assuming an average of 4 shipments per transporter per year, the cost per shipment for the generator to retain the reclamation agreement is approximately $0.68 per shipment. The cost for the transporter to record and carry the shipping papers and reclamation agreement is estimated at $58.53 per shipment. An additional $4.59 was assumed to be incurred by the transporter to retain the records for each generator. Assuming an average of 4 shipments per generator for each transporter a year, the cost per shipment for the transporter to retain the records for each generator is approximately $1.15. The transporter and generator costs were combined to estimate a total cost to prepare, carry and retain shipping papers of $86.86 per shipment ($89.26 inflated to 2002$). All pre rule scenario shipments were assumed to require hazardous waste manifests (including same NAICS recovery transportation shipments). Post rule shipments are all assumed to require non-hazardous manifesting, except for the portion of the residuals assumed to be characteristically hazardous (95% of metals recovery residuals, 85% of solvent recovery residuals, and 75% of acid regeneration residuals).

Training

Training includes costs for manifesting and hazardous materials handling training. These costs are assumed to be incurred for all large and small quantity generators. Facilities classified as conditionally exempt small quantity generators were not assumed to have training costs for manifesting as these facilities are not required to manifest wastes generated or the resulting manifest reporting/storage requirements. Conditionally exempt small quantity generators were excluded from hazardous materials handling training as described in 40 CFR 262.16 Subpart B. The hazardous materials handling training requirements for small and large quantity generators include on the job training for emergency response requirements and inspection of the facilities emergency response equipment.

Manifest training is estimated to cost $1,828 per year (2002$). Training costs include an estimated 8 hours per year each for a process technician and a manager. Each year, 3 hours is devoted to review/refresher of the training, 1 hour for administrative requirements associated with the training (updating records, refresher/new class scheduling, etc.), and annual turn over for the position occurring once every two years resulting in 4 hours per year devoted to training. A manual/class training is estimated to cost $125 based on current pricing for the training services from on-line providers.

Hazardous materials handling training is estimated to cost $2,191 per year for small quantity generators (2002$) and $9,974 per year for large quantity generators (2002$). Training costs for small quantity generators include an estimated 8 hours per year each for a process technician and a manager. Training costs for large quantity generators include an estimated 8 hours per year each for four process technicians, a manager, and a branch manager. Each year, 3 hours is devoted for review or refresher training, 1 hour for administrative requirements associated with the training (updating records, refresher/new class scheduling, etc.), and annual turn over for the position occurring once every two years resulting in 4 hours per year devoted to training. All training is assumed to be on the job and provided by the managers.

Contingency Planning Costs

This cost covers the requirements as stated in 40 CFR 264 Subpart D relating to the development of a contingency plan. The estimated basis was taken from the *Estimating Costs for the Economic Benefits of RCRA Noncompliance*, prepared for the Office of Regulatory Enforcement, USEPA, dated September 1994. The labor rates were updated to 2001 using RACER costs estimating software. Facilities generating more than 1,000 kilograms per month of hazardous waste (i.e., Large Quantity Generators) are required to prepare and maintain a contingency plan. The cost includes labor for a drafter (3 hours), process technician (11 hours), an engineer (16 hours), and a manager (3 hours), for a total expense of $2,800 (2002$). This cost is incurred once. Costs incurred from updating the contingency plan is included in the BRS/General Administrative Duties Cost.

Table 5-14. Estimated Contingency Planning Costs (2002$)

Labor Class:	Labor Rate ($/hour)	Estimated Utilization (hrs)	Labor Cost [1]
Drafter	$78.36	3	$235.08
Process Technician	$61.02	11	$671.22
Engineer	$89.61	16	$1,433.76
Manager	$151.89	3	$455.67
Total		33	$2,795.73

[1] Costs inflated to 2002$.

Salvage (Recovered Product) Value of Recovery Products

Salvage value of recovered products was estimated based on cost savings (i.e., reduced quantity of solvent or acid purchase) or a secondary sale (i.e., sale of recovered metals). A salvage value/revenue is estimated using the commercial market value of the product (solvent, acid, granular activated carbon, fluoride, catalyst, or metal). The metal salvage value (unless otherwise indicated) is based on $5,300/ton, which is the three year average price for chromium, nickel and copper--the three most recycled metals. This assumes that of the metal going to recycling, it is split evenly among the three metals. The salvage value for EAF metals is based on zinc recovery.[11] The market value for zinc was estimated using the London Metals Exchange price of $714.8/ton.[12] The salvage value for metal-containing liquids is based on copper recovery. The printed circuit board industry (SIC 3672) is the primary generator of metals containing liquid wastes. The printed circuit board industry uses copper in the etching and plating process; therefore, copper is assumed to be the primary metal recovered from the metals containing liquid wastes. The market value for copper was estimated using the London Metals Exchange price of $1,552.60/ton.[13] The salvage value for solvent was estimated using the average price as reported in the USACE Tech Bulletin of mineral spirits at $2.25/gallon and 1,1,1-trichloroethane at $11.33/gallon. The salvage value for acid and granular activated carbon (GAC) was estimated with RACER cost estimating software. For acids, sulfuric acid was used as a proxy. Sulfuric acid is estimated to cost $331/ton (2002$). GAC is estimated to cost $3,845 per ton. The salvage value of fluoride, using sodium fluoride as a proxy, was estimated from an online document at Dartmouth University *Comments on the Relative Cost of Fluoride from NAF and FSA.* Sodium fluoride is estimated to cost $1,240 per ton[14] (2002$). The salvage value of catalysts was estimated from an online quote[15]. Molybdenum disulfide was used as a proxy for catalysts reported recovered in the 1999 BRS. Molybdenum disulfide was identified as a catalyst in the comments of disposed quantities of spent catalyst from the petroleum refining industry (SIC 2911) with waste codes of K171 or K172. Molybdenum disulfide is estimated to cost $26,600 per ton (2002$).

The recovered products were assumed to be less than "pure". Through the recovery process, a loss of effectiveness for the solvents and acids is expected. For metals recovery, the quality loss is represented by a reduction in purity of the metal. A factor of 90 percent is applied to the above listed commercial cost associated with the product to represent this loss.

The mass recovered varies depending on the type of recovery waste streams. Using select 1999 BRS facility data, the residual mass fractions of solvents and acids recovered from solvent and acid waste streams was estimated. Assuming there are minimal lost products by spillage or evaporation, the mass of the original waste stream (recovery waste stream) minus the reported residuals waste stream (i.e., still bottoms, sludge, and wastewater) is the mass of the recovered product. The residual mass fraction is described in the respective recovery technology section. Based on the estimated residual waste mass fraction, the product mass fraction is estimated at 67 percent and 74 percent for solvent and acid product recovery, respectively (see Appendix W). The product mass fraction is highly dependant on the facility process and recovery technology and may vary greatly from this estimate. The mass fraction recovered from spent catalyst (waste codes K171 and K172), spent granular activated carbon, fluoride

---

[11] MR3 Systems Inc., http://www.mr3systms.com/pages/corp2.html

[12] London Metals Exchange, http://www.lme.co.uk/data_prices/monthly_prices.asp, dated July 19th, 2003

[13] London Metals Exchange, http://www.lme.co.uk/data_prices/monthly_prices.asp, dated July 19th, 2003

[14] Coplan, Myron J, C.E., *"Comments on the Relative Cost of Fluoride from NAF and FSA",* http://www.dartmouth.edu/~rmasters/AHABS/costof.html

[15] http://www.micronmetals.com/molybdenum_disulfide.htm

from spent aluminum potliner (waste code K088), and metals from liquids containing metals were estimated using engineering judgement as to the concentration of the recoverable product from the waste stream, likelihood of destruction during the recovery process and potential of the recovered product to retain useable characteristics. The product mass fractions estimated for spent catalyst (waste codes K171 and K172), spent granular activated carbon, fluoride from spent aluminum potliner (waste code K088), electric arc furnace control dust (ECD) (waste code K061), and metals from liquids containing metals are 5 percent (i.e., 5 percent of catalyst is reusable), 90 percent (i.e., 90 percent of carbon is reusable), 2 percent recovered fluoride values, 15 percent recovered zinc, and 0.02 percent recovered copper.

The mass fraction of metals recovered during smelting/high temperature metals recovery was estimated using F006 180-Day Accumulation Rule assumptions regarding the quality of the sludge produced from SIC 3471 facilities with the exception of EAF. A mass conservation approach was not utilized for smelting/high temperature recovery due to the assumed volatilization of the water in the sludge wastes. The metals mass fraction is estimated at 20 percent for wastes currently being recovered. The metals mass fraction is estimated to be five percent for wastes currently being disposed assuming they have lower metals content. A five percent metals concentration is the approximate break-even point between the cost of landfill verses metals recovery. Zinc concentration in EAF ranges from 15 to 30 percent[16]. The zinc concentration is dependant on the grade of iron ore processed and coal used in the smelting process. The other major constituents of EAF include lead and iron. Additional revenue may be generated from the recovery of iron in the HTMR process. The potential revenue from reclaiming the iron in EAF was not estimated for this estimate, given the majority of the recovery technologies for EAF are used to accumulate zinc oxide.

BRS/General Administrative Duties Cost

Biennial reporting as well as other generator recordkeeping and reporting is required for all LQGs. Similar, but less stringent, administrative requirements apply on an annual basis for SQGs. In addition to reporting requirements for hazardous waste generating facilities, review of contingency plans and other miscellaneous actions are also necessary. These costs are assumed to be direct labor costs for one manager with a labor rate of $152 per hour. For a CESQG facility BRS/general administrative duties labor is estimated at 4 hours at a cost of $608 per year, a SQG facility is estimated at 8 hours at a cost of $1,216 per year, and a LQG is estimated at 16 hours at a cost of $2,430 per year (2002$).

Initial Characterization/Waste Characterization Cost

The estimated cost was taken from the *Estimating Costs for the Economic Benefits of RCRA Noncompliance*, prepared for the Office of Regulatory Enforcement, USEPA, dated September 1994.

---

[16]Bagsarian, Tom Ed. "Cashing in on steelmaking byproducts", New Steel March 1999, http://www.newsteel.com/features/NS9903f2.htm

The labor rates and analytical costs were updated to 2001 using RACER cost estimating software. The collection of cost includes labor for a field technician (10.5 hours), an engineer (11 hours), and a manager (2 hours). Three samples are collected per waste stream, estimated at $1,410 per sample, for a total expense including labor of $6,160 per waste stream (2002$). This cost is incurred once.

One-Time Notification of Exclusion

Costs were estimated for generators to complete a notification of RCRA exclusion for their recovered waste(s). Labor rates were obtained from the RACER cost estimating software. The one time notification is assumed to be composed of 6 hours of a staff engineer and 2 hours clerical and cost $638.78, including mark ups (2002$).

Part B Permit Renewal Costs

Savings to within- industry off-site reclaimers are expected to result from no longer needing to renew their RCRA permits. The maximum duration that a RCRA permit is valid is 10 years; therefore, a TSD facility is required to renew the Part B portion of the permit application a minimum of once every 10 years. The Part B application is composed of the a general facility section and the technology specific section for storage and/or disposal of the hazardous waste. Facilities reclaiming metals, solvents, or acids on site may not require a TSD permit under the proposed rule making, as these wastes would not be considered solid wastes. Therefore, the facility would not be a RCRA TSD. The facilities effected by the proposed rule making would not need to resubmit the Part B application to renew the TSD permit.

Estimated costs for preparing and renewing the Part B application were presented in the *Estimating Costs for the Economic Benefits of RCRA Noncompliance*, prepared for the Office of Regulatory Enforcement, USEPA, dated September 1994. The general facility portion of the Part B application estimated cost was $43,693 ($49,249 inflated to 2002 dollars). The technology specific requirements estimated costs were $9,371 ($10,562 inflated to 2002 dollars) for container systems and $8,780 ($9,896 inflated to 2002 dollars) for tank systems.

It is assumed the majority of the Part B application information has already been accumulated in the initial preparation. The update of the Part B application is estimated to cost 25 to 50 percent the original preparation cost. All TSD facilities would be required to submit the general facility portion of the Part B application. In general, it is assumed that TSD facilities reclaiming metals would require the container systems technical requirements of the Part B application and the solvent and acid reclamation facilities would require the tank system technical requirements of the Part B application. The estimated savings through not renewing the TSD permit ranges from $14,953 to $29,906 every 10 years for metal reclaiming facilities. For facilities reclaiming solvents or acids, the estimated savings ranges from $14,786 to $29,573 every 10 years.

Spent Aluminum Potliner (K088) Cost Estimates

Baseline waste management unit costs are presented in Table 5-15. Following the promulgation of the current K088 land disposal treatment standards in October of 1997 management shifted to three facilities. Two off site facilities include the Reynolds' thermal treatment plant in Gum Springs, Arkansas, and Chem Waste Management's on-site storage facility in Gilliam County, Oregon (near the City of Arlington). One facility, Ormet Primary Aluminum Corporation, Hannibal, Ohio, has installed the Vortec vitrification technology which has been proven to treat to the new land disposal restriction standard the EPA is considering. All text and unit cost estimates contained in this section were taken or edited from the following report: U.S. EPA, *Economic Assessment of the Revised LDR Treatment Standards for Spent Aluminum Potliner (K088),* prepared by DPRA Incorporated, March 1, 2000. In the analysis all unit costs were inflated from 1999 dollars to 2002 dollars.

The Vortec process is a direct-fired vitrification system that destroys cyanide and other organic compounds contained in K088 waste, while recovering the fluoride values for use. K088 waste is mixed with sand and limestone and vitrified to form a glass-like residue or frit. The treatment process does not immobilize the fluoride in the glass matrix, but, it effectively partitions the fluoride into the baghouse dust for reuse.

The process unit performing this vitrification process is referred to as a combustion melting system (CMS) and consists of a Counter Rotating Vortec (CRV) Reactor, a cyclone melter and a separator/reservoir. The finely crushed K088 waste, sand and limestone mixture are preheated in a rapid suspension heating system before physical and chemical melting, which occurs within the cyclone reactor. The reactor is a refractory-lined, carbon steel, water-cooled vessel. Natural gas and preheated air are used to achieve temperatures of approximately 2,400 F in the reactor. Materials begin to melt in the reactor and flow downward to the cyclone melter. Melting of the waste and other additives, as well as combustion of the cyanide and other organic compounds, is completed in this vessel and the resultant molten glass is separated from the gas. The separated gas is used to preheat the air entering the reactor, and is then sent to a primary baghouse to remove particulate matter, primarily sodium fluoride. The exhaust from the baghouse is then transferred into the potroom "secondary" dry scrubber system (a baghouse air pollution device using alumina to dry scrub fluoride from aluminum reduction pot exhaust gas) where gaseous fluoride is removed and additional particulate removal occurs. The material from the primary and secondary baghouse systems are fluoride-enriched alumina material is collected for reuse (e.g., charged back into aluminum pots if feasible or sold as a substitute for fluorospar). The molten glass is dropped into a water quench tank where it solidifies into a glass-like residue or frit which is sold as a product (e.g., industrial-grade glass). This process is referred to as K088 vitrification.

Currently, only the Ormet facility in Ohio operates a 50 ton-per-day Vortec system. The baghouse dust containing fluoride is sold to the steel industry as a substitute for fluorospar. The frit, a granular glass-like material, that they generate is presently sold as a grinding and polishing material to a machinery shop.[17] Ormet generates approximately 6,500 short tons of frit annually.

TABLE 5-15. K088 BASELINE MANAGEMENT AND ANALYTICAL UNIT COSTS	
Baseline Management Method	**Baseline Unit Cost (1999 $/ton)**
Off-Site Thermal Treatment (Reynolds, Gum Springs, Arkansas)	$200 - $500 [1]
Off-Site Storage (Chem Waste Management, Gilliam County, Oregon)	$245 [2] treatment = $80 disposal = $80 storage = $85

1 Federal Register, Volume 63, Number 185, September 24, 1998, pp. 51260; 1994 price quote. Price quote still valid based on communication between Linda Barr, U.S. EPA, Office of Solid Waste and Reynolds in 1999.
2 Federal Register, Volume 63, Number 185, September 24, 1998, pp. 51260; 1998 price quote.

Table 5-16 presents the estimated compliance management unit costs. Crusher and hammer mill unit costs were developed by scaling vendor cost estimates received from Nordberg, Inc. assuming a 7 percent interest rate on borrowed capital, a 7 percent discount rate (consistent with OMB Circular No. A-94, October, 1992), 10-year equipment life, 20-year plant life, and a 30 percent profit margin. The Vortec technology is the only proven technology that can meet possible the new Land Disposal Treatment standards the Agency has been considering. So, it is assumed that facilities will install this technology.

One 36 ton per day plant using the Vortec technology has been constructed in Paducah, Kentucky, in 1996 for the DOE at a cost $11.6 million. Assuming operating costs of between $150 - $300/ton similar to the NHW vitrification system, a 7 percent interest rate on borrowed capital, a 7 percent discount rate, 20-year equipment life, 20-year plant life, 3 percent annual inflation, 30 percent profit margin, an initial licensing fee of $200,000 and an annual licensing fee equivalent to 10% of annual cost savings (assumed to be annual quantity of waste times $300/ton to treat waste) over a 10-year period, the unit commercial (off-site) price would range between $483/ton and $693/ton (excluding permitting) for a 36 ton per day Vortec system, including a jaw crusher, impact mill and hammer mill.

For comparison purposes, it is assumed that vitrification and incineration vendors have similar cost structures to the Vortec technology if costs for additional crushers and mills are added to account for the cost of reducing the K088 blocks of waste (e.g., potentially up to 3 feet in length) to sizes that can be fed into the Vortec technology. Therefore, published commercial prices for vitrification ($300/ton)

---

[17] Personal communication between Elaine Eby, U. S. EPA, and John Reggi, Ormet, December 6, 1999.

and incineration ($650/ton) were used as potential price ceilings for the Vortec technology in the market when new capacity is constructed. Estimates of commercial crushing ($18/ton to $26/ton depending on equipment size) and milling ($30/ton to $43/ton depending on equipment size) prices are added to the vitrification and incineration prices to determine the total compliance management unit cost. Assuming two crushing units, one hammer mill, and a vitrification unit, commercial prices range from $366/ton to $395/ton, excluding transportation. Similarly, assuming two crushing units, one hammer mill, and an incineration unit, commercial prices range from $716/ton to $745/ton, excluding transportation.

TABLE 5-16. K088 COMPLIANCE MANAGEMENT UNIT COSTS

Compliance Management Method	Compliance Unit Cost (1999 $/ton)
Crushers (assume one of each unit)(estimated commercial price): 1 - 30" x 42" jaw crusher (150 hp motor) [1] 1 - 78" x 40" impact mill (150 hp motor) [1]	Same unit price per unit: [5] 5,000 tpy = $26/ton/unit 10,000 tpy = $24/ton/unit 30,000 tpy = $21/ton/unit 55,000 tpy = $19/ton/unit 85,000 tpy = $18/ton/unit
Hammer Mill (10,000 tons/year; +200 mesh to 1" initial size)	Price per unit: [5] 5,000 tpy = $43/ton 10,000 tpy = $39/ton 30,000 tpy = $34/ton 55,000 tpy = $31/ton 85,000 tpy = $30/ton
Off-site Vitrification (ground solid) ECHOS (in situ soil vitrification) [7] NHW Vitrification System (3,000 tons/year) [2] Capital Costs ($1,000,000) Operating Costs ($150/ton - $300/ton) GeoMelt Vitrification [4]	assume $300/ton $300/ton $240 - $430/ton [3] $370 - $420/ton
Off-site Incineration (ground solid) On-site Vortec Technology (estimated cost for noncommercial crusher, impact mill and hammer mill added into unit cost): Capital: $11,600,000 for 36 ton of soil/day facility ($1996) [8] License Agreement: $5 to $10 million/municipal ash facility, size unspecified [9]	$650/ton [6] to $1,300/ton [7] Price per unit (example sizes): [10] 1,000 tpy = $499/ton 3,000 tpy = $409/ton 5,000 tpy = $414/ton 7,000 tpy = $437/ton 10,000 tpy = $485/ton
Incinerator RCRA/MACT Permit (assumed similar to the cost of permitting the Vortec process): Initial Permit Renewal of Permit (every 10 years)	 $350,000/facility [11] $130,000/facility/10-years [11]

1 Reynolds Metals Company Spent Potliner Treatment Plant, http://www.rmc.com/gbu/metals/gum_spr.html.

2 NHW Home Page, http://www.qn.net/~nhw/nhwtoc.html.

3 Annualized capital cost were estimated using a capital recovery factor based on a 7 percent real interest rate on borrowed capital, a 7 percent real discount rate, a 20-year operating life, and assuming a 30 percent profit margin.

4 GeoMelt Comparison with Alternative Technology Types, http://www.geomelt.com/geomeltnf_comparison_with_alternat.htm.

5 EPA derived cost based on scaling of vendor quotes from Nordberg. Inc.. Assumed a plant life of 20 years (equipment life of 10 years) and a 30 percent profit margin for commercial operation.

6 Per communication with author of Environmental Cost Handling Options and Solutions (ECHOS), Environmental Remediation Cost Data-Unit Price, 5th Annual Edition, published by R.S. Means, 1999, average unit cost of $1,300/ton is skewed given conservative unit price quotes received from commercial incinerators. $650/ton is more reasonable unit price estimate if outliers removed from average.

7 Environmental Cost Handling Options and Solutions (ECHOS), Environmental Remediation Cost Data-Unit Price, 5th Annual Edition, published by R.S. Means, 1999.

8 Vortec, http://www.vortec-cms.com/paducah.htm

9 "Montgomery County Green Technology News Clips", Louis S. Hansen, Philadelphia Inquirer, July 22, 1996; http://www.ehb.state.pa.us/dep/counties/Montgomery/Green_Technology_News.htm. Vortec licensed its technology to Japan's Mitsubishi Kasei Engineering Co. for treatment of municipal incinerator ash with the agreement bringing Vortec between $5 and $10 million for each plant built.

10 One 36 tons of soil per day plant has been constructed in Paducah, Kentucky, in 1996 for the DOE at a cost $11.6 million. EPA scaled capital costs using a scaling factor of 0.6. EPA assumed operating costs at the high end of the $150 - $300/ton range estimated for the NHW vitrification system. EPA scaled operating costs using a scaling factor of 0.9. EPA assumed a 7 percent real interest rate on borrowed capital, a 7 percent discount rate, 20-year equipment life, 20-year plant life, and 3 percent annual inflation. EPA assumed an initial licensing fee of $200,000 and an annual licensing fee equivalent to 10% of annual cost savings (assumed to be annual quantity of waste times $300/ton to treat waste) over a 10-year period. Estimate includes 40 percent excess capacity for Vortec Combustion Melting System. Cost estimates for a crusher, impact mill, and hammer mill are included.

11 EPA, Office of Solid Waste, Cost and Economic Impact Analysis of Listing Hazardous Wastes from the Petroleum Refining Industry, prepared by DPRA Incorporated, September 21, 1995. The 1992 cost estimates were inflated to 1999 dollars assuming a 4 percent annual rate of inflation.

Commercial Incineration

Incineration unit costs were estimated using RACER cost estimating software. RACER reports incineration costs of $827.38 per cubic yard of bulk material. A unit weight of 1.5 tons per cubic yards was assumed, resulting in an unit cost of $552 per ton. The incineration unit cost includes management and disposal of residuals. For loads less than 60 percent full, an added charge of 15 percent of the unit cost was added ($827.38 * 1.15 = $951.49 per cubic yard) to account for minimum charges.

Energy Recovery (Fuel Blending)

Energy recovery costs were reviewed from several sources. The U.S. Environmental Protection Agency Office of Solid Waste, Economics, Methods and Risk Analysis Division *Unit Cost Compendium (UCC)* reported offsite utility co-burning costs of $149/ton ($142 escalated to 2002$) and offsite cement kiln costs of $497/ton ($473 escalated to 2002$). Solvent disposal costs (assumed to be a energy recovery process) from the USACE Tech Bulletin reported a cost of $173/ton ($160 escalated to 2002$). An offsite energy recovery cost of $292/ton was estimated as a reasonable approximation of the differing types of energy recovery facilities. The unit cost is a processing fee ("tipping") and does not include transportation, handling, or any other costs.

Chemical Precipitation

Chemical precipitation costs were estimated using the UCC. Systems estimated ranged from 5 to 100 gallons per minute (gpm), with a throughput of 2,445 to 58,960 tons per year. Pickle liquor was used as a proxy for waste characteristics in estimating costs for the system. The estimated costs do no include residual management. Capital costs were annualized using a 10-year life for the equipment at a 7 percent real rate of return.

Table 5-17. Estimated On-site Chemical Precipitation Costs (2002$)

	Annual Expenditure ($/ton)
Capital Expenditure (Annualized)[1]	$32.37*(Waste Stream Quantity) + $33,553
Operation and Maintenance	$204.83*(Waste Stream Quantity) + $21,766

[1] Annualized over 10 years at 7 percent interest rate using a CRF of 0.14238.

Carbon Regeneration

Off-site carbon regeneration ("roasting") costs were estimated using RACER cost estimating software. RACER reports a unit cost of $0.85 per pound for masses less than 2,000 pounds, and $0.39 per pound for masses greater than 2,000 pounds.

On-site carbon regeneration costs were estimated using off-site unit costs. Profit, estimated at 15 percent, was subtracted from the unit cost. A scale factor of 0.83 is used to represent economies of scale. A range of facility sizes for off-site carbon regeneration facilities was estimated using 1999 BRS data. Carbon regeneration facilities were identified using the offsite EPA ID (receiver) of waste streams with the reported management system of "other recovery" (M125). The average carbon regeneration facility size is 100 tons per year, with the largest receiver facility accepting 493 tons in 1999. A facility size of 100 tons per year is estimated to have an carbon regeneration cost of $655 per ton.

5.7 Summary of Breakeven Analysis

A comparison of base line management practices with the on-site compliance management option for off-site disposal facilities and off-site recovery facilities with different NAICS is presented in Table 5-18. The breakeven analysis reflects the effect of the salvage value of the recovered products. In general, products with high salvage value reduced the facility size required for a cost savings from constructing an on-site recovery process.

The breakeven analysis considered all elements of the waste disposal or recovery process, including residual/waste stream disposal, recovery costs, waste characterization, manifesting, loading, transportation, salvage revenue, training, BRS and general administrative duties, contingency planning, and generation taxes. However, the generator size was assumed to remain constant. Additional cost benefit will be generated with the reduction in generator status in the post rule environment (i.e., generator status drop from LQG to SQG or CESQG). These cost savings will include reductions in hazardous materials training, BRS and general administrative duties, contingency planning, and generation taxes.

Recovery of spent carbon is shown to be profitable at all size facilities in the proposed rule making, as are many catalyst recovery facilities. However, profitability of spent carbon recovery processes may be the result of economic pressures such as an abundance of spent carbon recovery facilities or manufacturing of activated carbon is more expensive than recovering spent activated carbon.

Table 5-18. Breakeven Point (tons/year) Where On-Site Recovery is More Economical than Off-site or On-site Disposal (2002$)			
Waste Type	**Baseline Management**	**Compliance Management**	**Breakeven (tons/year)**
Off-site Disposal Wastes			
Organic Liquids (from Industrial Organic Chemicals, Paints and Allied Products, Pharmaceutical Preparations, and Plastics Materials and Resins Industries)	Off-site Fuel Blending	On-site Fractionation/Distillation	47
Emission Control Dust (from Steel Works Industry)	Stabilization and Subtitle D Landfill	On-site Smelting	47,067
Metal-Containing Liquids (from Printed Circuit Board Industry)	Off-site Chemical Precipitation	On-site Ion Exchange	125 (79 for on-site)
Electroplating Wastewater Treatment Sludges (from Printed Circuit Board Industry)	Stabilization and Landfill	On-site Smelting	3,443
Spent Carbon (from Industrial Organic Chemicals and Petroleum Refining Industries)	Off-site Incineration or Carbon Regeneration[1]	On-site Carbon Regeneration: "Roasting"	0
Spent Catalyst (from Petroleum Refining Industry)	Stabilization and Landfill	On-site Smelting	11
Spent Aluminum Potliner (from Aluminum Industry)	Off-site Incineration	On-site Fluoride Recovery using Vortec technology	347
Spent Pickle Liquor (from Steel Works Industry)	Off-site Chemical Precipitation	On-site Acid Regeneration	4,311 (0 for on site)
Offsite Recovery at NON-same NAICS Facilities			
Metal Recovery Wastes	Off-site Smelting	On-site Smelting	21,587
Solvent Recovery Wastes	Off-site Solvent Recovery	On-site Fractionation/Distillation	125
Acid Recovery Wastes	Off-site Acid Regeneration	On-site Acid Regeneration	36

[1] Costs inflated to 2002$.

5.8 Summary of Potential Cost Savings

Based on the above unit costs estimates of total costs and recovered values were estimated for the baseline scenario (pre-rule) and post-regulatory scenario (post-rule). Incremental cost savings (post-rule costs minus pre-rule costs) were estimated for the total number of plants currently recovering wastes in 1999 or recovered wastes in 1997. The total number of large quantity generators (plants) currently identified that may receive benefits from this rule are 1,374. These plants reclaim metal, solvent and other values from 910,000 tons of waste. The sum of the pre-rule costs, post-rule costs, and incremental cost savings for all plants that either recovered wastes on-site or off site within the same industry group (4-digit NAICS code) in 1999 and 1997 are presented in Table 5-19 by individual unit cost item.

The potential incremental annual cost savings range from $13.6 million if only 1999 plants benefit to $34.5 million if the plants that recovered wastes in 1997 and not in 1999 switch back to recovery are included. This total increases by $63 million to $97.5 million if plants that recovered wastes off site at facilities outside the same industry group elect to construct on-site recovery facilities because of potential cost savings (Table 5-20 and 5-23). All these wastes have proven recovery value.

In addition, disposed quantities for eight waste types with high recovery potential were evaluated to determine if it was economically viable to construct on-site recovery systems. Up to $266 million (excluding incremental state tax savings) in potential incremental cost savings (Tables 5-21 and 5-22) for roughly 708 out of 1,844 facilities (38 percent) has been estimated if the quality of the waste is sufficient for recovery. However, a significant limitation is that it is unknown if all eight of these wastes are of sufficient quality for recovery. Five of the eight wastes types have been identified as likely having sufficient constituent mix/concentration quality for recovery. Emission control dust (K061) from the steel works industry has a past history of being recovered for zinc values prior to the delisting of the significantly cheaper Envirosource stabilization technology. Most of the metal-containing liquids from the printed circuit board industry were reported being disposed either on-site or off-site by chemical precipitation and included in this group of waste. Upon further inspection of the Biennial Report data, the copper-containing sludge precipitated from this treatment process often goes on to metals recovery. This waste is of sufficient quality for recovery. Spent aluminum potliner (K088) from the aluminum industry has a proven technology for recovering fluoride values. The Vortec technology has been implemented at least at two sites and licensing agreements can be arranged for construction at other sites. The Vortec technology meets universal treatment standards for potliner waste. Spent catalyst (K171/K172) from the petroleum refining industry is believed to be recoverable based on communications with reclaimers. Spent pickle liquor (K062) from the steel works industry also is believed to have sufficient quality for recovery of acid values. Assuming these five wastes are of sufficient quality for recovery an additional $81 million in potential costs savings may be incurred because it will be more economical for facilities to construct on-site recovery facilities (Table 5-24). The remaining three wastes are not assumed to be of sufficient quality for recovery in this analysis. A breakdown of the potential cost savings by waste type are presented in Table 5-21 and Table 5-22. The total cost savings estimate increases to $178 million if plants that disposed these five wastes elect to construct on-site recovery facilities because of potential cost savings.

For the 1999 on-site recovery plants, the total estimated annual cost savings is $11 million. This total includes one-time (first year) contingency planning cost savings of $0.8 million that likely are sunk and one-time notification of exclusion costs of $0.5 million. The greatest annual savings result from a portion of the residual quantity generated by the recovery processes being classified as nonhazardous ($5.3 million in residual hazardous waste landfill cost savings - $3.0 million in new non-hazardous waste landfill costs + $2.3 million in nonhazardous transportation cost savings = $4.6 million in cost savings). The second largest annual cost savings is from a reduction in hazardous materials training costs ($2.8 million in cost savings). The third largest annual cost savings is from a reduction in waste characterization testing costs ($2.1 million).

For the 1997 on-site recovery plants, the total estimated annual cost savings is $16.2 million. This total includes one-time (first year) contingency planning cost savings of $0.2 million that likely are not sunk because plants are switching management technologies and one-time notification of exclusion costs of $0.2 million. The greatest annual savings result from a portion of the residual quantity generated by the recovery processes being classified as nonhazardous ($4.3 million in pre-rule baseline management costs - $1.5 million in post-rule residual hazardous waste landfill costs - $0.2 million in post-rule non-hazardous waste landfill costs - $8.0 million in post-rule recovery system costs + $2.0 million in nonhazardous transportation cost savings + $16.9 million in value from the recovered products = $13.5 million in cost savings). The second largest annual cost savings is from a reduction in waste characterization testing costs ($1.7 million). The third largest annual cost savings is from a reduction in hazardous materials training costs ($0.6 million).

For those 1999 plants that recovered wastes off-site within the same industry group (4-digit NAICS), the total estimated annual cost savings is $2.7 million. This total includes one-time (first year) contingency planning cost savings of $0.1 million that likely are sunk and one-time notification of exclusion costs of $0.2 million. The greatest annual savings result from a portion of the residual quantity generated by the recovery processes being classified as nonhazardous ($0.7 million in residual hazardous waste landfill cost savings - $0.5 million in post-rule non-hazardous waste landfill costs + $0.2 million in nonhazardous transportation cost savings = $0.4 million in cost savings). The second largest annual cost savings is from a reduction in hazardous materials training costs ($0.4 million). The third largest annual cost savings is from a reduction in waste characterization testing costs ($0.2 million).

For those 1997 plants that recovered wastes off-site within the same industry group, the total estimated annual cost savings is $4.7 million. This total includes one-time (first year) contingency planning cost savings of $0.02 million that likely are not sunk because the plants are switching management technologies and one-time notification of exclusion costs of $0.03 million. The greatest annual savings result from a portion of the residual quantity generated by the recovery processes being classified as nonhazardous ($1.6 million in pre-rule hazardous waste management costs - $0.5 million in post-rule residual hazardous waste landfill costs - $0.05 million in post-rule non-hazardous waste landfill costs - $0.9 million in post-rule recovery system costs + $0.4 million in post-rule nonhazardous transportation cost savings - $0.4 million in post-rule off-site recovery transport costs + $4.4 million in value from the recovered products = $4.4 million in cost savings). The second largest annual cost savings is from a reduction in waste characterization testing costs ($0.3 million).

For those 1999 plants that recovered wastes off-site outside their industry group, the total estimated annual cost savings is $63 million. The greatest annual savings result from a portion of the residual quantity generated by the recovery processes being classified as nonhazardous (-$19.5 million in residual hazardous waste landfill costs - $1.7 million in post-rule non-hazardous residual landfill costs + $64.6 million in on-site recovery process savings + $2.0 million in hazardous transportation cost savings = $45.4 million in cost savings). The second largest annual cost savings is from a reduction in waste characterization testing costs ($15.3 million). The third largest annual cost savings is from a reduction in manifest costs ($2.4 million).

For those 1999 plants that disposed the five waste types identified with sufficient quality for recovery either on-site or off-site, the total estimated annual cost savings is $80.1 million. This total includes one-time (first year) contingency planning cost savings of $0.14 million that likely are sunk and one-time notification of exclusion costs of $0.14 million. The greatest annual savings result from a portion of the residual quantity generated by the recovery processes being classified as nonhazardous ($84.5 million in pre-rule hazardous waste management costs -$13.7 million in residual hazardous waste landfill cost savings - $3.5 million in post-rule non-hazardous waste landfill costs + $13.2 million in nonhazardous transportation cost savings - $98.6 million in post-rule recovery system costs + $73.0 million in value from the recovered products = $54.9 million in cost savings). The second largest annual cost savings is from a reduction in waste characterization testing costs ($22.9 million). The third largest annual cost savings is from a reduction in manifest costs ($3.5 million).

Table 5-19. Summary of Pre- and Post-Rule Costs and Incremental Costs							
Cost Item	1999 Plants			1997 Plants			Total Costs ($/yr)
	Pre-Rule Costs ($/yr)	Post-Rule Costs ($/yr)	Incremental Costs ($/yr)	Pre-Rule Costs ($/yr)	Post-Rule Costs ($/yr)	Incremental Costs ($/yr)	
On-site Recovery							
Residual Hazardous Landfill Disposal	$60,719,000	$55,431,000	($5,288,000)	$0	$1,525,000	$1,525,000	($3,763,000)
Residual Non-Hazardous Landfill Disposal	$0	$2,976,000	$2,976,000	$0	$165,000	$165,000	$3,141,000
Pre-Rule Management (Hazardous Landfill, Energy Recovery, on-site Acid Neutralization)	$0	$0	$0	$4,257,000	$0	($4,257,000)	($4,257,000)
Pre-Rule and Post-Rule Metal/ Solvent/Acid Recovery	$167,814,000	$167,814,000	$0	$0	$7,953,000	$7,953,000	$7,953,000
Waste Characterization Testing	$24,026,000	$21,961,000	($2,065,000)	$3,245,000	$1,581,000	($1,664,000)	($3,729,000)
Manifesting	$3,701,000	$3,383,000	($318,000)	$500,000	$243,000	($257,000)	($575,000)

Table 5-19. Summary of Pre- and Post-Rule Costs and Incremental Costs							
Cost Item	**1999 Plants**			**1997 Plants**			**Total Costs ($/yr)**
	Pre-Rule Costs ($/yr)	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	**Pre-Rule Costs ($/yr)**	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	
Loading	$4,371,000	$4,371,000	$0	$71,000	$224,000	$153,000	$153,000
Waste Transportation	$23,184,000	$20,903,000	($2,281,000)	$3,749,000	$1,734,000	($2,015,000)	($4,296,000)
Recovery Transportation	$0	$0	$0	$0	$0	$0	$0
Salvage Revenue	($610,881,000)	($610,881,000)	$0	$0	($16,898,000)	($16,898,000)	($16,898,000)
Hazardous Materials Training	$7,479,000	$4,719,000	($2,760,000)	$2,291,000	$1,659,000	($632,000)	($3,392,000)
Manifest Training	$1,539,000	$1,095,000	($444,000)	$459,000	$382,000	($77,000)	($521,000)
BRS/General Administrative Duties	$1,927,000	$1,423,000	($504,000)	$584,000	$473,000	($111,000)	($615,000)
One-Time Contingency Planning	$2,072,000	$1,252,000	($820,000)	$640,000	$442,000	($198,000)	($1,018,000)
Initial Characterization	$7,066,000	$7,066,000	$0	$1,805,000	$1,805,000	$0	$0
One-Time Notification of Exclusion	$0	$542,000	$542,000	$0	$162,000	$162,000	$704,000

Table 5-19. Summary of Pre- and Post-Rule Costs and Incremental Costs							
Cost Item	**1999 Plants**			**1997 Plants**			**Total Costs ($/yr)**
	Pre-Rule Costs ($/yr)	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	**Pre-Rule Costs ($/yr)**	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	
On-site Recovery Subtotal	($306,983,000)	($317,945,000)	($10,962,000)	$17,601,000	$1,450,000	($16,151,000)	($27,113,000)
Off-site Recovery Within the Same Industry Group (4-Digit NAICS Code)							
Residual Hazardous Landfill Disposal	$6,389,000	$5,675,000	($714,000)	$0	$540,000	$540,000	($174,000)
Residual Non-Hazardous Landfill Disposal	$0	$481,000	$481,000	$0	$50,000	$50,000	$531,000
Pre-Rule Management (Hazardous Landfill, Energy Recovery, On-site Acid Neutralization)	$0	$0	$0	$1,605,000	$0	($1,605,000)	($1,605,000)
Pre-Rule and Post-Rule Metal/ Solvent/Acid Recovery Cost	$12,117,000	$12,117,000	$0	$0	$928,000	$928,000	$928,000

Table 5-19. Summary of Pre- and Post-Rule Costs and Incremental Costs							
Cost Item	**1999 Plants**			**1997 Plants**			**Total Costs ($/yr)**
	Pre-Rule Costs ($/yr)	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	**Pre-Rule Costs ($/yr)**	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	
Waste Characteriza-tion Testing	$2,677,000	$2,510,000	($167,000)	$571,000	$320,000	($251,000)	($418,000)
Manifesting	$761,000	$665,000	($96,000)	$88,000	$70,000	($18,000)	($114,000)
Loading	$1,387,000	$1,573,000	$186,000	$12,000	$154,000	$142,000	$328,000
Waste Transportation	$2,567,000	$2,344,000	($223,000)	$689,000	$301,000	($388,000)	($611,000)
Recovery Transportation	$8,585,000	$6,898,000	($1,687,000)	$0	$413,000	$413,000	($1,274,000)
Salvage Revenue	($55,712,000)	($55,712,000)	$0	$0	($4,439,000)	($4,439,000)	($4,439,000)
Hazardous Materials Training	$2,105,000	$1,729,000	($376,000)	$410,000	$360,000	($50,000)	($426,000)
Manifest Training	$437,000	$364,000	($73,000)	$82,000	$79,000	($3,000)	($76,000)
BRS/General Administrative Duties	$549,000	$478,000	($71,000)	$105,000	$97,000	($8,000)	($79,000)
One-Time Contingency Planning	$582,000	$475,000	($107,000)	$115,000	$98,000	($17,000)	($124,000)

Table 5-19. Summary of Pre- and Post-Rule Costs and Incremental Costs							
Cost Item	**1999 Plants**			**1997 Plants**			**Total Costs ($/yr)**
	Pre-Rule Costs ($/yr)	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	**Pre-Rule Costs ($/yr)**	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**	
Initial Characterization	$2,661,000	$2,661,000	$0	$302,000	$302,000	$0	$0
One-Time Notification of Exclusion	$0	$159,000	$159,000	$0	$29,000	$29,000	$188,000
Off-site Recovery Subtotal	($14,895,000)	($17,583,000)	($2,688,000)	$3,979,000	($698,000)	($4,677,000)	($7,365,000)
Aggregate Cost Total	($321,878,000)	($335,528,000)	($13,650,000)	$21,580,000	$752,000	($20,828,000)	($34,478,000)

NOTES: 1.) Numbers in parentheses, "( )", represent negative costs that reflect revenues or cost savings.
2.) Incremental facility-level state tax costs for firms are estimated to be ($372,000) [$470,000 pre-rule and $98,000 post-rule] for 1999 on-site recovery facilities and ($165,000) [$191,000 pre-rule and $26,000 post-rule] for 1997 on-site recovery facilities. For off-site recovery facilities, they are ($16,000) [$20,000 pre-rule and $4,000 post-rule] for 1999 off-site recovery facilities and ($0) [$282 pre-rule and $38 post-rule] for 1997 off-site recovery facilities. Total facility-level state tax costs are ($553,000).
3.) Incremental generation (per ton) state tax costs for firms are estimated to be ($1,552,000) [$3,364,000 pre-rule and $1,812,000 post-rule] for 1999 on-site recovery facilities and ($29,000) [$393,000 pre-rule and $364,000 post-rule] for 1997 on-site recovery facilities. For off-site recovery facilities, they are ($7,000) [$1,495,000 pre-rule and $1,488,000 post-rule] for 1999 off-site recovery facilities and ($9,000) [$17,000 pre-rule and $8,000 post-rule] for 1997 off-site recovery facilities. Total generation (per ton) state tax costs are ($1,597,000).

Table 5-20. Summary of Potential Incremental Cost Savings from Conducting On-Site Recovery Instead of Recovering in Other Industry Groups			
4-Digit NAICS Code (Industry Group)	**No. Facilities with Potential Savings**	**Quantity (tons)**	**Incremental Savings (2002 $)***
3241 Petroleum & Coal Products Mfg.	5 out of 112	8,229 out of 28,547	$272,513
3251 Basic Chemical Manufacturing	14 out of 227	15,917 out of 22,515	$9,293,753
3252 Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing	10 out of 99	25,803 out of 32,446	$18,709,701
3254 Pharmaceutical & Medicine Mfg.	14 out of 111	12,140 out of 15,447	$6,643,330
3255 Paint, Coating & Adhesive Mfg.	49 out of 156	21,549 out of 23,181	$12,117,532
3312 Steel Product Manufacturing from Purchased Steel	6 out of 119	136,518 out of 471,434	$5,012,838
3314 Non-Ferrous Metal (except Aluminum) Production and Processing	6 out of 83	18,826 out of 29,046	$1,219,361
3328 Coating, Engraving, Heat Treating and Allied Activities	1 out of 417	116 out of 25,069	$19,920
3344 Semiconductor and Other Electronic Component Mftg.	4 out of 382	1,174 out of 56,589	$527,843
3359 Other Electrical Equipment and Component Manufacturing	1 out of 67	71 out of 32,543	$8,670
3362 Motor Vehicle Body and Trailer Manufacturing	32 out of 74	17,400 out of 18,069	$9,518,978
Total	142 out of 1,847	257,743 out of 754,886	$63,346,441
* Includes $171,808 in incremental state tax savings. Does not include costs for one-time notification of exclusion.			

Table 5-21. Summary of Potential Incremental Cost Savings from Conducting On-Site Recovery Instead of Off-site Disposal by Waste Type					
Waste Types	**SIC Codes**	**Waste Forms**	**No. Facilities**	**Quantity (tons)**	**Incremental Cost Savings (2002 $)***
Organic Liquids (Industrial Organic Chemicals, Paints & Allied Products, Pharmaceutical Preparations, & Plastics Materials & Resins Industries)	2869 2851 2834 2821	Liquid Form Codes (B101-B119, B201-B219)	389 (out of 1,189)	190,003 (out of 219,929)	$174,599,586
Electric Arc Furnace Emission Control Dust (K061 - Steel Works Industry)	3312	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	1 (out of 30)	48,235 (out of 273,208)	$103,181
Metal-Containing Liquids (Printed Circuit Board Industry)	3672	Liquid Form Codes (B101-B119, B201-B219)	102 (out of 173)	18,795 (out of 21,842)	$2,884,000
Electroplating Wastewater Treatment Sludges (Printed Circuit Board Industry)	3672	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	0 (out of 129)	0 (out of 7,095)	$0
Spent Carbon (Industrial Organic Chemicals & Petroleum Refining Industries)	2869 2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	109 (out of 109)	2,376 (out of 2,376)	$10,839,402
Spent Catalyst (Petroleum Refining Industry)	2911	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	57 (out of 75)	10,843 (out of 11,001)	$7,089,685
Spent Aluminum Potliner (K088 - Aluminum Industry)	3334	Solid Form Codes (B301-B319, B401-B409) Sludge Form Codes (B501-B519, B601-B609)	19 (out of 21)	71,698 (out of 72,547)	$31,712,523
Spent Pickle Liquor (K062 - Steel Works Industry)	3312	Liquid Form Codes (B101-B119, B201-B219)	4 (out of 32)	72,938 (out of 88,128)	$14,360,111
Total			681 (out of 1,758)**	414,914 (out of 696,126)	$241,602,376

Table 5-21. Summary of Potential Incremental Cost Savings from Conducting On-Site Recovery Instead of Off-site Disposal by Waste Type					
Waste Types	**SIC Codes**	**Waste Forms**	**No. Facilities**	**Quantity (tons)**	**Incremental Cost Savings (2002 $)***
* Includes $6,933,750 in incremental state tax savings. Does not include costs for one-time notification of exclusion. ** The total number of unique plants is 1,585. Based on the above numbers, 173 plants dispose more than one of the eight waste types.					

Table 5-22. Summary of Potential Incremental Cost Savings from Conducting On-Site Recovery Instead of On-site Disposal by Waste Type					
Waste Types	**SIC Codes**	**Waste Forms**	**No. Facilities**	**Quantity (tons)**	**Incremental Cost Savings (2002 $)***
Metal-Containing Liquids (Printed Circuit Board Industry)	3672	Liquid Form Codes (B101-B119, B201-B219)	20 (out of 79)	313 (out of 133,512)	$254,000
Spent Pickle Liquor (Steel Works Industry)	3312	Liquid Form Codes (B101-B119, B201-B219)	7 (out of 7)	181,171 (out of 181,171)	$24,411,861
Total			27 (out of 86)	181,484 (out of 314,683)	$24,667,863
* Includes $2,266,653 in incremental state tax savings. Does not include costs for one-time notification of exclusion.					

Table 5-23. Summary of Pre- and Post-Rule Costs and Incremental Costs			
Cost Item	**Off-Site Recovery in Other Industry Groups (Different NAICS)**		
	Pre-Rule Costs ($/yr)	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**
Residual Hazardous Landfill Disposal	$0	$19,483,000	$19,483,000
Residual Non-Hazardous Landfill Disposal	$0	$1,652,000	$1,652,000
Pre-Rule Management (Hazardous Landfill, Energy Recovery, on-site Acid Neutralization)	$0	$0	$0
Pre-Rule and Post-Rule Metal/ Solvent/Acid Recovery	$129,989,000	$65,432,000	($64,557,000)
Waste Characterization Testing	$22,103,000	$6,838,000	($15,265,000)
Manifesting	$3,405,000	$1,053,000	($2,352,000)
Loading	$305,000	$1,382,000	$1,077,000
Waste Transportation	$8,552,000	$6,549,000	($2,003,000)
Recovery Transportation	$0	$0	$0
Salvage Revenue	($218,311,000)	($218,311,000)	$0
Hazardous Materials Training	$1,381,000	$653,000	($728,000)
Manifest Training	$258,000	$126,000	($132,000)
BRS/General Administrative Duties	$343,000	$204,000	($139,000)
One-Time Contingency Planning	$394,000	$185,000	($209,000)
Initial Characterization	$1,682,000	$1,682,000	$0
One-Time Notification of Exclusion	$0	$90,000	$90,000
Recovery Total	($49,899,000)	($112,982,000)	($63,083,000)

NOTES:
1.) Numbers in parentheses, “( )”, represent negative costs that reflect revenues or cost savings.
2.) Total incremental state tax costs are ($172,000).

Table 5-24. Summary of Pre- and Post-Rule Costs and Incremental Costs			
Cost Item	**Disposal Wastes (K061, K062, K088, Metal-Containing Liquids, K171/K172)**		
	Pre-Rule Costs ($/yr)	**Post-Rule Costs ($/yr)**	**Incremental Costs ($/yr)**
Residual Hazardous Landfill Disposal	$0	$13,742,000	$13,742,000
Residual Non-Hazardous Landfill Disposal	$0	$3,487,500	$3,487,500
Pre-Rule Management (Hazardous Landfill, Energy Recovery, on-site Acid Neutralization)	$84,541,000	$0	($84,541,000)
Pre-Rule and Post-Rule Metal/ Solvent/Acid Recovery	$0	$98,595,000	$98,595,000
Waste Characterization Testing	$33,713,000	$10,820,000	($22,893,000)
Manifesting	$5,193,000	$1,666,000	($3,527,000)
Loading	$336,000	$2,098,000	$1,762,000
Waste Transportation	$19,060,000	$5,857,000	($13,203,000)
Recovery Transportation	$0	$0	$0
Salvage Revenue	$0	($73,026,000)	($73,026,000)
Hazardous Materials Training	$1,950,000	$1,565,000	($385,000)
Manifest Training	$371,000	$330,000	($41,000)
BRS/General Administrative Duties	$487,000	$421,000	($66,000)
One-Time Contingency Planning	$573,000	$431,000	($142,000)
Initial Characterization	$2,033,000	$2,033,000	$0
One-Time Notification of Exclusion	$0	$135,000	$135,000
Recovery Total	$148,257,000	$68,154,500	($80,102,500)

NOTES:
1.) Numbers in parentheses, “( )”, represent negative costs that reflect revenues or cost savings.
2.) Total incremental state tax costs are ($4,651,000).